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Invoice No.: SGI/ANU/START-UP/ AI BOM DISPOSAL SYSTEM & METHOD -PATENT-13/2026

Vendor. A STARTUP: **SRJX RESEARCH AND INNOVATION LAB LLP**
- **Certificate No. DIPP/203406**

SATURDAY, **MAY 09, 2026**
Our Ref.: **ANU/AI BOM DISPOSAL SYSTEM & METHOD -PATENT-07/2026**

To
SRJX RESEARCH AND INNOVATION LAB LLP
PLOT No-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR,
AVINAB BIDANASI, CUTTACK- 753014

Description	**Fee. (INR)**
1. Professional fee towards providing general advisory on different intellectual property rights to start ups, providing information on protecting and promoting IPR to start ups in other countries, drafting Complete Specification and preparing and filing other documents such as Form-1, Form-2, Form-3, Form-9 and Form 18A, reporting to client the filing of the Patent Application No. **202631059321** dated 9th **MAY 2026.**	NIL
2. Government Fee for filing the Patent Application along with Form 9 and Form 18A.	INR 21,380/--
3. Miscellaneous expenses including charges for typing, phone, Print outs, photocopy, stamp fee, postal charges, conveyance etc.	INR 1000/-
Total	**INR 22,380/- (excluding taxes)**
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Sr. No.	App. Number	Ref. No./Application No.	Amount Paid	C.B.R. No.	Form Name	Fee Payment	Remarks
1	E-106/2516/2026/KOL	202631059321	0	-1	FORM28	Full	
2	202631059321	TEMP/E-1/64591/2026-KOL	10880	6886	FORM 1	Full	ARTIFICIAL SUPER-INTELLIGENCE (ASI) BASED NEUROMORPHIC BOMB DISPOSAL SYSTEM AND METHOD THEREOF

TransactionID	Payment Mode	Challan Identification Number	Amount Paid	Head of A/C No
N-0001948220	Online Bank Transfer	0905260043194	10880.00	1475001020000001

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Amount in Words: Rupees Ten Thousand Eight Hundred Eighty Only

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1	E20263031769	202631059321	8000	6891	FORM 18A	

TransactionID	Payment Mode	Challan Identification Number	Amount Paid	Head of A/C No
N-0001948384	Online Bank Transfer	1005260008183	8000.00	1475001020000001

Total Amount : ₹ 8000.00
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Sr. No.	App. Number	Ref. No./Application No.	Amount Paid	C.B.R. No.	Form Name	Fee Payment	Remarks
1	E-12/1641/2026/KOL	202631059321	2500	6887	FORM 9	Full	

TransactionID	Payment Mode	Challan Identification Number	Amount Paid	Head of A/C No
N-0001948356	Online Bank Transfer	1005260006062	2500.00	1475001020000001

Total Amount : ₹ 2500.00

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Application Details	
APPLICATION NUMBER	202631059321
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	09/05/2026
APPLICANT NAME	**SRJX RESEARCH AND INNOVATION LAB LLP**
TITLE OF INVENTION	ARTIFICIAL SUPER-INTELLIGENCE (ASI) BASED NEUROMORPHIC BOMB DISPOSAL SYSTEM AND METHOD THEREOF
FIELD OF INVENTION	ELECTRONICS
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E-MAIL (UPDATED Online)	
PRIORITY DATE	
REQUEST FOR EXAMINATION DATE	10/05/2026
PUBLICATION DATE (U/S 11A)	22/05/2026

Application Status	
APPLICATION STATUS	**Application Awaiting Examination**

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➡ Filed ➡ RQ Filed ➡ Published ➡ Under Examination

➡ Disposed

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FORM 2

THE PATENTS ACT, 1970
[39 of 1970]
&
THE PATENTS RULES, 2003

COMPLETE SPECIFICATION

(Section 10; Rule 13)

ARTIFICIAL SUPER-INTELLIGENCE (ASI) BASED NEUROMORPHIC BOMB DISPOSAL SYSTEM AND METHOD THEREOF

SRJX RESEARCH AND INNOVATION LAB LLP
PLOT NO-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR,
CUTTACK- 753014, ODISHA, INDIA

An Indian Company

The following Specification particularly describes the invention and the manner in which it is to be performed.

FIELD OF INVENTION

The present invention relates generally to the field of robotic platform. More particularly relates to an Artificial Super-Intelligence (ASI) based neuromorphic bomb disposal system and its method.

BACKGROUND

Bomb disposal remains one of the most hazardous activities in civilian security, military engineering, counter-terrorism response, airport safety, critical infrastructure protection, and post-conflict recovery operations. Human operators are often required to inspect suspicious objects, identify explosive threats, determine trigger mechanisms, and neutralize or isolate such threats under highly uncertain and time-sensitive conditions. Even when protective suits, remote tools, and controlled procedures are used, the risk to human life remains extremely high because explosive devices may contain anti-handling mechanisms, hidden sensors, chemical triggers, pressure switches, timing circuits, wireless activators, or improvised configurations that are difficult to predict in advance. As a result, bomb disposal technology has increasingly relied on remote robotic systems to create safer stand-off distances between the operator and the explosive hazard.

Existing bomb-disposal robots, however, are still largely dependent on teleoperation. In most conventional systems, a human operator remotely controls the movement of the robot, views camera feeds, manipulates the robotic arm, and decides each action based on visual interpretation and prior experience. Although such systems reduce direct exposure to danger, they also impose significant cognitive and operational burden on the operator. The operator must simultaneously assess the environment, interpret multiple sensor streams, navigate rough or cluttered terrain, maintain communication links, and perform delicate manipulation tasks with high precision. In real-world situations, poor lighting, dust, smoke, complex wiring, reflective surfaces, unstable ground, narrow passages, and signal interference can degrade robot performance and reduce the effectiveness of teleoperation. Communication delay or temporary loss of connectivity can further compromise mission safety and make conventional systems unreliable in dynamic or hostile environments.

Another limitation of present bomb-disposal units lies in their comparatively rigid intelligence architecture. Many available systems rely on pre-programmed motion routines, manual control logic, or conventional machine-learning models that function well only within constrained operating conditions. Such systems often struggle to generalize across unfamiliar explosive-device geometries, newly emerging trigger designs, or rapidly changing field scenarios. They may detect an object but cannot reason deeply about its probable construction, threat level, safe neutralization sequence, or the likely consequences of each manipulative action. They also tend to process sensory data in a centralized, power-hungry, and sequential manner, which can increase latency and reduce responsiveness during critical operations. In bomb disposal, where milliseconds can matter and subtle environmental cues may determine success or failure, there is a clear need for a more adaptive, efficient, and cognitively advanced robotic platform.

Recent developments in neuromorphic engineering suggest an alternative computing paradigm that may better suit high-risk autonomous robotics. Neuromorphic systems are inspired by the structure and operational principles of biological neural systems and are capable of event-driven, low-latency, energy-efficient perception and control. Unlike conventional processors that repeatedly poll and process large volumes of redundant data, neuromorphic architectures can respond selectively to meaningful sensory changes and support rapid pattern recognition, sensor fusion, contextual learning, and real-time decision adaptation. These properties make neuromorphic computation highly relevant for mobile robotic systems operating in uncertain environments, particularly where power efficiency, fast reaction time, compact hardware, and robust perception are essential. However, despite the promise of neuromorphic control and spiking neural processing in robotics generally, their application to bomb-disposal units remains limited and insufficiently integrated into a full mission-capable platform.

There therefore exists a strong unmet need for a next-generation bomb-disposal unit that goes beyond remote manipulation and limited automation. Such a unit should be capable of perceiving complex environments intelligently, recognizing explosive-device features from multimodal sensory inputs, learning from prior mission data, adapting its behaviour during operation, and supporting or reducing operator burden rather than merely extending manual control. It should also be able to maintain safe and purposeful functioning during communication degradation, uncertain terrain interaction, and unpredictable threat evolution. A system based on Artificial Super-Intelligence oriented decision support combined with neuromorphic sensing and control can address these shortcomings by providing deeper situational understanding, faster reasoning, more human-like adaptive response, and safer autonomous or semi-autonomous bomb-disposal capability. The present invention is conceived in view of these deficiencies of prior systems and seeks to provide an improved bomb-disposal unit capable of intelligent hazard analysis, low-latency actuation, resilient field operation, and enhanced protection of human life.

Therefore, there is a need for an Artificial Super-Intelligence (ASI) based neuromorphic bomb disposal system to overcome the above mentioned drawbacks.

OBJECTS OF THE INVENTION

According to embodiments of the present invention, the key objectives are given below:

1. To provide a bomb-disposal unit that minimizes direct human exposure to explosive threats.
2. To develop an Artificial Super-Intelligence based system capable of analyzing suspicious explosive devices with high accuracy and speed.

3. To integrate neuromorphic computing for fast, low-latency, and energy-efficient perception and decision-making.
4. To enable real-time detection, classification, and risk assessment of bombs, IEDs, and hazardous explosive objects.
5. To provide autonomous and semi-autonomous navigation in complex, cluttered, or hostile environments.
6. To equip the unit with a precision robotic manipulator for safe handling, cutting, lifting, isolating, or neutralizing explosive devices.
7. To improve robotic arm movement through brain-inspired adaptive control for smooth and stable operation.
8. To fuse data from multiple sensors such as visual, thermal, depth, acoustic, chemical, and proximity sensors for better situational awareness.
9. To identify trigger mechanisms, suspicious wiring patterns, hidden compartments, and surrounding hazards more effectively.
10. To reduce operator workload by providing intelligent decision support and automated task assistance.
11. To allow the system to recommend the safest bomb-disposal strategy based on real-time field conditions.
12. To maintain functional operation even during communication delay, signal loss, or degraded network conditions.
13. To support multiple control modes including teleoperated, assisted, semi-autonomous, and autonomous operation.
14. To continuously learn from previous missions, operator feedback, and real-time outcomes for improved future performance.
15. To enhance safety by incorporating fail-safe logic, self-diagnostics, and emergency response protocols.
16. To provide a modular and upgradeable platform for future integration of improved sensors, processors, and tools.

17. To increase the success rate of bomb neutralization while reducing accidental detonation risk.
18. To make bomb-disposal operations faster, smarter, and more reliable in military, police, airport, and critical-infrastructure applications.

SUMMARY OF THE INVENTION

The present innovation relates to an advanced robotic explosive-threat handling platform configured as an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal unit for use in military, paramilitary, police, airport-security, border-control, critical-infrastructure, disaster-response, and counter-terror operations. The present unit is designed to detect, assess, approach, inspect, manipulate, isolate, and neutralize suspected explosive devices while minimizing direct human exposure to danger. Unlike conventional bomb-disposal robots that depend mainly on teleoperation and fixed control logic, the present innovation combines neuromorphic sensing, brain-inspired event-driven computation, adaptive robotic manipulation, and an ASI-oriented decision layer capable of high-speed reasoning over complex threat scenarios. Through this integration, the unit is intended to operate with improved responsiveness, lower latency, reduced power consumption, and higher contextual awareness in dynamic and uncertain environments.

In one aspect, the innovation provides a mobile robotic platform equipped with multi-modal sensors including visible-spectrum cameras, thermal cameras, depth sensors, event-based neuromorphic vision sensors, acoustic sensors, chemical or vapor sensors, proximity sensors, tactile sensors, inertial sensors, electromagnetic anomaly sensors, and optionally radiation or explosive-trace sensors. Data from these sensing systems are processed through a neuromorphic computing architecture that mimics biological neural behavior using spike-driven or event-driven signal handling. This allows the system to focus computational resources only on meaningful changes in the environment, thereby enabling rapid scene understanding, object recognition, anomaly detection, wire-pattern interpretation, trigger-mechanism assessment, and terrain-aware navigation. The unit can therefore detect suspicious packages, improvised explosive device features, concealed triggers, environmental hazards, and manipulator-contact conditions more efficiently than systems relying solely on conventional frame-based or sequential processing.

In another aspect, the innovation includes an articulated bomb-disposal manipulator arm with multi-degree-of-freedom joints, precision end effectors, grippers, cutters, disruptor interfaces, sensor-mounted wrists, and force-feedback capabilities. The arm is governed by a neuromorphic control engine capable of generating smooth, adaptive, and low-latency motion trajectories in constrained or hazardous environments. By using spiking neural control principles and predictive sensor fusion, the manipulator can perform delicate operations such as wire separation, cap removal, container opening, X-ray alignment, explosive disruptor positioning, and suspicious-object relocation with greater stability and reduced operator burden. Tactile and proprioceptive feedback may be continuously interpreted by the neuromorphic controller so that the arm can adjust grip force, movement speed, and approach strategy in real time based on contact conditions and device fragility.

A further aspect of the innovation lies in the ASI-oriented cognitive decision framework, which serves as a high-level intelligence layer above the sensing and actuation subsystems. This layer is configured to maintain an evolving threat knowledge model using prior mission records, operator inputs, learned action outcomes, explosive-device archetypes, environmental mappings, and real-time field observations. Based on this knowledge model, the system can estimate threat probabilities, generate ranked intervention strategies, simulate potential action consequences, recommend or autonomously select safer neutralization workflows, and continuously update its plan as new evidence becomes available. The ASI-oriented framework may further include risk scoring, uncertainty estimation, self-correction, mission-priority balancing, operator intent interpretation, and fallback safety logic. In semi-autonomous mode, the system can provide decision support to a human EOD specialist; in higher-autonomy mode, it can continue mission execution under restricted supervision or degraded communication conditions.

The innovation may also include a secure human-machine interface through which an operator can monitor sensor feeds, approve actions, define mission constraints, intervene during high-risk operations, or switch between teleoperated, assisted, semi-autonomous, and autonomous modes. In some embodiments, operator commands may be enhanced through gesture, voice, physiological, or brain-signal interfaces for faster control under stressful conditions. The system may further incorporate encrypted communications, mission logging, self-diagnostics, fault prediction, cyber-resilience measures, and modular hardware design for field maintenance and upgradeability. Because the neuromorphic architecture supports energy-efficient edge intelligence, the platform can sustain advanced onboard reasoning without constant reliance on high-bandwidth remote computation.

Overall, the innovation provides a unified bomb-disposal solution that combines mobility, precision manipulation, neuromorphic sensing, adaptive control, and ASI-oriented reasoning in a single integrated platform. The principal advantage of the invention is that it transforms bomb disposal from a predominantly remote-manual operation into an intelligent, context-aware, and safety-focused robotic process. By reducing cognitive load on operators, improving reaction speed, increasing autonomy during communication failure, and enabling more informed intervention strategies, the present system aims to significantly enhance operational effectiveness while protecting human life and critical assets.

An embodiment of the present invention describes an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system (100). The system comprises a mobile robotic platform (102) including a locomotion subsystem comprising at least one of a tracked drive, a wheeled drive, and a hybrid drive, configured for controlled movement over uneven terrain, a multi-sensor perception module (104) mounted on the mobile robotic platform (102), the multi-sensor perception module (104) comprising at least one of: at least one visible-spectrum imaging sensor, at least one thermal imaging sensor, at least one depth sensor, at least one event-based neuromorphic vision sensor, at least one chemical or vapor detection sensor, at least one proximity sensor, and at least one tactile or force feedback sensor, a neuromorphic processing core (106) comprising neuromorphic hardware circuitry (122) configured to perform event-driven spike-based signal processing, the neuromorphic processing core (106) being operatively coupled to the multi-sensor perception module (104) to receive sensor signals therefrom, an intelligence processing unit (108) comprising at least one processor (118) and at least one memory unit (120) storing executable instructions, the intelligence processing unit (108) being operatively coupled to the neuromorphic processing core (106), a robotic manipulator subsystem (110) comprising: a multi-degree-of-freedom articulated arm, at least one end effector selected from a gripper, cutter, and disruptor interface, and a force-feedback interface, a motion control unit (112) comprising control circuitry (124) operatively coupled to the robotic manipulator subsystem (110), the motion control unit (112) being configured to generate actuation control signals based on real-time feedback received from the force-feedback interface, a communication interface (114) configured to enable bidirectional data communication with a remote operator console, and a fail-safe control module (116) configured to monitor at least one of communication status, sensor confidence level, and actuator stability, wherein the neuromorphic processing core (106), the intelligence processing unit (108), and the motion control unit (112) are configured to cooperatively execute a closed-loop control sequence comprising: receiving, by the neuromorphic processing core (106), multi-modal sensor signals from the multi-sensor perception module (104), converting, by the neuromorphic processing core (106), the multi-modal sensor signals into event-driven spike-based signal representations, generating, by the neuromorphic processing core (106), a fused perception output based on the event-driven spike-based signal representations, generating, by the intelligence processing unit (108), a structured threat model based on the fused perception output, determining, by the intelligence processing unit (108), at least one ranked intervention strategy based on the structured threat model, generating, by the motion control unit (112), actuation control signals corresponding to the at least one ranked intervention strategy, actuating, by the robotic manipulator subsystem (110), a physical manipulation action on a target object in accordance with the actuation control signals, and updating, by the motion control unit (112) and the neuromorphic processing core (106), the actuation control signals based on real-time feedback received from the force-feedback interface, wherein the closed-loop control sequence reduces response latency and power consumption relative to frame-based processing and improves manipulation precision under hazardous conditions.

According an embodiment of the present invention, the neuromorphic processing core (106) comprises a spiking neural network implemented in neuromorphic hardware circuitry, the neuromorphic processing core (106) being configured to: encode incoming multi-modal sensor signals into asynchronous spike trains based on temporal variations in the sensor signals, process the spike trains using neuron models configured for event-driven spike propagation, and generate the fused perception output by selectively processing only temporally significant changes in the sensor signals, thereby reducing processing of non-changing sensor data and enabling lower-latency response generation.

According another embodiment of the present invention, the intelligence processing unit (108) is configured to: receive the fused perception output comprising at least one of spatial features, thermal characteristics, chemical signatures, and proximity data associated with the target object, extract a plurality of threat parameters from the fused perception output, the plurality of threat parameters comprising at least one of: detected structural features of the target object, presence of potential trigger mechanisms, environmental instability indicators, and sensor-derived anomaly indicators, compute a quantitative risk score by applying a weighted evaluation of the plurality of threat parameters, wherein each threat parameter is assigned a predefined or dynamically updated weighting factor stored in the memory unit (120) of the intelligence processing unit (108), generate the quantitative risk score as a numerical value representing a probability of hazardous response or detonation associated with the target object, and assign the quantitative risk score to the structured threat model by embedding the quantitative risk score as a risk attribute within the structured threat model for use in determining the ranked intervention strategy.

According to yet another embodiment of the present invention, the motion control unit (112) is configured to: receive real-time feedback signals from the force-feedback interface indicative of at least one of contact force, resistance, and positional deviation, compare the real-time feedback signals with predefined control thresholds stored in the memory unit, generate adjusted actuation control signals by modulating at least one of grip force, velocity, and movement trajectory of the robotic manipulator subsystem (110), and transmit the adjusted actuation control signals to the robotic manipulator subsystem (110) during execution of the physical manipulation action, whereby controlled and stable interaction with the target object is achieved.

According to yet another embodiment of the present invention, the fail-safe control module (116) is configured to: continuously monitor communication signal strength, sensor confidence level, and actuator status; detect a fault condition when at least one monitored parameter deviates from a predefined safety threshold, generate a safety control signal in response to the detected fault condition, and execute a safe-state transition by at least one of: suspending actuation of the robotic manipulator subsystem

(110), retracting the robotic manipulator subsystem (110) to a predefined safe position, and stabilizing the mobile robotic platform (102), whereby unsafe operation is prevented under degraded operating conditions.

According to yet another embodiment of the present invention, the neuromorphic processing core (106) is further configured to: receive thermal data and electromagnetic anomaly data from corresponding sensors within the multi-sensor perception module (104), temporally align and correlate the thermal data and electromagnetic anomaly data, identify co-occurring anomalies indicative of concealed trigger mechanisms based on the correlated data, and incorporate the identified anomalies into the fused perception output.

According to yet another embodiment of the present invention, the communication interface (114) is configured to: receive control inputs from the remote operator console, selectively switch between operational modes comprising a tele-operated mode, an assisted mode, a semi-autonomous mode, and an autonomous mode based on the received control inputs, and route control authority between the remote operator console and the intelligence processing unit (108) in accordance with the selected operational mode.

According to yet another embodiment of the present invention, the robotic manipulator subsystem (110) further comprises a wrist-mounted sensor array configured to: detect at least one of contact proximity, applied force, and surface resistance, generate feedback signals corresponding to the detected parameters, and transmit the feedback signals to the motion control unit (112) for real-time adjustment of actuation control signals.

According to yet another embodiment of the present invention, the mobile robotic platform (102) further comprises an inertial measurement unit configured to: detect at least one of orientation, acceleration, and vibration of the mobile robotic platform

(102), generate stabilization signals based on the detected parameters, and adjust movement of the locomotion subsystem to maintain platform stability during execution of the physical manipulation action.

According to yet another embodiment of the present invention, the intelligence processing unit (108) is further configured to: compare the quantitative risk score with a predefined risk threshold, and modify the ranked intervention strategy when the quantitative risk score exceeds the predefined risk threshold.

According to yet another embodiment of the present invention, the neuromorphic processing core (106) and the motion control unit (112) are configured to: detect a change in sensor signals, and generate updated actuation control signals in response to the detected change within a predefined response time threshold, whereby real-time responsiveness of the system (100) is optimized relative to frame-based processing systems.

Another embodiment of the present invention describes a method for intelligent bomb-disposal by an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system (100). The method comprises: acquiring multi-modal sensor signals from a plurality of sensors mounted on a mobile robotic platform (102), converting the multi-modal sensor signals into event-driven spike-based signal representations using a neuromorphic processing core (106) comprising neuromorphic hardware circuitry (122), generating, by the neuromorphic processing core (106), a fused perception output based on the event-driven spike-based signal representations, generating a structured threat model based on the fused perception output using at least one processor (118), determining at least one ranked intervention strategy based on the structured threat model, generating actuation control signals corresponding to the at least one ranked intervention strategy, actuating a robotic manipulator subsystem (110) to perform a physical manipulation action on a target object based on the actuation control signals, and updating the actuation control signals based on real-time feedback from a force-feedback interface, wherein the method operates as a closed-loop control process and achieves reduced latency and improved control precision through event-driven spike-based signal processing.

According to another embodiment of the present invention, the method further comprises determining the at least one ranked intervention strategy comprises evaluating multiple candidate strategies and selecting a strategy minimizing a computed risk score.

According to yet another embodiment of the present invention, the method further comprises converting into event-driven spike-based signal representations comprises encoding only changes in sensor signals.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

This invention is described by way of example with reference to the following drawings. These drawings being referred herein are for the purpose of illustrating preferred embodiments of the invention only, and not for the purpose of limiting the same.

FIG. 1	illustrates a schematic block representation of an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system, according to an embodiment of the present invention.
FIG. 2	illustrates an Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit/system, according to an embodiment of the present invention.
FIG. 3	illustrates a flow chart of Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit/system, according to an embodiment of the present invention.
FIG. 4	illustractes a logic layer architecture of an Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit/system, according to an embodiment of the present invention.

FIG. 5	illustrates an external device view of Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit, according to an embodiment of the present invention.
FIG. 6	illustractes a communication architecture of an Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit, according to an embodiment of the present invention.
FIG. 7	illustractes an exploded view of Robotic bomb disposal unit, according to an embodiment of the present invention.
FIG. 8	illustractes a flow chart representing a method for intelligent bomb-disposal performed by an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system (100), according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The present invention is described hereinafter by various embodiments with reference to the accompanying drawings, wherein reference numerals used in the accompanying drawings correspond to the like elements throughout the description. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. Rather, the embodiments are provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those skilled in the art.

It will be understood by those skilled in the art that the foregoing general description and the following detailed description are exemplary and explanatory of the invention and are not intended to be restrictive thereof. The terms "comprises", "comprising", or any other variations thereof, are intended to cover a non-exclusive inclusion, Appearances of the phrase "in an embodiment", "in another embodiment" and similar language throughout this specification may, but not necessarily do, all refer to the same embodiment.

Further, the words "a" or "an" mean "at least one” and the word “plurality” means “one or more” unless otherwise mentioned. Furthermore, the terminology and phraseology used herein is solely used for descriptive purposes and should not be construed as limiting in scope. The systems, methods, and examples provided herein are only illustrative and not intended to be limiting.

The present invention is unique in that it combines Artificial Super-Intelligence oriented decision capability with a neuromorphic bomb-disposal platform in a single integrated system rather than treating robot mobility, sensing, manipulation, and threat analysis as separate functional modules. In conventional bomb-disposal systems, the robot typically acts only as a remotely controlled mechanical tool, while reasoning, interpretation, and tactical decisions remain almost entirely dependent on the human operator. In the present invention, however, a higher-order intelligence layer is embedded into the bomb-disposal unit itself, enabling the platform to analyze environmental context, interpret explosive-device features, estimate threat behaviour, rank possible intervention strategies, and support or execute selected disposal actions with reduced dependence on continuous human micromanagement. This integration of advanced machine cognition with field robotics represents a significant departure from earlier bomb-disposal approaches.

A further unique aspect lies in the use of neuromorphic computing as the core operational architecture for perception, control, and adaptive response. Unlike conventional processor-based bomb-disposal units that rely on continuous frame-by-frame computation and power-intensive sequential data handling, the present invention employs brain-inspired, event-driven processing capable of reacting only to meaningful environmental changes. This allows the system to process visual, thermal, tactile, acoustic, chemical, and proximity inputs with lower latency and higher efficiency, especially in dynamic and uncertain environments. The neuromorphic architecture enables rapid recognition of suspicious object features, motion anomalies, trigger indicators, manipulator-contact conditions, and terrain disturbances in a way that is faster and more biologically efficient than traditional robotic controllers. The application of such neuromorphic intelligence specifically to bomb-disposal operations constitutes an important inventive distinction.

Another unique feature of the invention is the coordinated fusion of multi-modal sensing with ASI-level situational reasoning. The unit does not merely collect data from multiple sensors; rather, it integrates those inputs into a continuously evolving threat model that can identify possible explosive-device types, hidden triggers, wiring patterns, casing irregularities, environmental hazards, and operator-relevant risk factors. The system can correlate heat signatures with structural outlines, tactile resistance with object fragility, acoustic anomalies with cavity presence, and electromagnetic signals with potential remote-trigger circuits. This deep, cross-domain interpretation of sensor data enables the bomb-disposal unit to move beyond simple detection and toward intelligent understanding. Such a unified threat-awareness framework is novel in comparison with prior systems that process individual sensor streams in isolation or depend on a human operator to mentally combine those inputs.

The invention is also unique in its manipulator control strategy, wherein the robotic arm is governed by a neuromorphic motion-control engine capable of smooth, adaptive, and precision-sensitive actuation. Conventional bomb-disposal manipulators often rely on rigid command-response mechanisms that can produce abrupt movement, poor force regulation, and limited dexterity when interacting with delicate explosive components. In contrast, the present invention introduces biologically inspired control behaviour based on spiking or event-driven actuation logic, allowing the arm to adapt its motion in real time according to tactile, positional, and resistance feedback. This enables safer handling of wires, switches, detonators, containers, and suspicious objects, especially where a slight excess of force or a sudden jerk could trigger detonation. The combination of neuromorphic manipulation with explosive-threat neutralization is a distinguishing inventive contribution.

A further inventive aspect resides in the system’s ability to operate intelligently under degraded communication conditions. In earlier bomb-disposal robots, communication failure can severely limit or entirely halt operations because control logic remains external to the robot. The present invention, by contrast, incorporates onboard cognition, local threat reasoning, and adaptive action continuity. If a communication link weakens or is interrupted, the system can maintain mission memory, preserve safety boundaries, pause hazardous actions, retreat to a safe position, stabilize the manipulator, or continue pre-authorized low-risk procedures according to embedded decision policies. This mission-resilient autonomy represents a novel advance over conventional teleoperated EOD robots that become ineffective or unsafe when remote control is interrupted.

The invention is further unique in its learning capability and knowledge evolution mechanism. The bomb-disposal unit can store prior mission patterns, operator decisions, action outcomes, environmental signatures, and threat-response histories in a continuously improvable intelligence framework. Over time, the system can refine its assessment models, optimize handling strategies, and improve intervention recommendations based on experience. Thus, the invention is not limited to static programming but is designed to become progressively more capable in recognizing and responding to complex explosive-threat scenarios. This self-improving, neuromorphically supported intelligence architecture, when applied specifically to bomb disposal, creates a distinctive and forward-looking technical contribution not found in ordinary robotic disposal systems.

Finally, the invention is unique because it transforms bomb disposal from a manually supervised hazard-response task into an intelligent, context-aware, adaptive robotic operation. The originality lies not in any single sensor, arm, or processor alone, but in the specific combination of ASI-oriented reasoning, neuromorphic perception, adaptive manipulation, resilient autonomy, and safety-centered explosive-threat handling within one unified disposal unit. This integrated architecture produces a new class of bomb-disposal platform capable of higher intelligence, faster reaction, deeper situational understanding, and substantially reduced risk to human life.

FIG. 1 illustrates a schematic block representation of an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system **100**, according to an embodiment of the present invention. The system **100** comprises an integrated arrangement of sensing, processing, actuation, communication, and safety subsystems configured to cooperatively execute a closed-loop bomb-disposal operation.

The system **100** comprises a mobile robotic platform **102** configured to provide controlled locomotion over uneven, hazardous, or constrained terrain. The mobile robotic platform **102** includes a locomotion subsystem comprising at least one of a tracked drive, wheeled drive, or hybrid drive, driven by electromechanical actuators and associated motor drivers. In an embodiment, the platform **102** further comprises an inertial measurement unit configured to detect orientation, acceleration, and vibration parameters, and to generate stabilization signals for dynamically adjusting locomotion during manipulation operations, thereby ensuring positional stability while interacting with a target object.

Mounted on the mobile robotic platform **102** is a multi-sensor perception module **104** configured to acquire multi-modal environmental data. The multi-sensor perception module **104** comprises at least one visible-spectrum imaging sensor, at least one thermal imaging sensor, at least one depth sensor, at least one event-based neuromorphic vision sensor, at least one chemical or vapor detection sensor, at least one proximity sensor, and at least one tactile or force feedback sensor. Each sensor generates corresponding sensor signals representing spatial features, thermal gradients, depth information, chemical signatures, proximity conditions, and contact forces. The module **104** is configured to continuously stream sensor data to downstream processing components.

In one embodiment, the event-based neuromorphic vision sensor is configured to generate asynchronous event streams corresponding to temporal intensity changes in a visual scene, wherein only changes in pixel intensity exceeding a predefined threshold produce event outputs, thereby reducing redundant data acquisition and enabling low-latency perception.

The system **100** further comprises a neuromorphic processing core **106** including neuromorphic hardware circuitry **122**, configured to perform event-driven spike-based signal processing. The neuromorphic processing core **106** is operatively coupled to the multi-sensor perception module **104** to receive multi-modal sensor signals. The neuromorphic hardware circuitry **122** implements a spiking neural network architecture configured to encode incoming sensor signals into asynchronous spike trains based on temporal variations in the sensor signals. The spike trains are processed using neuron models configured for event-driven spike propagation, wherein only temporally significant signal variations trigger computation. The neuromorphic processing core **106** further performs temporal alignment and correlation of heterogeneous sensor inputs, including thermal data and electromagnetic anomaly data, to identify co-occurring anomalies indicative of concealed trigger mechanisms. Based on such processing, the neuromorphic processing core **106** generates a fused perception output comprising integrated representations of spatial, thermal, chemical, and proximity features, thereby enabling efficient sensor fusion with reduced latency and power consumption.

In an embodiment, the neuromorphic processing core **106** encodes sensor signals into spike trains using a temporal encoding scheme, wherein changes in sensor intensity exceeding a predefined threshold generate discrete spike events. The neuromorphic hardware circuitry **122** processes the spike trains using layers of spiking neurons configured with synaptic weights to perform feature extraction and temporal correlation. The fused perception output is generated as a structured data representation comprising time-aligned feature maps corresponding to spatial, thermal, and chemical attributes. The fused perception output is transmitted to the intelligence processing unit **108** via a data bus interface in a predefined data structure format, thereby enabling deterministic data exchange between hardware modules.

In one embodiment of the present invention, a spiking neuron model refers to a computational neuron representation implemented in the neuromorphic hardware circuitry **122** of the neuromorphic processing core **106**, wherein information is encoded and processed in the form of discrete spike events occurring over time, rather than continuous-valued signals. Each spiking neuron model is configured to receive one or more input spike trains, process the temporal characteristics of the received spike trains, and generate output spike events based on a defined neuron state and firing condition.

In an embodiment, each spiking neuron model comprises a membrane potential state variable representing an accumulated input signal over time, wherein the membrane potential is updated based on incoming spike events received from connected neurons or sensor interfaces. Each incoming spike contributes to the membrane potential according to an associated synaptic weight stored in the memory unit **120**, wherein the synaptic weight defines the strength of the connection between neurons. The membrane potential is dynamically updated using a time-dependent integration function implemented in the neuromorphic hardware circuitry **122**, wherein the contribution of prior spikes decays over time according to a predefined decay constant.

In an embodiment, the spiking neuron model implements a threshold-based firing mechanism, wherein the neuron generates an output spike when the membrane potential exceeds a predefined firing threshold. Upon generation of the output spike, the membrane potential is reset to a baseline value or reduced according to a reset function, thereby enabling subsequent spike generation. The output spike is propagated to downstream neurons or processing units through synaptic connections, thereby enabling layered spike-based signal processing.

In an embodiment, the neuromorphic hardware circuitry **122** implements a network of interconnected spiking neuron models arranged in one or more processing layers, wherein each layer performs feature extraction, temporal correlation, or pattern recognition based on received spike trains. The synaptic weights associated with the connections between neurons are stored in the memory unit **120** and are configurable to adapt the processing behavior of the spiking neural network. In some embodiments, the synaptic weights are updated using a spike-timing dependent adaptation mechanism, wherein the relative timing between pre-synaptic and post-synaptic spikes influences the adjustment of synaptic strength.

In operation, multi-modal sensor signals received from the multi-sensor perception module **104** are first encoded into spike trains based on temporal variations in the sensor signals. These spike trains are provided as inputs to the spiking neuron models implemented in the neuromorphic processing core **106**. The spiking neuron models process the spike trains by integrating incoming spikes, applying synaptic weighting, evaluating firing thresholds, and generating output spikes representing detected features or events. The resulting output spike trains are further processed across successive neuron layers to generate a fused perception output representing spatial, temporal, and contextual characteristics of a target object.

In an embodiment, the spiking neuron models are configured to selectively process only temporally significant changes in the input signals, thereby reducing redundant computation associated with static data and enabling low-latency processing. The event-driven nature of the spiking neuron models allows the neuromorphic processing core (106) to operate with reduced power consumption and improved responsiveness compared to conventional frame-based processing systems.

In one embodiment, the spiking neuron model is implemented using a leaky integrate-and-fire (LIF) model or an equivalent hardware-implementable neuron model.

An intelligence processing unit **108** is operatively coupled to the neuromorphic processing core **106**. The intelligence processing unit **108** comprises at least one processor **118** and at least one memory unit **120** storing executable instructions and parameter datasets. The intelligence processing unit **108** is configured to receive the fused perception output and extract a plurality of threat parameters, including detected structural features of a target object, presence of potential trigger mechanisms, environmental instability indicators, and sensor-derived anomaly indicators. The plurality of threat parameters are encoded as a multi-dimensional feature vector stored in the memory unit **120**. The processor **118** is configured to compute a quantitative risk score using a processor-executed numerical aggregation function comprising weighted multiplication and summation operations applied to the feature vector, wherein each threat parameter is assigned a predefined or dynamically updated weighting factor stored in the memory unit **120**. The quantitative risk score is generated as a numerical value representing a probability of hazardous response or detonation associated with the target object.

In an embodiment, the plurality of threat parameters are encoded as a multi-dimensional feature vector stored in the memory unit **120**, wherein each feature corresponds to a normalized sensor-derived attribute. The processor **118** executes a weighted scoring function defined as a parameterized computational model, wherein weighting factors are retrieved from a lookup table or dynamically updated using prior mission data. The processor **118** performs a numerical aggregation operation comprising multiplication of each feature with a corresponding weighting factor followed by summation to generate the quantitative risk score. The ranked intervention strategy is generated by executing a comparative evaluation of a plurality of candidate intervention actions stored in the memory unit **120**, wherein each candidate action is associated with a predicted outcome score, and the processor **118** applies a sorting and selection operation to select at least one optimal strategy. The selected strategy is mapped to actuator-level command parameters including position vectors, velocity profiles, and force thresholds for execution by the motion control unit **112**.

The intelligence processing unit **108** further generates a structured threat model by embedding the quantitative risk score as a risk attribute within a machine-readable data structure representing the detected threat. Based on the structured threat model, the processor **118** evaluates a plurality of candidate intervention strategies stored in the memory unit **120**, wherein each candidate strategy is associated with predicted outcome parameters including risk level, execution feasibility, and environmental impact. The processor **118** performs a comparative evaluation and sorting operation to determine at least one ranked intervention strategy and modifies the strategy dynamically when the computed quantitative risk score exceeds a predefined threshold stored in the memory unit **120**.

In the present disclosure, the term “structured threat model” refers to a machine-readable data structure stored in the memory unit **120** comprising a set of threat parameters, associated quantitative risk scores, and contextual metadata representing characteristics of the target object. The term “ranked intervention strategy” refers to an ordered set of candidate manipulation actions, each associated with a computed risk score and execution parameters, wherein the order represents priority based on safety and effectiveness. The term “Artificial Super-Intelligence (ASI)” refers to an advanced decision-processing framework implemented through the intelligence processing unit **108** capable of multi-parameter evaluation, adaptive weighting, and strategy optimization based on stored and real-time data.

The system **100** further comprises a robotic manipulator subsystem **110** mounted on the mobile robotic platform **102**. The robotic manipulator subsystem **110** includes a multi-degree-of-freedom articulated arm, at least one end effector selected from a gripper, cutter, and disruptor interface, a wrist-mounted sensor array, and a force-feedback interface. The force-feedback interface is configured to provide real-time feedback indicative of interaction forces between the end effector and a target object during manipulation. The wrist-mounted sensor array is configured to detect contact proximity, applied force, and surface resistance, and to generate corresponding feedback signals.

A motion control unit **112** comprising control circuitry **124** is operatively coupled to the robotic manipulator subsystem **110**. The motion control unit **112** is configured to receive the ranked intervention strategy from the intelligence processing unit **108** and convert the ranked intervention strategy into actuator-specific control signals. In an embodiment, the motion control unit **112** generates trajectory parameters including joint angles, velocity profiles, and force constraints corresponding to the ranked intervention strategy, and transmits the generated actuation control signals to motor drivers associated with the robotic manipulator subsystem **110**. The motion control unit **112** receives real-time feedback signals from the force-feedback interface indicative of contact force, resistance, and positional deviation, compares the feedback signals with predefined control thresholds stored in the memory unit **120**, and generates adjusted actuation control signals by modulating grip force, velocity, and movement trajectory. The motion control unit **112** is further configured to detect changes in sensor signals and update actuation control signals within a predefined response time threshold, thereby enabling real-time responsiveness.

A communication interface **114** is configured to enable bidirectional data communication with a remote operator console. The communication interface **114** is further configured to receive control inputs and selectively switch between operational modes including tele-operated mode, assisted mode, semi-autonomous mode, and autonomous mode, and to route control authority between the remote operator console and the intelligence processing unit **108** based on the selected operational mode.

The system **100** further comprises a fail-safe control module **116** configured to monitor operational parameters including communication status, sensor confidence level, and actuator stability. The fail-safe control module **116** detects a fault condition when at least one monitored parameter deviates from a predefined safety threshold, generates a safety control signal, and executes a safe-state transition by suspending actuation, retracting the robotic manipulator subsystem **110** to a predefined safe position, and stabilizing the mobile robotic platform **102**, thereby preventing unsafe operation under degraded conditions.

The neuromorphic processing core **106**, the intelligence processing unit **108**, and the motion control unit **112** are configured to cooperatively execute a closed-loop control sequence. In operation, the neuromorphic processing core **106** receives multi-modal sensor signals from the multi-sensor perception module **104**, converts the signals into event-driven spike-based representations, and generates the fused perception output. The intelligence processing unit **108** generates the structured threat model and determines the ranked intervention strategy. The motion control unit **112** generates actuation control signals corresponding to the ranked intervention strategy, and the robotic manipulator subsystem **110** performs a physical manipulation action on a target object. Real-time feedback from the force-feedback interface is continuously processed by the motion control unit **112** and the neuromorphic processing core **106** to update actuation control signals, thereby maintaining adaptive closed-loop control.

The closed-loop control sequence enables selective processing of temporally significant sensor data, reduces redundant data processing, decreases response latency, minimizes power consumption relative to frame-based processing systems, and improves manipulation precision under hazardous bomb-disposal conditions.

According to an embodiment, the present invention relates to an Artificial Super-Intelligence based neuromorphic bomb-disposal system designed as an advanced robotic platform for detecting, analyzing, approaching, handling, and neutralizing explosive threats with minimal human exposure. The system includes a mobile robotic base, a neuromorphic processing core, an ASI-oriented decision engine, a multi-sensor perception module, a precision manipulator arm, a communication subsystem, and a human-machine supervision interface. All of these components are arranged to work together so that the unit can perform bomb-disposal tasks in teleoperated, assisted, semi-autonomous, or autonomous modes depending on mission requirements.

The mobile base of the unit is configured to move in hazardous and uncertain environments such as roadsides, buildings, airports, tunnels, industrial plants, military zones, and crowded public areas. The base may use wheels, tracks, hybrid locomotion, or articulated movement depending on terrain needs. It is equipped with drive motors, suspension support, obstacle-avoidance sensors, inertial guidance, and stabilization mechanisms so that the platform can safely travel over rough surfaces, narrow passages, debris, slopes, and unstable ground. This mobility system allows the unit to reach suspicious objects while maintaining balance and protecting sensitive onboard components during vibration or shock.

The sensory architecture of the invention forms one of its most important operational layers. The unit may include visible-light cameras, thermal imagers, depth sensors, event-based neuromorphic vision sensors, acoustic detectors, proximity sensors, gas or chemical sensors, electromagnetic anomaly detectors, tactile sensors, and force-feedback elements. These sensors continuously observe the environment and the suspicious object from different perspectives. Instead of processing all incoming data in a conventional heavy frame-by-frame manner, the neuromorphic subsystem processes significant sensory changes in an event-driven way. As a result, the unit can quickly recognize suspicious motion, surface heating, wiring patterns, casing irregularities, trigger components, contact changes, and environmental threats with lower latency and improved energy efficiency.

The processing core of the invention includes a neuromorphic computing architecture combined with an ASI-oriented intelligence layer. The neuromorphic section handles fast perception, pattern recognition, adaptive motion control, and sensor fusion using brain-inspired processing principles such as spiking or event-based computation. Above this, the ASI-oriented intelligence layer maintains a dynamic threat model. This layer evaluates what type of device may be present, how dangerous it is, what trigger mechanisms may exist, what intervention path is safest, and what consequences may arise from each possible action. It can compare live field data with stored knowledge, previous missions, learned patterns, and operator-defined safety rules. In this way, the invention supports high-level reasoning rather than simple remote mechanical operation.

The manipulator system of the unit includes a robotic arm with multiple degrees of freedom, joint control actuators, wrist articulation, end effectors, gripping tools, cutters, disruptor mounts, and optional X-ray or probe attachments. The arm is controlled through a neuromorphic motion engine that allows smooth, adaptive, and highly precise movement. During operation, the manipulator may lift covers, inspect containers, cut wires, place disruption devices, reposition suspicious packages, or remove detonating elements. Tactile and force feedback from the end effector are used by the control engine to regulate grip pressure, movement speed, and contact force in real time. This reduces the chance of accidental triggering caused by abrupt or excessive motion.

The invention also includes a supervision and communication framework through which a human bomb-disposal expert can monitor and control the platform. A control console may display camera feeds, thermal views, depth maps, hazard indicators, manipulator status, and recommended intervention strategies. The operator can authorize actions, modify task parameters, assume direct control, or permit the system to continue in assisted or autonomous mode. In certain embodiments, the interface may also support voice commands, gesture input, physiological input, or advanced cognitive command channels. Secure communication, encrypted data transmission, mission logging, and operator override functions are included to preserve safety and accountability.

An important part of the detailed invention is its fail-safe and resilience logic. If communication becomes weak or interrupted, the unit does not immediately become inactive or unsafe. Instead, the onboard intelligence can hold its last safe state, retreat, stabilize the arm, avoid further hazardous interaction, or continue only previously authorized low-risk procedures according to embedded rules. The system may also conduct self-diagnostics for sensor health, actuator status, processor integrity, and mission readiness. This makes the invention more dependable than conventional bomb-disposal robots that rely heavily on uninterrupted remote control.

Overall, the invention provides a unified bomb-disposal platform that combines smart mobility, neuromorphic perception, adaptive manipulation, ASI-based reasoning, and operator-supervised safety control into a single integrated system. Its purpose is not merely to move a robotic arm near a suspicious object, but to create an intelligent disposal unit capable of understanding, deciding, adapting, and acting with far greater speed and safety than conventional systems. This integrated design makes the invention suitable for modern explosive-threat handling where accuracy, resilience, autonomy, and protection of human life are essential.

FIG. 2 illustrates an Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit/system, according to an embodiment of the present invention. The architecture diagram represents an integrated ASI-based neuromorphic bomb disposal unit designed to perform explosive-threat detection, analysis, handling, and neutralization with minimal human risk. At the center of the diagram is the bomb disposal robot itself, shown as a tracked mobile platform carrying a robotic manipulator arm. Around this central unit, the system is organized into functional modules that work together through two-way information exchange. The arrows in the diagram indicate that the robot is not operating as a simple remote-controlled machine; instead, it continuously receives sensory data, processes that data intelligently, makes decisions, and then executes actions through movement and manipulation.

On the left upper side, the Multi-Sensor Perception Module acts as the sensing layer of the invention. This block includes HD cameras, thermal sensors, event-based vision sensors, chemical sensors, acoustic sensors, proximity sensors, and radiation or explosive sensors. Its purpose is to observe the suspicious object and surrounding environment from multiple perspectives. The HD cameras provide visual inspection, thermal sensors help identify heat signatures, chemical sensors may detect explosive vapors, acoustic sensors capture sound-based anomalies, and proximity sensors help maintain safe distance. Together, these sensors create a rich real-time picture of the threat environment. This module sends its collected information to the processing core for interpretation.

At the top center, the Neuromorphic Processing Core functions as the main intelligence-processing layer for fast perception and pattern recognition. It includes spiking neural networks and sensor fusion with pattern recognition capability. This means the system does not merely store raw sensor data; it intelligently combines and interprets it in a brain-inspired way. The neuromorphic core identifies relevant changes, detects suspicious patterns, and reduces processing delay by focusing on meaningful events. In practical terms, this enables faster recognition of bomb components, unusual object features, trigger indicators, and environmental hazards. The vertical arrow from this core to the robot indicates that the core directly supports real-time robot behavior and manipulator control.

On the upper right side, the ASI Decision Engine serves as the high-level reasoning and mission-planning block. This module performs threat analysis, risk assessment, strategy planning, and autonomous control. Once the neuromorphic core has interpreted the sensor inputs, the ASI engine evaluates what the object may be, how dangerous it is, and what disposal strategy is safest. It can compare different response options and determine whether the robot should inspect further, hold position, retreat, isolate the object, or proceed with manipulation. This block gives the system its advanced cognitive capability, allowing it to support or partially replace human decision-making in high-risk bomb disposal scenarios.

On the left middle side, the Robotic Manipulator System is the physical action arm of the invention. It includes a multi-degree-of-freedom robotic arm, tactile and force feedback, and disruptor tools. This means the robot can perform delicate tasks such as gripping, cutting, lifting, positioning neutralization tools, or moving suspicious objects. The tactile and force feedback are especially important because bomb disposal requires careful handling; even a small excess of force may cause danger. The two-way arrows between this block and the robot show that the manipulator both receives commands and returns feedback, enabling fine, controlled, and adaptive movement during operation.

At the left lower side, the Mobile Robotic Platform provides the movement and field-deployment capability of the system. It includes a tracked or wheeled base, obstacle avoidance, and terrain navigation. This block allows the unit to move safely across rough ground, stairs, debris, narrow passages, or unstable outdoor and indoor environments. In bomb disposal, mobility is essential because suspicious devices may be located in difficult positions. The platform must therefore approach carefully, maintain balance, avoid collisions, and position the manipulator accurately. This block makes the overall unit field-capable and not just a stationary handling system.

On the right middle side, the Communication and Control Interface connect the robot with the human operator. It includes the operator console, video display, haptic and voice control, and cognitive interface. This means the bomb disposal expert can monitor live video, review sensor outputs, supervise robot status, and intervene whenever necessary. Haptic and voice control improve ease of operation, while the cognitive interface suggests an advanced supervision mechanism through which the operator and intelligent system cooperate. The arrows show that this module exchanges information both with the robot and with the ASI engine, making it the bridge between human expertise and machine intelligence.

At the lower right side, the Fail-Safe and Resilience Systems block ensure operational safety. It includes emergency protocols, signal-loss handling, self-diagnostics, and safety overrides. This part is very important because bomb disposal missions cannot depend only on ideal communication and perfect hardware behavior. If the signal is interrupted, a fault occurs, or danger increases unexpectedly, the system must respond safely. This module enables the robot to stop dangerous actions, stabilize itself, preserve mission integrity, and protect both the operator and nearby people. It also supports reliability by checking system health continuously.

Overall, the diagram shows a complete closed-loop architecture in which sensing, intelligent processing, decision-making, mobility, manipulation, operator supervision, and safety protection are all integrated into one platform. The invention is therefore much more advanced than a traditional remote-controlled bomb disposal robot. It combines multi-sensor perception for awareness, neuromorphic processing for rapid brain-inspired interpretation, ASI reasoning for strategic decisions, robotic mobility and manipulation for physical action, communication interfaces for human supervision, and fail-safe systems for safety and resilience. This integrated architecture is what gives the invention its novelty and practical value for patent filing purposes.

FIG. 3 illustrates a flow chart of Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal system/unit, according to an embodiment of the present invention. This working flowchart explains how the ASI-based neuromorphic bomb disposal unit operates from mission start to mission completion. It presents the sequence of sensing, analysis, decision-making, operator supervision, physical intervention, verification, and safe shutdown. The logic of the flowchart shows that the invention is not a simple remote-controlled robot; instead, it is an intelligent bomb-disposal system that continuously observes the environment, reasons about risk, checks safety conditions, and then performs controlled neutralization or removal of the threat.

The first step is Start Mission and Initialize System. In this stage, the bomb disposal unit powers up and prepares all major subsystems for operation. This includes initializing the sensing devices, neuromorphic processing unit, ASI reasoning engine, communication link, mobility platform, manipulator arm, safety controller, and logging system. The purpose of this stage is to ensure that the robot is in a mission-ready condition before it enters a hazardous environment. Any self-check, calibration, or health verification would logically occur here so the system begins from a known safe state.

The next stage is Capture Multi-Sensor Inputs. Here, the robot gathers raw data from its sensing hardware, such as HD cameras, thermal sensors, event-based vision sensors, chemical sensors, acoustic sensors, proximity sensors, and any explosive or radiation detectors. This is the first actual interaction between the robot and the suspicious environment. The purpose is to collect as much field evidence as possible before taking action. Since bomb disposal is highly sensitive, this stage ensures that the system does not rely on a single source of information when evaluating a possible threat.

After receiving the raw inputs, the system performs Neuromorphic Perception and Sensor Fusion. This is a critical stage of the invention because it represents the brain-inspired processing capability of the platform. Instead of treating all data in a conventional heavy and slow manner, the neuromorphic logic focuses on significant changes, important patterns, and meaningful events. The sensor streams are fused together so that the system can interpret the scene more accurately. For example, it may combine visual shape, thermal signature, and chemical traces to identify whether the suspicious object behaves like an explosive device. This stage transforms raw sensor data into useful threat intelligence.

The next block is Identify Suspicious Object or Explosive Threat. At this point, the processed information is used to determine whether the object in the field is actually a potential bomb or a hazardous suspicious article. This stage may involve feature recognition, pattern matching, anomaly detection, and comparison with stored threat models. The system essentially asks whether what it sees is ordinary or dangerous. This is a very important step because all further action depends on correct identification of the suspected threat.

That leads to the first decision diamond, Threat Confirmed?. This is the first major logical checkpoint in the flowchart. If the answer is No, the robot does not proceed to intervention. Instead, it moves to Continue Monitoring and Re-scan, meaning the system keeps observing, collects more sensor data, and loops back into the sensing stage. This is a safety-oriented design because the robot avoids premature action when confidence is not sufficient. If the answer is Yes, the workflow proceeds to the disposal planning stage. This shows that the invention uses evidence-based confirmation rather than blindly reacting to every suspicious signal.

Once the threat is confirmed, the system performs Assess Risk and Generate Disposal Strategy. In this stage, the ASI-oriented intelligence evaluates how dangerous the device may be, what trigger mechanisms may exist, how stable the environment is, and what disposal method is safest. It may determine whether the device should be isolated, disrupted, cut, moved, or inspected further. This step reflects the strategic reasoning capability of the innovation. It is not only identifying a threat, but also deciding how that threat should be handled in the safest possible way.

The next step is Request Operator Approval for High-Risk Action. This block is important because it shows that the system supports human supervision for critical interventions. Even though the invention includes ASI-based reasoning and neuromorphic logic, the design still allows a human bomb-disposal expert to approve major risk-bearing actions. This makes the system practical and safer for real operations. It also supports accountability and controlled autonomy, which are very important in bomb disposal missions.

This leads to the second decision diamond, Approval Granted?. If the answer is No, the system moves to Hold Position and Await New Command. In other words, the robot does not perform the risky operation until authorization is given. It stays in a controlled and safe standby condition, ready to receive further instructions. If the answer is Yes, the system continues with physical execution. This decision stage proves that the invention is not an uncontrolled autonomous machine; it can act with supervisory permission when the circumstances demand it.

After approval, the robot proceeds to Navigate Robot to Safe Working Position. In this stage, the mobility system carefully places the unit in the most suitable operational position relative to the suspicious object. The aim is to ensure stability, maintain safe stand-off distance, avoid obstacles, and create a proper angle for manipulator action. Correct positioning is essential because even a well-planned disposal method can fail if the robot is too close, too far, unstable, or poorly aligned.

The next stage is Align Manipulator and Select Tool. Here, the robotic arm is brought into the correct orientation for the chosen task, and the proper tool is selected or positioned. Depending on the threat type, this could involve a gripper, cutter, disruptor, or isolation tool. This step highlights the precision nature of the invention. The robot must not only move toward the device, but also orient its wrist, joints, and end-effector in a carefully controlled way before making contact.

Then comes the key operational step, Inspect, Grip, Cut, Disrupt, or Isolate Threat. This is the main intervention phase of the bomb disposal mission. The robot physically acts on the suspicious object according to the disposal strategy selected earlier. It may inspect more closely, stabilize the object, sever wires, apply a disruptor, or move the object to a containment or safer location. This step represents the actual execution capability of the invention, where the combined results of sensing, intelligence, and planning are converted into field action.

After intervention, the system performs Verify Neutralization or Safe Removal. This is another crucial safety stage. The robot must confirm that the threat has actually been neutralized or safely relocated. It may use visual inspection, thermal re-check, chemical sensing, or manipulator feedback to determine whether the device is still active or hazardous. This step prevents the mission from ending too early and ensures that the system validates the result of its own action.

The next step is Store Logs and Return to Safe State. In this stage, the system records mission data, operator decisions, sensor evidence, action history, and final status. Logging is important both technically and operationally, because it supports later review, training, diagnostics, and documentation. At the same time, the robot transitions back into a safe configuration by retracting the manipulator, stabilizing its body, and reducing active intervention posture.

Finally, the mission ends at End Mission. This means the bomb disposal sequence has been completed, either because the threat was neutralized, removed, or safely resolved. At this point the system is no longer in intervention mode and can either power down, return to base, or await another task, depending on deployment requirements.

On the right side of the flowchart, the Fail-Safe and Safety Supervision block operates in parallel with the main mission steps. This block continuously monitors communication status, sensor confidence, manipulator safety, actuator condition, and power integrity. If communication is lost, confidence falls too low, motion becomes unsafe, or a fault is detected, the system can enter safe stop mode, retract the manipulator if possible, and preserve logs and alerts. This means safety monitoring is not an afterthought; it runs alongside the whole mission and can influence execution whenever necessary.

The bottom of the flowchart summarizes this protective logic by stating that if communication is lost or risk exceeds the permitted threshold, the system stops hazardous action, preserves evidence, and returns to a controlled safe state. This note reflects the fundamental design philosophy of the invention: intelligent action must always remain subordinate to safety. Overall, the flowchart clearly explains that the present invention bomb disposal unit operates through a closed-loop process of sensing, interpreting, confirming, planning, approving, acting, verifying, logging, and safeguarding throughout the mission.

FIG. 4 illustractes a logic layer architecture of an Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit/system, according to an embodiment of the present invention. The software and logic layer diagram represents the intended decision flow of the ASI-based neuromorphic bomb disposal unit, starting from sensing, then interpretation, then intelligent reasoning, then action execution, and finally safety supervision with continuous feedback. Although a few labels in the generated image appear duplicated or misspelled, the overall logic is clear: the system first collects raw signals from the environment, converts those signals into meaningful threat information, evaluates risk and strategy using ASI-based reasoning, carries out a disposal or neutralization action, and continuously checks safety conditions before, during, and after execution.

The first layer is the Multi-Sensor Perception and Signal Input Layer. This is the entry point of the entire software system. It receives raw data from HD video feeds, event-based vision sensors, thermal or infrared sensing, chemical and gas detectors, radiation detectors, acoustic and vibration sensors, and proximity or touch signals. In simple terms, this layer acts like the robot’s sensory nervous system. It does not yet make high-level decisions; instead, it gathers all possible environmental evidence about the suspicious object, surrounding terrain, and risk conditions. Its purpose is to ensure that the robot is not depending on one single sensor, because bomb disposal requires multiple sources of information for reliable operation.

The second layer is the Neuromorphic Perception and Interpretation Layer. This layer performs event-driven signal processing, rapid feature extraction, object recognition, trigger-pattern detection, and sensor-fusion correlation. Here, the raw inputs from the first layer are converted into meaningful machine-understandable information. For example, the layer may determine whether a heat signature is abnormal, whether a wiring pattern resembles an improvised explosive trigger, whether motion or vibration is risky, or whether contact pressure has changed during manipulator movement. This layer is called neuromorphic because it is intended to process information in a brain-inspired manner, focusing on important changes and patterns rather than treating all input equally. As a result, the system can respond faster and more efficiently in hazardous environments.

The third layer is the ASI Reasoning and Decision Layer, shown in the diagram as the main intelligence layer. This is where the interpreted information from the neuromorphic layer is turned into actionable mission logic. In this layer, the system performs risk and threat assessment, strategy evaluation, autonomous action planning, terrain navigation reasoning, and robotic arm control planning. In practical terms, this layer decides what the robot should do next. It may determine whether the suspicious object should first be inspected, whether the robot should reposition for better access, whether a tool should be deployed, whether the arm should stop movement, or whether the device should be isolated instead of immediately neutralized. This is the central decision-making brain of the invention.

The upper ASI block in the diagram appears to represent a supervisory or higher-priority ASI control stage. Even though the generated figure repeats the title in a confusing way, the intended meaning is that there is a higher-level strategic reasoning function above the normal action-planning layer. This supervisory stage likely refines or approves the operational decisions before the final neutralization step. In patent terms, this can be understood as a strategic intelligence level that compares possible interventions, evaluates consequences, checks mission goals, and coordinates disposal strategy with navigation and manipulator readiness. So, the lower ASI block can be seen as operational planning, while the upper ASI block can be interpreted as mission-level decision supervision.

Above the ASI reasoning stage is the Threat Neutralization or Removal Step, which is the execution layer of the logic architecture. This layer carries out bomb disruption tactics, defusing or disarming operations, object isolation or containment, and safe relocation of the threat. In other words, once the system has sensed the environment, interpreted the threat, and chosen the safest strategy, this is the layer where physical action happens. It represents the point where logic becomes mission execution. The actions produced here may involve movement of the robot base, positioning of the manipulator, deployment of neutralization tools, or controlled relocation of the suspicious object.

On the right side of the diagram is the Safety and Resilience Module, which acts as a cross-layer protection mechanism rather than a simple standalone block. This module includes self-diagnostics and health monitoring, emergency protocols and system overrides, operator approval for high-risk actions, and mission safety logic. Its role is critical because bomb disposal software must never operate only on mission success; it must also continuously protect against unsafe behavior. This module checks whether the hardware is healthy, whether communications are stable, whether an action exceeds allowed safety thresholds, and whether human approval is needed before proceeding. If any dangerous or uncertain condition appears, this module can stop, override, or modify the planned action.

The arrows between the ASI layers, neutralization step, and safety module indicate continuous closed-loop supervision. This means the robot does not make one decision and blindly continue. Instead, it keeps checking whether the action is still safe, whether the manipulator is functioning correctly, whether the threat state has changed, and whether the chosen strategy remains valid. This feedback-based design is important because explosive devices may behave unpredictably, and a safe action at one moment may become unsafe a few seconds later.

The lower right feedback area of the diagram appears to represent a state feedback and operational status layer. Even though some labels in that section are not cleanly rendered, the intended meaning is that the system receives ongoing feedback about motor health, tactile system condition, threat status, and risk assessment updates. This feedback returns to the neuromorphic and ASI layers so the machine can revise its understanding and modify its next action. In effect, this is the self-correcting mechanism of the invention. It ensures that perception, reasoning, and action are always linked by real-time status monitoring.

Overall, the diagram describes a layered intelligent software architecture in which sensing forms the foundation, neuromorphic interpretation extracts threat meaning, ASI reasoning selects strategy, the execution layer performs neutralization or removal, and the safety module continuously supervises all actions. The value of this architecture is that it transforms bomb disposal into a closed-loop intelligent mission process rather than a simple remote-control task. It gives the system the ability to observe, understand, decide, act, and re-evaluate repeatedly until the mission is safely completed.

FIG. 5 illustrates an external device view of Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit, according to an embodiment of the present invention. Fig. 5 shows the external device view of the present ASI-based neuromorphic bomb disposal unit, meaning it presents how the main parts of the machine are physically arranged on the outside. The unit is built as a tracked robotic platform carrying a multi-jointed robotic arm and an elevated sensor mast. Its working principle is simple in sequence: first it observes the suspicious environment through its sensors, then it sends that information to the onboard intelligence system, after that it approaches the object safely, and finally it uses the robotic arm and tools to inspect, grip, cut, disrupt, or isolate the threat without placing a human operator in direct danger.

At the upper portion of the robot, the sensor mast acts as the observation tower of the system. This mast raises the sensing devices above the main body so the robot can look farther ahead and view suspicious objects from a better angle. By placing the cameras and sensors on a mast, the unit can inspect an area before the full robot body gets too close. This is especially useful when the suspicious object is hidden behind an obstacle, placed on the ground, or located in a cluttered environment. The mast therefore improves field visibility and helps the machine collect safer stand-off information before manipulation begins.

Mounted on the mast are the HD cameras, thermal camera, and event-based vision sensor. The HD cameras provide clear visual images for object identification, wire inspection, label reading, and general navigation. The thermal camera detects unusual heat patterns, which may indicate an active circuit, battery heating, or a recently handled device. The event-based vision sensor is intended for fast motion-sensitive detection, allowing the robot to notice meaningful changes in the scene with very low delay. Together, these visual sensing elements provide complementary information so the robot can understand both the appearance and behavior of the suspicious object and its surroundings.

The mast area also includes the chemical sensor, which is intended to detect the possible presence of explosive vapors or hazardous chemical traces near the suspicious object. This adds another layer of inspection because some threats cannot be judged safely by visual appearance alone. The robot may first scan the environment visually, then move closer only after confirming that chemical indicators and other sensor signals remain within acceptable limits. In this way, the machine combines external sensing with intelligent decision-making before physical contact is attempted.

On the side of the mast and upper body, the diagram shows the antenna and GPS module. The antenna supports wireless communication between the robot and the operator control station, enabling remote supervision, command input, and real-time transmission of camera feeds and status information. The GPS module helps determine outdoor position and route awareness, especially during field deployment in military zones, public places, roadsides, or large industrial areas. These components ensure that the robot does not act in isolation but remains connected to a remote human expert who can monitor or override its actions when required.

The central mechanical action part of the device is the robotic arm. This arm is mounted on the main chassis and has multiple articulated joints so it can extend, raise, rotate, bend, and approach the suspicious object from different angles. Its purpose is to perform the dangerous physical work that would otherwise be done by a bomb disposal technician. Once the sensors and onboard intelligence determine that the object needs closer inspection or intervention, the arm moves into position and carries the required tool to the exact working point. The arm is designed for controlled and careful movement because even small sudden motions can be risky in bomb disposal operations.

Near the front portion of the arm, the diagram shows tool mounts, which indicate places where handling or neutralization tools can be attached. These mounts allow the robot to be configured for different tasks depending on the nature of the threat. One mission may require gripping and lifting, another may require cutting wires, and another may require applying a disruptor tool. This modular arrangement is important for a patent concept because it shows that the same robotic platform can support different external operational tools without redesigning the whole system.

At the end of the arm, the gripper, cutter, disruptor, and wrist rotation functions form the active end-effector assembly. The gripper is used to hold, stabilize, or move suspicious items. The cutter is intended for controlled cutting operations, such as severing wires or removing parts of a device under guided conditions. The disruptor is typically used to neutralize or disable a threat through a controlled intervention method. The wrist rotation feature allows the end-effector to rotate and align correctly with the target, which is essential when the robot must approach from a difficult angle or position the tool precisely. Together, these components allow the robot not only to observe a threat but also to physically act on it in a careful, mission-specific way.

The lower part of the system is the tracked mobile base, which supports the entire robot and allows it to travel over rough ground, debris, uneven terrain, or confined approaches. Tracks are especially useful in bomb disposal because they give better stability and traction than simple wheels in hazardous environments. The base carries the chassis, sensors, power system, control electronics, and arm mount. It moves the robot to the target area, stabilizes the platform during arm operations, and helps maintain safe balance when the arm is extended. This means the base is not just for transport; it is also an important part of operational safety.

In practical working sequence, the robot would first approach the suspicious area at a safe distance while using the mast sensors to inspect the scene. After identifying the object and evaluating risk, the onboard intelligence and remote operator would decide the safest action. The tracked base would then position the robot carefully, the arm would extend toward the object, the wrist and tools would align, and the gripper, cutter, or disruptor would perform the selected operation. Throughout this process, the antenna and communication systems keep the operator informed, while the sensing components continue feeding information back to the control system.

Overall, the diagram shows that the invention works as a sensor-guided, intelligence-assisted, remotely supervised bomb disposal platform. Each external component has a clear role: the mast senses, the communication units connect, the tracked base moves, the arm reaches, and the end tools act on the threat. By combining these external parts into one coordinated machine, the device allows dangerous bomb disposal tasks to be carried out with greater distance, precision, and safety than direct human handling.

FIG. 6 illustractes a communication architecture of an Artificial Super-Intelligence (ASI)-based neuromorphic bomb disposal unit, according to an embodiment of the present invention. Fig. 6 represents the communication architecture of the present ASI-based neuromorphic bomb disposal system, showing how information flows between the operator console and the robotic bomb disposal unit through a secure wireless network. Its main purpose is to ensure that commands, live sensor data, video feeds, system status, threat alerts, and emergency override instructions can move safely and reliably between the remote operator and the robot during bomb-disposal missions. Even though a few labels in the generated figure contain spelling errors, the intended communication structure is clear and technically understandable.

On the left side, the architecture begins with the operator console. This is the human control station from which the bomb-disposal expert supervises the mission. The console typically includes a display screen, control software, and input devices that allow the operator to view live video, check sensor readings, send motion commands, select tools, approve high-risk actions, and monitor system health. In practical operation, this console acts as the command center for the entire robot mission.

Below the operator console, the control interface is shown as the functional layer that manages video, sensor feeds, commands, and status signals. This means the operator does not directly communicate with low-level robot electronics; instead, the control interface organizes all incoming and outgoing mission information into a usable command-and-monitoring environment. It collects live feedback from the robot and presents it to the operator in a manageable way, while also converting operator decisions into control instructions.

The next block on the operator side is the encode/decode module, which performs encryption and signal processing. This is a critical security element of the architecture. Before operator commands are transmitted to the robot, they are encoded and encrypted so that the communication remains protected against interception, tampering, or unauthorized access. Likewise, information coming back from the robot is decoded and processed before being displayed at the console. This block therefore acts as the secure gateway between the control interface and the wireless communication hardware.

Below that is the operator transmitter/receiver module. This is the radio communication hardware at the operator side. Its task is to physically send encrypted commands, messages, and control signals to the robotic unit and receive return data such as live video, sensor outputs, and status updates. In short, this module provides the actual wireless communication link that connects the human operator to the bomb-disposal machine.

The central vertical section of the figure highlights the secure encrypted wireless link. This is the communication bridge between the remote operator and the robot. The diagram emphasizes that this link carries protected data rather than open signals. That is very important in bomb disposal, because the system may be operating in hostile, sensitive, or high-risk environments where communication integrity is essential. The architecture is designed so that not only normal mission commands but also emergency instructions and feedback signals are exchanged over protected channels.

On the right side, the main receiving part of the robot is the onboard transmitter/receiver module. This is the robot-side wireless communication hardware that receives operator instructions and transmits back field information. It serves as the robot’s radio gateway. Any command sent by the operator first arrives here, and any response from the robot—such as status, location, video, or alerts—passes back through this unit toward the control console.

Below that, the figure shows another transmitter/receiver module connected to the robot’s internal control system. Although the labeling is imperfect, the intended function is that the robot has internal communication handling between the wireless receiver and the main onboard processor. This means received commands do not directly move the motors or arm; instead, they are passed to the robot’s processing and decision hardware, which then decides how to execute them safely and correctly.

At the center of the robot-side logic is the processor unit / ASI decision engine. This is the main onboard intelligence block. Once communication arrives from the operator, the processor interprets the commands, combines them with current sensor data, and applies the system’s decision logic. It may also generate autonomous responses, risk warnings, or safety corrections. In other words, the processor is the point where communication and intelligent mission control meet. It ensures that instructions are not only received but are evaluated in the context of real-time threat conditions.

The figure/diagram also includes a remote GPS module on the robot side and an operator GPS module on the operator side. These modules indicate that location awareness is part of the communication architecture. GPS information may help the system track the robot’s position, coordinate deployment, record mission location, and support navigation in outdoor or field-based bomb-disposal scenarios. This adds an important situational-awareness layer to the communication network.

The sensor suite block on the operator side represents the variety of robot-generated inputs that can be transmitted back through the communication system. These may include video, thermal data, chemical sensing, and other environmental observations. The meaning is that the operator does not only send commands to the robot; the robot also continuously sends sensory information back to the operator. Thus, communication in this architecture is bidirectional: command flow moves toward the robot, while intelligence and feedback flow back toward the operator.

Near the lower middle area, the diagram also shows an encrypted signal authorized override channel. This is an important emergency feature. It means that under critical conditions, the operator may send a special high-priority override command to the robot. Such a channel is useful when the operator must immediately stop motion, retract the manipulator, cancel a risky autonomous step, or force the robot into a safe state. This override path strengthens operational safety and gives the human controller final authority when needed.

The lower-right area connects the processor with the manipulator and motor control functions of the robot. This means the communication system is not limited to abstract data exchange; it ultimately supports real physical action. Commands received from the operator, or decisions generated by the ASI engine, are translated into manipulator movement, track motion, or tool operation. Likewise, feedback from these systems can be sent back through the processor and communication link to inform the operator about execution status and safety conditions.

The communication status / system feedback pathway shown near the bottom indicates that the robot continually reports its condition back to the operator. This may include communication quality, operational constraints, system warnings, arm status, motor status, and other mission-relevant information. This constant feedback loop is essential for bomb disposal because the operator must know not only what the robot sees, but also whether the robot itself is functioning safely and reliably.

The note at the bottom explains the significance of the override channel, stating that it acts as a secure backup frequency for immediate remote control signals during emergencies. This confirms that the architecture has been designed with redundancy and safety in mind. If the normal communication path becomes unreliable or the situation suddenly becomes dangerous, the operator still retains a protected route to assert control.

Overall, the figure explains a secure, bidirectional, intelligence-assisted communication framework for the bomb-disposal system. The operator console forms the human command center, encryption modules protect the data, wireless transmitter/receiver blocks create the remote link, the onboard processor interprets commands and sensor feedback, and the manipulator and motor systems carry out the resulting action. Thus, the communication architecture supports not just remote control, but secure supervision, real-time feedback, emergency override, and intelligent coordination between the human operator and the robotic bomb-disposal unit.

FIG. 7 an exploded view of Robotic bomb disposal unit/system, according to an embodiment of the present invention. The system covers are the external protective enclosure panels of the device. Their main function is to shield the internal electronics, wiring, processors, and sensor-support structures from dust, moisture, impact, vibration, and accidental contact during bomb-disposal operations. These covers also help maintain mechanical rigidity and provide access points for servicing, replacement, and maintenance. In a patent context, they may be described as removable or fastened panels that protect sensitive internal assemblies while preserving overall structural integrity.

The sensor mast is the elevated support structure that positions the sensing elements above the main chassis. Its purpose is to provide a better field of view, extended visual reach, and safer stand-off sensing before the robot body approaches a suspicious object.

By mounting the cameras and other detection units higher than the base, the system can observe obstacles, identify threats, and inspect surrounding conditions more effectively. The mast therefore improves situational awareness and helps the robot operate in cluttered or hazardous environments.

The sensor mast base is the mounting interface that secures the sensor mast to the upper body of the robot. It provides mechanical stability, alignment, and load support for the mast and any sensing hardware mounted on it. This base may also contain routing paths for wires, signal lines, and connectors passing between the mast-mounted sensors and the internal electronics. In operation, it ensures that the mast remains rigid and stable even when the robot is moving across uneven terrain.

The sensor unit housing is the enclosure that contains and protects the sensing electronics associated with the mast and perception system. Its function is to physically shield sensor modules, interface circuits, and connectors from environmental exposure, physical shock, and electromagnetic interference. This housing may also support thermal dissipation, cable management, and component organization. In practical use, it keeps the perception hardware safe while allowing the sensor system to operate reliably in field conditions.

The sensor unit circuitry is the electronic circuit assembly dedicated to receiving, conditioning, and forwarding raw sensor signals. This circuitry may include interface boards, signal converters, data acquisition components, filtering logic, and power-conditioning elements for the attached sensors. Its role is to prepare the outputs of cameras, thermal sensors, event-based vision devices, chemical detectors, and other sensors so the processing system can use them accurately. It acts as the first electronic stage of perception inside the bomb-disposal unit.

The antenna module provides the physical wireless communication interface of the system. It enables the robot to send and receive encrypted signals, telemetry, control commands, status data, and sensor information to and from the remote operator console or command station. The antenna module is essential for maintaining real-time communication during bomb-disposal missions, especially where direct human proximity is unsafe. It may support one or more radio channels for normal control, data feedback, and emergency override communication.

The processor housing is the protective enclosure that contains the main computational hardware. Its purpose is to shield the processing electronics from dust, vibration, thermal stress, and accidental mechanical damage. The processor housing also helps organize internal components such as processor boards, memory units, connectors, and support circuits. In many embodiments, it may also provide mounting features, thermal paths, and access openings for servicing the core computing hardware.

The processor unit is the primary computational control hardware of the device. It coordinates sensor acquisition, data processing, mobility commands, manipulator control, communication handling, and system-state management. This unit receives information from the sensor circuitry and converts it into meaningful machine-level decisions or actions. In the overall architecture, it serves as the central control hub that links perception, intelligence, actuation, and communication.

The ASI decision engine is the higher-level intelligence layer associated with the processor unit. Its function is to analyze threats, assess risk, compare action choices, generate disposal strategies, and support intelligent decision-making for bomb-neutralization tasks. It may evaluate environmental conditions, probable trigger mechanisms, manipulator access paths, and possible intervention outcomes before selecting or recommending an action. In simple terms, it is the strategic reasoning section of the system that elevates the robot beyond basic remote control.

The system unit is the main structural and functional body section that supports the internal electronics and upper mechanical assemblies. It serves as an intermediate chassis portion connecting the processor section, arm base, and lower power and mobility subsystems. This unit provides mounting space, alignment surfaces, and protected internal volume for major device components. It can be viewed as the core body housing around which the rest of the robot is assembled.

The arm base is the mounting and rotational support structure for the robotic manipulator. Its purpose is to anchor the manipulator securely to the chassis while allowing controlled movement of the arm through one or more primary joints. It transfers loads from the manipulator to the main body and helps maintain stability when the arm is extended or carrying a tool. In bomb-disposal work, the arm base is critical because it supports precise, controlled, and vibration-minimized manipulation.

The multi-degree-of-freedom manipulator with tool end-effector is the main operational handling arm of the invention. It is composed of multiple joints and articulated links that allow extension, lifting, rotation, bending, and precise positioning. The tool end-effector at its distal end may be a gripper, cutter, disruptor, probe, or another specialized disposal tool. Its job is to physically inspect, grip, cut, isolate, or neutralize a suspicious device while keeping the human operator at a safe distance. This is the primary action-performing component of the bomb-disposal unit.

The cooling fans are thermal-management components that remove heat from the internal electronics and power systems. Their purpose is to keep the processor, driver circuits, and other heat-generating hardware within safe operating temperatures. Since high-performance processing and motor-driving operations can generate substantial heat, the fans help maintain reliability, prevent overheating, and extend component life.

In hazardous field use, proper cooling is important for stable and uninterrupted device performance.

The battery pack is the onboard energy-storage source that powers the entire system. It supplies electrical power to the processors, sensors, communication modules, actuators, mobility motors, and cooling components. The battery pack enables the bomb-disposal unit to operate as a mobile field robot without needing an external tethered power line. In patent description terms, it may be defined as a rechargeable, protected power source designed for safe, portable, high-reliability mission use.

The internal frame is the structural support skeleton inside the lower body of the robot. It provides mounting surfaces and mechanical reinforcement for the battery pack, processor sections, motor drivers, and other major internal components. The frame distributes loads, resists torsion, and helps maintain overall chassis strength during movement, arm operation, and shock exposure. It is essentially the structural backbone of the internal device arrangement.

The drive motors / actuators are the powered mechanical elements that generate movement in the robot. Some of these motors drive the tracks for mobility, while others may support arm movement, rotation, or other mechanical functions. Their purpose is to convert electrical power into controlled physical motion. In the context of this invention, these actuators are crucial because they allow both locomotion and precise bomb-handling operations under remote or intelligent control.

The component frame and mount points are the designated structural areas where different modules are attached to the robot. These points ensure proper alignment, secure fastening, modular replacement, and load transfer between assemblies. They enable the chassis to hold the processor housing, battery pack, frame plates, manipulator base, and other device sections in a stable and serviceable arrangement. From a patent perspective, these mount points help define the assembly architecture of the device.

The drive track assembly is the lower mobility mechanism that allows the bomb-disposal unit to move across rough ground, debris, confined passages, and unstable surfaces. It typically includes the continuous track, support rollers, drive sprockets, and structural side assemblies. Its main purpose is to provide traction, stability, and load-bearing movement in environments where ordinary wheeled platforms may struggle. This assembly gives the robot the ability to approach hazardous objects safely while maintaining balance during manipulator operation.

Taken together, these components form a complete bomb-disposal machine in which the upper section provides sensing and intelligence, the middle section provides processing and manipulation, and the lower section provides power, structure, and mobility. Each component has a distinct role, but all of them are mechanically and functionally integrated so the system can detect, analyze, approach, handle, and neutralize explosive threats with reduced human risk.

In one embodiment, the system works as an intelligent robotic bomb-disposal platform that first senses the environment, then interprets the threat, next decides the safest response, and finally performs the required physical action through its manipulator system. Its purpose is to keep the human operator away from direct danger while still allowing precise inspection and neutralization of a suspicious explosive object. The device combines a mobile robotic base, a multi-sensor mast, a neuromorphic processing unit, an ASI-based decision layer, a robotic arm with specialized tools, and a fail-safe control system.

At the beginning of operation, the device is deployed near the suspicious area and its tracked or wheeled base moves it toward the target under remote supervision or assisted autonomy. During this stage, the sensor mast continuously captures information through HD cameras, thermal imaging, event-based vision sensors, chemical sensors, acoustic sensors, proximity sensors, and explosive or radiation detectors. These sensors allow the robot to observe the object and its surroundings from multiple perspectives without making immediate physical contact. In this way, the system first builds situational awareness before taking any risky action.

The collected sensor signals are then sent to the neuromorphic processing core. This part of the device works in a brain-inspired manner, meaning it focuses on meaningful changes and relevant patterns rather than processing all data in a slow conventional way. It performs rapid sensor fusion, object recognition, anomaly detection, and trigger-pattern identification. As a result, the machine can quickly determine whether the suspicious article resembles a bomb, improvised explosive device, hazardous container, or non-threatening object. This stage improves speed, reduces computational delay, and supports operation in dynamic environments.

After perception and interpretation, the ASI-based reasoning layer evaluates the level of threat and determines the safest disposal strategy. It may assess probable trigger mechanisms, surrounding hazards, terrain conditions, manipulator access angle, and likely consequences of each possible action. Based on this analysis, the system can recommend inspection, isolation, gripping, wire cutting, disruption, or safe relocation. In higher-autonomy mode, it can generate an action plan on its own, while in supervised mode it presents the recommendation to the human operator for approval before execution.

Once the strategy is selected, the mobile base positions itself at a safe working distance and the robotic manipulator arm begins operation. The arm contains multiple joints, wrist rotation, and tool mounts so it can approach the suspicious object from a suitable angle. Depending on the mission, the end-effector may use a gripper to hold the object, a cutter to sever wires, a disruptor to neutralize it, or another specialized tool to isolate or move it. Force and tactile feedback help the arm regulate pressure and movement so that delicate bomb components can be handled with greater precision and reduced risk of accidental activation.

Throughout the entire mission, the operator can monitor the robot through the control interface, which may provide live video, sensor outputs, status information, and action prompts. The system can work in teleoperated, assisted, semi-autonomous, or autonomous modes, depending on the operational requirement. This means the operator may directly command every movement, approve only high-risk actions, or allow the machine to execute low-risk steps automatically. This flexible control structure makes the device suitable for both controlled and unpredictable field conditions.

A key part of the present device is its fail-safe and resilience logic. During operation, the system continuously checks communication status, sensor confidence, actuator health, and mission risk. If communication is lost, if confidence falls below a safe threshold, or if the manipulator detects unsafe movement, the robot can stop hazardous action, retract the arm if possible, preserve evidence and mission logs, and return to a controlled safe state. This makes the device more dependable than conventional bomb-disposal robots that rely only on continuous remote control.

The present invention works by combining sensing, neuromorphic interpretation, ASI-based reasoning, robotic manipulation, supervised decision-making, and continuous safety monitoring into one integrated device. It does not merely move a robotic arm toward a suspicious object; it intelligently observes, analyzes, plans, acts, verifies, and safeguards the mission from start to finish.

FIG. 8 illustrates a flow chart representing a method for intelligent bomb-disposal performed by an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system **100**, according to an embodiment of the present invention. The method is executed as a closed-loop control process integrating sensing, neuromorphic processing, threat evaluation, decision generation, actuation, and feedback-based adjustment.

The method comprises initializing the system **100**, wherein the mobile robotic platform **102**, the multi-sensor perception module **104**, the neuromorphic processing core **106** including neuromorphic hardware circuitry **122**, the intelligence processing unit **108** including processor **118** and memory unit **120**, the motion control unit **112** including control circuitry **124**, the robotic manipulator subsystem **110**, the communication interface **114**, and the fail-safe control module **116** are activated and configured for operation. Initialization further includes calibration of sensors and verification of system readiness.

At step **802**, the method comprises acquiring multi-modal sensor signals using a plurality of sensors mounted on a mobile robotic platform **102**. The acquired signals include visible-spectrum imaging data, thermal data, depth data, event-based vision data, chemical or vapor detection signals, proximity signals, and tactile or force feedback signals corresponding to a target object and its surrounding environment.

At step **804**, the method comprises converting the acquired multi-modal sensor signals into event-driven spike-based signal representations using the neuromorphic processing core **106**. In an embodiment, temporal changes in the sensor signals exceeding a predefined threshold generate asynchronous spike events, and the neuromorphic hardware circuitry **122** processes the spike events using spiking neuron models configured for event-driven propagation, thereby reducing redundant processing of static sensor data.

At step **806**, the method comprises generating a fused perception output using the neuromorphic processing core **106**, based on the event-driven spike-based signal representations. The spike-based representations from multiple sensor modalities are temporally aligned and correlated to produce a structured representation comprising spatial features, thermal characteristics, chemical signatures, and proximity data associated with the target object. The fused perception output is transmitted to the intelligence processing unit **108** via a data interface in a predefined structured data format.

At step **808**, the method comprises generating a structured threat model based on the fused perception output, using at least one processor **118** of the intelligence processing unit **108**. The processor **118** extracts a plurality of threat parameters from the fused perception output, including structural characteristics, presence of trigger mechanisms, environmental instability indicators, and anomaly indicators, and encodes the extracted parameters into a machine-readable data structure stored in the memory unit **120**.

Further, the method comprises computing a quantitative risk score associated with the target object. In an embodiment, the plurality of threat parameters are encoded as a multi-dimensional feature vector stored in the memory unit **120**, wherein each feature corresponds to a normalized sensor-derived attribute. The processor **118** executes a weighted scoring function defined as a parameterized computational model, wherein weighting factors are retrieved from a lookup table or dynamically updated using prior mission data. The processor **118** performs a numerical aggregation operation comprising multiplication of each feature with a corresponding weighting factor followed by summation to generate the quantitative risk score representing a probability of hazardous response.

At step **810**, the method comprises determining at least one ranked intervention strategy based on the computed quantitative risk score. The processor **118** evaluates a plurality of candidate intervention strategies stored in the memory unit **120**, wherein each candidate strategy is associated with a predicted outcome score. The processor **118** performs a sorting and selection operation to generate an ordered set of intervention strategies and selects at least one optimal strategy having a minimum computed quantitative risk score among the evaluated candidate strategies

At step **812**, the method comprises generating actuation control signals corresponding to the at least one ranked intervention strategy using the motion control unit **112**. The motion control unit **112** converts the selected intervention strategy into actuator-specific control parameters including joint angles, velocity profiles, and force constraints, and transmits corresponding control signals to motor drivers associated with the robotic manipulator subsystem **110**. The selected intervention strategy is provided as an input to the motion control unit **112** for execution.

At step **814**, the method comprises actuating the robotic manipulator subsystem **110** to perform a physical manipulation action on the target object based on the generated actuation control signals, wherein the manipulation action includes at least one of gripping, cutting, repositioning, and disrupting the target object.

The method further comprises receiving real-time feedback signals from a force-feedback interface associated with the robotic manipulator subsystem **110**, wherein the feedback signals are indicative of contact force, resistance, and positional deviation during interaction with the target object.

At step **816**, the method comprises updating the actuation control signals based on real-time feedback signals from a force-feedback interface. The motion control unit **112** compares the feedback signals with predefined control thresholds stored in the memory unit **120** and dynamically adjusts the actuation control signals to maintain stable and controlled interaction with the target object.

The method further comprises detecting changes in sensor signals and updating system response, wherein the neuromorphic processing core **106** and the motion control unit **112** cooperate to update the actuation control signals within a predefined response time threshold in response to detected changes, thereby ensuring real-time responsiveness.

The method further comprises executing a fail-safe control operation, wherein the fail-safe control module **116** monitors communication status, sensor confidence level, and actuator stability, and upon detection of a fault condition, generates a safety control signal and transitions the system **100** to a safe state.

The steps **802** to **816** are executed iteratively to form a closed-loop control process, wherein sensor inputs, processing outputs, and feedback signals are continuously updated, thereby achieving reduced latency, improved precision, and enhanced operational safety compared to conventional frame-based systems.

In an embodiment corresponding to step **804**, the conversion of multi-modal sensor signals into event-driven spike-based signal representations comprises encoding sensor signals into spike trains using a temporal encoding function, wherein a spike event is generated when a rate of change of a sensor signal exceeds a predefined threshold. In a further embodiment, only changes in sensor signals are encoded, and static or non-changing signal components are suppressed, thereby reducing redundant data processing and enabling low-latency perception. The neuromorphic hardware circuitry **122** processes the generated spike trains using layers of spiking neurons configured with programmable synaptic weights to extract temporal and spatial features, wherein synaptic weights are stored in memory and updated based on observed signal correlations, thereby enabling efficient feature detection and adaptive perception.

In an embodiment corresponding to step 808 to a step of computing a quantitative risk, the structured threat model is generated by encoding the plurality of threat parameters into a multi-dimensional feature vector stored in the memory unit **120**, wherein each feature corresponds to a normalized sensor-derived attribute. The processor **118** executes a processor-implementable computational model comprising a weighted scoring function, wherein weighting factors are retrieved from a lookup table stored in the memory unit **120** or dynamically updated using prior mission data. The processor **118** performs a numerical aggregation operation comprising multiplication of each feature with a corresponding weighting factor followed by summation to generate a quantitative risk score representing a probability of hazardous response associated with the target object. The structured threat model is stored as a machine-readable data structure comprising the feature vector, associated weighting factors, and the computed quantitative risk score.

In one embodiment, the method further comprises determining the at least one ranked intervention strategy comprises evaluating multiple candidate strategies and selecting a strategy minimizing a computed risk score. In an embodiment corresponding to step **810**, determining the at least one ranked intervention strategy comprises evaluating a plurality of candidate intervention strategies stored in the memory unit **120**, wherein each candidate strategy is associated with a predicted outcome score derived from the computed quantitative risk score and contextual parameters. The processor **118** performs a sorting and selection operation on the candidate strategies based on their associated scores to generate an ordered set of ranked intervention strategies and selects at least one optimal intervention strategy having a minimum computed quantitative risk score among the evaluated candidate strategies.

In an embodiment corresponding to steps **812–816**, the selected intervention strategy is mapped to actuator-level control parameters including position vectors, joint angles, velocity profiles, and force thresholds for execution by the motion control unit **112**.

The motion control unit **112**, comprising control circuitry **124**, generates actuation control signals based on the mapped parameters and transmits the signals to motor drivers associated with the robotic manipulator subsystem **110**. The motion control unit **112** further receives real-time feedback signals from a force-feedback interface indicative of contact force, resistance, and positional deviation, compares the feedback signals with predefined thresholds stored in the memory unit **120**, and dynamically updates the actuation control signals to maintain stable and adaptive manipulation under varying interaction conditions.

The present invention offers a major safety advantage by reducing direct human exposure to bombs, improvised explosive devices, and other hazardous explosive objects. Instead of sending a human operator close to the threat, the robotic unit performs inspection, approach, handling, and neutralization from a safer distance. This significantly lowers the chance of injury or death during bomb-disposal missions.

Another important advantage is its intelligent decision-making capability. By combining neuromorphic processing with an ASI-based reasoning layer, the system can analyze sensor inputs rapidly, identify suspicious threat patterns, assess risk, and recommend or execute safer intervention strategies. This reduces operator burden and improves the speed and quality of disposal decisions in high-pressure situations.

The invention also provides superior multi-sensor situational awareness. It can integrate visual, thermal, event-based vision, chemical, acoustic, proximity, and explosive-sensing inputs into one unified threat picture. Because of this, the robot can detect hidden dangers more effectively than systems relying only on ordinary camera-based inspection.

A further advantage lies in its low-latency neuromorphic architecture. Since the system is designed to process meaningful events rather than all data uniformly, it can react faster and more efficiently in dynamic environments. This improves real-time perception, manipulator response, navigation accuracy, and overall mission reliability while also supporting better power efficiency.

The robotic manipulator of the invention provides precise and adaptive explosive-handling capability. With multi-degree-of-freedom movement, wrist rotation, tactile and force feedback, and support for tools such as grippers, cutters, and disruptors, the system can perform delicate operations with greater control. This reduces the risk of accidental triggering caused by abrupt or poorly regulated movement.

The invention further supports multiple operational modes, including teleoperated, assisted, semi-autonomous, and autonomous control. This flexibility allows the system to be used in both highly supervised missions and more complex field situations where partial autonomy is necessary. It therefore adapts well to different operational doctrines and threat scenarios.

Another technical advantage is its fail-safe and resilience capability. The system can monitor communication quality, sensor confidence, actuator condition, and mission risk in real time. If communication is lost or unsafe conditions arise, it can stop hazardous action, retract if possible, preserve logs, and return to a controlled safe state. This makes the invention more dependable than ordinary remote bomb-disposal robots.

The invention is also modular and upgradeable. Different sensor combinations, tool heads, communication modules, and mobility platforms can be integrated depending on operational needs. This makes the platform suitable for long-term deployment and future technical improvements without requiring a complete redesign.

It is also highly applicable in police, counter-terrorism, and homeland security operations, where suspicious packages, vehicle-borne threats, public-area explosive threats, and improvised devices must be examined and neutralized without exposing personnel to unnecessary danger.

The invention has direct applicability in airport, railway, metro, seaport, and border-security environments, where unattended baggage, cargo threats, and restricted-area explosive risks require rapid, controlled, and intelligent robotic response.

It is further applicable in industrial plants, oil and gas facilities, chemical facilities, nuclear sites, power stations, and critical infrastructure installations, where hazardous devices or suspicious packages may create severe safety and economic consequences if not handled properly.

The system may also be used in public-event security, VIP protection zones, government buildings, embassies, courts, and urban emergency response, where quick deployment and safe threat handling are essential.

In addition, the invention is applicable in training, simulation, testing, and research environments related to robotics, neuromorphic computing, hazardous-object handling, and advanced AI-based field systems.

Because the invention can be manufactured using available robotics, sensing, communication, embedded-control, and computing technologies, and because it serves clear operational needs across multiple sectors, it has strong industrial applicability and practical commercial value.

The foregoing description describes embodiments of the present invention. It should be appreciated that these embodiments are described for the purpose of illustration only, and that numerous alterations and modifications may be practiced by those skilled in the art without departing from the scope of the invention. It is intended that all such modifications and alterations be included in so far as they come within the scope of the invention as claimed or the equivalents thereof.

We claim:

1. An Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system (100) comprising:

a mobile robotic platform (102) including a locomotion subsystem comprising at least one of a tracked drive, a wheeled drive, and a hybrid drive, configured for controlled movement over uneven terrain;

a multi-sensor perception module (104) mounted on the mobile robotic platform (102), the multi-sensor perception module (104) comprising at least one of:

- at least one visible-spectrum imaging sensor,
- at least one thermal imaging sensor,
- at least one depth sensor,
- at least one event-based neuromorphic vision sensor,
- at least one chemical or vapor detection sensor,
- at least one proximity sensor, and
- at least one tactile or force feedback sensor;

a neuromorphic processing core (106) comprising neuromorphic hardware circuitry (122) configured to perform event-driven spike-based signal processing, the neuromorphic processing core (106) being operatively coupled to the multi-sensor perception module (104) to receive sensor signals therefrom;

an intelligence processing unit (108) comprising at least one processor (118) and at least one memory unit (120) storing executable instructions, the intelligence processing unit (108) being operatively coupled to the neuromorphic processing core (106);

a robotic manipulator subsystem (110) comprising:

- a multi-degree-of-freedom articulated arm,
- at least one end effector selected from a gripper, cutter, and disruptor interface, and
- a force-feedback interface;

a motion control unit (112) comprising control circuitry (124) operatively coupled to the robotic manipulator subsystem (110), the motion control unit (112) being configured to generate actuation control signals based on real-time feedback received from the force-feedback interface;

a communication interface (114) configured to enable bidirectional data communication with a remote operator console; and

a fail-safe control module (116) configured to monitor at least one of communication status, sensor confidence level, and actuator stability,

wherein the neuromorphic processing core (106), the intelligence processing unit (108), and the motion control unit (112) are configured to cooperatively execute a closed-loop control sequence comprising:

receiving, by the neuromorphic processing core (106), multi-modal sensor signals from the multi-sensor perception module (104);

converting, by the neuromorphic processing core (106), the multi-modal sensor signals into event-driven spike-based signal representations;

generating, by the neuromorphic processing core (106), a fused perception output based on the event-driven spike-based signal representations;

generating, by the intelligence processing unit (108), a structured threat model based on the fused perception output;

determining, by the intelligence processing unit (108), at least one ranked intervention strategy based on the structured threat model;

generating, by the motion control unit (112), actuation control signals corresponding to the at least one ranked intervention strategy;

actuating, by the robotic manipulator subsystem (110), a physical manipulation action on a target object in accordance with the actuation control signals; and

updating, by the motion control unit (112) and the neuromorphic processing core (106), the actuation control signals based on real-time feedback received from the force-feedback interface, wherein the closed-loop control sequence reduces response latency and power consumption relative to frame-based processing and improves manipulation precision under hazardous conditions.

2. The system (100) as claimed in claim 1, wherein the neuromorphic processing core (106) comprises a spiking neural network implemented in neuromorphic hardware circuitry, the neuromorphic processing core (106) being configured to:

   encode incoming multi-modal sensor signals into asynchronous spike trains based on temporal variations in the sensor signals;

   process the spike trains using neuron models configured for event-driven spike propagation; and

   generate the fused perception output by selectively processing only temporally significant changes in the sensor signals, thereby reducing processing of non-changing sensor data and enabling lower-latency response generation.

3. The system (100) as claimed in claim 1, wherein the intelligence processing unit (108) is configured to:

   receive the fused perception output comprising at least one of spatial features, thermal characteristics, chemical signatures, and proximity data associated with the target object;

   extract a plurality of threat parameters from the fused perception output, the plurality of threat parameters comprising at least one of:

   detected structural features of the target object,
   presence of potential trigger mechanisms,
   environmental instability indicators, and
   sensor-derived anomaly indicators;

   compute a **quantitative risk score** by applying a weighted evaluation of the plurality of threat parameters, wherein each threat parameter is assigned a predefined or dynamically updated weighting factor stored in the memory unit (120) of the intelligence processing unit (108);

generate the quantitative risk score as a numerical value representing a probability of hazardous response or detonation associated with the target object; and

assign the quantitative risk score to the structured threat model by embedding the quantitative risk score as a risk attribute within the structured threat model for use in determining the ranked intervention strategy.

4. The system (100) as claimed in claim 1, wherein the motion control unit (112) is configured to:

   receive real-time feedback signals from the force-feedback interface indicative of at least one of contact force, resistance, and positional deviation;

   compare the real-time feedback signals with predefined control thresholds stored in the memory unit;

   generate adjusted actuation control signals by modulating at least one of grip force, velocity, and movement trajectory of the robotic manipulator subsystem (110); and

   transmit the adjusted actuation control signals to the robotic manipulator subsystem (110) during execution of the physical manipulation action,

   whereby controlled and stable interaction with the target object is achieved.

5. The system (100) as claimed in claim 1, wherein the fail-safe control module (116) is configured to:

   continuously monitor communication signal strength, sensor confidence level, and actuator status;

   detect a fault condition when at least one monitored parameter deviates from a predefined safety threshold;

   generate a safety control signal in response to the detected fault condition; and

   execute a safe-state transition by at least one of:

      suspending actuation of the robotic manipulator subsystem (110),

      retracting the robotic manipulator subsystem (110) to a predefined safe position, and stabilizing the mobile robotic platform (102),

whereby unsafe operation is prevented under degraded operating conditions.

6. The system (100) as claimed in claim 1, wherein the neuromorphic processing core (106) is further configured to:

   receive thermal data and electromagnetic anomaly data from corresponding sensors within the multi-sensor perception module (104);

   temporally align and correlate the thermal data and electromagnetic anomaly data;

   identify co-occurring anomalies indicative of concealed trigger mechanisms based on the correlated data; and

   incorporate the identified anomalies into the fused perception output.

7. The system (100) as claimed in claim 1, wherein the communication interface (114) is configured to:

   receive control inputs from the remote operator console;

   selectively switch between operational modes comprising a tele-operated mode, an assisted mode, a semi-autonomous mode, and an autonomous mode based on the received control inputs; and

   route control authority between the remote operator console and the intelligence processing unit (108) in accordance with the selected operational mode.

8. The system (100) as claimed in claim 1, wherein the robotic manipulator subsystem (110) further comprises a wrist-mounted sensor array configured to:

   detect at least one of contact proximity, applied force, and surface resistance;

   generate feedback signals corresponding to the detected parameters; and

   transmit the feedback signals to the motion control unit (112) for real-time adjustment of actuation control signals.

9. The system (100) as claimed in claim 1, wherein the mobile robotic platform (102) further comprises an inertial measurement unit configured to:

detect at least one of orientation, acceleration, and vibration of the mobile robotic platform (102);

generate stabilization signals based on the detected parameters; and

adjust movement of the locomotion subsystem to maintain platform stability during execution of the physical manipulation action.

10. The system (100) as claimed in claim 1, wherein the intelligence processing unit (108) is further configured to:

compare the quantitative risk score with a predefined risk threshold; and

modify the ranked intervention strategy when the quantitative risk score exceeds the predefined risk threshold.

11. The system (100) as claimed in claim 1, wherein the neuromorphic processing core (106) and the motion control unit (112) are configured to:

detect a change in sensor signals; and

generate updated actuation control signals in response to the detected change within a predefined response time threshold;

whereby real-time responsiveness of the system (100) is optimized relative to frame-based processing systems.

12. A method for intelligent bomb-disposal by an Artificial Super-Intelligence (ASI) based neuromorphic bomb-disposal system (100), the method comprising:

acquiring multi-modal sensor signals from a plurality of sensors mounted on a mobile robotic platform (102);

converting the multi-modal sensor signals into event-driven spike-based signal representations using a neuromorphic processing core (106) comprising neuromorphic hardware circuitry (122);

generating, by the neuromorphic processing core (106), a fused perception output based on the event-driven spike-based signal representations;

generating a structured threat model based on the fused perception output using at least one processor (118);

determining at least one ranked intervention strategy based on the structured threat model;

generating actuation control signals corresponding to the at least one ranked intervention strategy;

actuating a robotic manipulator subsystem (110) to perform a physical manipulation action on a target object based on the actuation control signals; and

updating the actuation control signals based on real-time feedback from a force-feedback interface,

wherein the method operates as a closed-loop control process and achieves reduced latency and improved control precision through event-driven spike-based signal processing.

13. The method as claimed in claim 12, wherein determining the at least one ranked intervention strategy comprises evaluating multiple candidate strategies and selecting a strategy minimizing a computed risk score.

14. The method as claimed in claim 12, wherein converting into event-driven spike-based signal representations comprises encoding only changes in sensor signals.

Dated this 9th day of May 2026

Signature

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Patent Agent (IN/PA-1514)
Agent for the Applicant

ABSTRACT

ARTIFICIAL SUPER-INTELLIGENCE (ASI) BASED NEUROMORPHIC BOMB DISPOSAL SYSTEM AND METHOD THEREOF

The present invention discloses an Artificial Super-Intelligence based neuromorphic bomb-disposal system configured to detect, assess, approach, manipulate, neutralize, or safely remove explosive threats while minimizing human exposure. The system integrates multi-sensor perception suite including HD cameras, thermal imaging, event-based vision sensors, chemical, acoustic, proximity, and explosive/radiation sensors with a neuromorphic processing core and an ASI decision engine. The neuromorphic architecture enables event-driven, low-latency sensor fusion, rapid threat recognition, adaptive navigation, and precision manipulator control. The ASI layer performs risk assessment, strategy generation, mission planning, and supervised autonomous decision-making for safe intervention. Robotic platform carries multi-degree-of-freedom manipulator with gripper, cutter, disruptor, wrist rotation, and force/tactile feedback for delicate explosive-handling tasks. The system supports teleoperated, assisted, semi-autonomous, and autonomous modes through a secure operator interface and wireless link. Fail-safe supervision monitors communication, sensor confidence, actuator status, and mission risk, enabling safe stop, retraction, logging, and controlled recovery during hazardous or uncertain conditions.

FIG. 1

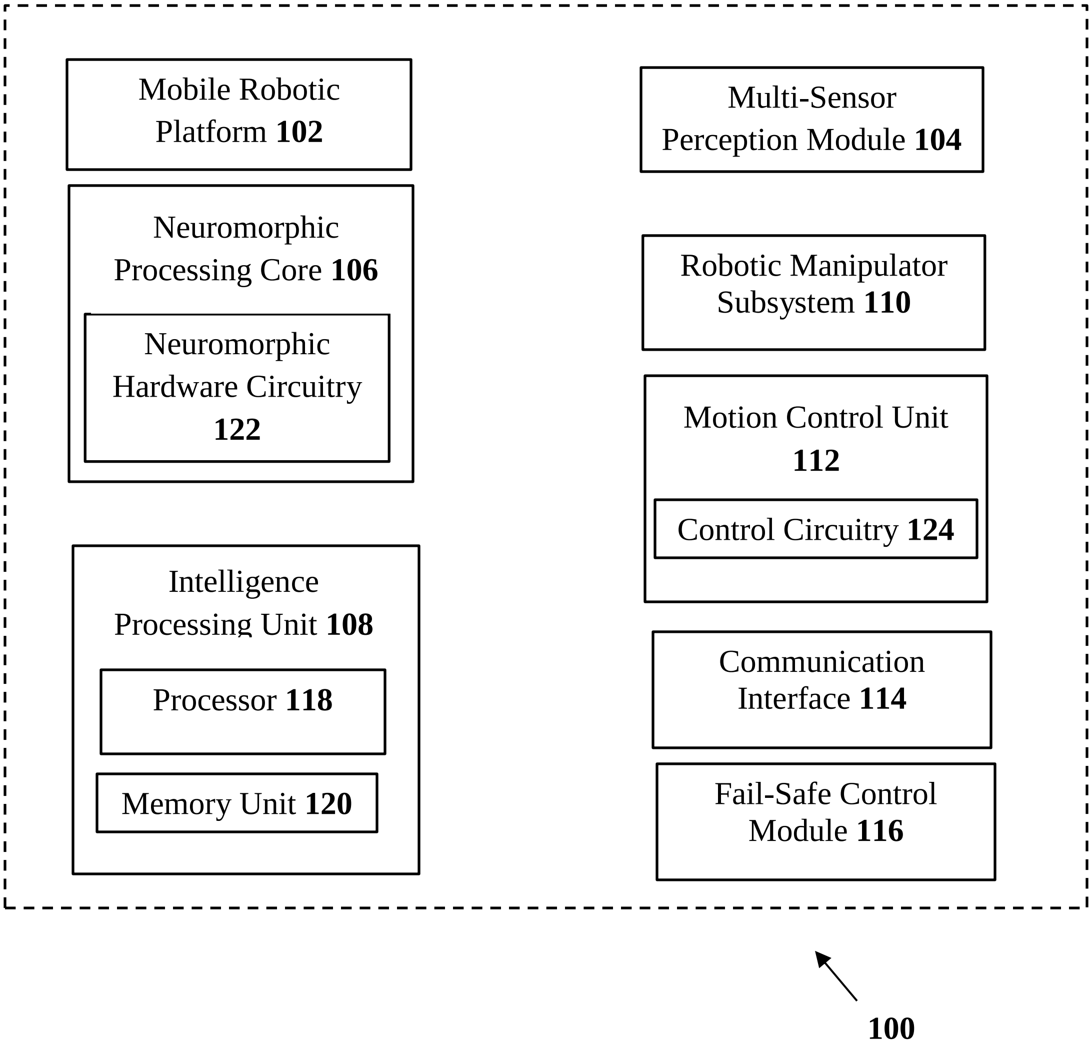

FIG. 1

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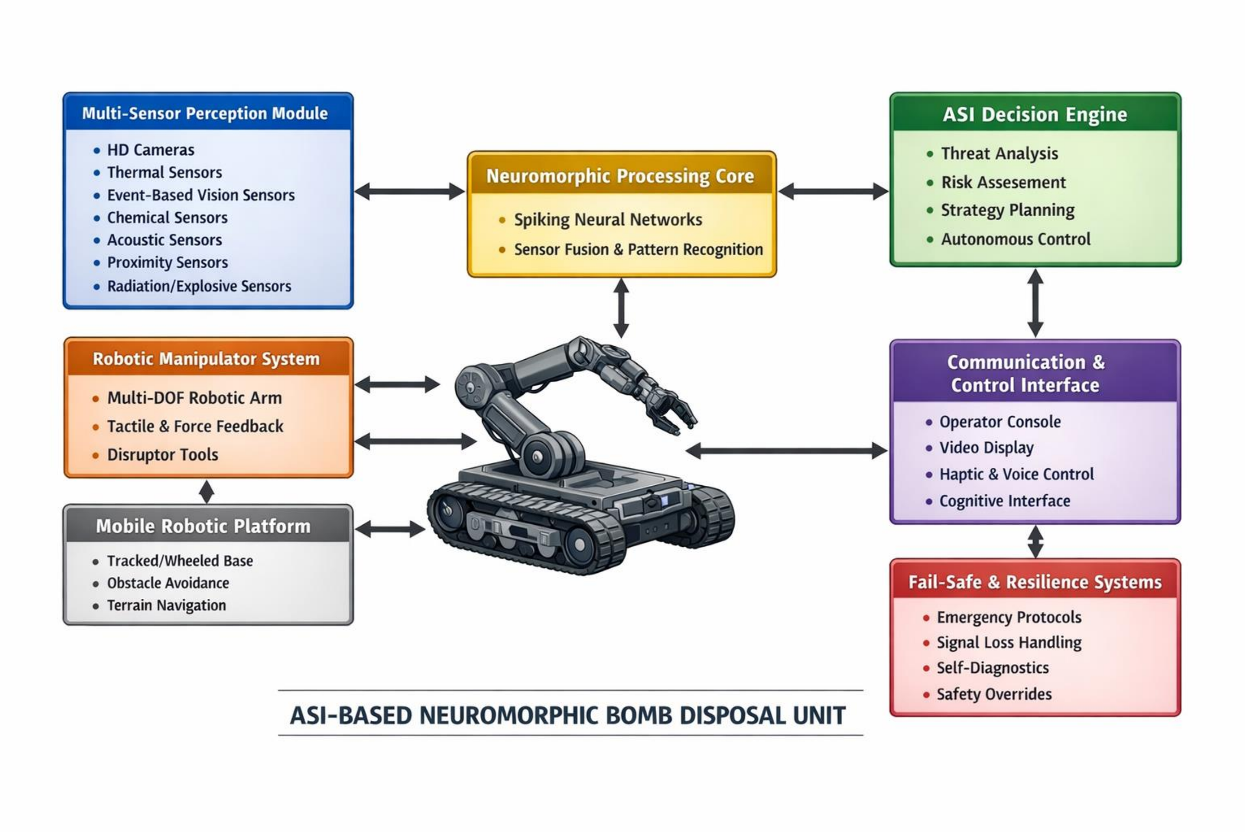

FIG. 2

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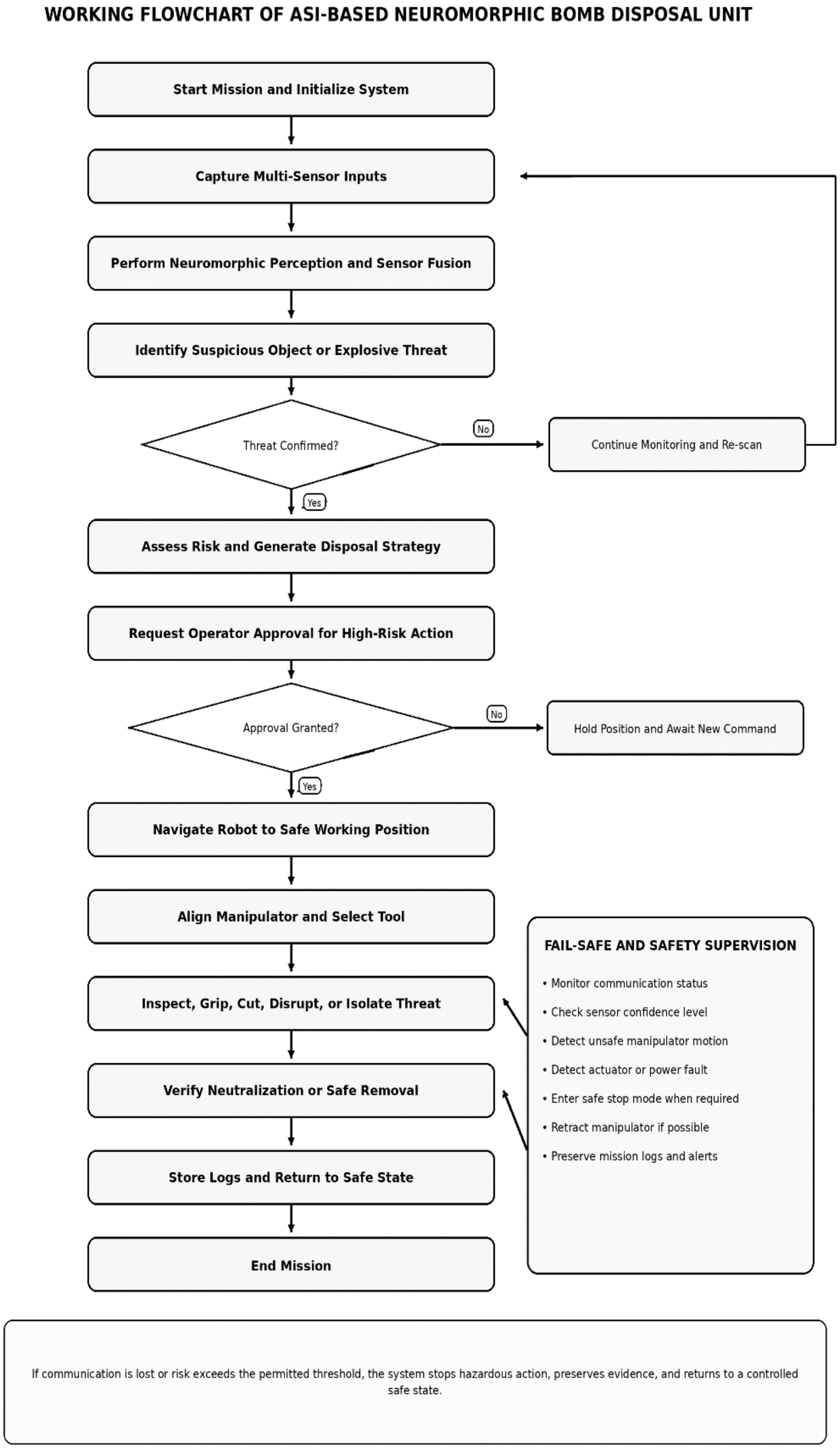

FIG. 3

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Agent for the applicant

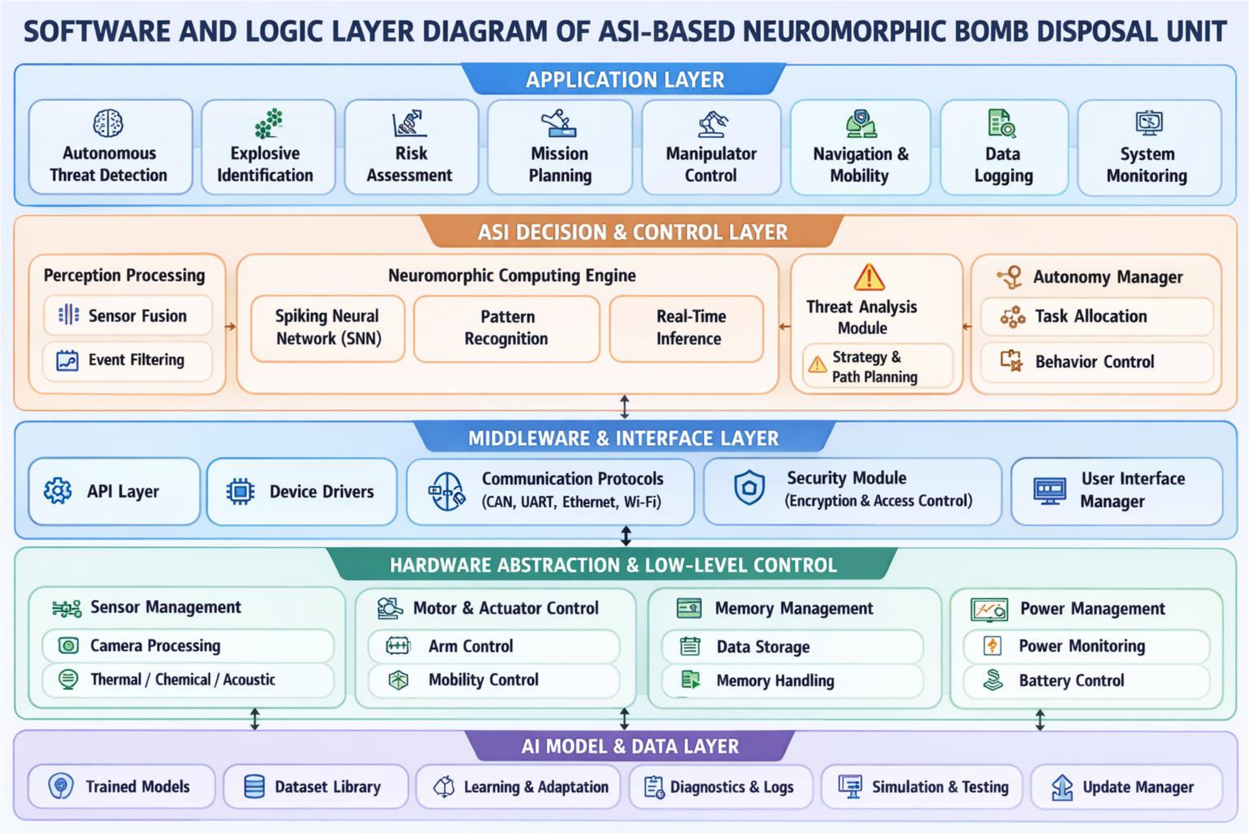

FIG. 4

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Agent for the applicant

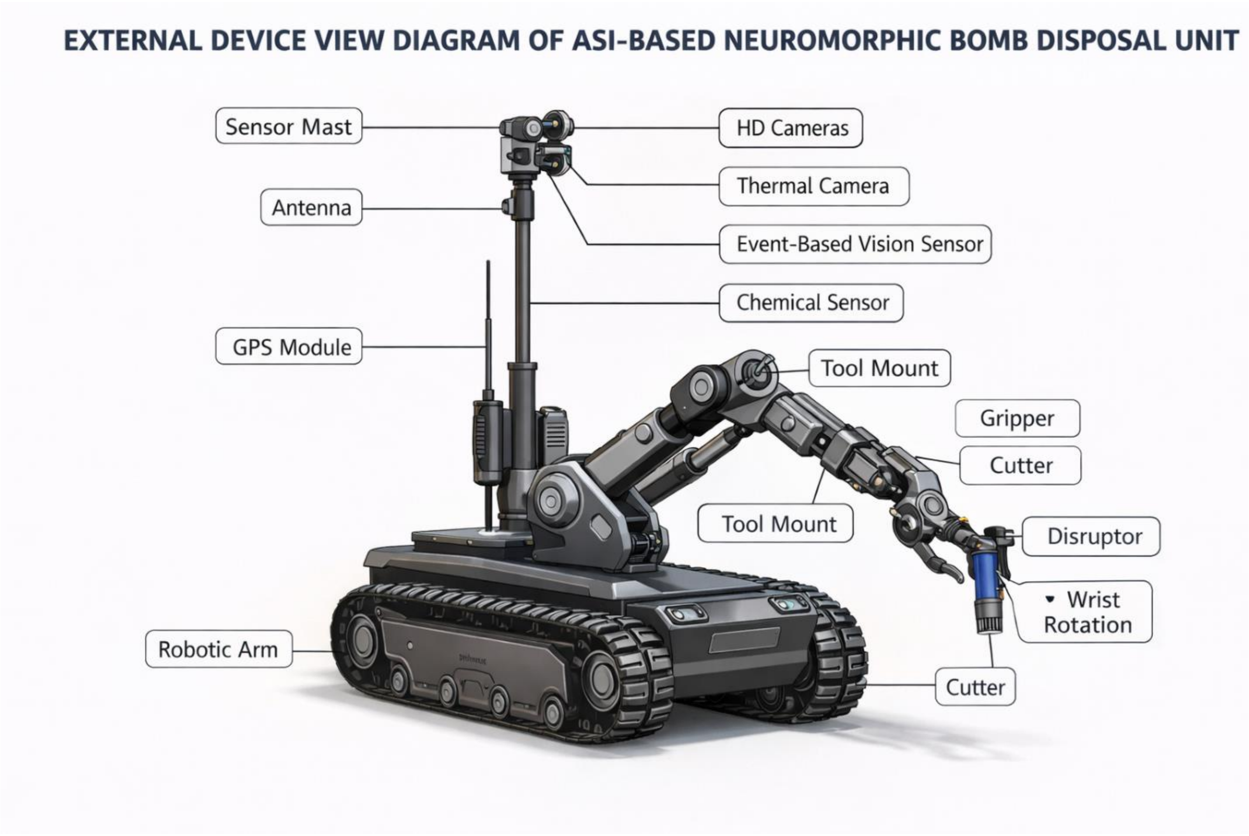

FIG. 5

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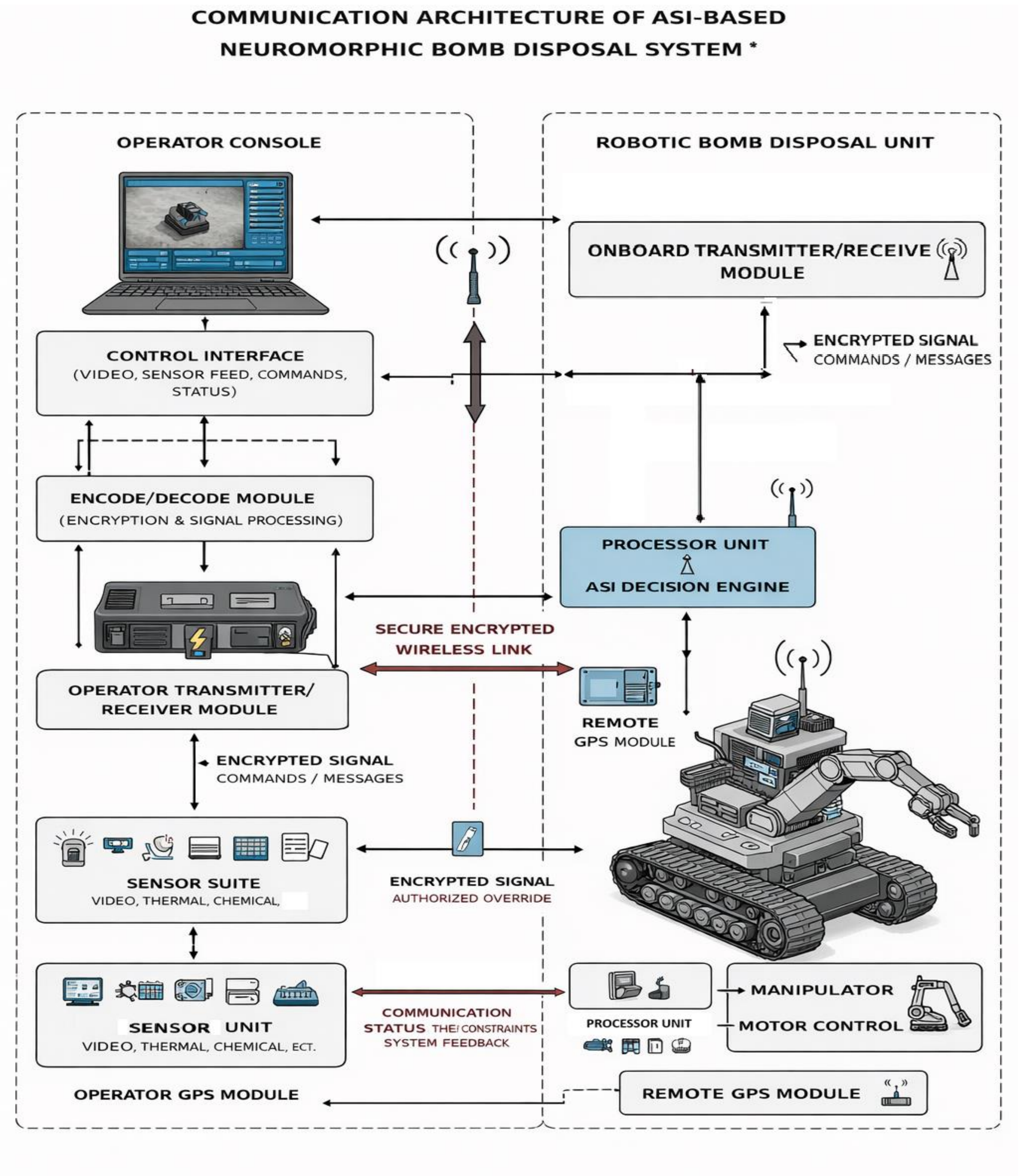
Agent for the applicant



** **Override** channel is a secure backup frequency allowing the operator to issue immediate remote control signals under critical emergency situations.

FIG. 6

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Agent for the applicant

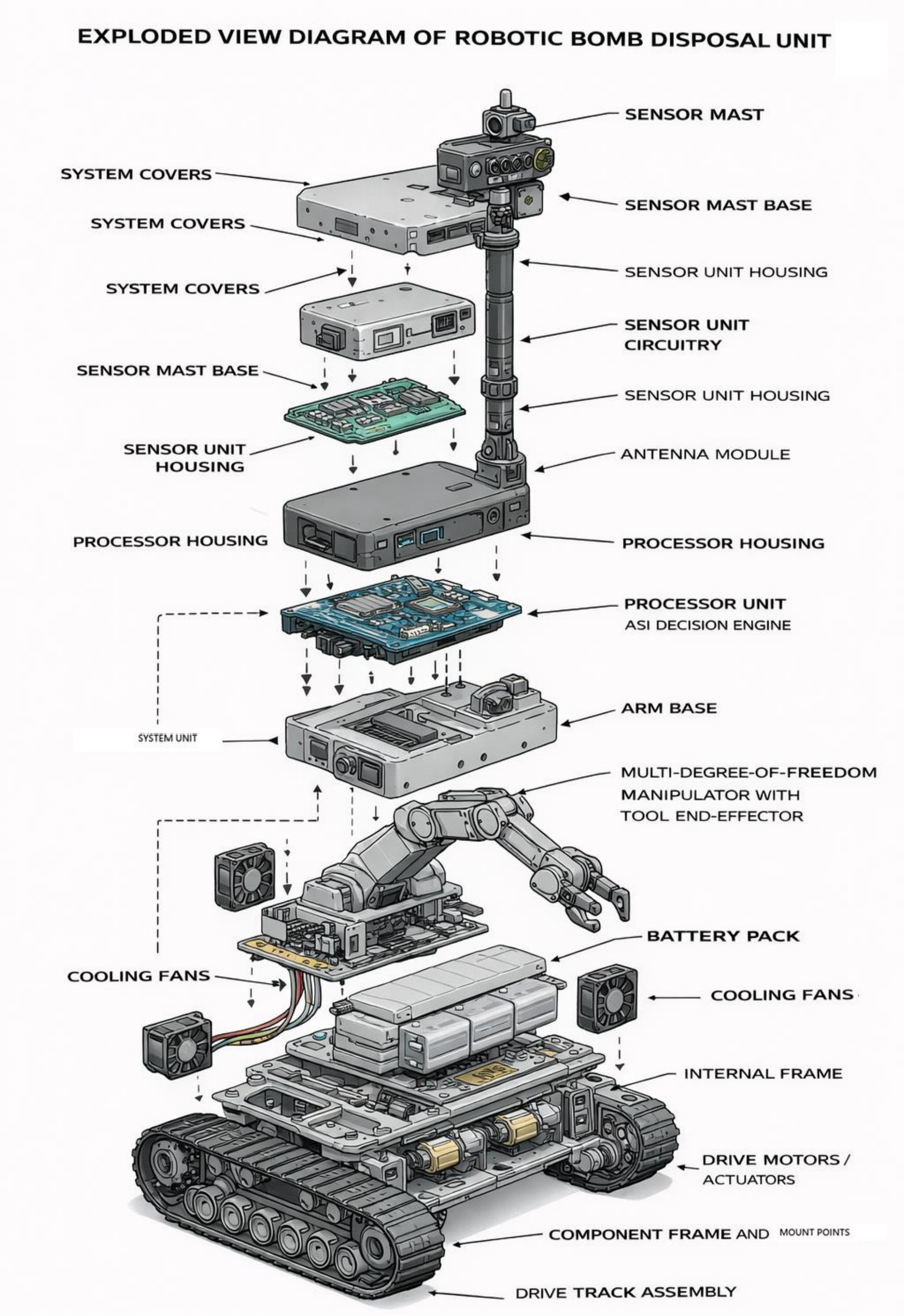

FIG. 7

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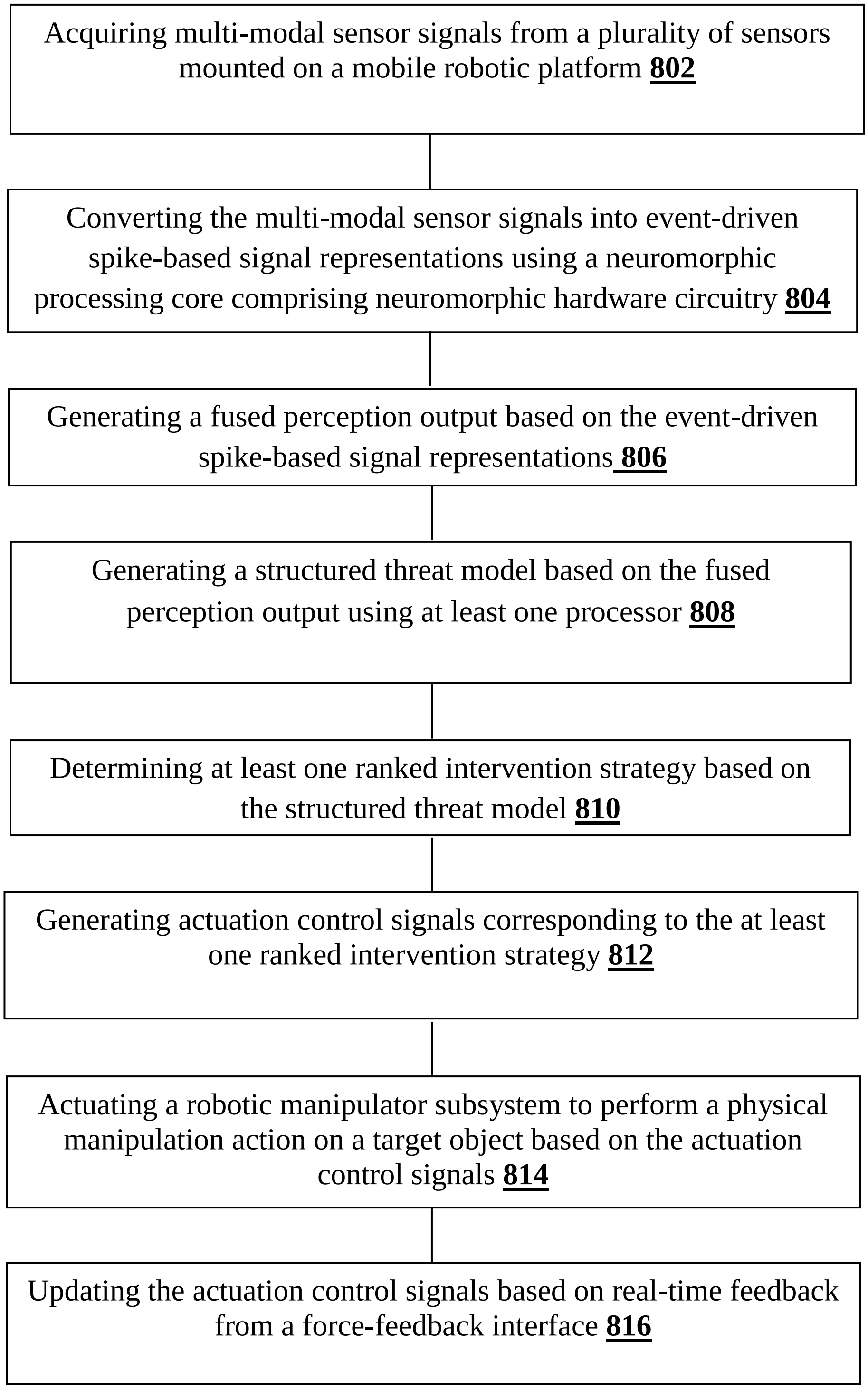

FIG. 8

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Agent for the applicant

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ANURADHA GUPTA
Date: 09-05-2026 19:29:50

FORMS 28
THE PATENTS ACT, 1970
(39 of 1970)
AND
THE PATENTS RULES, 2003
TO BE SUBMITTED BY A SMALL ENTITY / STARTUP
[See rules 2 (fa), 2(fb) and 7]

1.	Insert name, address and nationality	We, **SRJX RESEARCH AND INNOVATION LAB LLP**, a company registered in India, having office at PLOT NO.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR, CUTTACK-753014, ODISHA, INDIA Applicant in respect of the patent application No. 202631059321. Hereby declare that we are a startup in accordance with rule 2(fb) and submit the following documents(s) as proof:
2.	Documents to be submitted	
	ii. For claiming the status of a startup	
	A. For an Indian applicant: Any document as evidence of eligibility, as defined in rule 2(fb).	
	Certificate of Recognition issued by DIPP: Certificate No. DIPP203406	
3.	To be signed by the applicant(s) / patentee(s) / authorized registered patent agent.	The information provided herein is correct to the best of our knowledge and belief. Dated this 9th day of May 2026. Signature : -Digitally Signed- (Anuradha Gupta) Patent Agent (IN/PA-1514) Agent for the Applicant To The Controller of Patents, The Patent Office, At Kolkata.
4.	Name of the natural person who has signed. Designation and official seal, if any, of the person who has signed.	

Digitally Signed By:
ANURADHA GUPTA
Date: 10-05-2026 14:06:58

FORM 9
THE PATENTS ACT, 1970
(39 of 1970)
&
The Patents Rules, 2003
REQUEST FOR PUBLICATION
[See section 11A (2); Rule 24A]

1. Name, address and nationality of Applicant(s)	We, **SRJX RESEARCH AND INNOVATION LAB LLP** a Company registered in India, having office at PLOT No.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR, CUTTACK- 753014, ODISHA, India,
2. To be signed by the applicant or his authorized registered patent agent	hereby request for early publication of our Patent Application No. 202631059321 dated 9th May 2026 under Section 11A (2) of the Patent Act.

.

Dated this 10th day of May 2026

3. Name of the natural person who has signed.	-Digitally Signed- (Anuradha Gupta) Patent Agent (IN/PA-1514) Agent for the Applicant

To
The Controller of Patents,
The Patent Office,
At KOLKATA

Digitally Signed By:
ANURADHA GUPTA
Date: 10-05-2026 13:33:59

FORM 1 THE PATENTS ACT 1970 (39 of 1970) and THE PATENTS RULES, 2003 APPLICATION FOR GRANT OF PATENT (See section 7, 54 and 135 and sub-rule (1) of rule 20)	(FOR OFFICE USE ONLY)

	Application No.	
	Filing date:	
	Amount of Fee paid:	
	CBR No:	
	Signature:	

1. APPLICANT'S REFERENCE / IDENTIFICATION NO. (AS ALLOTTED BY OFFICE)	

2. TYPE OF APPLICATION *Please tick (✓) at the appropriate category+

Ordinary (✓)		Convention ( )		PCT-NP ( )	
Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )

3A. APPLICANT(S)

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			City	**CUTTACK**
			State	**ODISHA**
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			Pin code	**753014**

3B. CATEGORY OF APPLICANT *Please tick (✓) at the appropriate category+			
Natural Person ()	Other than Natural Person (✓)		
	Small Entity ( )	Startup (✓)	Others ()

4. INVENTOR(S) *Please tick (✓) at the appropriate category+		
Are all the inventor(s) same as the applicant(s) Named above?	Yes ()	No (✓)
If "No", furnish the details of the inventor(s)		

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			State	**ODISHA**
			Country	**INDIA**
			Pin Code	**753014**

5. TITLE OF INVENTION- **ARTIFICIAL SUPER-INTELLIGENCE (ASI) BASED NEUROMORPHIC BOMB DISPOSAL SYSTEM AND METHOD THEREOF**

6. AUTHORISED REGISTERED PATENT AGENT(S)	Name	**ANURADHA GUPTA**
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	Telephone No.	**011 35586108**
	Mobile No.	**9213764385**
	E-mail ID	**sav@sgintellectual.com**

8. IN CASE OF APPLICATION CLAIMING PRIORITY OF APPLICATION FILED IN CONVENTION COUNTRY, PARTICULARS OF CONVENTION APPLICATION

Country	Application Number	Filing date	Name of the applicant	Title of the Invention
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9. IN CASE OF PCT NATIONAL PHASE APPLICATION, PARTICULARS OF INTERNATIONAL APPLICATION FILED UNDER PATENT CO-OPERATION TREATY (PCT)

International application number	International filing date
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10. IN CASE OF DIVISIONAL APPLICATION FILED UNDER SECTION 16, PARTICULARS OF ORIGINAL (FIRST) APPLICATION-NA

Original (first) application No	Date of filing of original (first) application
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11. IN CASE OF PATENT OF ADDITION FILED UNDER SECTION 54, PARTICULARS OF MAIN APPLICATION OR PATENT-NA

Main application/patent No.--------------	Date of filing of main application ----------------

12. DECLARATIONS

(i) Declaration by the inventor(s)-
(In case the applicant is an assignee: the inventor(s) may sign herein below or the applicant may upload the assignment or enclose the assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period).

We, the above named inventors are the true & first inventors for this Invention and declare that the applicant herein is our assignee ~~or legal representative~~.

i) (a) Date: 09-MAY-2026
(b) Signature: Sucharu Suchismita Pradhan
(c) Name : **PRADHAN, Sucharu Suchismita**

ii) (a) Date: 09-MAY-2026
(b) Signature: Soumya Ranjan Jena
(c) Name: **JENA, Soumya Ranjan**

ii) Declaration by the applicant(s) in the convention country ---N/A
~~(In case the applicant in India is different than the applicant in the convention country: the applicant in the convention country may sign herein below or applicant in India may upload the assignment from the applicant in the convention country or enclose the said assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period)~~
~~I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.~~
~~(a) Date~~
~~(b) Signature(s)~~
~~(c) Name(s)~~

(iii) Declaration by the applicant(s)

- ~~I~~/We the applicant(s) hereby declare(s) that: -
- ~~I am~~/We-are in possession of the above-mentioned invention.
- The Complete Specification relating to the invention is filed with this Application.
- ~~The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.~~
- There is no lawful ground of objection(s) to the grant of the Patent to me/us.
- ~~I am/we are the true & first inventor(s).~~
- ~~I am~~/we are the assignee or legal representative of true & first inventor(s).
- ~~The application or each of the applications, particulars of which are given in Paragraph-8, was the first application in convention country/countries in respect of my/our invention(s).~~
- ~~I/We claim the priority from the above-mentioned application(s) filed in convention country/countries and state that no application for protection in respect of the invention had been made in a convention country before that date by me/us or by any person from which I/We derive the title.~~
- ~~My/our application in India is based on international application under Patent Cooperation Treaty (PCT) as mentioned in Paragraph-9.~~
- ~~The application is divided out of my /our application particulars of which is given in Paragraph-10 and pray that this application may be treated as deemed to have been filed on DD/MM/YYYY under section 16 of the Act.~~

13. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION

(a) Form 1

Item	Details	Fee	Remarks
Complete specification	No. of Pages - 64	Rs. 10880/-	
Claim(s)	No. of Claims - 14 No. of Pages - 7	-------------- --	-------------------
Abstract	No. of Pages - 1		
Drawing(s)-	No. of Drawings - 8 No. of Pages - 8		

(b) Complete Specification
(d) Drawings
(c) Abstract
(d) Application Form-1
(e) Power of Attorney
(f) DIPP Certificate.
(g) Form-28

……

We hereby declare that to the best of our knowledge, information and belief, the fact and matters stated herein are correct and We request that a patent may be granted to us for the said invention.

Dated this 9th day of May 2026

Signature: Soumya Ranjan Jena
(Dr. Soumya Ranjan Jena)
DIRECTOR
Name of Applicant: **SRJX RESEARCH AND INNOVATION LAB LLP**

To
The Controller of Patents
The Patent Office, KOLKATA

SRJX Research and Innovation Lab LLP
LLPIN: ACO-1435

Digitally Signed By:
ANURADHA GUPTA
Date: 11-05-2026 16:42:54

FORM 18 A **THE PATENTS ACT,1970** **and THE PATENT RULES,2003** **REQUEST FOR EXPEDITED EXAMINATION OF APPLICATION FOR PATENT** **[See section 11B and Rule 24C]**	(FOR OFFICE USE ONLY) RQ. No.: Filing Date: Amount of fee Paid: CBR no: Signature:

1. APPLICANT:

(A) NAME: **SRJX RESEARCH AND INNOVATION LAB LLP**

(B) NATIONALITY: **Indian Company**

(C) ADDRESS: **PLOT No.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR,**
CUTTACK- 753014, ODISHA, INDIA

2. We, **SRJX RESEARCH AND INNOVATION LAB LLP** established at PLOT No-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR, CUTTACK- 753014, ODISHA, INDIA, hereby request that our Application Patent No. 202631059321 filed on 9th May 2026 for invention Titled "**ARTIFICIAL SUPER-INTELLIGENCE (ASI) BASED NEUROMORPHIC BOMB DISPOSAL SYSTEM AND METHOD THEREOF"** shall be examined under sections 12 and 13 of the Act.

~~or~~

~~I/We -- hereby request that my/our application for patent no. -------------- filed on ------------------- for ------------------------------------ the --- invention titled --- based on Patent Cooperation Treaty (PCT) application no………………..…. dated………………….. made in country ……….. shall be examined under sections 12 and 13 of the Act, immediately without waiting for the expiry of 31 months as specified in rule 20(4)(ii).~~ ~~or~~

~~I/We hereby request that my/our request for examination bearing no. ------------ for application for patent no. -------------- filed on -------------------- for -- the --- invention titled -- may be converted to a request for expedited examination of patent application under rule 24C and the application shall be examined under sections 12 and 13 of the Act.~~

3. The applicant(s) to indicate (by ticking the appropriate box) any of the grounds applicable for request for expedited examination:

() that India has been indicated as the competent International Searching Authority or elected as an International Preliminary Examining Authority in the corresponding international application; or

(✓) that the applicant is a startup; or

( ) that the applicant is a small entity; or

( ) that the applicant is a natural person or in the case of joint applicants, all the applicants are natural persons, then applicant or at least one of the applicants is a female; or

( ) that the applicant is a department of the Government; or

( ) that the applicant is an institution established by a Central, Provincial or state Act, which is owned or controlled by the Government; or

( ) that the applicant is a Government company as defined in clause (45) of section 2 of the Companies Act, 2013 (18 of 2013); or

( ) that the applicant is an institution wholly or substantially financed by the Government; or

( ) that the application pertains to a sector which has been notified by the Central Government, on the basis of a request from the head of department of the Central Government; or

( ) that the applicant is eligible under an arrangement for processing a patent applicant pursuant to an agreement between Indian Patent Office and a foreign Patent Office.

ADDRESS FOR SERVICE IN INDIA:
ANURADHA GUPTA
4-D (UPPER FLOOR), DDA Pocket-2, Sector-6, Dwarka, New Delhi-110075, India
Mobile No. +91 9213764385
Email: sav@sgintellectual.com; anuradha@sgintellectual.com

Dated this 10th day of May, 2026 Signature

-Digitally Signed-

Name of the signatory: **Anuradha Gupta**
Agent for the Applicant
IN/PA-1514

To
The Controller of Patent
The Patent Office, at Kolkata

Digitally Signed By:
ANURADHA GUPTA
Date: 10-05-2026 14:06:58

FORM 5
THE PATENTS ACT, 1970
(39 of 1970)
&
The Patents Rules, 2003
DECLARATION AS TO INVENTORSHIP
[See section 10(6) and Rule 13 (6)]

1. **NAME OF THE APPLICANTS: SRJX RESEARCH AND INNOVATION LAB LLP** established at PLOT No.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR, CUTTACK-753014, ODISHA, INDIA,

hereby declare that the true and first inventor(s) of the invention disclosed in the Complete specification filed in pursuance of our application Numbered 202631059321 dated 9th May 2026 are:

2. INVENTORS:

(i) (a) NAME : **PRADHAN, Sucharu Suchismita**
(b) NATIONALITY : **INDIAN**
(c) ADDRESS : PLOT No.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR,
CUTTACK- 753014, ODISHA, INDIA

(ii) (a) NAME : **JENA, Soumya Ranjan**
(b) NATIONALITY: **INDIAN**
(c) Address : PLOT No.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR,
CUTTACK- 753014, ODISHA, INDIA

3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(~~S~~) IN THE CONVENTION COUNTRY :- N/A

~~We the applicant in the convention country hereby declares that our right to apply for a Patent in India is by way of assignment from the true and first inventors.~~

-Digitally Signed-
Dated this 10th day of May 2026 Name of the signatory **Anuradha Gupta**
Patent agent - IN/PA-1514

4. STATEMENT (to be signed by the additional inventor(s) not mentioned in the application Form : **N/A**

~~/We assent to the invention referred to in the above declaration, being included in the Complete specification filed in pursuance of the stated application.~~

Dated this day of 20……..

Signature of the additional inventor(s):
Name-------------------

To
The Controller of Patent
The Patent Office Branch
At KOLKATA

Digitally Signed By:
ANURADHA GUPTA
Date: 11-05-2026 08:17:50

FORM 3

THE PATENT ACT, 1970
(39 of 1970)
and
THE PATENTS RULES, 2003

STATEMENT AND UNDERTAKING UNDER SECTION 3

(See Section 8; Rule 12)

1. Name of Applicant	I/We, **SRJX RESEARCH AND INNOVATION LAB LLP** established at PLOT No.-3E/474, SECTOR-9, CDA, POST- MARKAT NAGAR, CUTTACK- 753014, ODISHA, INDIA, Hereby Declare:
	(i) That I/We who have made the application for Patent number 202631059321 in India, dated 9th May 2026 alone (ii) that I/We have not made any application for the same/substantially the same invention outside India Or (ii) ~~that I/We have made for the same/substantially same invention, application(s) for patent in the other countries, the particular of which are given below:~~

Name of the Country	Date of application	Application No.	Status of the application	Date of publication	Date of grant
---------	-------	NIL	----------	-----------	-------------

2. Name and address of the assignee	~~(i) that the rights in the application(s) filed in India has/have been assigned to…………………….~~ (ii) that I/We undertake that upto the date of grant of the patent by the Controller, I/We would keep him informed in writing regarding the details of corresponding applications for patents filed outside India in accordance with the provisions contained in section 8 and rule 12. Dated this 10th day of May 2026.
3. To be signed by the applicant or his authorized registered patent agent	-Digitally Signed- Signature
4. Name of the Natural person who has signed	(**Anuradha Gupta)** Patent Agent (IN/PA-1514) Agent for the Applicant
	To The Controller of Patents, The Patent Office At Kolkata

Digitally Signed By:
ANURADHA GUPTA
Date: 11-05-2026 08:18:41

सत्यमेव जयते

INDIA NON JUDICIAL

Government of National Capital Territory of Delhi

₹100

e-Stamp

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Unique Doc. Reference : SUBIN-DLDL-SELF21149788829774Y

Purchased by : SATYA NARAYAN SAV

Description of Document : Article 48(c) Power of attorney - GPA

Property Description : GPA FOR FILING PATENT APPLICATIONS

Consideration Price (Rs.) : 0
(Zero)

First Party : SRJX RESEARCH AND INNOVATION LAB LLP

Second Party : SATYA NARAYAN SAV AND ANURADHA GUPTA

Stamp Duty Paid By : SRJX RESEARCH AND INNOVATION LAB LLP

Stamp Duty Amount(Rs.) : 100
(One Hundred only)

₹100

SELF PRINTED CERTIFICATE TO BE VERIFIED BY THE RECIPIENT AT WWW.SHCILESTAMP.COM

IN-DL49794072924674Y

Please write or type below this line

FORM 26

THE PATENTS ACT, 1970

(39 of 1970)

&

THE PATENTS RULES, 2003

Form of authorization of a patent agent/or any person in a matter or proceeding under the Act

(See sections 127 and 132 and rule 135)

We,

SRJX RESEARCH AND INNOVATION LAB LLP, a company registered in India, having office at **PLOT NO.-3E/474, SECTOR-9, CDA, POST-MARKAT NAGAR, CUTTACK- 753014, ODISHA, INDIA**

do hereby authorize **S. N. Sav and Anuradha Gupta**, Patent Agent of **S G Intellectual**, 4-D (UPPER FLOOR) DDA Pocket-2, Sector-6, Dwarka, New Delhi--110075, **Delhi** , and also at A-108, Block -A, MBR Shangri La, Mysore Road, Kengeri, **Bangalore**-560059, India and/or all or any Associates/ Partners of the firm, to act on our behalf in connection with filing any and all Patent Application for any and all the inventions with the Controller of Patents, appearing on our behalf before the Controller, processing our application in respect of the same, filing provisional and/or complete specifications, and other necessary request and documents in connection with the grant of Patent for the patent application, obtaining certified copies/extracts from the Patent Office, Certificate/s of Registration, filing request for renewal of the Patent and generally to do all acts, deeds and things that may be necessary in connection with the above application, including appointment of any substitute or substitutes.

We request that all notices, requisitions and communication relating thereto may be sent to such person at the above address unless otherwise specified.

We hereby revoke all our previous authorization, if any made, in respect of same matter or proceeding.

We hereby assent to the action already taken by the above said person in the matter.

Dated this 7th day of **February 2026**

Soumya Ranjan Jena

(Dr. Soumya Ranjan Jena)
Designation: Director
SRJX RESEARCH AND INNOVATION LAB LLP

To,
The Controller of Patents
Patent Office, Kolkata

SRJX Research and Innovation Lab LLP
LLPIN: ACO-1435

CERTIFICATE NO:
DIPP203406

सत्यमेव जयते

Government of India
Ministry of Commerce & Industry
Department for Promotion of Industry and Internal Trade

#startupindia

CERTIFICATE OF RECOGNITION

*This is to certify that **SRJX RESEARCH AND INNOVATION LAB LLP** incorporated as a **Limited Liability Partnership** on **05-05-2025**, is recognized as a startup by the Department for Promotion of Industry and Internal Trade. The startup is working in 'Professional & Commercial Services' Industry and 'Professional Information Services' sector as self-certified by them.*

This certificate shall only be valid for the Entity up to **Ten** years from the date of its incorporation only if its turnover for any of the financial years has not extended ₹ **100 Cr.**

14-05-2025
DATE OF ISSUE

Scan to Verify

04-05-2035
VALID UPTO

Digitally Signed By:
ANURADHA GUPTA
Date: 10-05-2026 14:06:58