LATE BHAUSAHEB HIRAY S.S. TRUST'S INSTITUTE
OF COMPUTER APPLICATION, MUMBAI

Internet of Things Lab Manual

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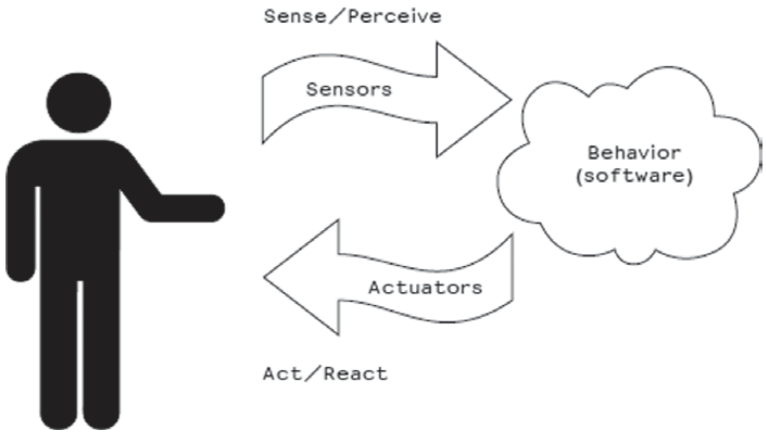
Chapter 1 Introduction to Basic Components

Arduino

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs, light on a sensor, a finger on a button, or a Twitter message and turn it into an output, activating a motor, turning on an LED, publishing something online.

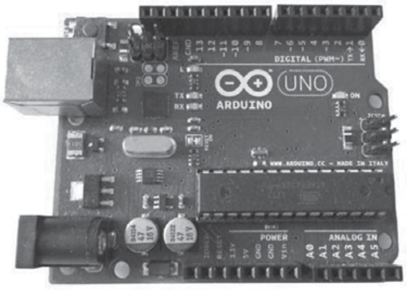
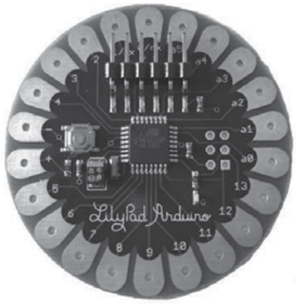
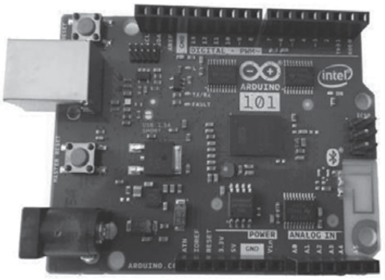
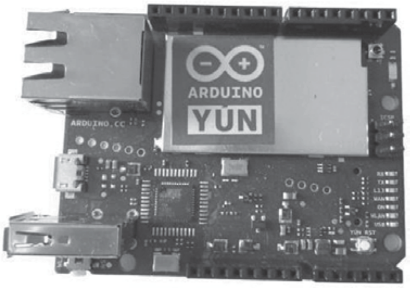
- Most simply, it is an affordable,small-scale, simple computer that focuses on interaction with the outside world.
- Most of the computers you are familiar with are controlled almost exclusively through the keyboard and mouse, touchscreen, or trackpad.
- An Arduino allows you to take information from the outside world with sensors that measure temperature, light and sound levels, or even the vibrations underneath your feet, and convert these measurements into motion, sound, light, and more.

Sensors and Actuators:

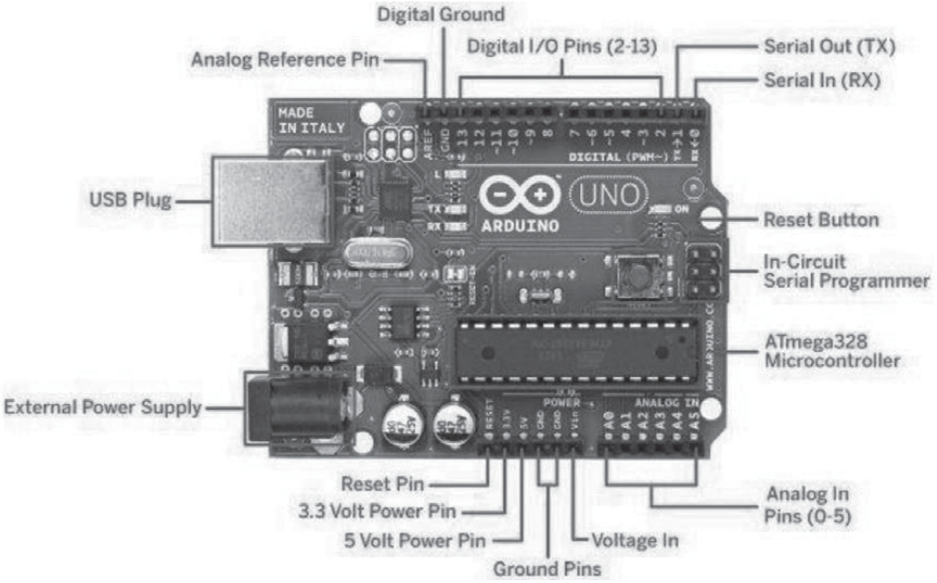


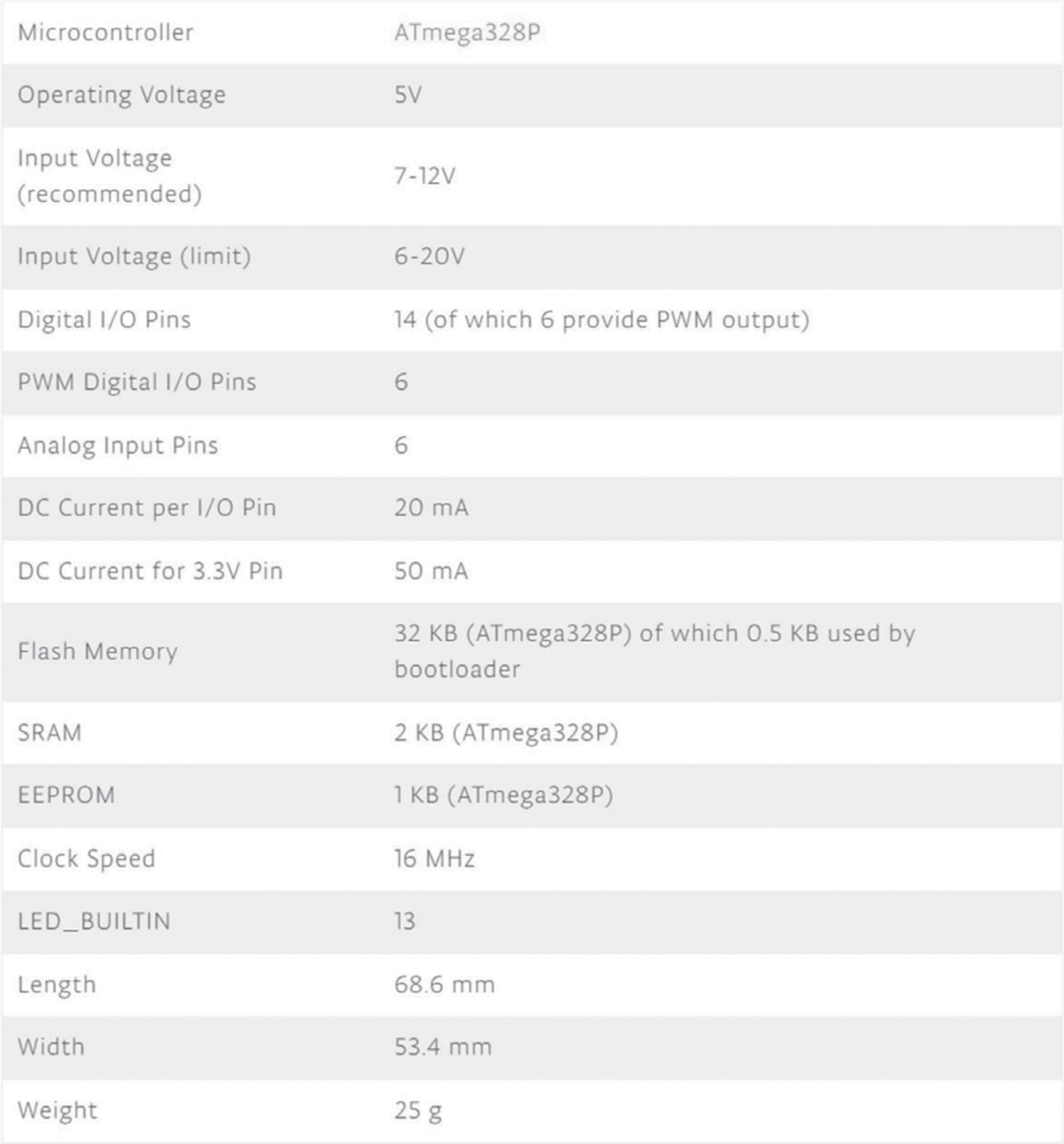
- Sensors and actuators are electronic components that allow a piece of electronics to interact with the world.
- As the microcontroller is a very simple computer, it can process only electric signals (a bit like the electric pulses that are sent between neurons in our brains).
- For it to sense light, temperature, or other physical quantities, it needs something that can convert them into electricity. In our body, for example, the eye converts light into
- signals that get sent to the brain using nerves. In electronics, we can use a simple device called a light-dependent resistor (an LDR or photoresistor) that can measure the amount of light that hits it and report it as a signal that can be understood by the microcontroller.

» Once the sensors have been read, the device has the information needed to decide how to react. The decision-making process is handled by the microcontroller, and the reaction is performed by actuators. In our bodies, for example, muscles receive electric signals from the brain and convert them into a movement. In the electronic world, these functions could be performed by a light or an electric motor.

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button.





Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

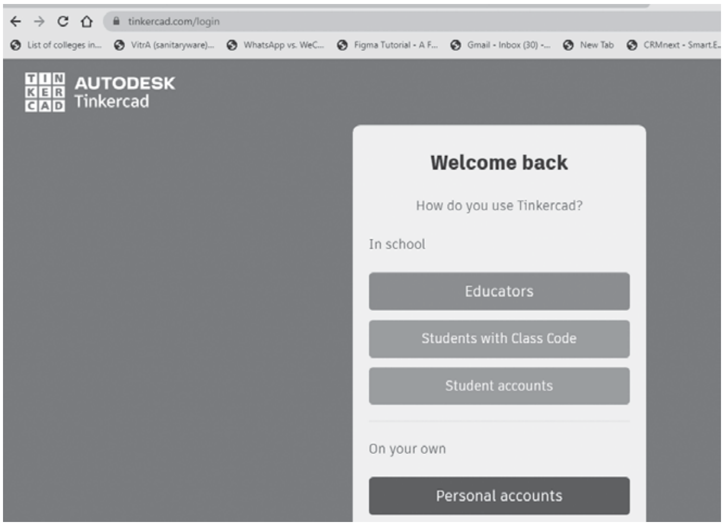
Note: All programs to be done using Simulation Tool like Tinkercad or any other Simulation Tool.

Program 1.1: Program to blink Arduino onboard LED

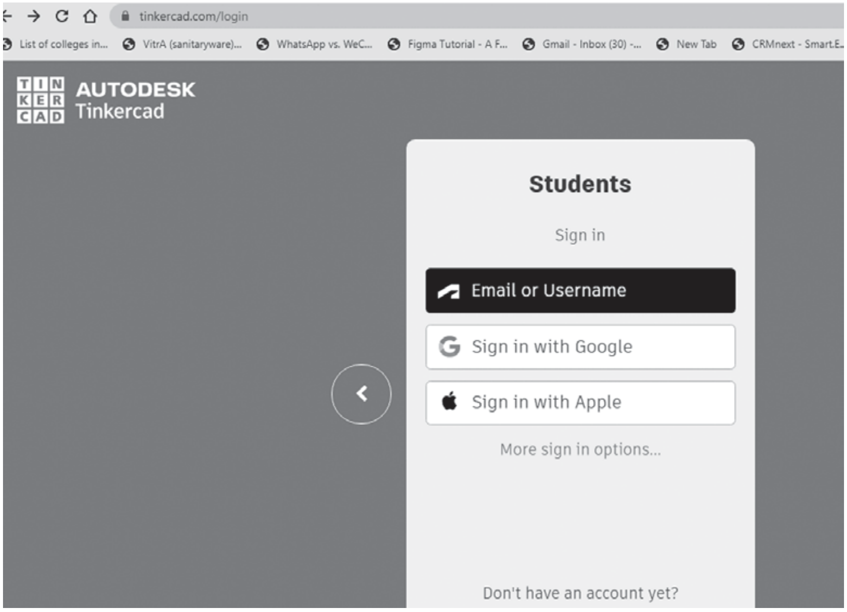
Components: Arduino Uno

Implementation:

Step-1: Open www.tinkercad.com

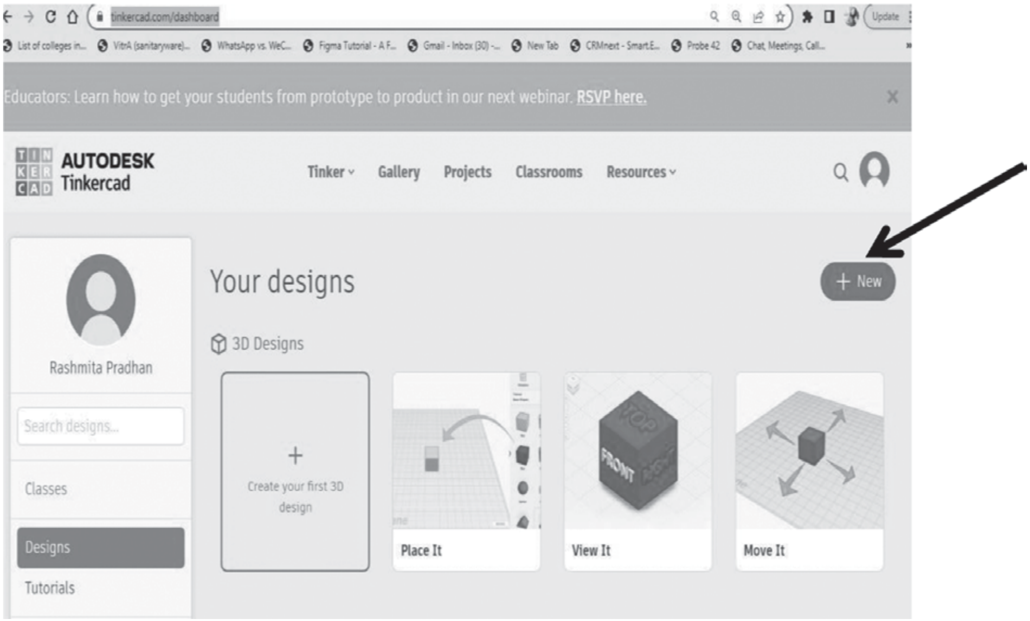


Step-2: If you are an Educator click on Educators or else click on Student accounts and sign in.



Step-3: Create Your own account.

Step-4: open https://www.tinkercad.com/dashboard and click on New



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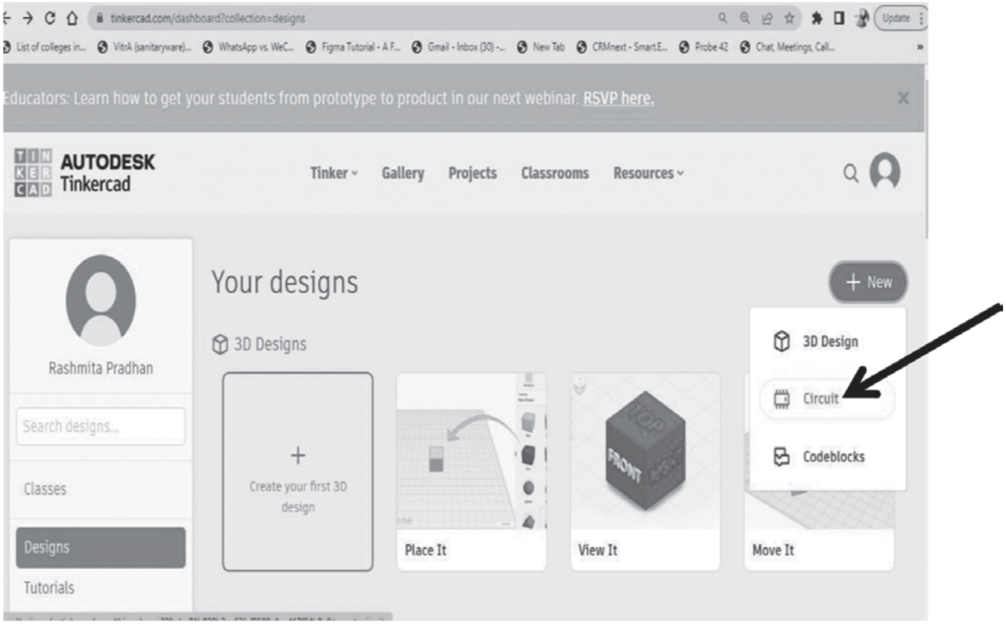
Step -5: Select Circuit



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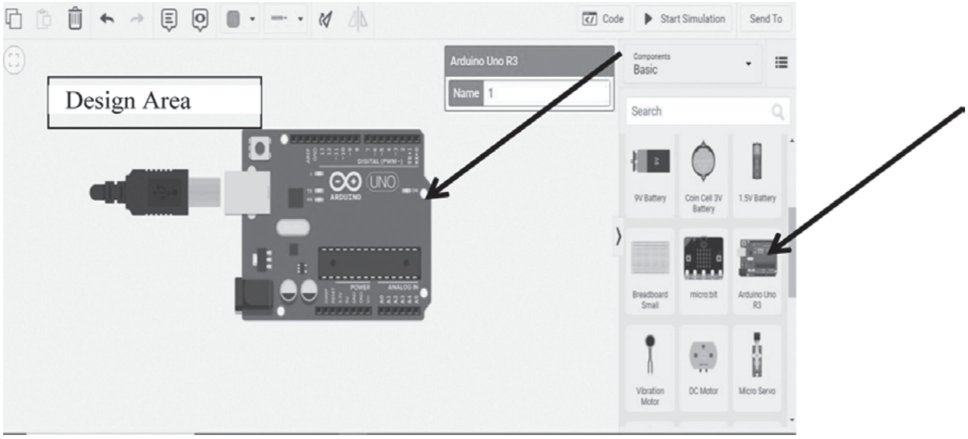
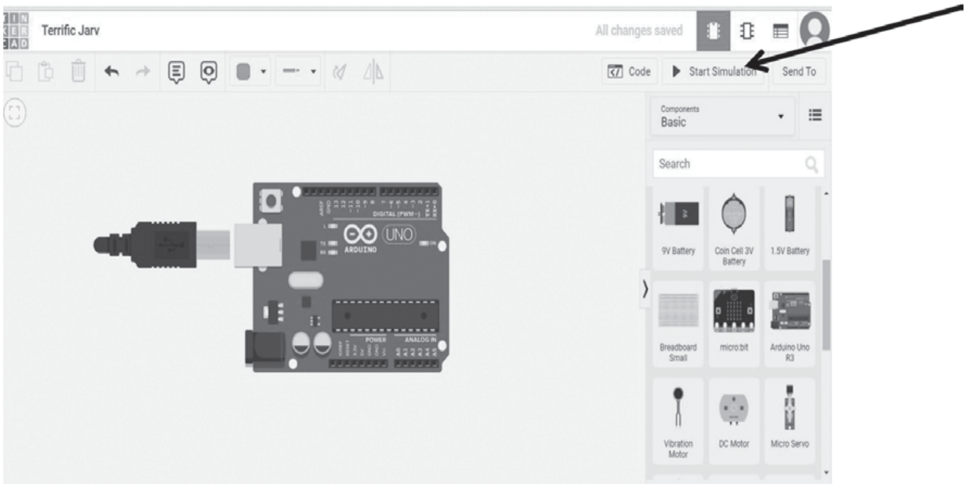
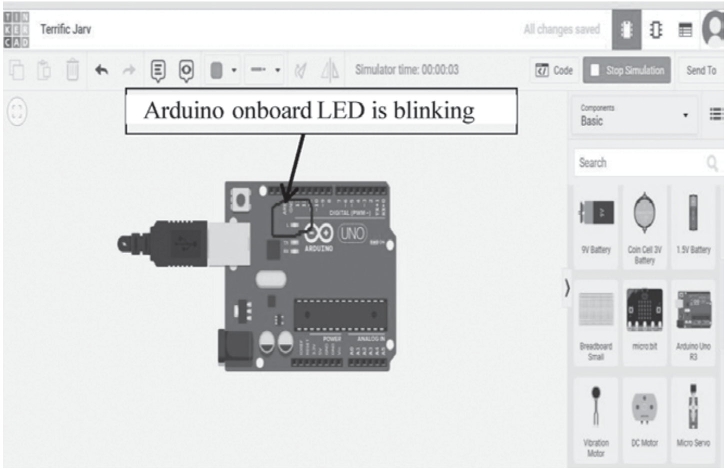
Step -6: From the left panel of the Workspace select Arduino Uno R3 and drag to the design area.


Design Area

Step -7: Click on Start Simulation.

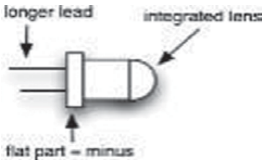


Output:


Arduino onboard LED is blinking

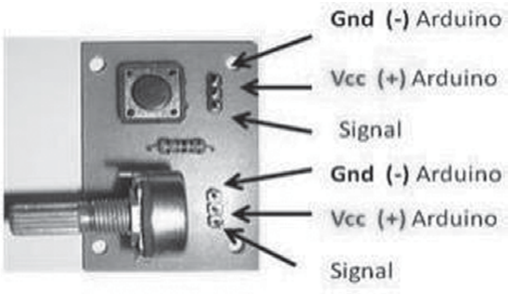
Chapter 2 Switches, LEDs, and More

LED: A light-emitting diode (LED) is a small electronic component that's a bit like a light bulb, but is more efficient and requires lower voltages to operate.



Switches:

Pushbutton: Pushbutton, is a very simple device: two bits of metal kept apart by a spring, and a plastic cap that when pressed brings the two bits of metal into contact. When the bits of metal are apart, there is no circulation of current in the pushbutton (a bit like when a water valve is closed); when we press it, we make a connection.



Thermostats:

A switch that opens when the temperature reaches a set value

Magnetic switches (also known as "reed relays"):

Has two contacts that come together when they are near a magnet; used by burglar alarms to detect when a window is opened

Carpet switches:

Small mats that you can place under a carpet or a doormat to detect the presence of a human being (or heavy cat)

Tilt switches:

A simple electronic component that contains two contacts and a little metal ball (or a drop of mercury, but I don't recommend using those) An example of a tilt switch is called a tilt sensor

Program 2.1: Interface external LED with Arduino and write a program to turn ON LED for 1 sec after every 2 seconds.

Components: Arduino Uno, 1 Green LED, 1 Resistor of 100 Ω

Theory:.

digitalWrite():

Description:

Write a HIGH or a LOW value to a digital pin.

If the pin has been configured as an OUTPUT with pinMode(), its voltage will be set to the corresponding value: 5V (or 3.3V on 3.3V boards) for HIGH, 0V (ground) for LOW.

If the pin is configured as an INPUT, digitalWrite() will enable (HIGH) or disable (LOW) the internal pullup on the input pin.

If you do not set the pinMode() to OUTPUT, and connect an LED to a pin, when calling digitalWrite(HIGH), the LED may appear dim. Without explicitly setting pinMode(), digitalWrite() will have enabled the internal pull-up resistor, which acts like a large current-limiting resistor.

Syntax:

digitalWrite(pin, value)

Parameters:

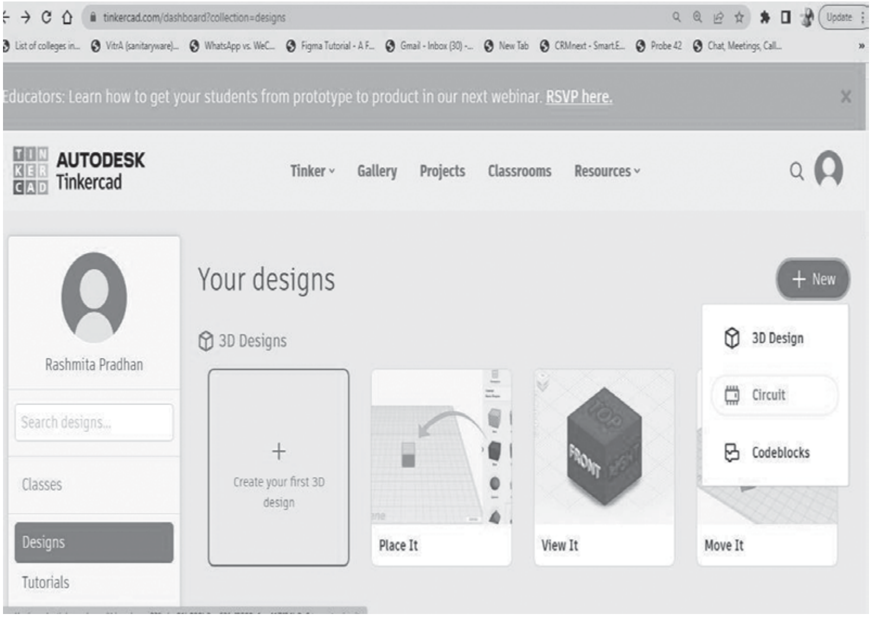
pin: the Arduino pin number. value: HIGH or LOW.

Implementation:

Step 1: Open tinkercad dashboard by using the following link and click on new:

https://www.tinkercad.com/dashboard

Step 2: Select Circuit



tinkercad.com/dashboard?collection=designs

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