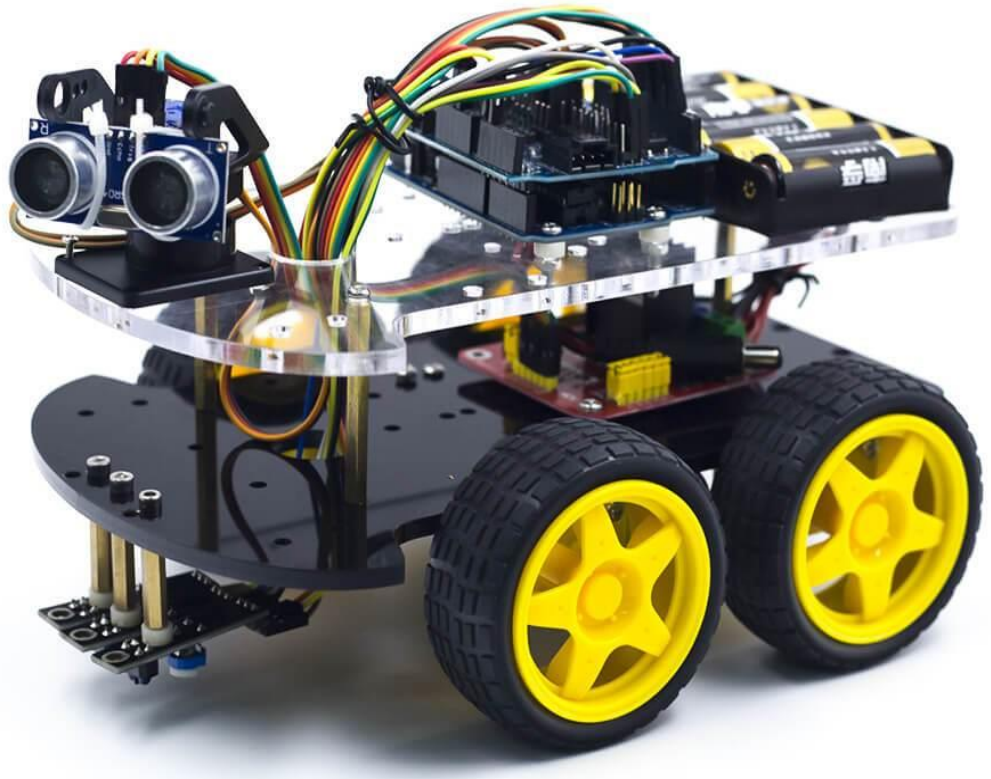
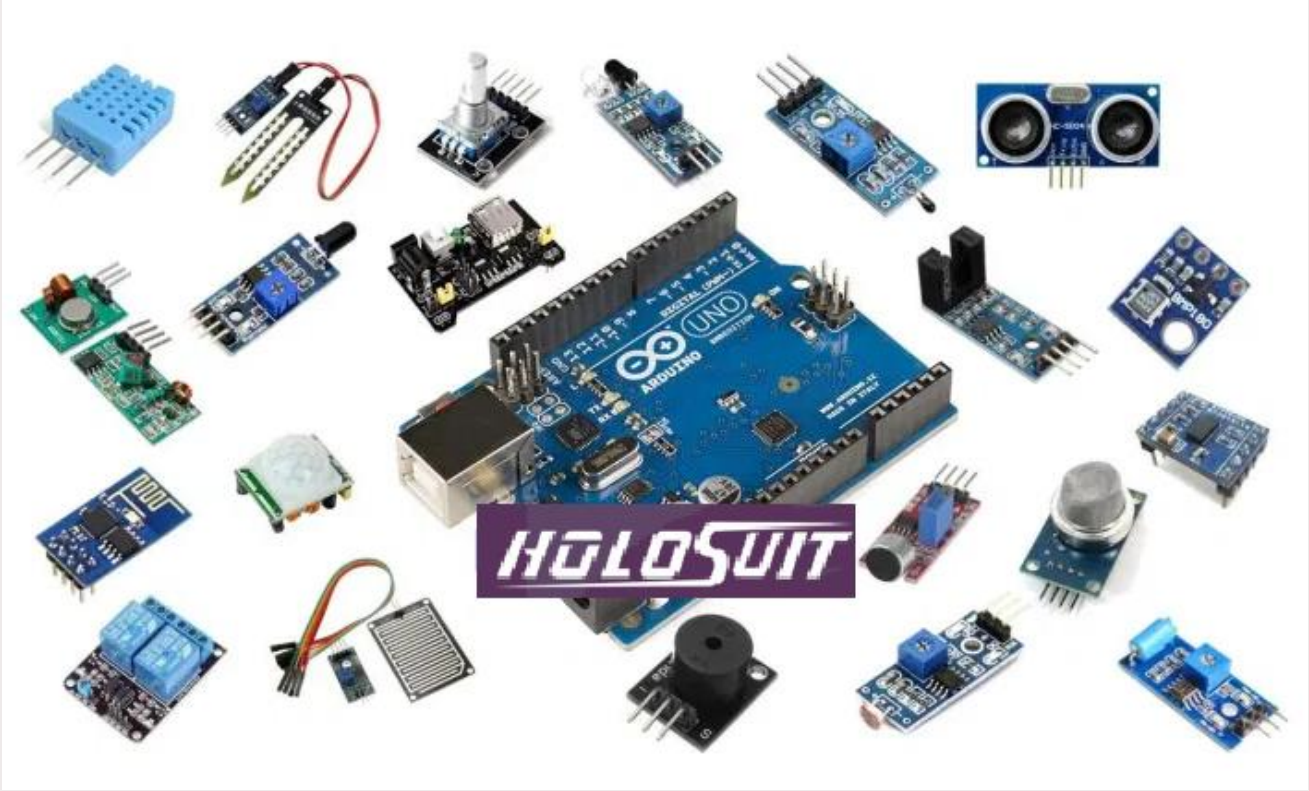
NSDC – Junior Skills Championship
Mobile robotics



HOLOWORLD

Agenda – Day 4

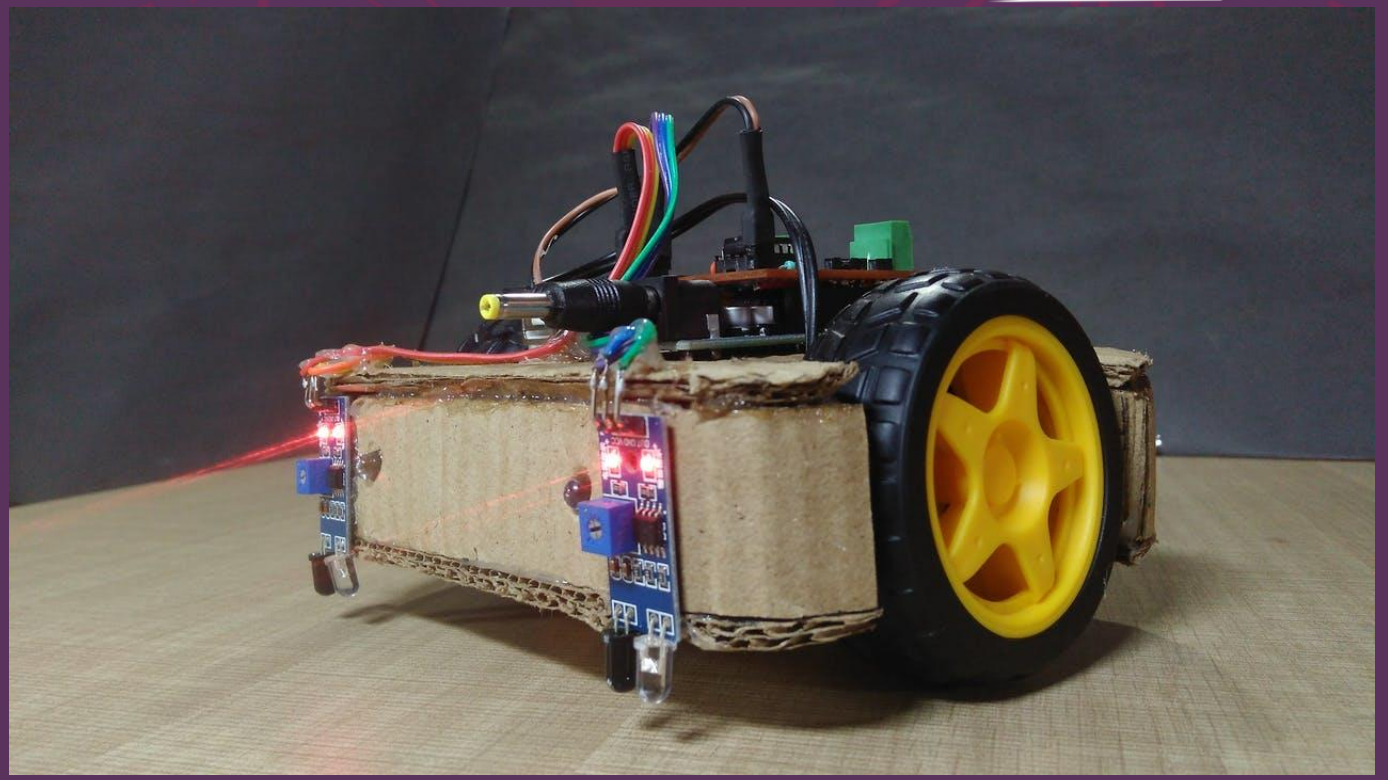
- Cliff detection robot – Experiment 3
  - What's cliff detection robot
  - Working principle
  - Components
  - Schematic and connection
  - Let's code!
- Wall following robot – Experiment 4
  - What's wall following robot
  - Working principle
  - Components
  - Schematic and connection
  - Let's code!



Wednesday, August 18, 2021

Cliff detection robot

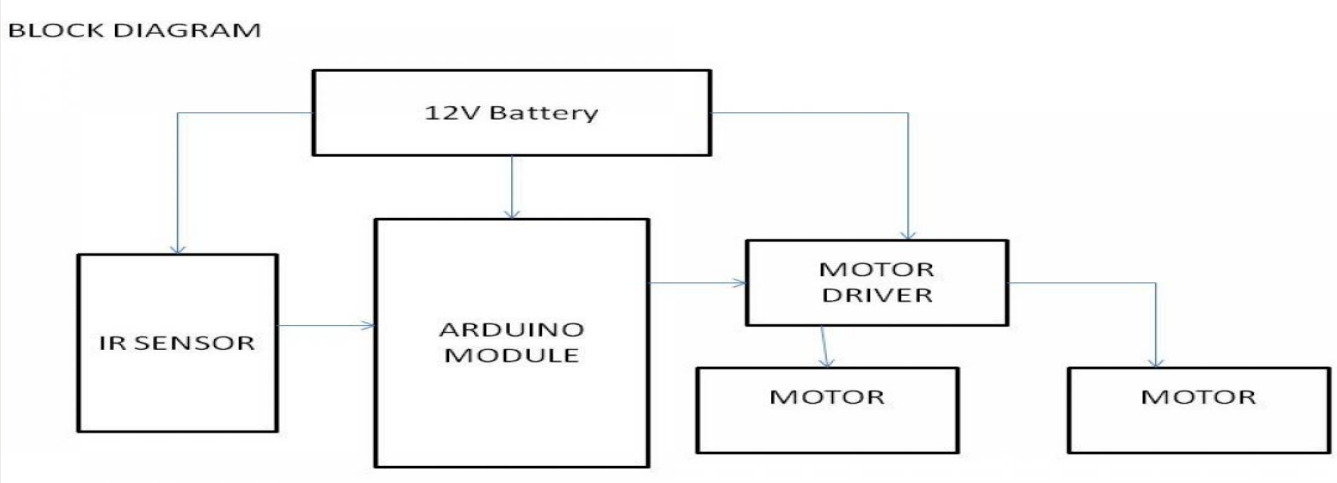
- The edge detection robot is a decision-maker robot which can take its own decision depending on the real-time situation.
- If any edge appears, it can sense it and take an alternative route free of obstacles or edges.
- Here, the range sensors which are pointed at the floor are used to detect the absence of the floor.
- After circumnavigating, the robot returns to the point that is nearest to the obstacle and then continues the hovering.



Working - Cliff detection robot

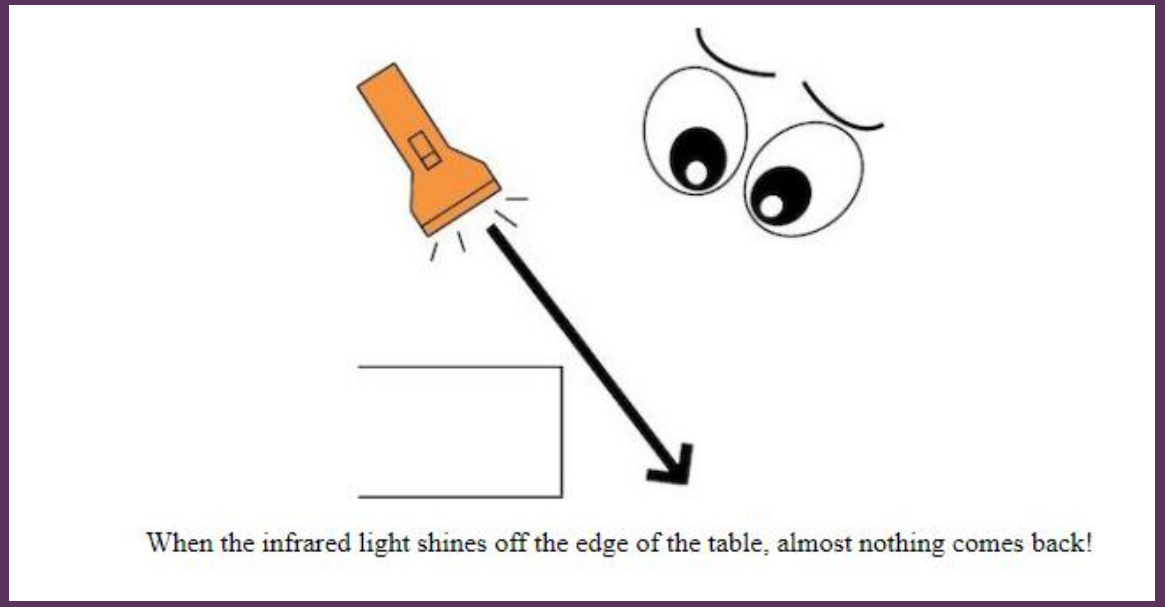
HOLOWORLD

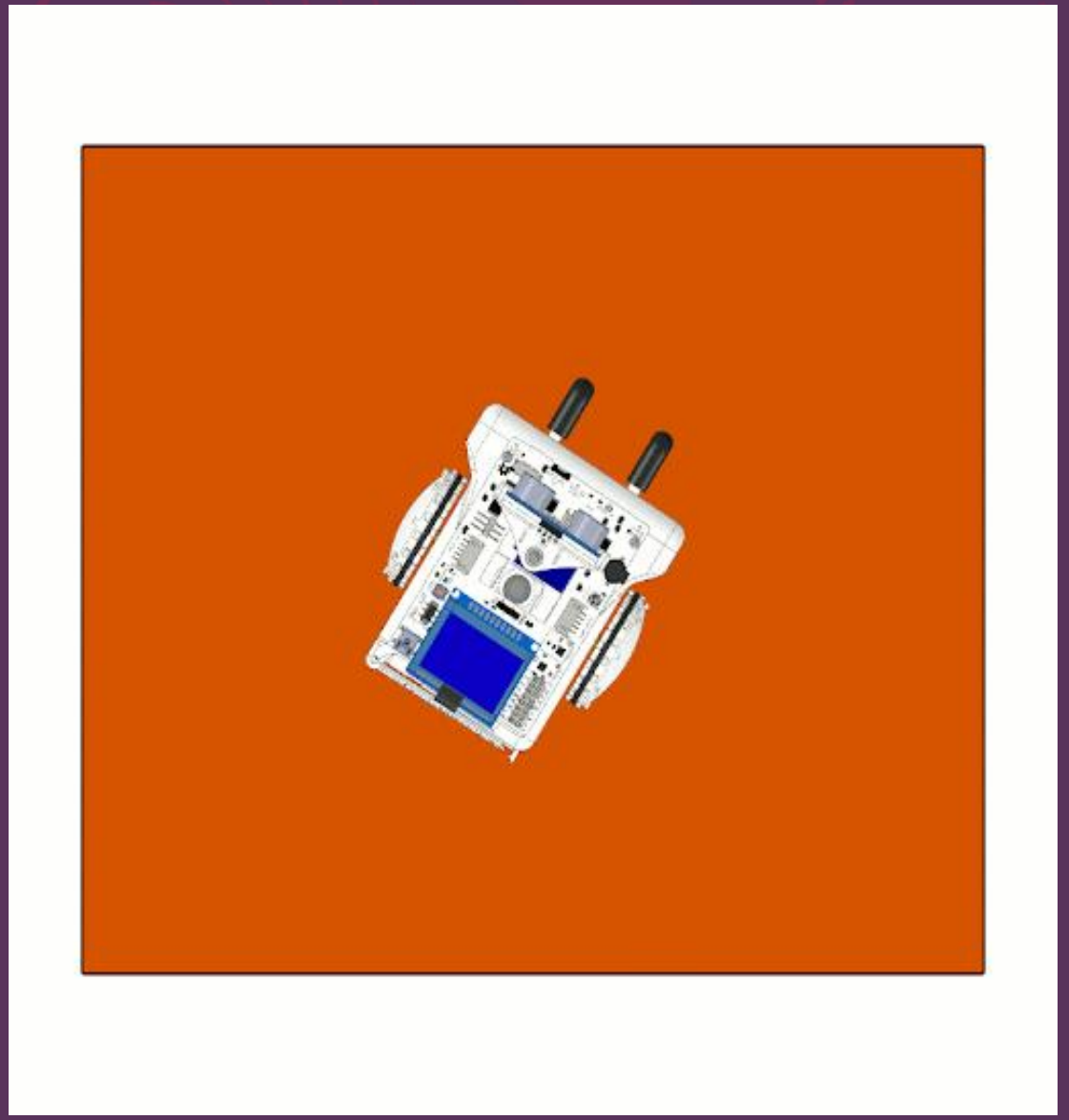
- Edge or cliff detection Robot which senses and avoids the absence of surface below it.
- A robot that moves on an elevated surface by automatically detecting edges and avoiding the fall.
- This works with the signal generated by the IR sensors mounted in front of the moving robot
- To avoid the edge of platform, sensors are mounted in front of robot at both left and right side.
- Each sensor has a motor associated with it which is connected to the microcontroller to receive real-time signals
- If it gets the reflected light(means there is still surface below the sensor), the comparator sends logic 1 to microcontroller thus the robot keeps moving in the forward direction.
- When the reflection is low or no detected, with respect to the sensor that sends logic 0 to the microcontroller the robot wheels turn accordingly
- This robot moving is completely autonomous and does not involve manual operation



Cliff detection robot

- After the circuit connections, the robot must be powered on and it starts hovering around.
- The robot moves around the table with the sensor data from the IR sensor mounted on it
- When the refection from a particular sensor mounted gives higher reflection comparing the other, the sensor turns other way and starts moving.
- In this manner, the robot avoids falling off the table.

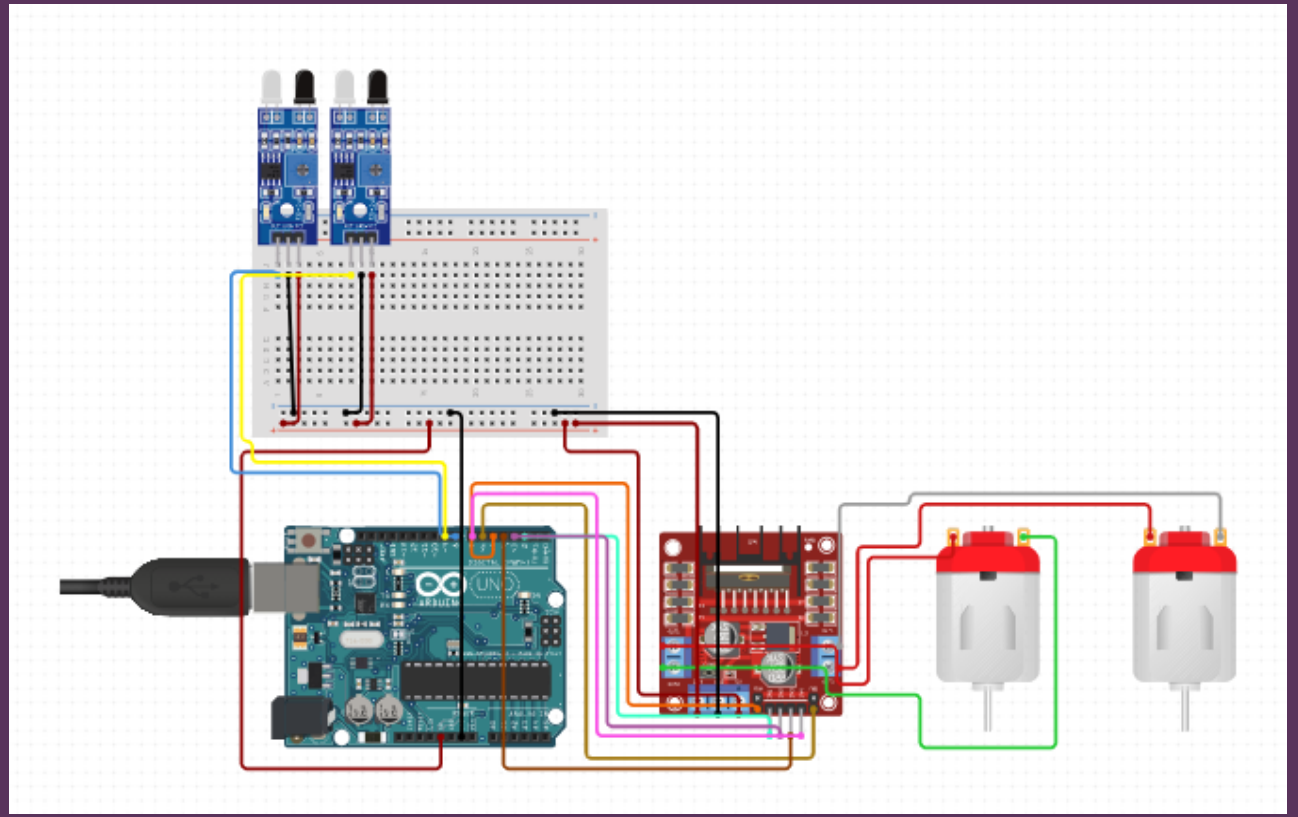




Cliff detection robot

Schematic and connections

Battery positive	Arduino Vin
Battery negative	Arduino GND
Motor driver 12v pin	VCC or battery positive
Motor driver GND	Arduino GND
Motor 1 A and B	Motor driver A1 B1
Motor 2 A and B	Motor driver A2 B2
Arduino - D4 D5 D6 D7	Motor driver IN1,IN2,IN3,IN4
IR sensor VCC	Arduino 5v pin
IR sensor GND	Arduino GND
IR sensor Output(Two IR sensors)	Arduino A0 and A1



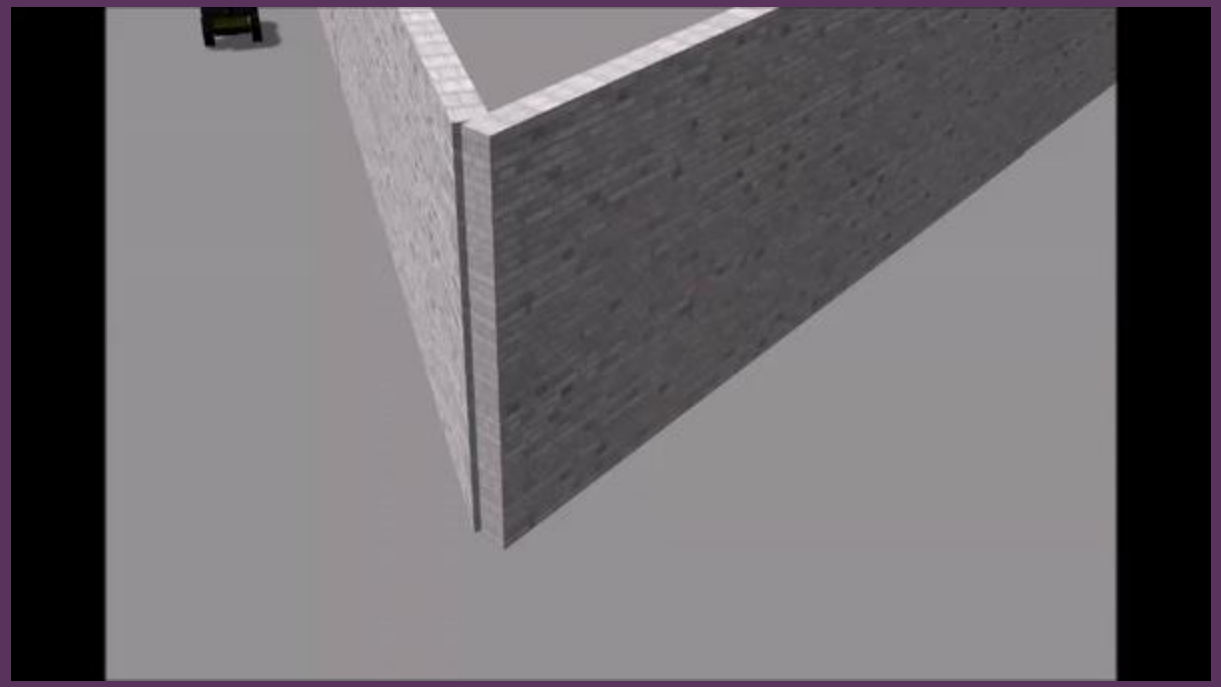
Cliff detection robot

Applications

- This concept is also used in space programs and moons to detect the craters and big holes on the surface and saving robot to fall into the craters or holes.

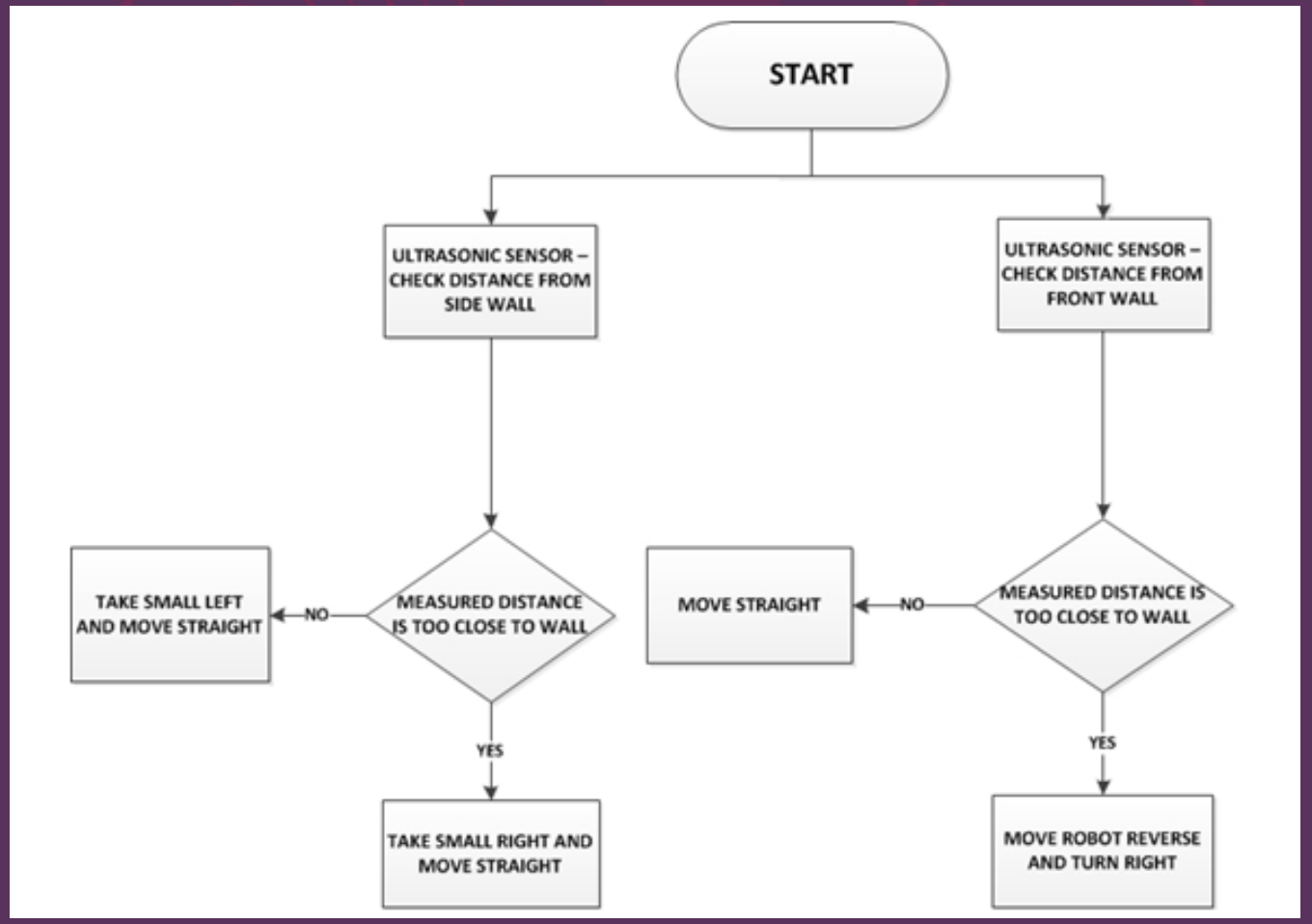
Wall follower robot

- A wall following robot is **designed to move along a wall without hitting it**
- It has obstacle detection sensors mounted on the body which detects wall and drive DC motors attached to the wheels such that the robot keeps moving along the wall.
- In order to follow walls, you need at least two sensors (2 bits of information) to handle the four potential situations the robot could be in.
- One sensor has to be in the front, and the second could be on the left or right of the robot.
- Based on second sensor the robot could be left or right oriented



Algorithm - Wall follower robot

- The robot moving algorithm is designed as, the robot must follow the wall at a certain distance from the wall to avoid collision.
- When the robot meets an intersecting area, if there's no disturbance in the signal it follows the previous line
- If there's a signal interference, it looks for the wall between right or front.
- If right oriented wall follower is designed, the obstacle detection sensors need to be mounted on front and right side of the robot.
- If Left oriented wall follower is designed, the obstacle detector sensors need to be mounted on front and left side of the robot.
- If the robot is designed to follow either sides, obstacle detector sensors need to be mounted on front, left and right side of the robot.



Wall follower robot

- When the robot is powered on, it is initialized to move forward and keep turning left until it reaches a minimum distance with the left wall.
- Now onwards, the robot can face two conditions either some obstacle appears in front of the robot or the distance with the wall may reduce due to the structure or layout of the wall.
- If an obstacle is detected in front of the robot at a preset distance, the robot will be turned right until it overcomes the obstacle.
- If there is no obstacle in front of the robot, the robot will continue forward motion.
- In case, the distance between the left wall and robot is reduced below minimum value, the robot will be made to move again in right direction by driving left side motor more speedily until the distance reaches a maximum value

Front Sensor	Left Sensor	Situation	Follow Up Action
OFF	OFF	Robot has moved away from wall	Turn Robot left until it reaches a minimum distance away from wall
OFF	ON	Robot is following the wall	Keep Robot moving forward
ON	ON	Robot has reached a corner or approached an obstacle	Turn Robot right until it overcomes obstacle or turn right from the corner
ON	OFF	Robot is moving away from the wall and approaching an obstacle	Turn left quickly to keep moving parallel to the wall

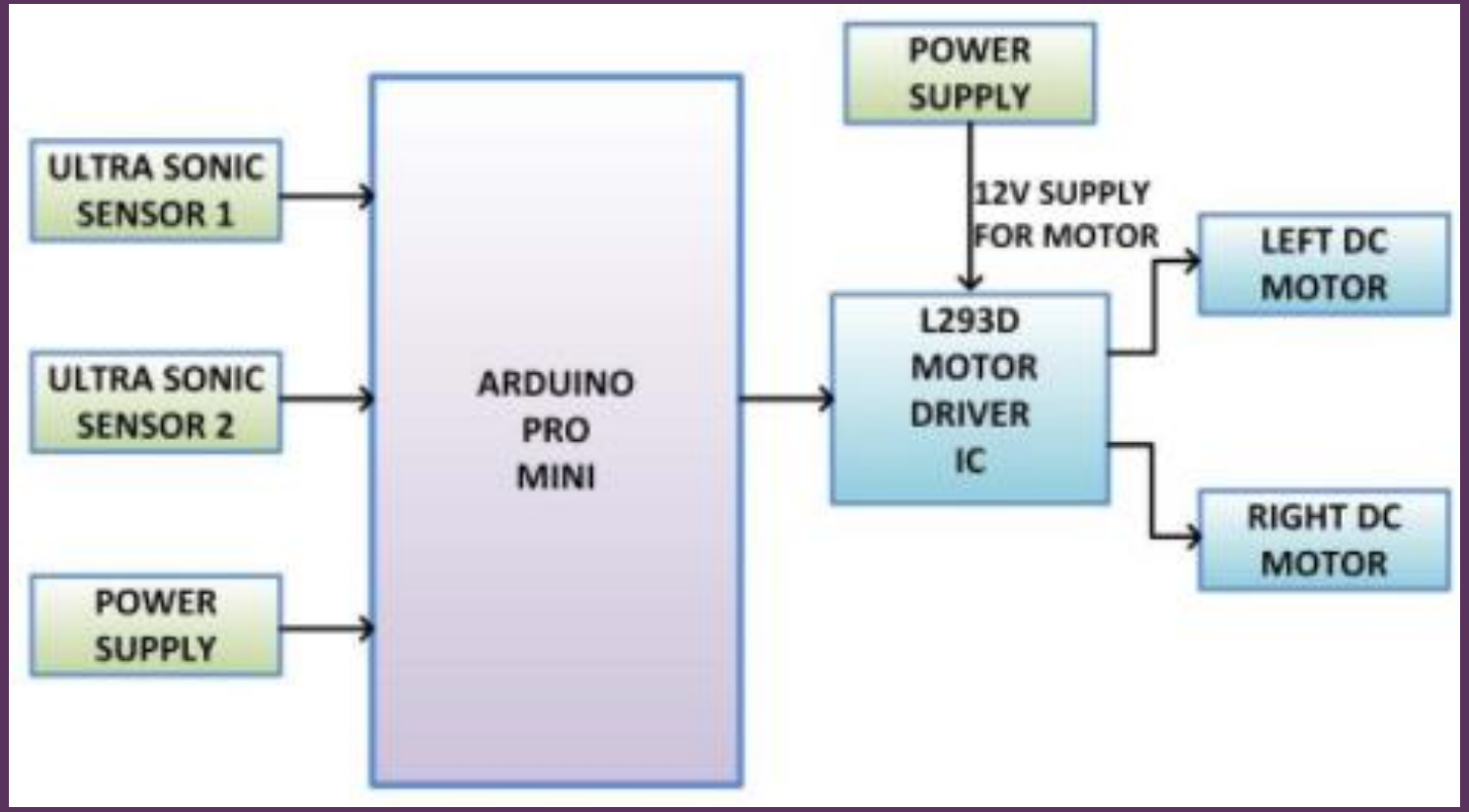
Working - Wall follower robot

The hardware involves interface of two sensor signals to the microcontroller.

According to the sensor signals, the motor turns left, or right and moves forward

This is continued until the robot encounters any obstacle or interference that blocks the robot path

When this case happens the robot finds alternate path and deviates to avoid the obstacle



Wall follower robot - Schematic and connections

Components	Arduino
Echo1 and trig1	D13,D12
Echo 2 and trig 2	D10,D11
DC motor 1	D3,D5
DC motor 2	D4,D2
ENA 1	D8
ENA 2	D9
Slide switch	D7
Battery GND Ultrasonic sensor GND L293D GND Slide switch GND	-ve Rail of breadboard Arduino GND
Ultrasonic sensor VCC L293D VCC	+ve rail of Breadboard 5V pin of arduino