INFORMATION TECHNOLOGY UNIVERSITY

Semester PROJECT REPORT

Of

Electronics Workbench Lab

(Semester One)

Line Following & Obstacle Avoidance Robot

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1. Abstract

This paper is designed to build a line follower and obstacle avoidance bot using IR sensor and ultrasonic sensor. The IR sensor is meant to trace a particular line, and ultrasonic sensors are meant to detect obstacles which it encounters. ROBOT has sufficient intelligence to cover the maximum area of space provided. It will move in a particular direction specified by the user and avoids the obstacle which is coming in its path. Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. The path can be visible like a black line on the white surface (or vice-versa). The base of the robot is Arduino UNO which is a microcontroller board based on the ATmega328.

2. Introduction

A robot is usually a machine controlled by a computer program or electronic circuitry. These are designed mainly to reduce the work of a human. In most of the situations where humans are under risks. So, to reduce the risk factors as well as to increase the comfort these are developed. We have designed a robot that performs additional tasks along with following a path. It avoids an obstacle in its path and continues to follow its path after the obstacle been avoided. We can set the gap between the robot and intrusion at that point which the robot takes its deviation from the path. As it performs two tasks; thus, we have separate one code to another by a switch. In one scenario, our robot follows the black line if it is removed from the black line. Moreover, in other, it avoids any obstacle that comes into its path. Our robot contains a single ultra-sonic sensor mounted on the servo motor helps to detect obstacles, and for the detection of the black line, two colour sensors are used.

3. Components Used :

These are the main components we used in doing our project (line following and obstacle avoidance)

- Arduino UNO
- Servo Motor
- L298 DC Motor driver
- IR sensor
- Ultrasonic Sensor HC SR04
- Wheel car chassis
- Lithium Oil Cell with holder 18650 x2
- Power Module
- Two dc motors (5V)
- Jumper Wires
- On-off switches x2

4. Working of Components :

In order to understand and build a robot, it is must to have quick information about the components. The simple explanation about some of the heart components is given below.

4.1 Arduino UNO

Arduino is a single-board microcontroller meant to make the application more accessible which are interactive objects and its surroundings. It has 14 digital input/output pins in which six can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, six analogue inputs, a power jack and a reset button. This contains all the essential support needed for the microcontroller. In order to get started, they are connected to a computer, with a USB cable or with an AC-to-DC adapter or battery. Moreover, due to its vast advantage, it has been used in our project. It is specially programmed to control all the component used in robot, and we can say it is the brain of our project in a true sense.

There are several types of micro-A controller like Arduino UNO Like, **Arduino Leonardo, Arduino-Mega,** Arduino Due

4.2 Servo Motor

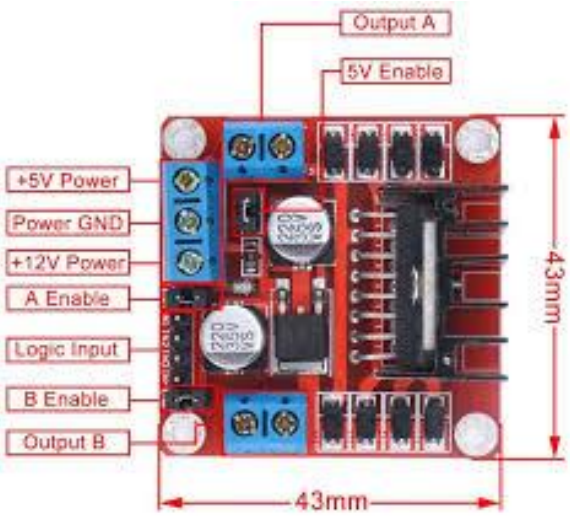
It is another important component used while assembling Obstacle avoidance part. A servo motor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. Servomotors are not a specific class of motor, although the term *servomotor* is often used to refer to a motor suitable for use in a closed-loop control system. For this reason, it is used along with the Ultrasonic sensor. The motor is used to rotate sensor over 180 degrees to locate hurdles or obstacles in the robot's way.

Servo motor has wide use
And also, it is available in many
Classic form that are very reliable.

4.3 L298 DC Motor driver

The Motor Driver is a module for motors that allows you to control the working speed and direction of two motors simultaneously. This Motor Driver is designed and developed based on L293D IC. L293D is a 16 Pin Motor Driver IC. This is designed to provide bidirectional drive currents at voltages from 5 V to 36 V. Bi-conditional means; the driver can also move motors forward and backwards.

There are four basic **motor** controller and drive **types**: AC, DC, **servo**, and **stepper**, each having an input power **type** modified to the desired output function to match with an application.

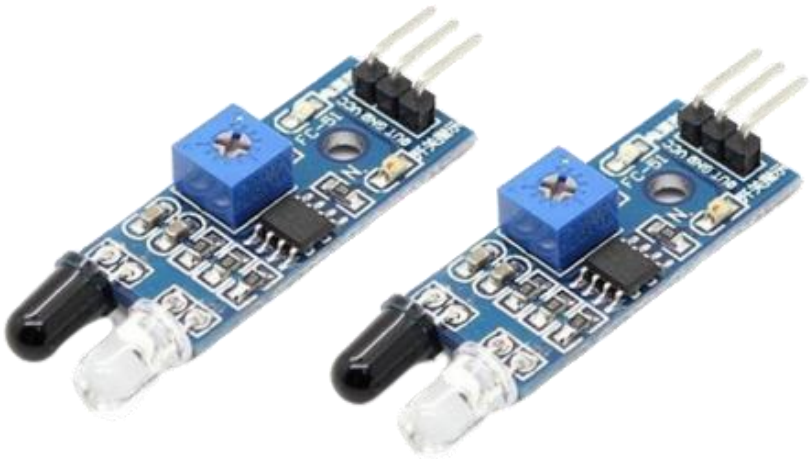


4.4 IR sensor

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation.

Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

There are two **types of infrared sensors**: active and passive. Active **infrared sensors** both emit and detect **infrared** radiation. Active **IR sensors** have two parts: a light emitting diode (LED) and a **receiver**



4.5 Ultrasonic Sensor HC SR04

Ultrasound is high-pitched sound waves with frequencies higher than the audible limit of human hearing. It emits ultrasound at 40 000 Hz which travels through the air and if there is an object or obstacle on its path. It will bounce back to the module. Considering the travel time and the speed of the sound, you can calculate the distance. The HC-SR04 Ultrasonic Module has four pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.

There are three types of sensors.

Ultrasonic through-beam sensors
Ultrasonic retro-reflective sensors
Ultrasonic diffuse proximity sensors

4.6 3 Wheel car chassis

It is the base of all the project. It is a car type three-wheeled form that is used to assemble all components on it. When everything is done, the final shape looks like a small car. It is also available in four tires. It may or may not be fixed liked some chassis are required to build only the small parts are given with instruction along. It is made up of plastic and has all the necessary cuts require to fit other components for line following and obstacle avoidance robot. Moreover, it is easily available in Market.

There are also 4-wheel chassis available
But due to its more effective movement
To right, left it was preferred over that.

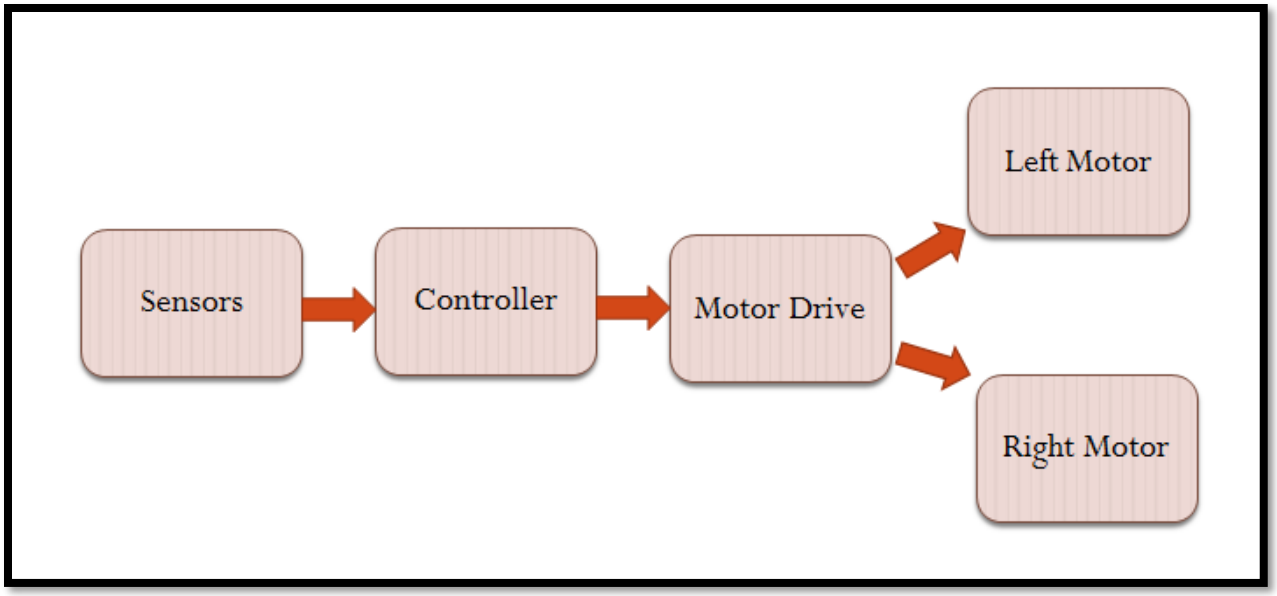
4.7 DC motors (5V)

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in a part of the motor. In our case, it is used to rotate the tires of the robot, one for left and one for the right tire. A 5V DC motor can have up to 3,100 rpm speed. (rotation per minute)

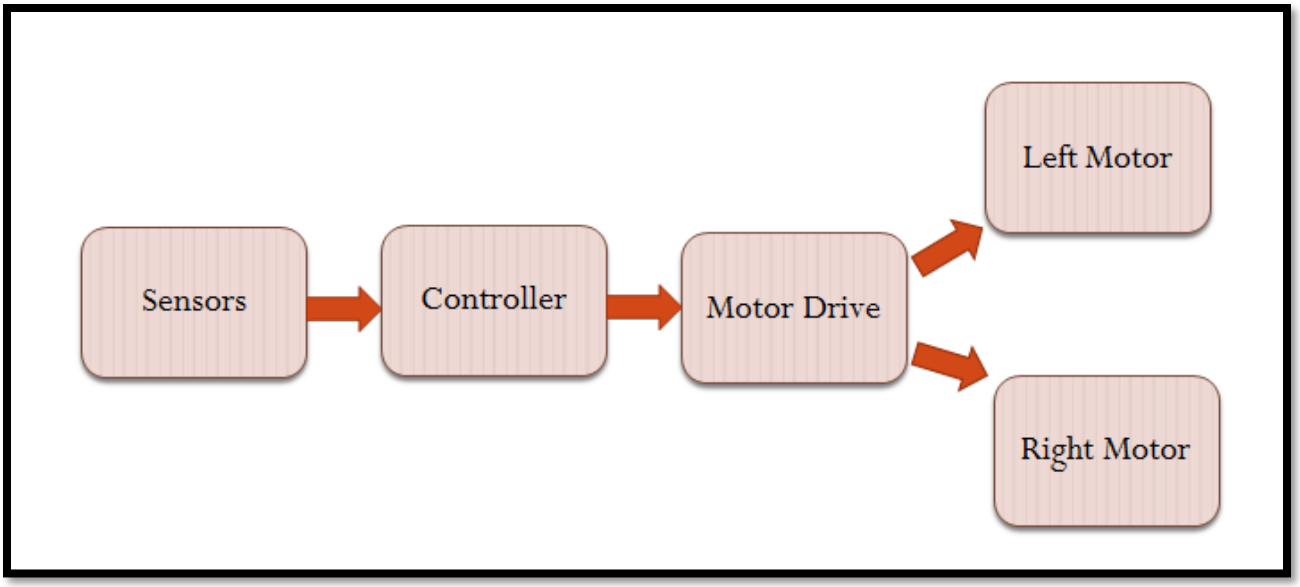
5. Block Diagram:

A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks. They are heavily used in engineering in hardware design, electronic design, software design, and process flow diagrams. In order to understand our logic better and simple way, we have used block diagram here too..

5.1 Block Diagram of Line Following.



5.2 Block Diagram of Obstacle Avoidance



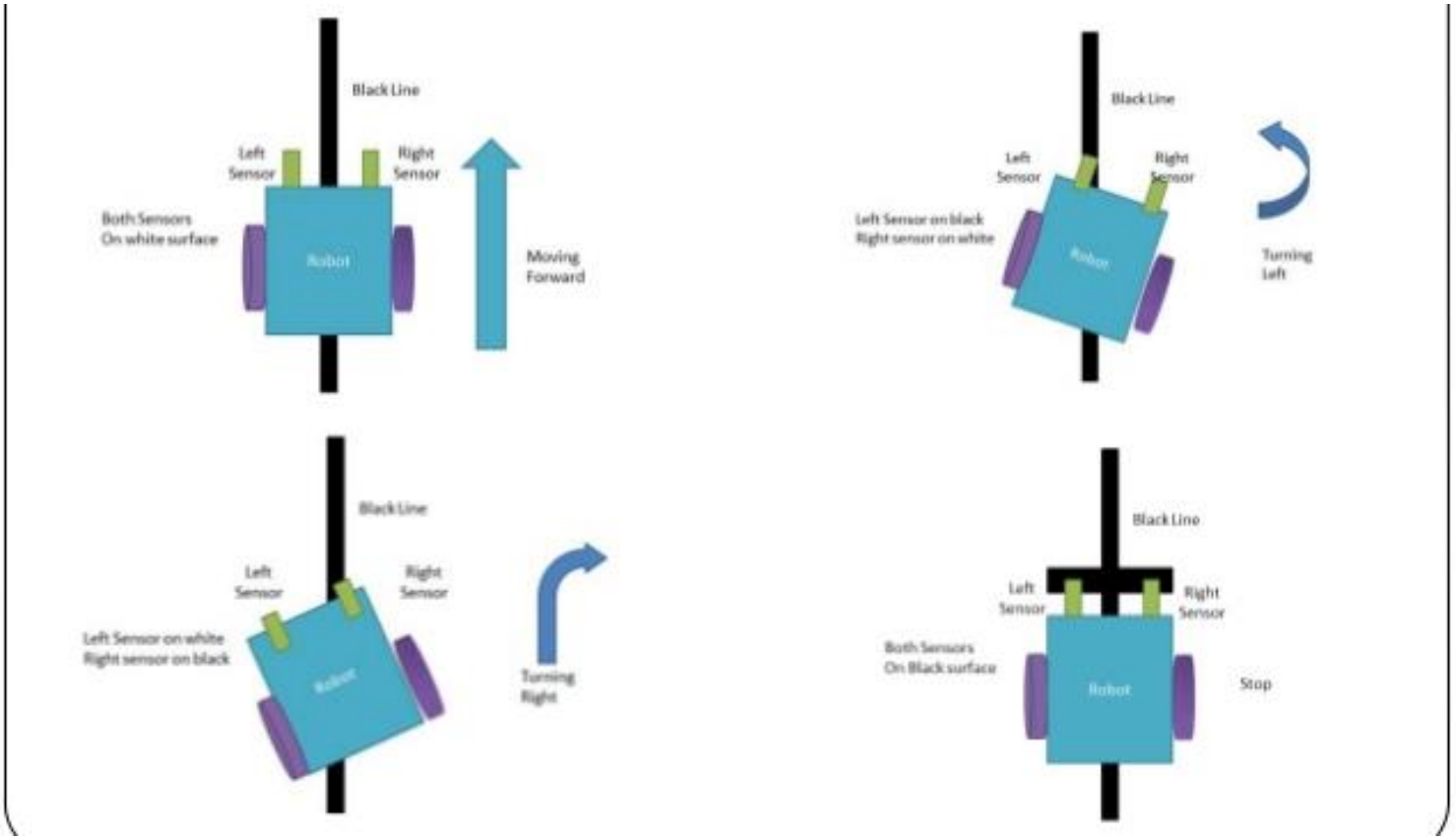
6. Working

As this project has two functions to do, one is line following and other is obsticle avoidence, therefor I would like to explain there working separatly and the conclusion will be whole. Logic is the main part of any of the project and the wrost thing about it is that to solve a problem you might take years and also a seconds. I have a different logic while making this robort and after testing dozens of times I feel proud to show that to you. It may not be perfect but it is working and had my best experience.

6.1 Working of Line Following

As it is cleared from its name that, it ll follow line (a specific colour line). In general we are going to tell it to ollow a bloack colour line. Now, the logic is clear we are going to use two IR (infared) sensors. These sensors output “0’s” to Controller when the serface in front of them is white or anyother colour except black. When ever colour in their front is black they output “1’s” in this way we come to know that we have to change the direction of car robot. In simple way, when the left sensor outputs 1’s” we will move the robot to Right direction and viseversa. So, that the car always remain in the black line. This is the simple logic we are going to use.

Explanation:



Arduino Code:

In order to minimize the space and to make the report clean and also to avoide any confusion I have tried to put the code for this project in a separate cloude space. The link below can be acceseed by any of the email account(google account). Click on the folder link to access folder and to direct access file click on file link.

Folder link :

File link :

Line Following working Video Sample:

In order to minimize the space and to make the report clean and also to avoide any confusion I have tried to put the video for this project in a separate cloude space. The link below can be acceseed by any of the email account(google account). Click on the folder link to access folder and to direct access file click on file link.

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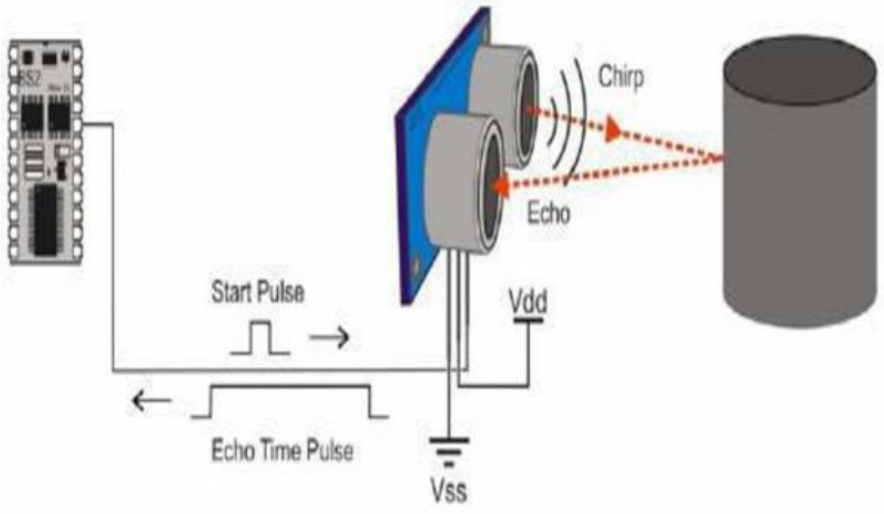
6.2 Working Of Obsticle avoidence

This type of robot is designed to avoide the hurdels that comes in its way. When ever any obsticle comes to its way it senses and changes its way. In simple way, this function is done by the Ultrasonic Sensor. As we know it emits high pitched waves, when the waves return back to it, it means there is something in its front and it tells controller about it and controller then change its path. This process is so simple and the major part of this type of robot is Ultrasonic Sensor.



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Line Following working Video Sample:

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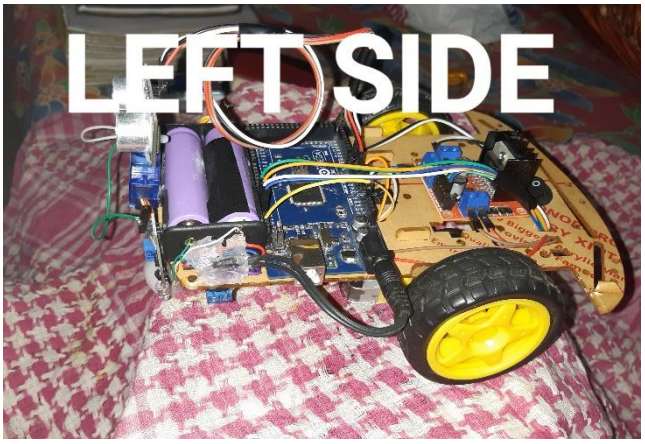
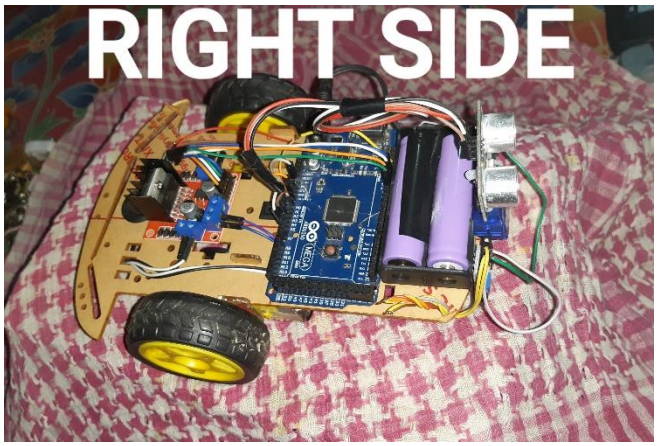
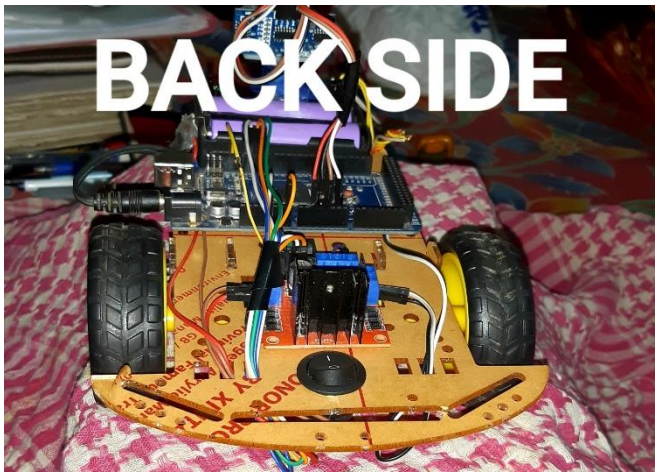
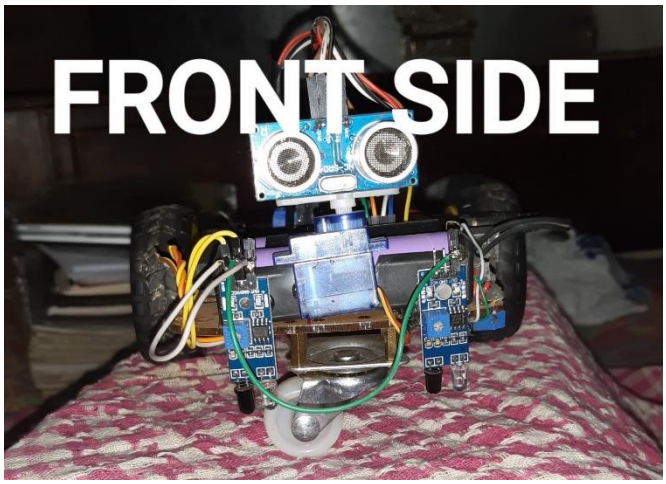
7. Final Project Images:









8. Conclusion

The goal of our project is to create an autonomous robot which intelligently detects the obstacle in its path and navigates according to the actions that we set for it. So what this system provides is an alternate to the existing system by replacing skilled labor with robotic machinery, which in turn can handle more patients in less time with better accuracy and a lower per capita cost.

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