PI CODE CLUB

MavBoard syllabus

1.Introduction to mavboard

2.LED & Buzzer

- Introduction to led and buzzer
- Project- Blinking led
- Project- buzzer on/off
- Task for students - make sequence led project or different led patterns

3. RGB LED

- Introduction to RGB LED
- RGB LED glowing
- Project - Traffic light project
- Task- to make use of buzzer in traffic light project

4.Push Button

- Introduction to push button
- Project- led ON/OFF
- Project - rgb ON/OFF
- Project - buzzer ON/OFF

5. LDR

- Introduction to LDR
- Project - street light project
- Task-

6. Potentiometer

- Introduction to potentiometer
- Project- Controlling brightness of led/rgb
- Task -

7. Motor

- Introduction to motor

- Project - Rotate clockwise / anti clockwise
- task - move forward / backward / left / right

8. Ultrasonic sensor

- Introduction to ultrasonic sensor
- Project - alarm system
- Task - security system (led + buzzer + ultrasonic sensor)

9. Obstacle avoiding robot

Mavboard Introduction

Mavboard is a customized all in one board with microcontroller, small electronic components, motors and sensors.

It has Arduino Nano as a microcontroller. We can also call it as a brain of the Mavboard.

Basically microcontroller means which can control small-small functions or activity.

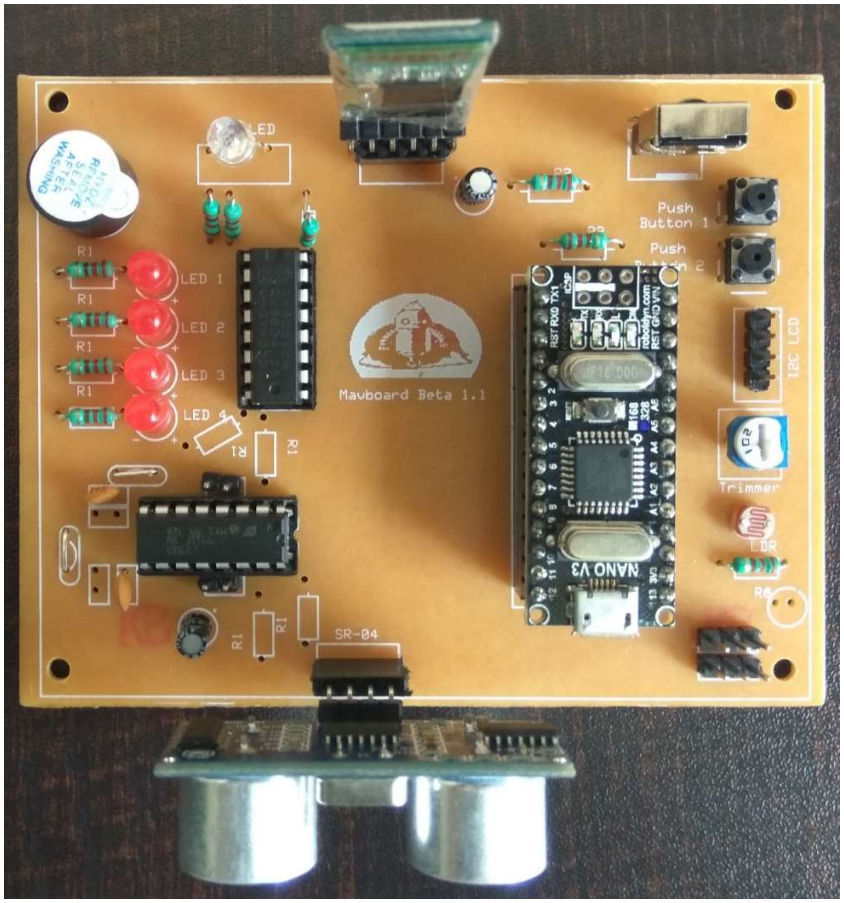
It has led's, RGB LED, Push Button, Potentiometer, LDR, Sensors and motor driver to control motors.

We have to give commands to microcontroller to perform particular activities, in the form of coding.

Here we are going to use blocks-based programming language, which means that you program by dragging and dropping chunks of code – the blocks.

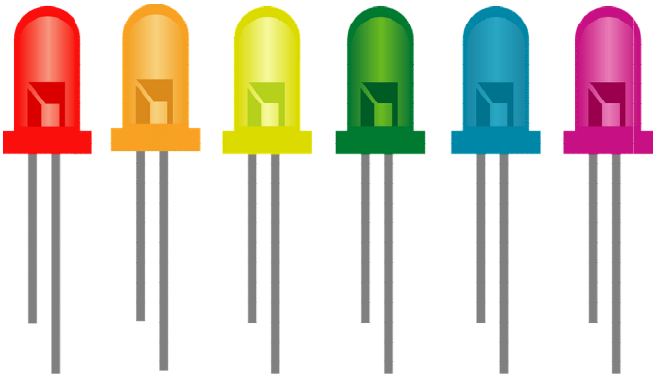
Ardublock is visual programming software we are going to use for it.

Instead of writing code in a programming language, we prefer drag and drop the blocks.

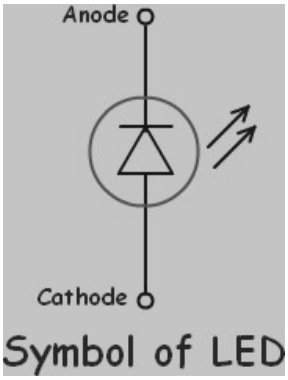


1. LED- Light Emitting Diode

A light releasing diode is an electronic component that emits light when an electric current flows through it. It is a light source based on semiconductors.



LED Symbol



Uses of LED

LEDs find application in various fields, including optical communication, alarm and security systems, remote-controlled operations, robotics etc. It finds usage in many such areas because of its long-lasting capability, low power requirements, swift response time and fast switching capabilities. Below are a few standard LED uses:

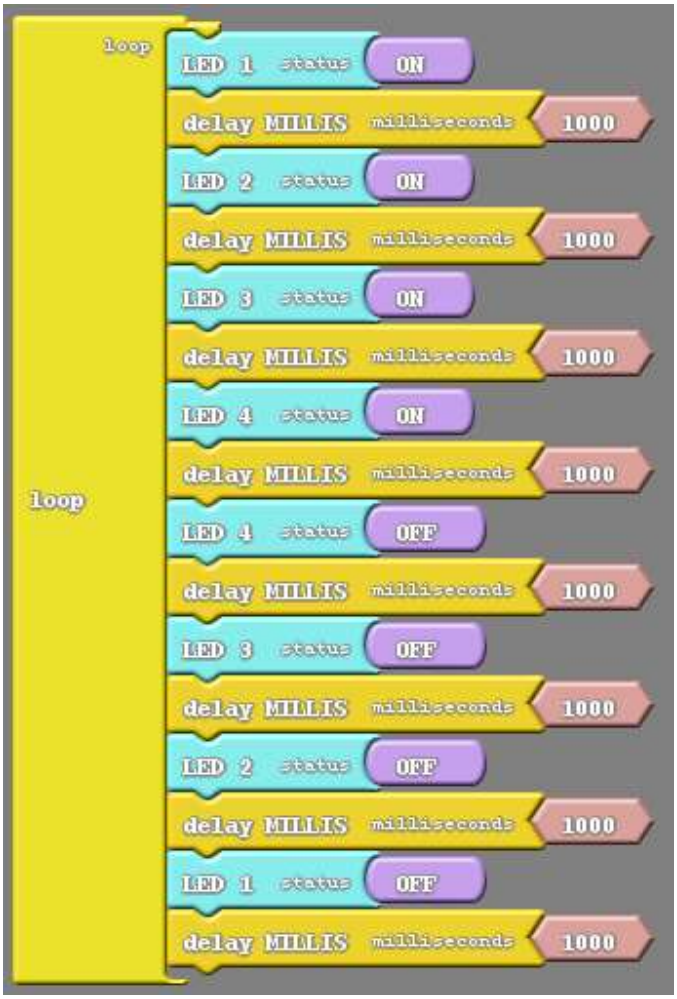
- Used for TV backlighting
- Uses in displays
- Used in automotive
- LEDs used in the dimming of lights

Project 1: Blinking of led


loop
loop
LED 1 status ON
delay MILLIS milliseconds 1000
LED 1 status OFF
delay MILLIS milliseconds 1000

Activity for Students

Project 1 - Make a project that shows sequence of led



2. Buzzer (Speaker)

What is Sound?

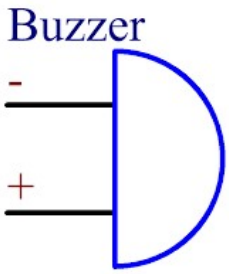
Sound is Vibrations that travel through the air or another medium and can be heard when they reach a person's or animal's ear.

What is Buzzer?

A buzzer or beeper is a signaling device, which produces sound. It may be mechanical, electromechanical, or piezoelectric.

Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Circuit Symbol:



Example:

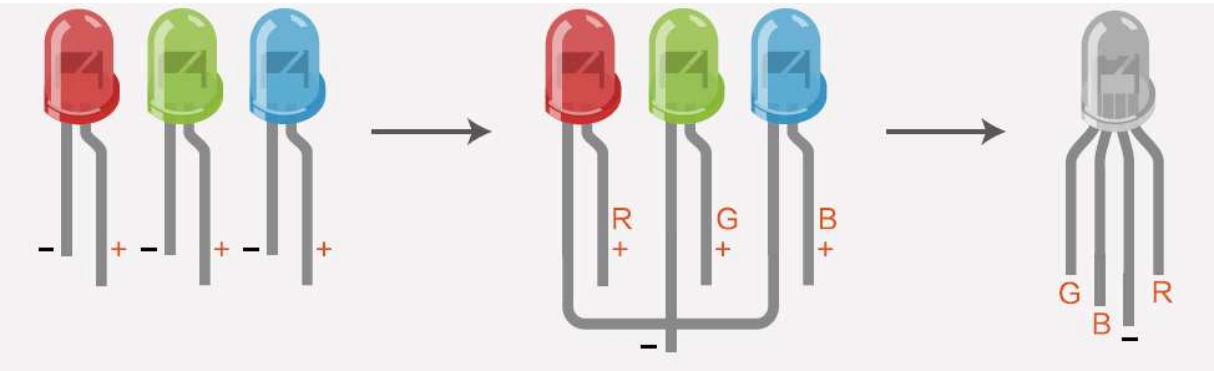
Project 2: Buzzer ON / OFF

Activity for Students

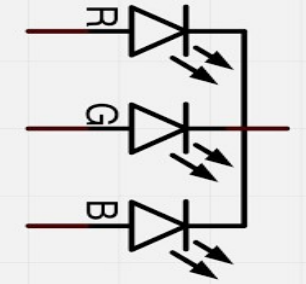
3. RGB LED

Introduction to RGB

RGB LED means red, blue and green LEDs. RGB LED products combine these three colors to produce over 16 million hues of light. Note that not all colors are possible. Some colors are "outside" the triangle formed by the RGB LEDs. Also, pigment colors such as brown or pink are difficult, or impossible, to achieve.



Circuit Symbol:



Example:

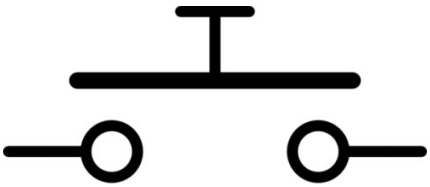
Project - Traffic light


loop
RGB RED status ON
RGB GREEN status OFF
RGB BLUE status OFF
delay MILLIS milliseconds 1000
RGB RED status OFF
RGB GREEN status ON
RGB BLUE status OFF
delay MILLIS milliseconds 1000
RGB RED status OFF
RGB GREEN status OFF
RGB BLUE status ON
delay MILLIS milliseconds 1000
RGB RED status OFF
RGB GREEN status OFF
RGB BLUE status OFF
delay MILLIS milliseconds 1000
RGB ALL status ON
delay MILLIS milliseconds 1000
loop

4. Push Button

- A push button is a simple type of switch that controls an action in a machine or some type of process.
- Most of the time, the buttons are plastic or metal.
- The shape of the push button may conform to fingers or hands for easy use, or they may simply be flat.
- It all depends on the individual design.
- The push button can be normally open or normally closed.

Circuit Symbol:

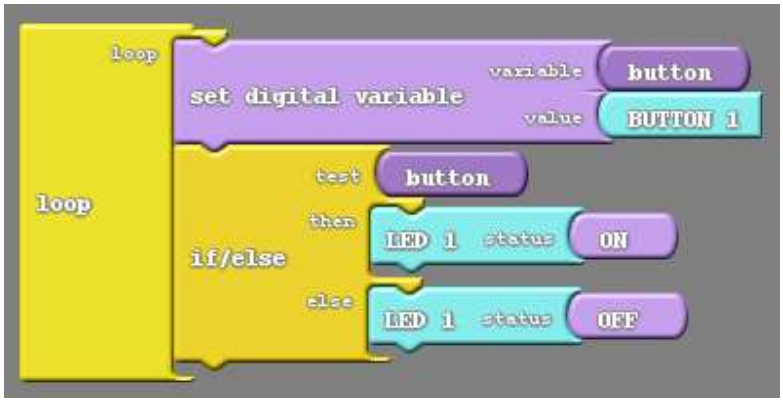


Applications:

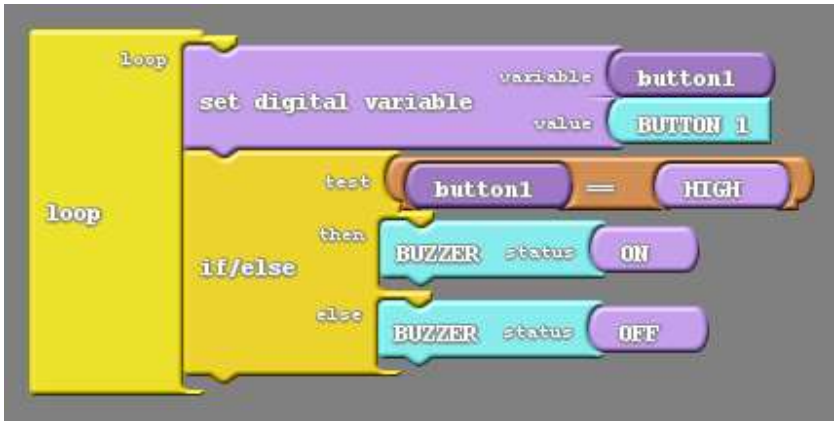
These switches are ordinarily used in calculators, push-button telephones, kitchen appliances, magnetic locks, and several other mechanical and electronic devices used across homes or industries.

Example:

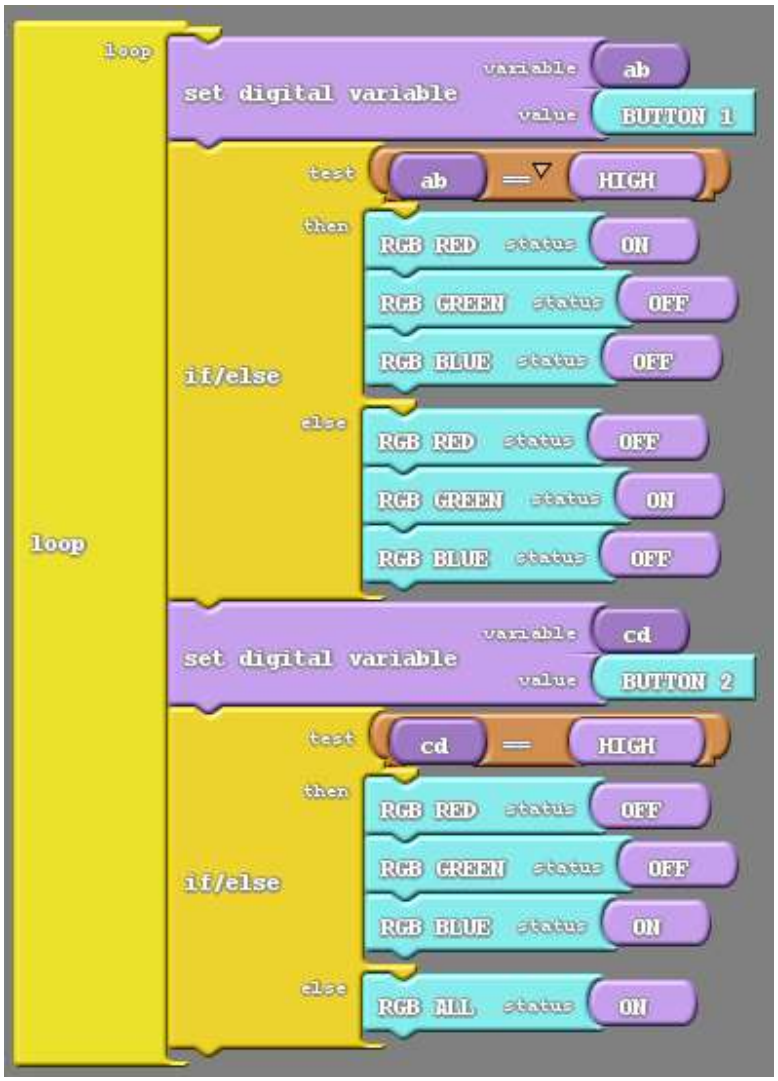
Project 1: ON / LED using Push Button



Project 2 : Buzzer ON / OFF using Push Button

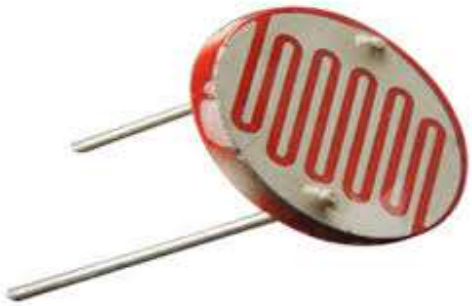


Project 3: RGB On off using button

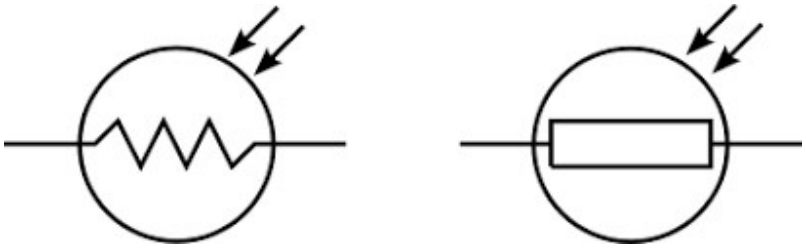


5. Light Dependent Resistor (LDR)

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells.



Circuit Symbol:



Applications:

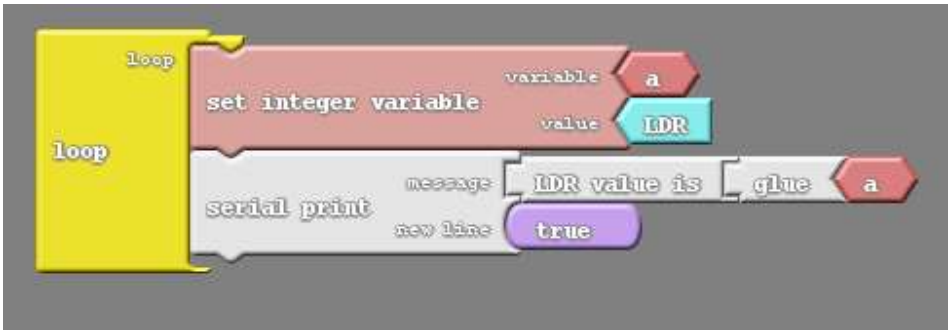
Light dependent resistors are simple and low cost devices. These devices are used where there is a need to sense the presence and absence of light is necessary. These resistors are used as light sensors and the applications of LDR mainly include alarm locks, street lights, light intensity meters, burglar alarm circuits.
For better understanding of this concept, here we have explained one project namely;
Power conserving of intensity controlled street lights using LDR.

Power Conserving of Intensity Controlled Street Lights using LDR

- Nowadays, lightening-up of highways is done through HID **(High-intensity discharge)** lamps but, the energy consumption of these lights is high as well as there is no particular mechanism to turn on/off the lights from sunrise to sunset.
- To overcome this problem, here is an alternative method using LEDs i.e. power conserving of intensity controlled street lights using LDR.
- The proposed system determines the usage of light emitting diodes as a light source and its adjustable intensity control according to the requirement.
- These lights consume less power as well as the lifespan of these lights is more compared to conventional HID lamps.
- The most important feature of this project is, the light intensity can be controlled according to the necessity during night time, which is not possible in HID lamps.
- An LDR is used to detect the light and the resistance of the LDR drastically reduces according to the light in the day time that forms as an i/p signal to the controller.
- A bunch of LEDs is used to make a street light and the microcontroller using in the project is pre-programmed with instructions which controls the light intensity based on the Pulse width modulation signals generated.
- The light intensity is kept high during the night time, and as the traffic on the roads tend to fall during peak hours; the intensity also falls gradually till morning.
- Finally the LED lights get turned off in the morning at 6 am, and continue again at 6pm in the evening. This process will continue.

Example:

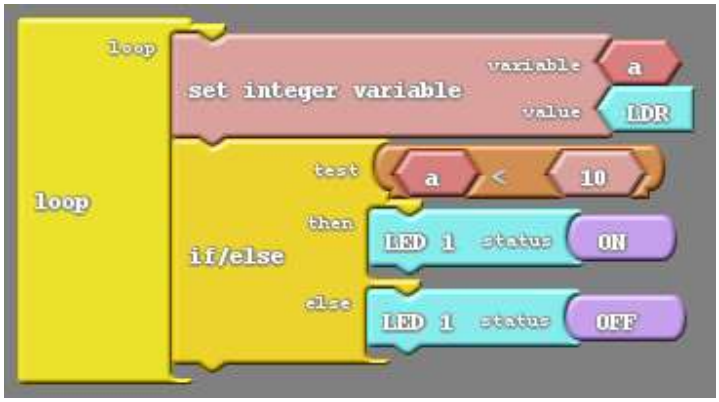
Project 1- Read the lDR value and display it on serial monitor



Project 2: Power Conserving of Intensity Controlled Street Lights using LDR

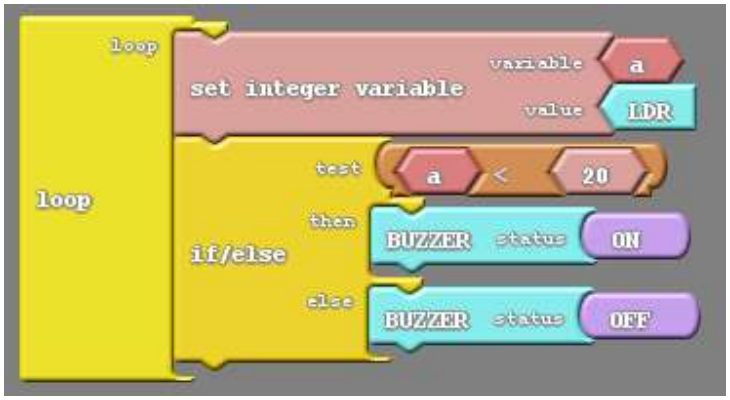
Save electricity by this simple project.

It glows light during the night and switches off automatically as the sun rises.

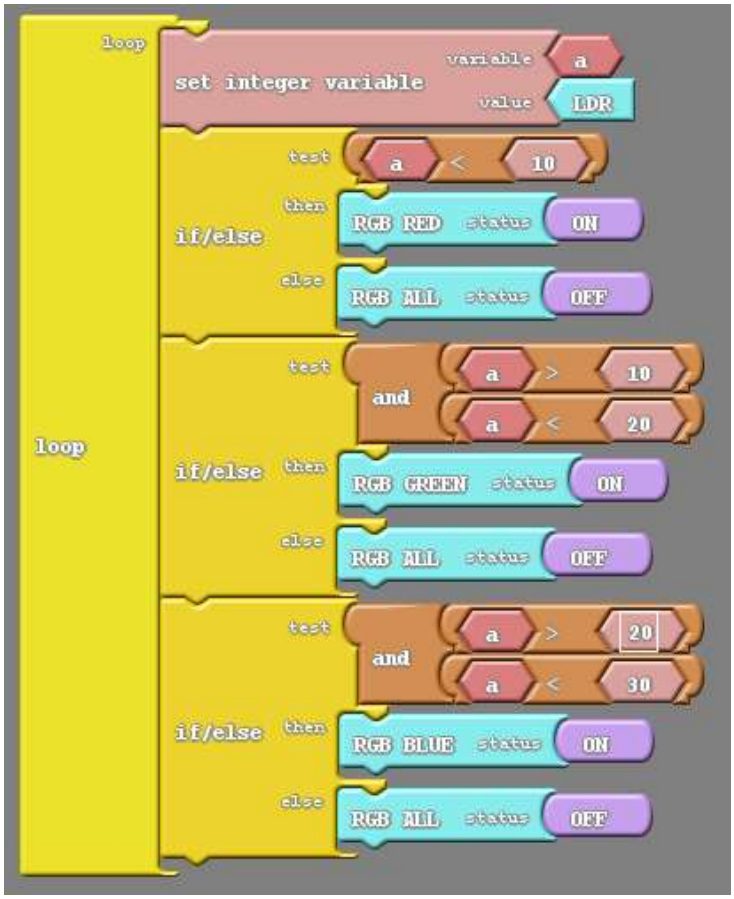


Activity for Students

Project 1 - Controlling Buzzer using LDR



Project 2 - Controlling RGB using LDR



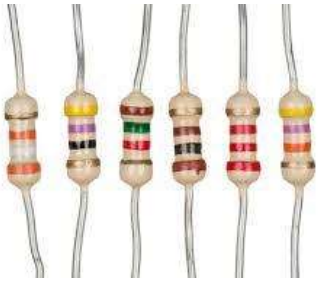
6. Potentiometer

What is Resistance?

Resistance is the opposition that a substance offers to the flow of electric current.
Resistance is a material's tendency to resist the flow of charge (current).

What is Resistor?

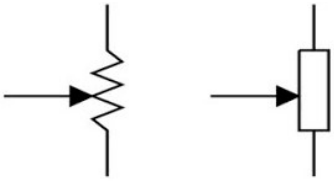
A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit.
Resistors can also be used to provide a specific voltage for an active device such as a transistor.



What is Potentiometer?

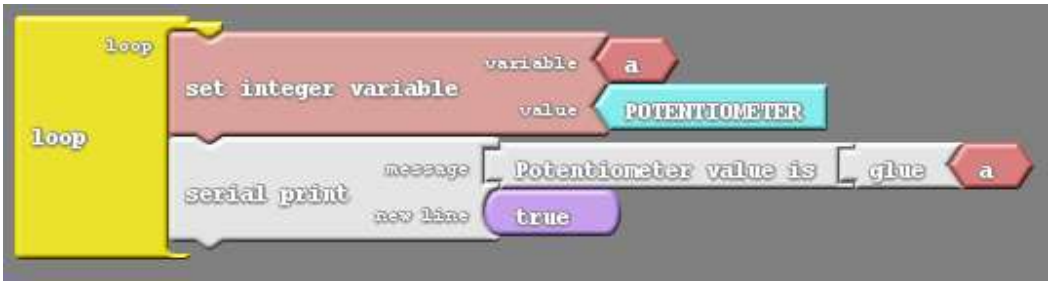
The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.
Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment.

Circuit Symbol:

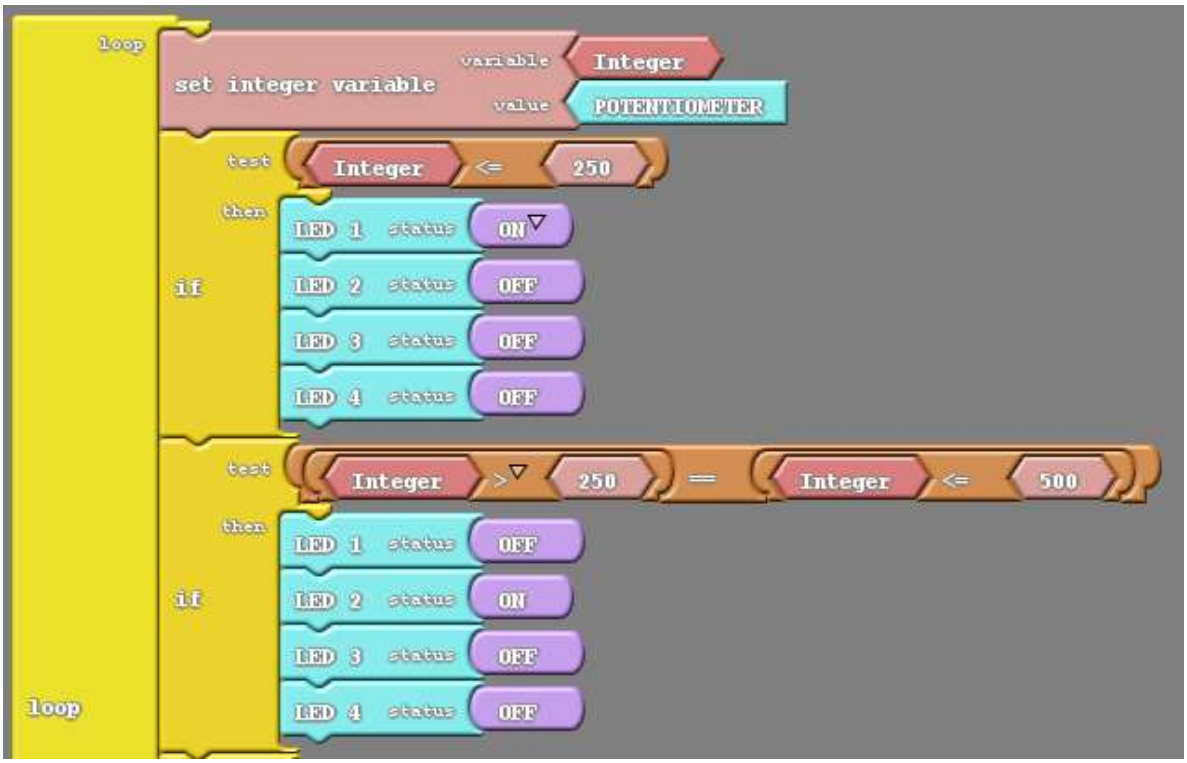


Example:

Project 1- read potentiometer value and display on serial monitor.



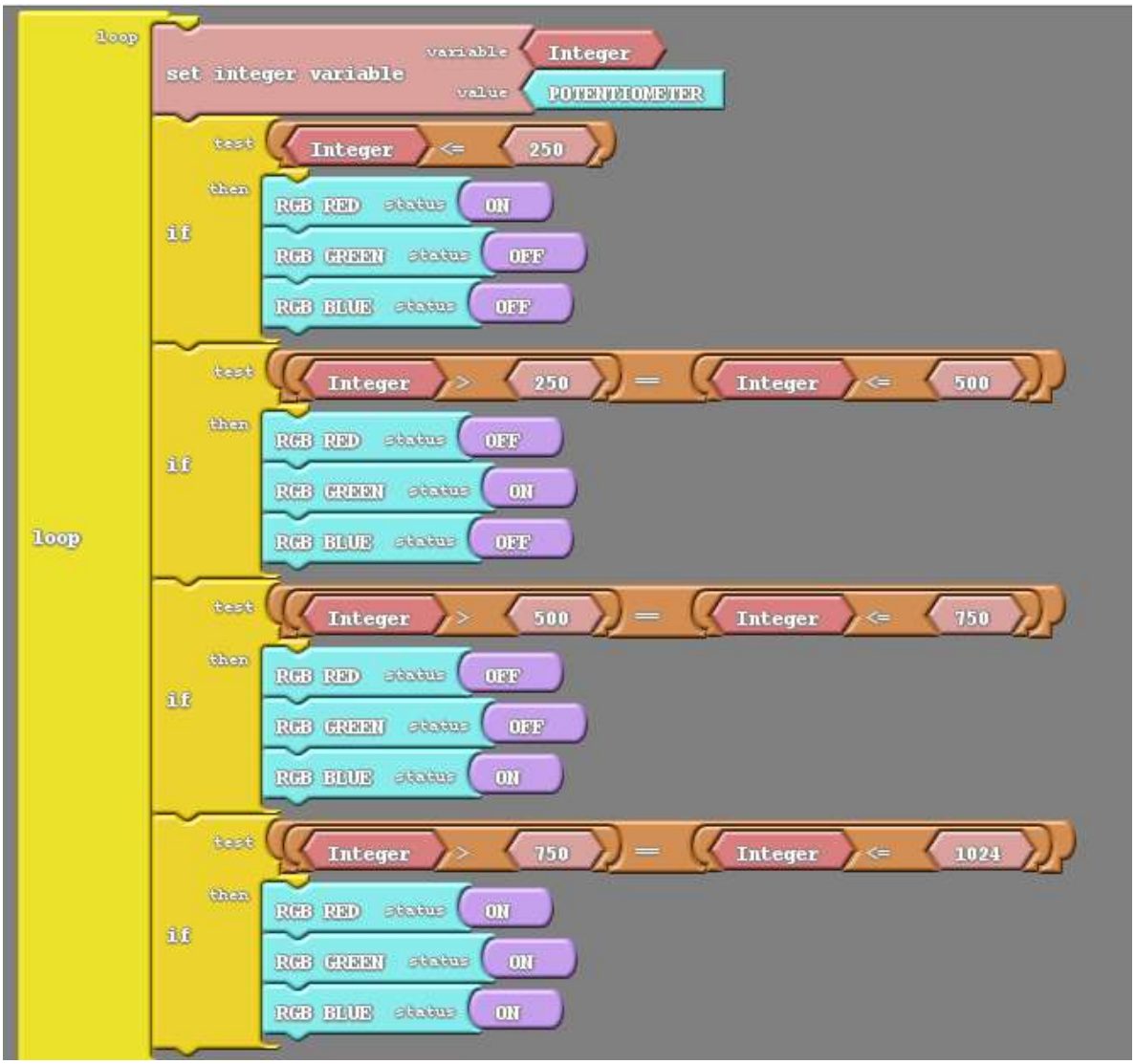
Project 2- controlling led with potentiometer




if
test
Integer > 500 == Integer <= 750
then
LED 1 status OFF
LED 2 status OFF
LED 3 status ON
LED 4 status OFF
test
Integer > 750 == Integer <= 1024
then
LED 1 status OFF
LED 2 status OFF
LED 3 status OFF
LED 4 status ON
Main

Activity for Students

Project: Controlling RGB LED using Potentiometer



7. Motor

What is Motor?

Motor is the electro-mechanical machine which converts the electrical energy into mechanical energy. In other words, the devices which produce rotational force is known as the motor.

Types of Motor

They are the AC motor and a DC motor. The AC motor takes alternating current as an input, whereas the DC motor takes direct current.

DC Motors

The DC Motor or Direct Current Motor to give it its full title, is the most commonly used actuator for producing continuous movement and whose speed of rotation can easily be controlled, making them ideal for use in applications were speed control, servo type control, and/or positioning is required.

DC Motors can come in: 9V, 12V or 24V

BO Motor

BO (Battery Operated) Motor is a lightweight DC geared motor which gives good torque and RPM at lower voltages. This motor can run at approximately 200 rpm when driven by a single Li-Ion cell. Great for battery operated light weight robots. It can do reverse and forward directions.

Torque is the twisting force that tends to cause rotation. The point where the object rotates is known as the axis of rotation. The higher the torque, the higher the pickup and force at the wheels.

RPM stands for revolutions per minute, and it's used as a measure of how fast any machine is operating at a given time.

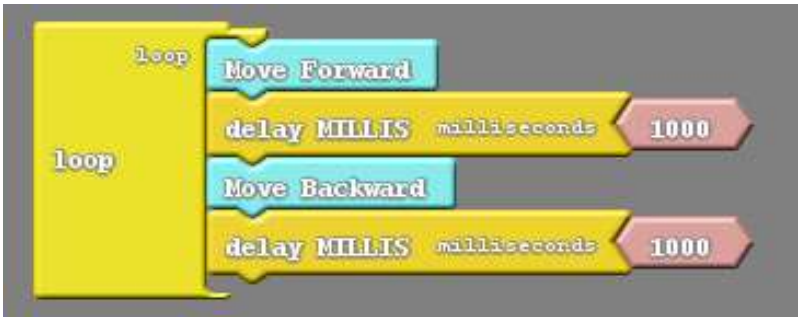
Circuit Symbol:

Types of BO Motor

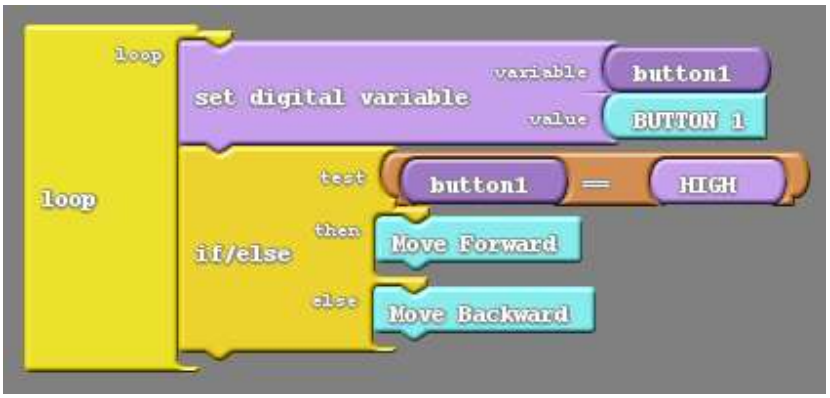
 **Single Shaft - I Shape**	 **Double Shaft - I Shape**
 **Single Shaft - L Shape**	 **Double Shaft - L Shape**

Examples:

Project 1 - Rotating Motor clockwise and anticlockwise



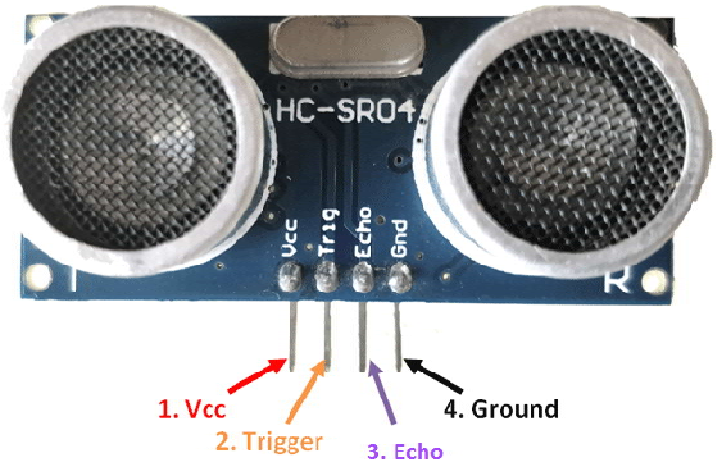
Project 2 - Motor On / off using button



Activity for Students

Project - To move motor forward / backward / Left / Right

8. Ultrasonic Sensor



As shown above the HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below

Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken

for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

Ultrasonic Sensor Pin Configuration

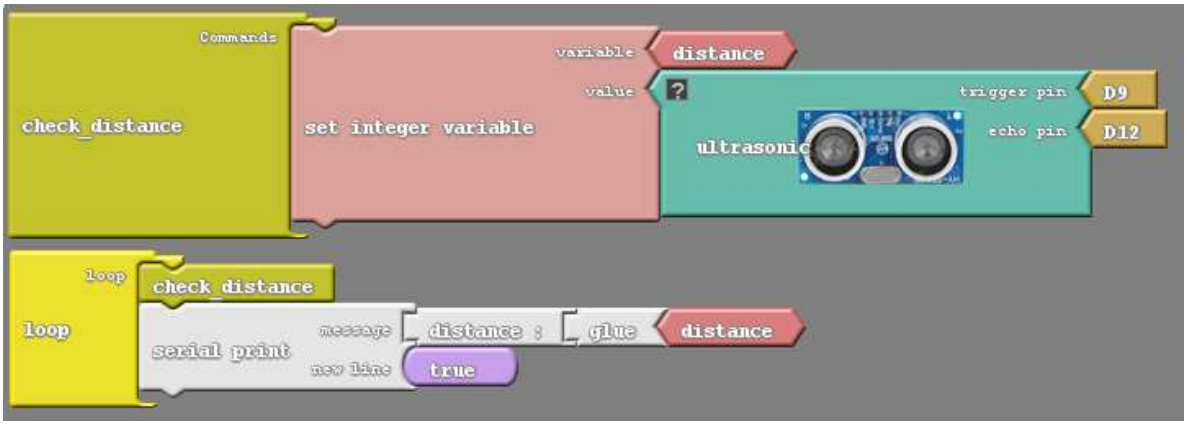
Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

Applications

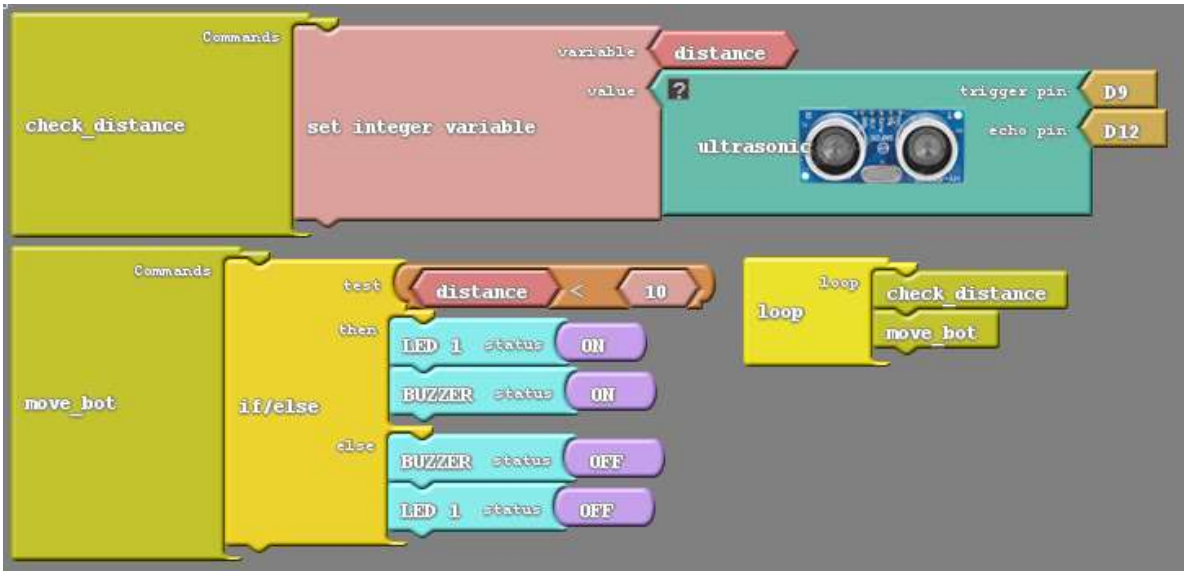
- Used to avoid and detect obstacles with robots like obstacle avoider robot, path finding robot etc.
- Used to measure the distance within a wide range of 2cm to 400cm
- Can be used to map the objects surrounding the sensor by rotating it
- Depth of certain places like wells, pits etc. can be measured since the waves can penetrate through water

Examples:

Project 1 - Measuring Distance using Ultrasonic Sensor

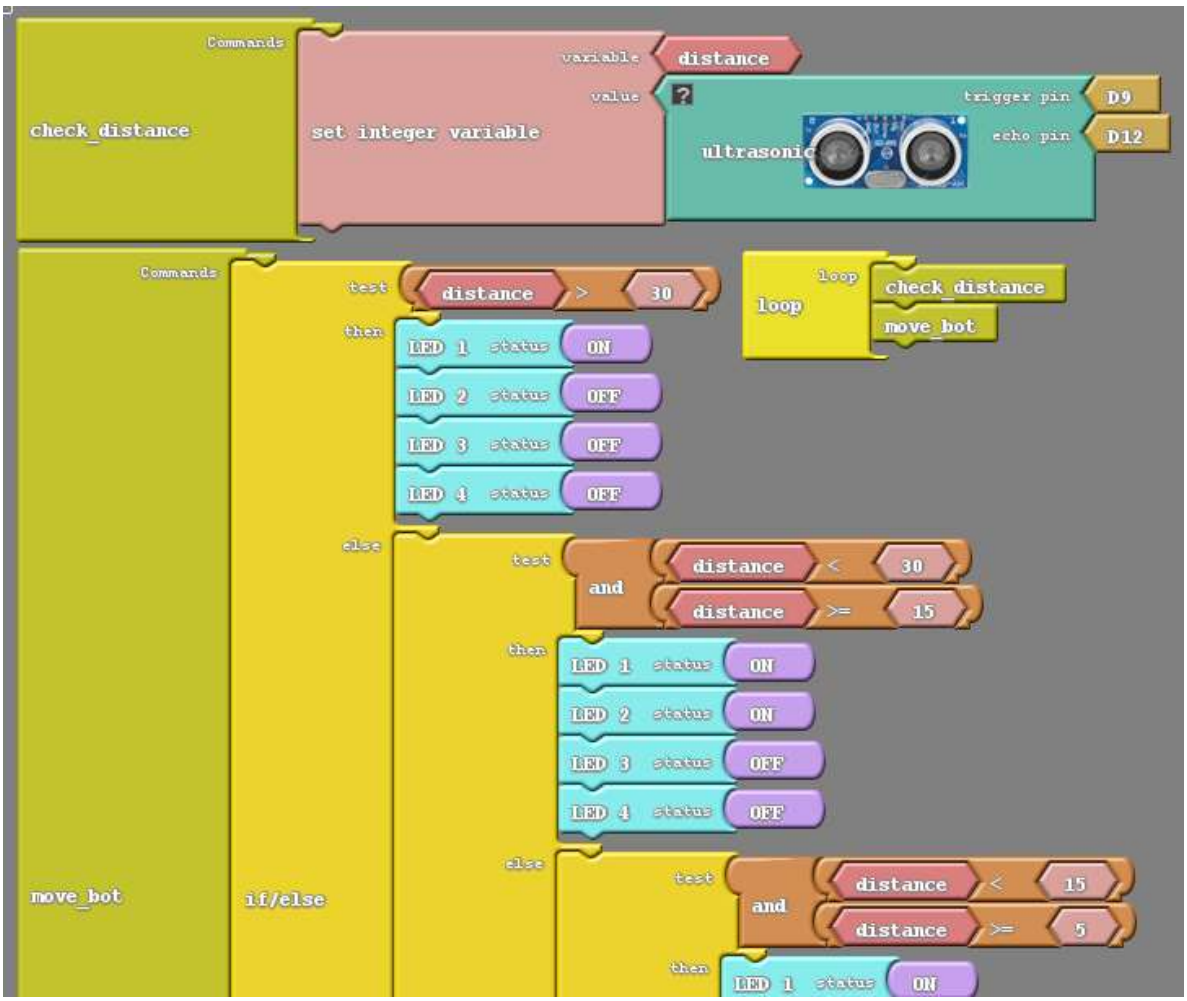


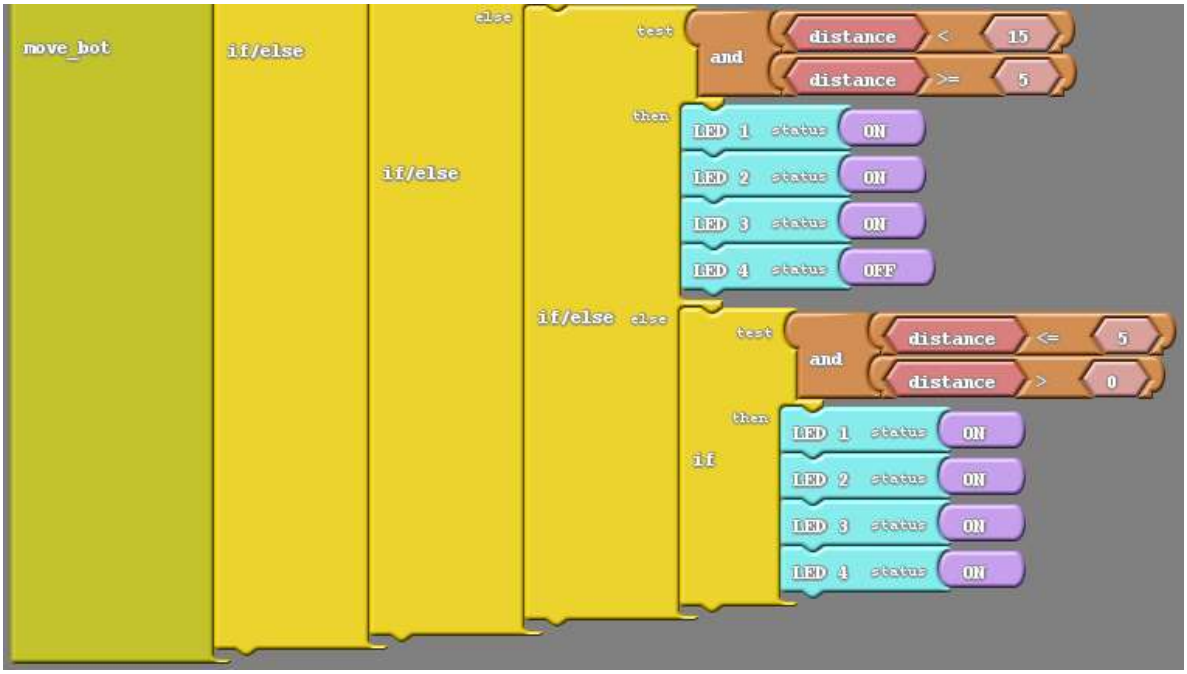
Project 2 - Security System



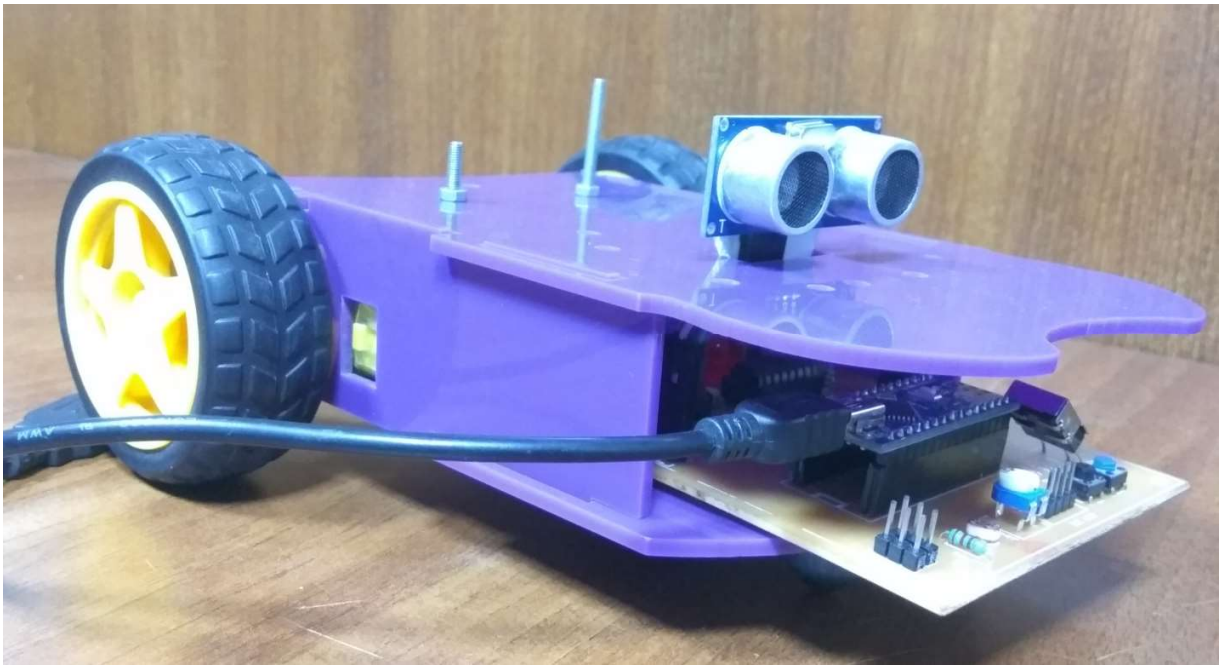
Activity for Students

Project - Water Level Indicator




move_bot
if/else
else
if/else
test
and
distance < 15
distance >= 5
then
LED 1 status ON
LED 2 status ON
LED 3 status ON
LED 4 status OFF
if/else else
test
and
distance <= 5
distance > 0
then
if
LED 1 status ON
LED 2 status ON
LED 3 status ON
LED 4 status ON

9. Obstacle Avoiding Robot



Introduction:

An obstacle avoiding robot is a fully automated robot which can be able to avoid any obstacle which it faces when it moves.

Simply, when it met an obstacle while it moving forward, automatically stop moving forward and makes a step back.

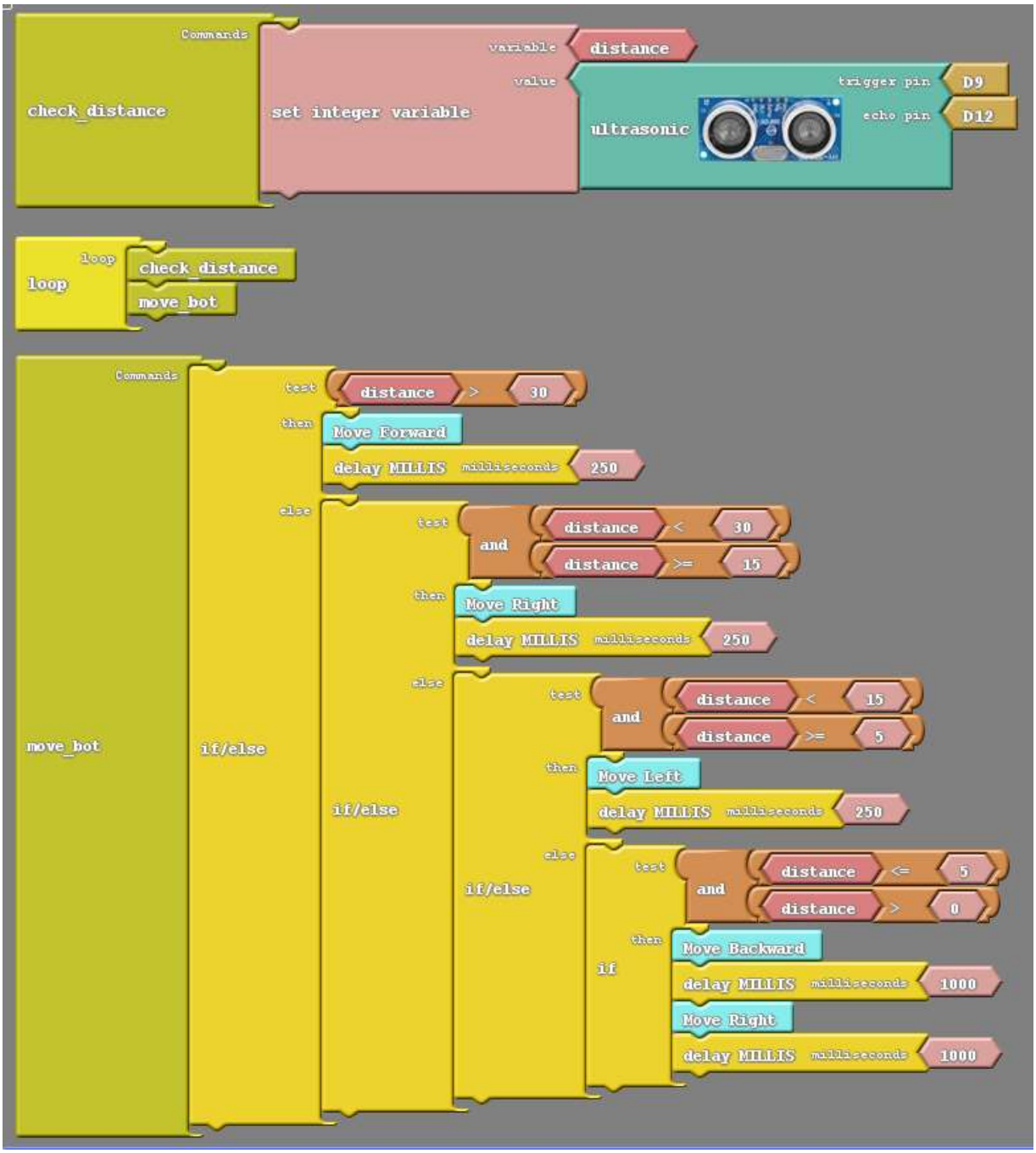
Then it looks it's two sides left & right and starts to move the best possible way; which means either in left direction if there is another obstacle in right or in the right direction if there is another obstacle in left side.

The obstacle avoiding robot is very helpful and it is the base of many large projects such as Automatic cars, robots used in Manufacturing factories, even in robots used in spacecraft's.

Connections:

1. **Connect your ultrasonic sensor to the Mavboard.**
2. **Connect both the Bo Motors to Mavboard.**

Code:


Commands
check_distance
variable
distance
value
set integer variable
trigger pin
D9
ultrasonic
echo pin
D12
loop
loop
check_distance
move_bot
Commands
move_bot
if/else
test
distance > 30
then
Move Forward
delay MILLIS milliseconds 250
else
if/else
test
and
distance < 30
distance >= 15
then
Move Right
delay MILLIS milliseconds 250
else
if/else
test
and
distance < 15
distance >= 5
then
Move Left
delay MILLIS milliseconds 250
else
if
test
and
distance <= 5
distance > 0
then
Move Backward
delay MILLIS milliseconds 1000
Move Right
delay MILLIS milliseconds 1000