DESIGN AND CONSTRUCTION OF AN AUTOMATIC WHEELCHAIR FOR VISUALLY IMPAIRED PEOPLE

A Project submitted in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering

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CERTIFICATION

This is to certify that this project and thesis entitled "DESIGN AND CONSTRUCTION OF AN AUTOMATIC WHEELCHAIR FOR VISUALLY IMPAIRED PEOPLE" is done by Md. Rafiqul Islam, ID No: 152-33-2802 and Md. Sowrov Hassan, ID No: 151-33-2458, under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on September 2018.

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Dedicated to

Our Parents

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LIST OF ABBREVIATIONS

NSF	National Science Foundation
CPU	Central Processing Unit
EMI	Immune to Electromagnetic Interference
PWM	Pulse width modulation
FWHM	Full Width at Half Maximum
LED	Light Emitting Diodes
AREF	Analog Reference
USB	Universal Serial Port
TX/RX	Transmit and Receive
IC	Integrated Circuit
RMS	Root Mean Square
US	Ultrasonic Sensor
MC	Multipoint Control Unit
UV	Ultraviolet
WD	Waveguide Dispersion

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ABSTRACT

A smart wheelchair (SW) is a power wheelchair (PW) to which computers, sensors, and assistive technology are attached. In the past decade, there has been little effort to provide a systematic review of SW research. This paper aims to provide a complete state-of-the-art overview of SW research trends. We expect that the information gathered in this study will enhance awareness of the status of contemporary PW as well as SW technology, and increase the functional mobility of people who use PWs.We systematically present the international SW research effort, starting with an introduction to power wheelchairs and the communities they serve. Then we discuss in detail the SW and associated technological innovations with an emphasis on the most researched areas, generating the most interest for future research and development. We conclude with our vision for the future of SW research and how to best serve people with all types of disabilities.

CHAPTER 1
INTERODUCTION

1.1 Introduction

Automated innovation has increased considerably in the recent years. Such advancements were just a fantasy for a few people two or three years back. However, in this quickly moving world presently there is a purpose of the robot, for example, an article following robot that can interface and co-subsist with them providing enough current to drive two rigging engines for each wheel. [1]

Unmanned robots are of sign can't intrigue right now. There is a push from the NSF to quicken the improvement of robots that can work inside or helpfully with individuals. Before, a few distinct methodologies have been utilized to accomplish unmanned control. These methodologies are condensed in the accompanying segments. The objective of this work is to build up an identity following technique that will work in numerous settings, where obstructions and hardware are continually evolving. [2]

The robot turns out to be broadly used in mechanical because of their qualities. The robot ready to work in 24 hours ceaselessly without feeling worn out, not at all like human that bind to a specific time. The expense to setup the robot these days turns out to be increasingly reasonable and their long haul prospect is brilliant making a decision from their ability to perform. Be that as it may, in credibility, there is no robot ready to work flawlessly and as yet making blunders. A superior controller required here to endorse the robot to perform effectively and make less mistake.

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Utilizing object adherent robot doing an explicit errand, is more affordable, increasingly dependable and it can achieve similar points of one robot. A few instances of uses are in assembling, medication, space investigation and home. The idea of the workplace requires the mechanical frameworks be completely self-rulingly in accomplishing human-provided objectives. These days mechanical autonomy is a component of the present correspondence. Correspondence is a component of the progression of innovation so we chose to work in the apply autonomy field and plan something which will make human life the present angle. There are variations of portable robots which can be isolated into a few classes comprises of the wheeled robot slithering robot and legged robot. This task manages a wheeled self-ruling robot..[3]

1.2 Problem statement

The traditional article following wheelchair is an ease back answer to the blunder happens will just leave its track that drawn on the floor. This Obstacle will make the notice of the robot be unsmooth. Despite the fact that this robot can pursue the human and item, its development still should be created.

1.3 Objectives

The capability of a robot to track and follow a moving object can be used for several purposes. To design a low cost device in order to use general purpose.

i. To save time.
ii. To help humans.
iii. To create easier for people.

iv. Can be used for defense purpose.

1.4 Applications of this project

- Industrial automation
- Tour guide in a museum
- Deliver the mail in office buildings
- It can be used in place of crane in various lifting and carriage applications
- Can assist in carrying loads of people working in hospitals, libraries, airports, etc.
- Can service people at shopping centers or public areas
- Can assist elderly people, special children and babies
- Can follow a particular Vehicle.

1.5 Research Methodology

A methodical research technique is embraced remembering a definitive objective of a completely utilitarian and independent human and article following robot. A decentralized best down methodology is used for this task. The task is partitioned into five modules. Every module is free of each other. Distinctive eliminates were conveyed well-ordered beginning from introductory sensor testing and continuing towards impediment evasion, object location, object following and information transmission. Because of the decentralized methodology, all modules and sensors act freely. Information acquired by various sensors and modules is on the whole broke down and an insightful choice based on data got is made that educate the robot to pursue a specific heading. Two separate units are used, i.e. Microchip and a controller. The preparing is completed by the chip and the data acquired by the sensors is controlled by a controller i.e. Arduino board. A sequential correspondence between the chip and the controller is built up to trade the visual detecting data. This methodology was progressively appropriate provided that there is blame in any of the modules then it would not influence the whole framework. Thus this gives the most ideal outcomes by looking after precision. Human following, keeping up an explicit separation from the item and setting up a correspondence connect among chip and controller are the fundamental parts of this task.

1.6 Project Outline

This project is organized as follows:

Chapter 1 Introduction of the project

Chapter 2 Reviews the literature knowledge of live object follower robots

Chapter 3 Analysis of the system components of the project

Chapter 4 Describes all the Hardware Development parts

Chapter 5 Discussion

Chapter 6 Concludes with some recommendations

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

People with cognitive/motor/sensory impairment, whether it is due to disability or disease, rely on power wheelchairs (PW) for their mobility needs. Since some people with disabilities cannot use a traditional joystick to navigate their PW they use alternative control systems like head joysticks, chin joysticks, sip-n-puff, and thought control [1]–[5]. In many cases PW users have difficulties with daily maneuvering tasks and would benefit from an automated navigation system. Mobility aside, people with disabilities are heavily reliant on their caregivers for eating and drinking, handling items, and communicating with others, especially in large groups.

2.2 How WheelchairSystems works

Operating modes range from autonomous to semiautonomous depending on the abilities of the user and the task at hand. Table V lists subtopics and example references in the field of SW operating mode research. Users who lack the ability to plan or execute a path to a destination benefit most from an autonomous system, but only if they spend the majority of their time within the same controlled environment. If the user can effectively plan and execute a path to a destination it may be more beneficial to have a system that is confined to collision avoidance [106], [113]. Ideally the design should be based around each individual user's abilities and desires, maximizing the amount of control they are given, while offering the user help, as and when it is required [36].

Fig.2.1 Modern wheelchair.

2.3 Sensor

Ultrasonic separation sensor characterizes the separation to an item by evaluating the time required by the sound to reflect over from that object. The recurrence of the sound is around in the scope of ultrasound, this affirms the more focused bearing of the sound wave since sound at higher recurrence spends less on the earth. An ordinary ultrasonic separation sensor comprises of two layers. One film induces sound another catch reflected reverberate. At first, they are a verbalizer and amplifier. The sound induced causes short the length is two or three period's ultrasonic motivations and triggers the clock. The second film enlists the methodology of the sound drive and ends the clock from the clock's time it is conceivable to figure the separation peregrinated by the sound. The separation to the item is a moiety of the separation peregrinated by the sound wave.[8]

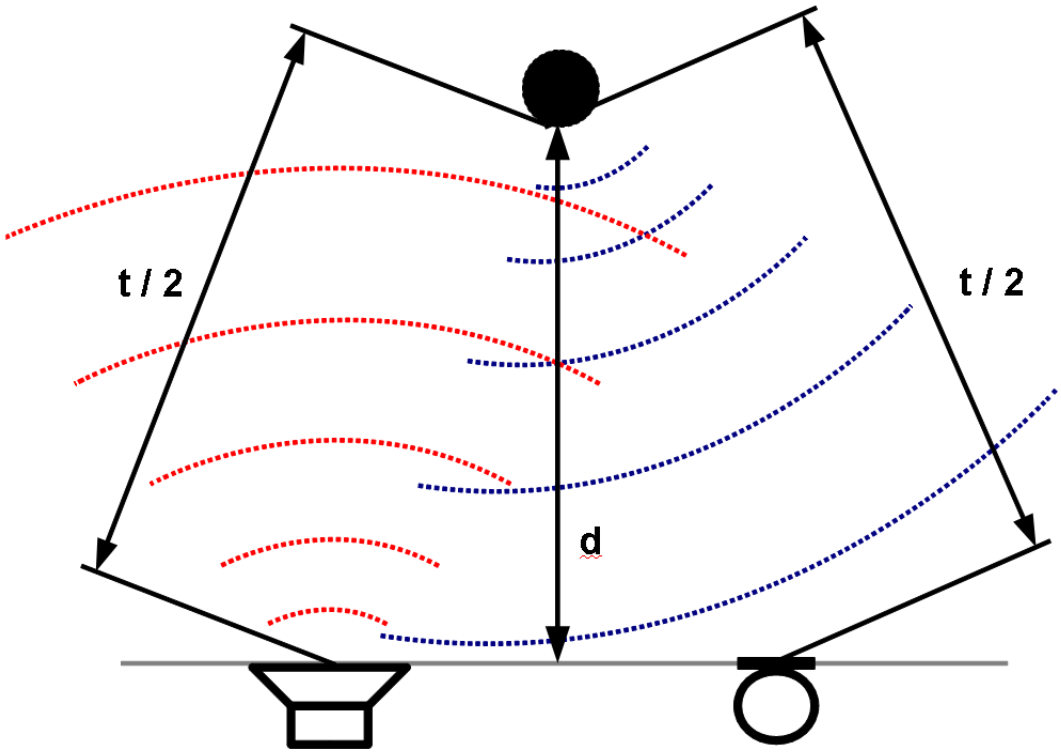


Fig. 2.2 Ultrasonic distance sensor

2.4 Project overview

Robots are comprehensively used the enterprises in view of their properties. Robots are skilled to work 24 hours persistently without feeling exhausted, not at all like human that constrained to explicit occasions. These days the expense of robot setup

ends up less expensive and their long haul conspire is the gleaming judgment from their capacities to work. However, indeed, there is no robot competent to work consequently are as yet getting mistakes. The best controller is expected to support the robot to perform precisely and increase less mistake. This undertaking endeavors to actualize a microcontroller on oneself overseeing robot to see whether the robot works precisely. This self-overseeing robot comprises of an article following module where it will pursue the track framed from items. This is where the microcontroller is actualized the robot will be competent to pursue the item productively and running along the track effortlessly. A decent and stable self-ruling robot is required so as to fathom the article devotee easily. Item devotee robot is utilized in programming by Arduino to set the microcontroller as the CPU. This readied CPU is utilized to the article adherent robot so as to test the usefulness of each electronic part, for example, DC engine driver sensors and so forth. In the event that the equipment framework and the product framework ought to be finished. The venture will be prepared to run. Where relying on the sensor yield the microcontroller work will be performed by the program.

2.5 System Block Diagram

This Project can be described with the two types of system block diagram are

i. Hardware system block diagram
ii. Software system block diagram

2.5.1 Hardware System Block Diagram

This square outline portrays which working first to execute the item following explaining robots work. From the beneath the figure 2.3 we can accept crafted by the equipment framework. Where from the contribution of infrared sensor setting off to the preparing unit microcontroller and from the microcontroller yield is heading off to the engine control driver which controlling engine activity.[12]

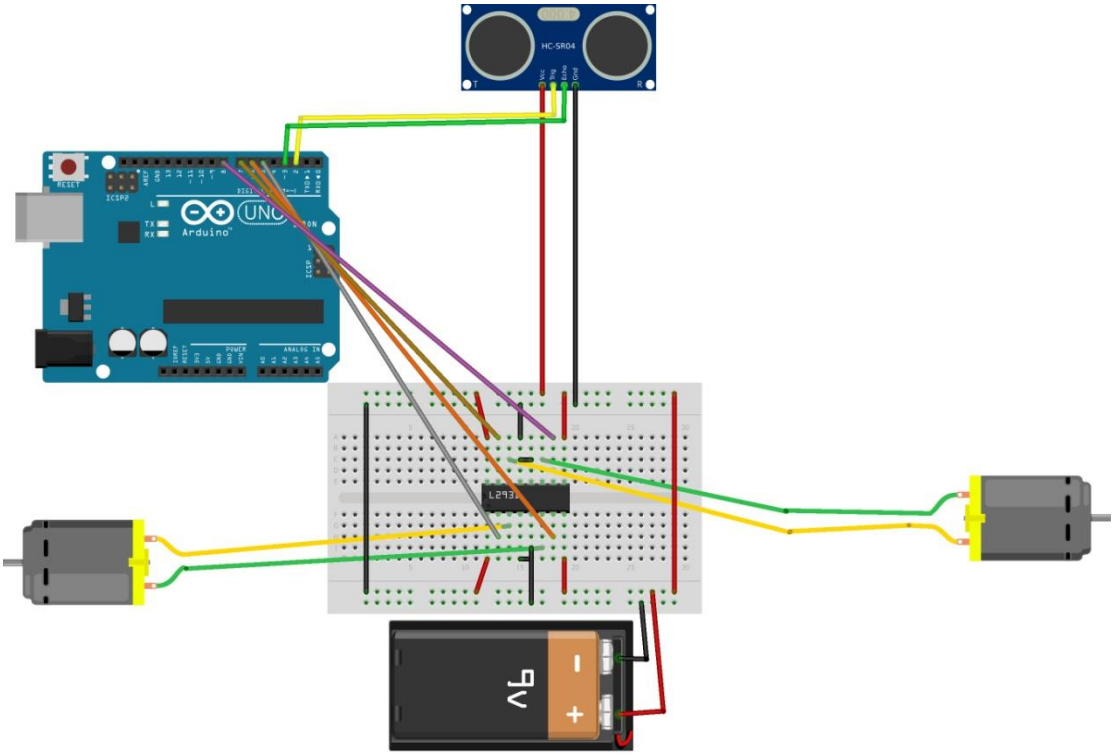


Fig. 2.3 Hardware System Block Diagram

2.5.2 Software System Block Diagram

From the equipment layer programming segment takes the yield of equipment gadgets fundamentally from the sensor and by investigation the yield programming segment gives the conceivable contribution for the equipment layer area. For the most part programming area has three segments as we are seeing from the Fig. 2.4 All three are giving and taking data to actualize the assignment. Sensor module segment standardized detecting information and offering it to the microcontroller. Microcontroller areas programming taking the standardized information from the sensor module and sparing the redressed way. As indicated by the information input microcontroller segment giving essential contribution for the engine control area to managing the engines.

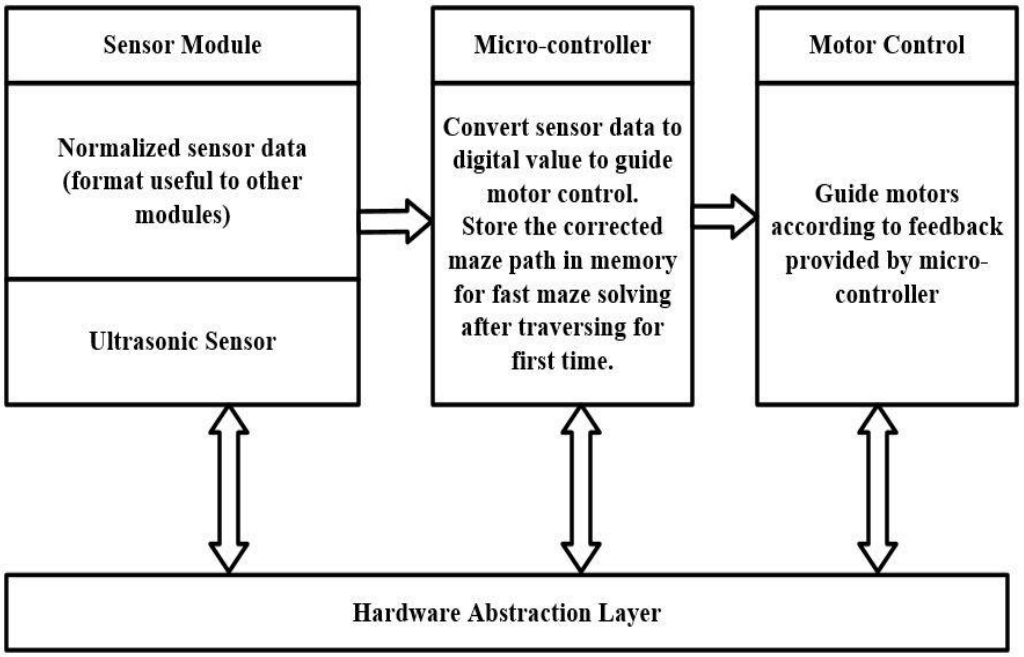


Fig. 2.4 Software System Block Diagram

2.6 Summary

In this part, we have examined writing survey of this item following robot. The robot is definitely not another thought the traditional Greeks were envisioning mechanical technology. However, the segment of this robot is dealt with into another part or robot one of them is an article supporter robot. It is a standout amongst the most well-known self-ruling robots. The utilization of self-governing robot was starting presented since the 1960s. Its market into robotized work is rising step by step.

CHAPTER 3

ANALYSIS OF THE SYSTEM COMPONENT

3.1 Introduction

In this chapter, we have discussed various components that will be needed to make this human and object follower robot.

3.2 Components

The Object follower robot has the following main components are

i. Arduino.
ii. Ultrasonic sensor
iii. L293D IC
iv. Two DC Gear Motor
v. Power Supply (9 volt battery)
vi. Wheel
vii. Ball Caster
viii. Robot Chassis
ix. Jumper Wire
x. Bread Board
xi. Tools Needed

3.2.1Arduino Board

Arduino is a programmable electronic circuit expansive that can incorporate into a wide assortment of undertakings both simple and troublesome. It has a microcontroller which is competent to compose a program for detecting and controlling articles in reality. The Arduino is fit to speak with a cosmically colossal cluster of yields, for example, engines, LED and shows by responding to sensors and sources of info. Arduino turns into an extremely well known compiler for innovators hoping to structure intuitive equipment ventures on account of its adaptability and reasonable. Arduino was displayed in 2005 by Massimo banzi in Italy as an arrangement for non-architects to access for actualizing a minimal effort

straightforward equipment venture. As the Arduino board is open-source it is distributed under an innovative center permit which affirms anybody to plan their own board.[16]

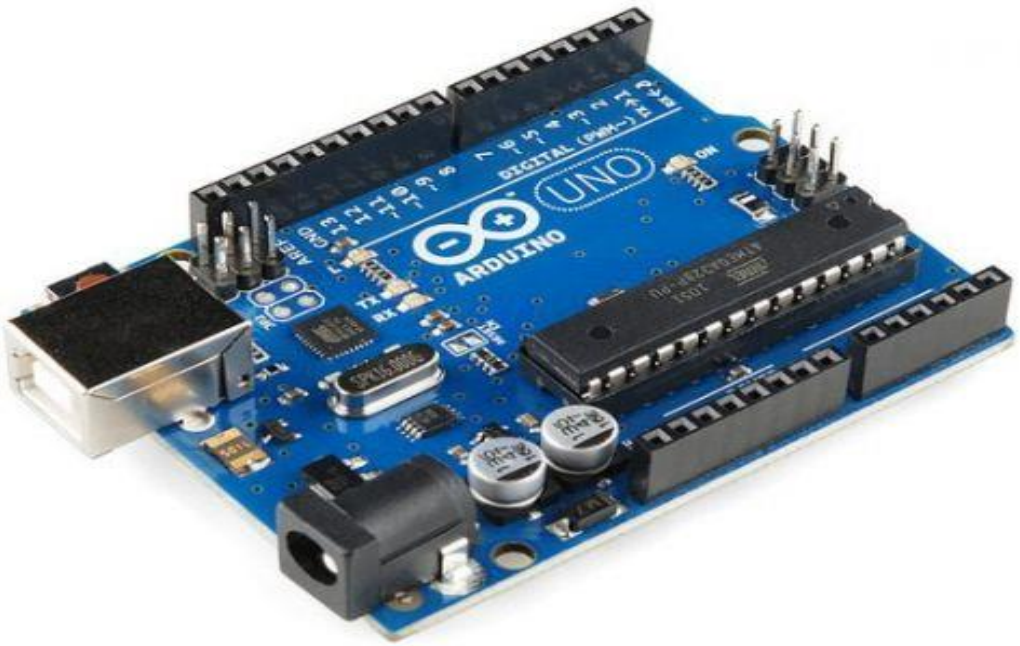


Fig. 3.1 Front side of ArduinoUNO board

3.2.2ArduinoUNO Board

The Arduino UNO is one of the most popular Arduino board. Although it was not actually first board to be renounced, It remains the most actively used and most broadly documented in the marketplace because of its greatest demand.[16]

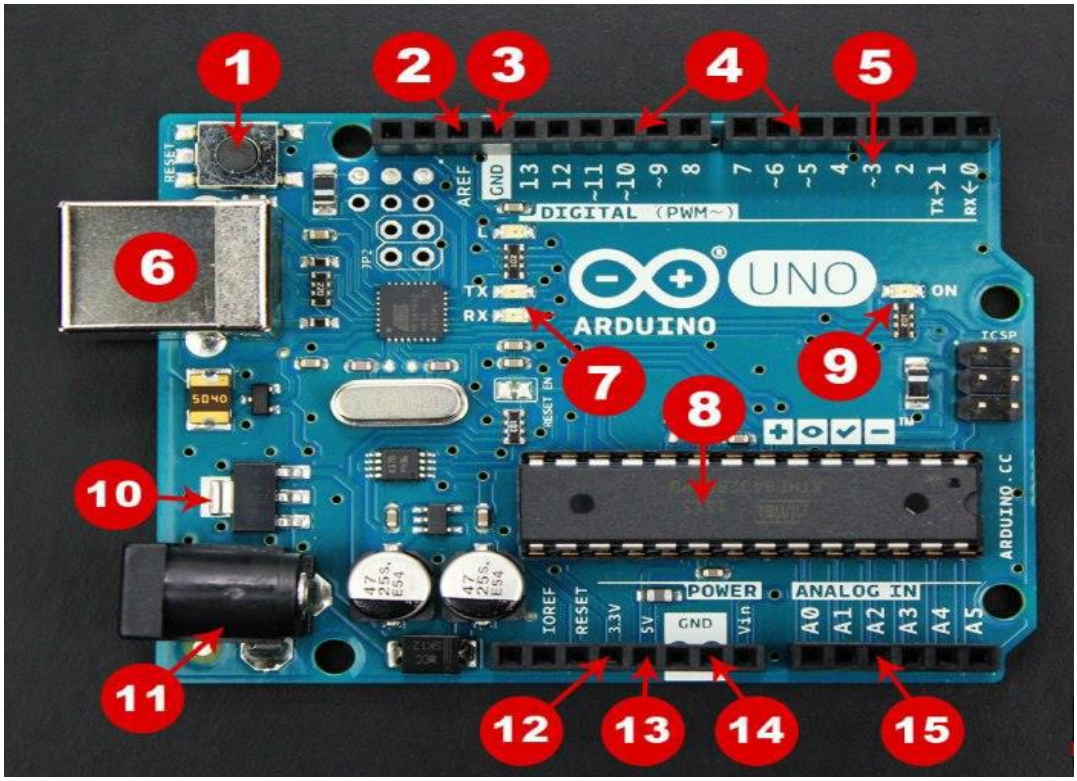


Fig. 3.2 ArduinoUNO board breakdown

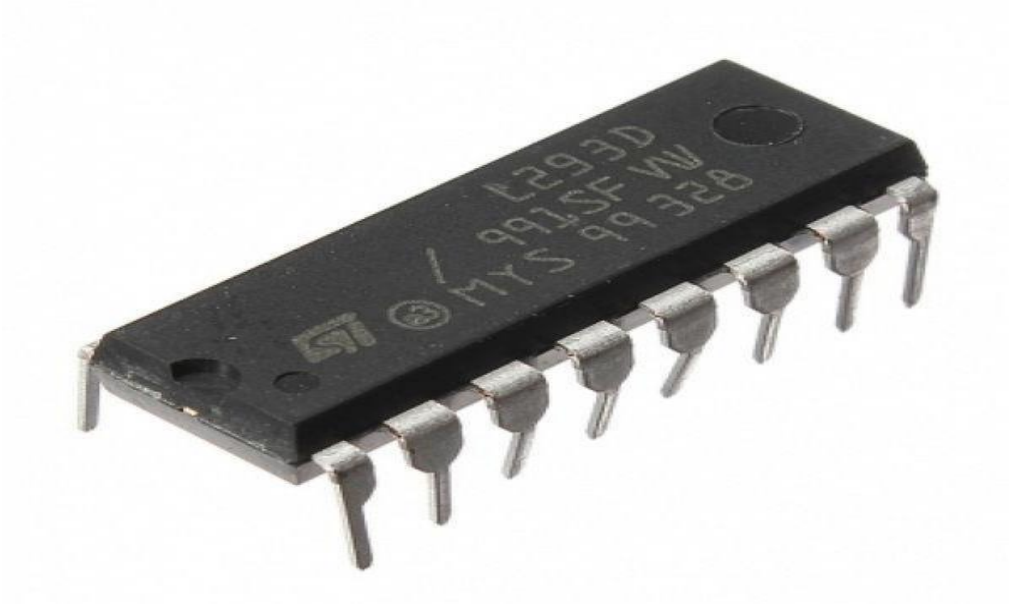
Here we are discussed about the function of the component of the Arduino board. That is

1. **Reset Button** – This button is used for restarting the code that is stored to the Arduino board.
2. **AREF** – That's meant Analog Reference and utilized to set an outer reference voltage.
3. **Ground Pin** – There are several ground pins on the Arduino board and they all do the same thing.
4. **Digital Input/output** – Pins 0-13 utilize for digital input/output.
5. **PWM** – Stands for Pulse Width Modulation. This pin mark with thesymbol(~) that can reproduce the analog output.
6. **USB Port** – works on uploading code and power supply on the Arduino board.
7. **TX/RX** – These LEDs are betokening data transmit or receive.
8. **AT-mega Microcontroller** – This is called brain where the program is stored.
9. **Power Indicator** – When the board plugs into a potency source, the LED lights up anytime.

10. **Voltage Regulator** – This regulator is used to control the amount of voltage passing into the Arduino board.
11. **DC Power Jack** – This is utilized for powering your Arduino with a puissance supply.
12. **3.3V Pin** – Get 3.3v from this pin for our project.
13. **5V Pin** – Get 5v from this pin for our project.
14. **Ground Pin** – There are several ground pins on the Arduino board and they all do the same thing.
15. **Analog Pin** – This pin can read the signal from the analog sensor and convert it to the digital.

3.2.3 IC L293D

The L293D is a double H-connect engine driver IC (Integrated Circuit). This engine driver IC goes about as an ebb and flow speaker as it takes low momentum control flags and gives higher ebb and flow signals. This higher current flag is used to run the



engine.

Fig. 3.3 IC L293D

The IC L293D comprises of two implicit H-connect driver circuits. The regular method of in its task, two DC engines can be worked simultaneously both in advances and in reverse course. The activity of the two engines can be managed by info rationale stick 2,7 and 10,15. The information rationale 00 or 11 will pull up the comparing engine. The information rationale 01 and 10 will turn the engine in

clockwise and anticlockwise headings consecutively. The empower stick 1 and 9 (like 36 for two engines) must be high for two engines to begin working. At the point when the empower input stick is high, the associated driver progresses toward becoming empowered. Accordingly, the yield gets initiated and work in stage with its info. At the point when the empower input stick is low, the driver is impaired and its yield is off and in the high impedance state.

Table 3.1 The logical truth table of the motor driver (L293D)

Enable-1 Pin-1	In-1 Pin-2	In-2 Pin-7	Out-1 Pin-3	Out-2 Pin-6	Result Motor
High	Low	Low	Low	Low	Stop (No rotation)
High	High	Low	High	Low	Forward (Clockwise)
High	Low	High	Low	High	Reverse (Anticlockwise)
High	High	High	High	High	Break
Low	X	X	Z	Z	Stop

3.2.3. L293D Pin Configuration

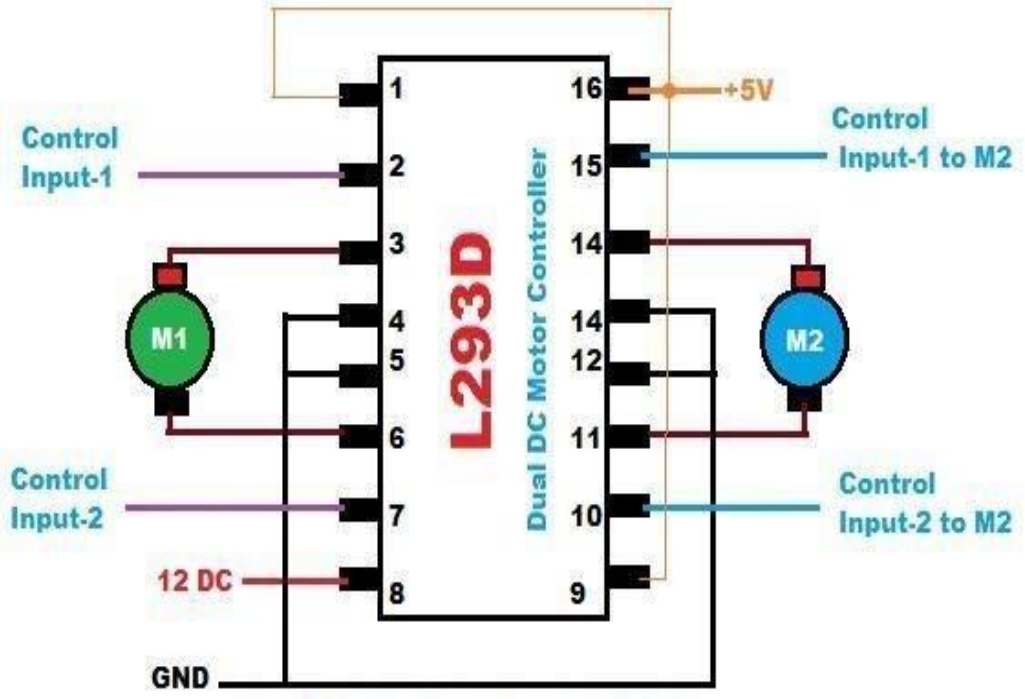


Fig. 3.4 Connection diagram of L293D

Table 3.2 Pin configuration table of motor driver (L293D)

Pin Number	Pin Name	Description
1	Enable 1 &2	This pin enables the input pin input-1(2) and input-2(7).
2	Input 1	Straightly controls the Output-1 pin that Controlled by digital circuits.
3	Output 1	Connected to one terminal of the motor-1.
4& 5	Ground	Connected to the ground of circuit (0V).
6	Output 2	Connected to another terminal of the motor-1.
7	Input 2	Straightly controls the Output-2 pin that controlled by digital circuits.
8	Vcc1 (Vss)	Connect to the voltage pin for driving the motor (4.5V to 36V).
9	Enable 3 &4	This pin enables the input pin Input-3 (10) and Input-4 (15).
10	Input 3	Straightly controls the Output-3 pin that Controlled by digital circuits.
11	Output 3	Connected to one terminal of the motor-2.
12& 13	Ground	Connected to the ground of the circuit (0V).
14	Output 4	Connected to another terminal of the motor-2.
15	Input 4	Straightly controls the Output-4 pin that controlled by digital circuits.
16	Vcc2 (Vss)	To enable the IC function is connected to + 5V.

3.2.4 Ultrasonic Sensor (HC-SR04)

The ultrasonic sensor is called for measuring the attributes of sound waves with the recurrence over the perceptible scope of human. It is taking a shot at three essential standards: Flight time, Doppler Effect, and the decline of sound waves. The ultrasonic sensor is non-meddlesome in that it has no requirement for physical association with its objective and it can recognize explicit sparkling or clear targets Otherwise, it is misty from some vision-situated sensors. Something else, its estimation is profoundly delicate to temperature and the point of targets.[9]

3.2.4.1 HC-SR04 Ultrasonic Sensor Pin Configuration

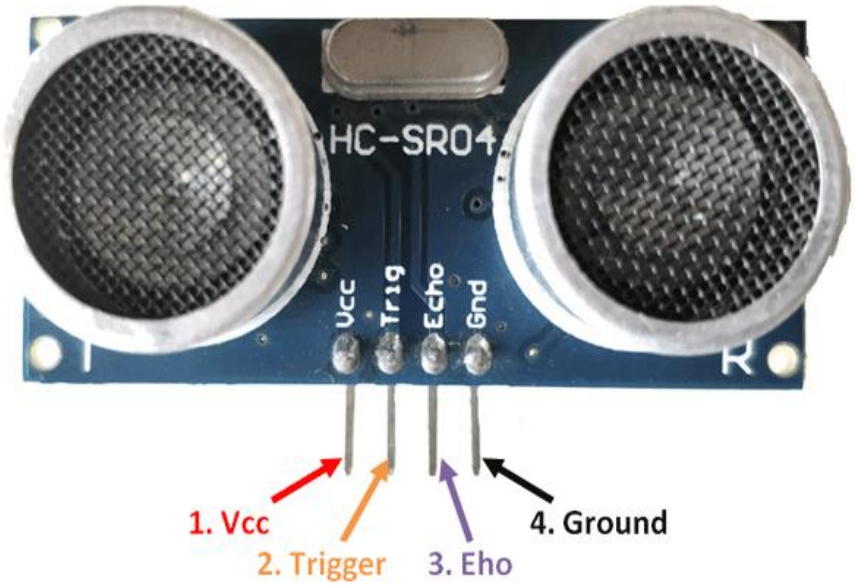


Fig. 3.5 HC-SR04 Ultrasonic Sensor

Table 3.3 Pin configuration tableof ultrasonic sensor (HC-SR04)

Pin Number	Pin Name	Description
1	Vcc pin	The Vcc pin is typically working for input power supply with +5v
2	Trigger pin	The trigger pin is used to take input. This pin has to keep high for 10µs to initialize measurement by transmitting the ultrasonic wave.
3	Echo pin	The echo pin is an output pin. This echo pin becomes higher for a period of time which is equal to the time needed for the ultrasonic wave to reverse back toward the sensor.
4	Ground pin	This pin is connected to the system's ground pins.

3.2.4.2 Working process of ultrasonic sensor(HC-SR04)

The ultrasonic sensor (HC SR04) is a four pins module as appeared in Fig 3.5 over whose stick names are Vcc stick, Trigger stick, Echo stick, and Ground stick consecutively. This sensor is the most well-known sensor connected to different purposes where separate estimations or detecting components are required. This sensor (HC SR04) has two gadgets like a human eye which goes about as a ultrasonic transmitter and beneficiary. This sensor demonstrations with simple secondary school recipes that are

Separation = Speed × Time

The ultrasonic transmitter sends a ultrasonic wave which moves noticeable all around. At the point when this wave finds an item by any fields it moves toward becoming returned back to the sensor and this returned wave is gotten by the ultrasonic recipient module as given in underneath the image.

Fig. 3.6 An ultrasonic sensors working process

Presently, we measure the separation by using the recipe above and need to know the speed and time. Though we are using the ultrasonic wave we know the general speed of the ultrasonic wave at room conditions that is 330 m/s. The gadget worked in on the module that will gauge the time taken for the ultrasonic wave to get back and witch on the resound stick high for that level with certain measure of time. Along these lines, we can likewise understand the time taken. Presently we can without much of a stretch measure the separation by using a microcontroller or chip.[10]

3.2.5DC Gear Motor

DC adapt engines can be resolved as an augmentation of the DC engine which interim had its understanding. A dc equip engine has an apparatus part appended to the engine. The speed of the engine is registered as far as upsets of the pole every moment and is called RPM. The apparatus framework utilizes in augmenting the transformation and diminishing the speed. In a DC outfit engine, the rigging associates the engine and the Gearhead is very moment. Henceforth it adds more speed to the enormously goliath teeth and makes it turned. The more sizable voluminous segment of the rigging extra turns the more minute twice port. The compacted twice port gets the torque however not the scramble of its predecessor which changes to an increasingly sizable voluminous piece of other gear, etc. The

third apparatuses twice part has a greater number of teeth than others thus it adds additional torque to the rigging that is appended to the pole.[18]

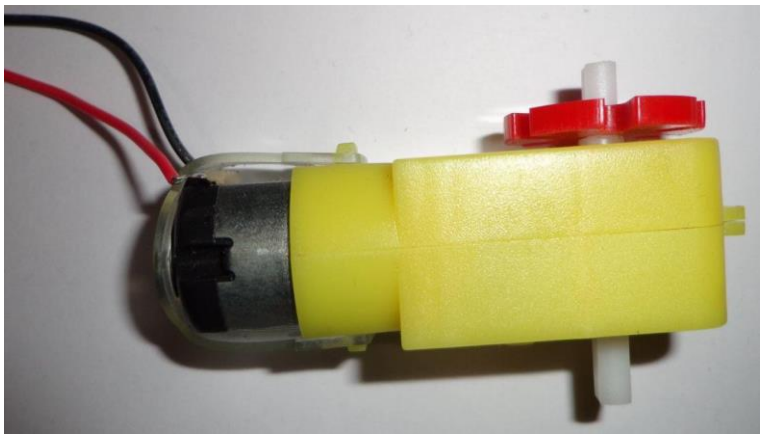


Fig. 3.7DC Gear motor

3.2.6 Wheel

A wheel is the fundamental segments to move an item follower robot. Here we use plastic wheel secured by evaluating elastic tire whose measurement is 1.65" (42 mm) and it is set the yield shafts on our apparatus engines. Those apparatus engines should mount in favor of the center with the overhanging teeth. The yield shaft will move into the attachment effortlessly at first yet accomplish a cozy fit when pushed through the opposite side of the center point.[18]

Fig 3.8: Wheel of object follower robot

3.2.6.a Specifications of wheels

Wheel weight: 0.66 ounce (19g)

Wheel diameter: 1.65 inch (42mm)

Tire width: 0.75 inch (19mm)

3.2.7 Ball Caster

Ball caster is full metal and it bolsters object devotee robot to move effectively and easily, it has a 1 mm thick steel plate for stepping the machine and the ability to convey 15 kg. The ball caster is lightweight and solid. It has a 20 mm roundabout body with a load of 37g which make the robot keep running in an all the more delicately and simple way.[18]

Fig. 3.9 Ball caster

3.2.7.1 Specifications ball caster

- Specific hole: 4 mm
- The distance of centre fixed holes: 40 mm
- Ball Extruding Height: 4 mm
- Ball Body Height: 20 mm
- Weight: 37 g
- Max Load: 15 kg
- Ball Diameter: 15 mm
- Bearing Ball Number: 40

3.2.8 Robot Chassis

Suspension assumes a fundamental job to hold all equipment of Object supporter, for example, microcontroller, control unit, engine, engine driver, and so forth. For this task, there utilized undercarriage which is known as the conjurer frame since it is appropriate for a wide range of versatile robot equipment. The Chassis is the most recent robot stage from Dagu. It can hold two or three rigging engines with 65 mm haggles ball caster. The suspension plate is made of acrylic with a roomy scope of mounting spaces or openings for controllers, sensors, engine drivers, battery, camera and so forth. We can without much of a stretch jolt the two pre-sliced stages commonly and conceivable to connect some ideal apply autonomy controller. This suspension can hold 4xAA battery holder and have adequate space to keep some other DC battery

Fig. 3.10 Chassis for modern wheelchair

3.2.9 Jumper Wire

A hop wire, is a short electrical wire with a strong tip at each end (or now and again without them, basically "tinned"), which is regularly used to interconnect the segments in a breadboard. Depending up on its two end tip or tip gap jumper wire has a few kinds Male-Female, Female-male, Male-Male and so forth. In our undertaking we utilized male to female jumper wire which is associated with the robots MCU to

the sensor. What's more, in bread board for various association other straightforward jumper wire was utilized. The image of a few jumpers is given beneath

Fig.3.11 Jumper wire

3.2.10 Bread Board

A breadboard is an implementing device to design and test our circuits. We don't need to solder components and wires to make a circuit by utilizing a breadboard. It is easier to attach components and reuse them. Since parts are not soldered we can transmute our circuit and redesign at any time without any trouble.

3.2.10.Construction of a breadboard

A breadboard is a line of conductive metal strips included in a crate made of white ABS plastic. A breadboard has numerous gaps that structure in vertically or on a level plane. Each gap of lines is isolated by protection. There are various gaps in the plastic box that orchestrated in an individual way. A standard breadboard course of action comprises of two sorts of the zone called strips (transport strips and attachment strips). Transport strips are commonly used to actualize control supply to the circuit. It comprises of two lines, one for +ve line and the other for - ve line or ground. Attachment strips are utilized to contain the majority of the components in a circuit. As a rule, it comprises of two sections and each with 5 lines and 64 segments. Every segment electrically interfaces from within the breadboard.

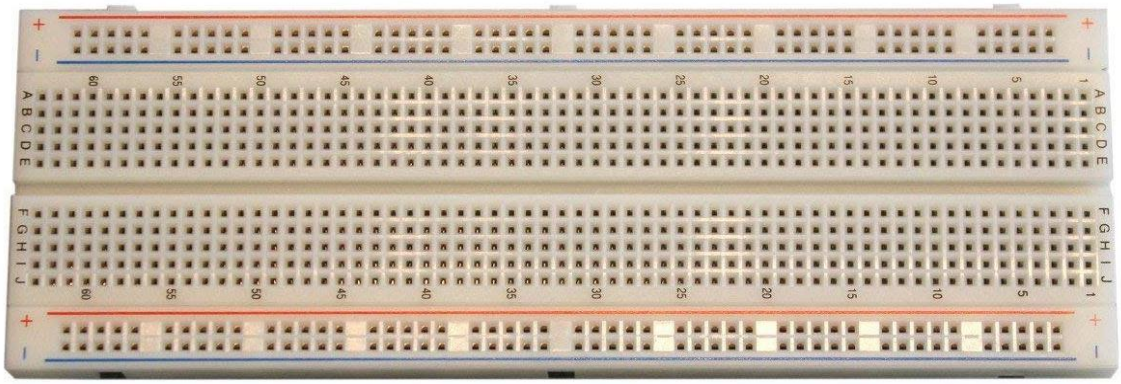


Fig. 3.12 Breadboard

3.2.11 Tools Needed

Fig. 3.13 Some tools

Some tools name are given below

i. Soldering Iron
ii. Glue gun
iii. Cutter
iv. Knife
v. Digital Multimeter

vi. Screwdriver
vii. Tweezer
viii. Panavisejr
ix. Wire Strippers
x. Needle nose Pliers

3.3 Summary

This section is about those utilized equipment in this undertaking labyrinth tackling robot. All the equipment that has been utilized in this undertaking are fit as a fiddle and working appropriately and for that the robot vehicle should work legitimately. In this section, we are endeavoring to examine insights regarding the utilized every individual equipment working portrayal and their works.

CHAPTER 4

HARDWARE DEVELOPMENT

4.1 Introduction

This chapter describes the methods implemented in an object follower robot solving algorithms. The main topics discussed in this chapter are how this project flowing software. The description hardware connection information.

4.2 Project Flowchart

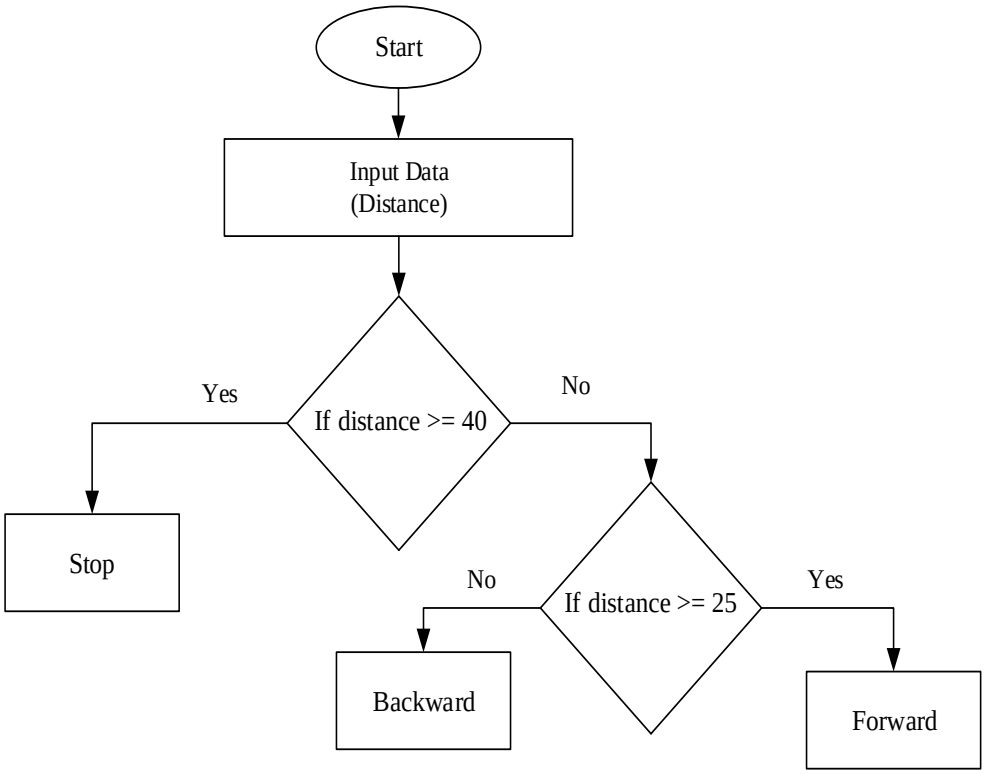


Fig. 4.1 Flowchart of the object follower robot

4.3 Algorithm of the object follower robot

Step 1: Start

Step 2: Take input from the sensor (Distance)

Step 3: If distance >= 40, motors are stop

Step 4: If distance >= 25, motors run forward otherwise backward

Step 5: End

4.4 Hardware Connection

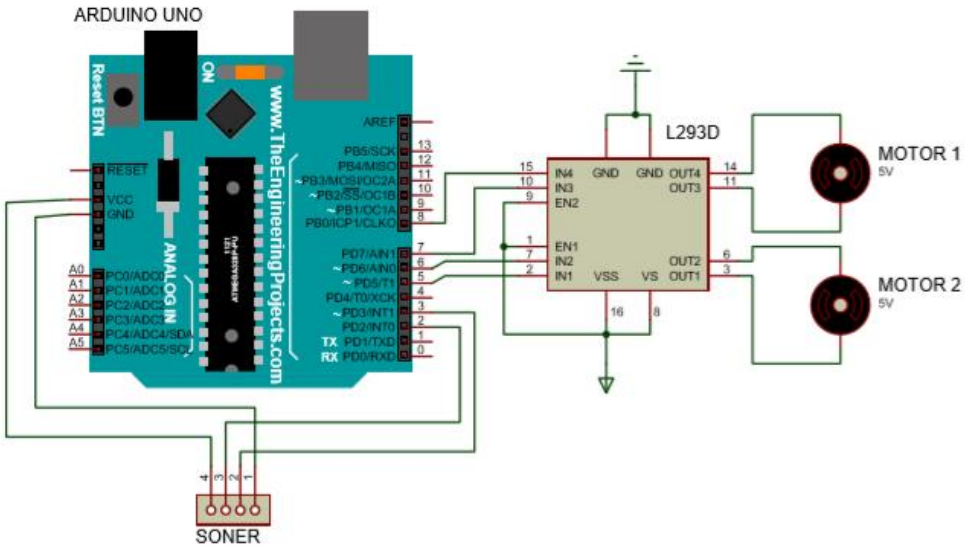


Fig. 4.2 Block diagram of object following Robot

4.4.1 Descriptions of Hardware Connection

Here is the simple circuit diagram in the figure 4.3

- The trigger pin connect to Arduino 2 number of pin
- Echo pin connect to Arduino 3 number of pin
- The motor driver (L293D) has 16 pin
- 1, 8,9 and16 pins of the motor driver are connected to +5v pin
- 4,5,10 and 11 pins of the motor driver are connected to Ground pin
- 2 pin of the motor driver connect to 4pin of Arduino
- 7 pin of Arduino connect to 10pin of the motor driver
- 8 pin of Arduino connect 15pin of the motor driver
- Motor1 connect to 11and14 pins of the motor driver
- Motor2 connect to 3 and 6 pins of the motor driver

That's done. Now connect the power supply. [12]

4.5 Summary

In the wake of finishing every one of the stuffs as indicated by this part the Autonomous item Follower robot will be prepared to perform. The principle troublesome thing about this section was to manufacture a calculation on which working conduct of this robot depending. So the principle object of this part was to comprehend the calculation and the association graph.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 Introduction

This chapter will present all the results and calculation and relevant discussions.

5.2 Final Result

In this undertaking, the article following robot has been made to pursue the item or human. This robot has a ultrasonic sensor which identifies the article and sends the data to the comparator (L293D) and H-connect which controls the procedure of the haggles controls the entire activity. The item following robot was finally wrapped up by a great deal of exertion. For this robot, we invested a great deal of energy in planning, actualizing, composing and investigating the code sitting before the PC. The robot was inevitably working with a little blunder here and thither. which were arranged in the later surveys of the firmware. The item following robot has a couple of shortcomings yet however increases the greater part of the reasons.

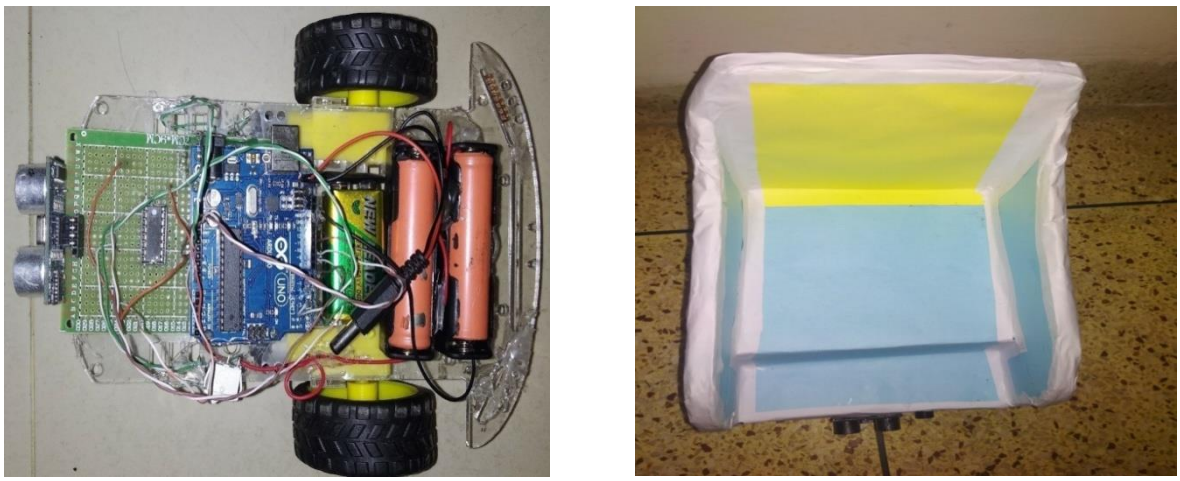


Fig. 5.1 Final projects (Top view)

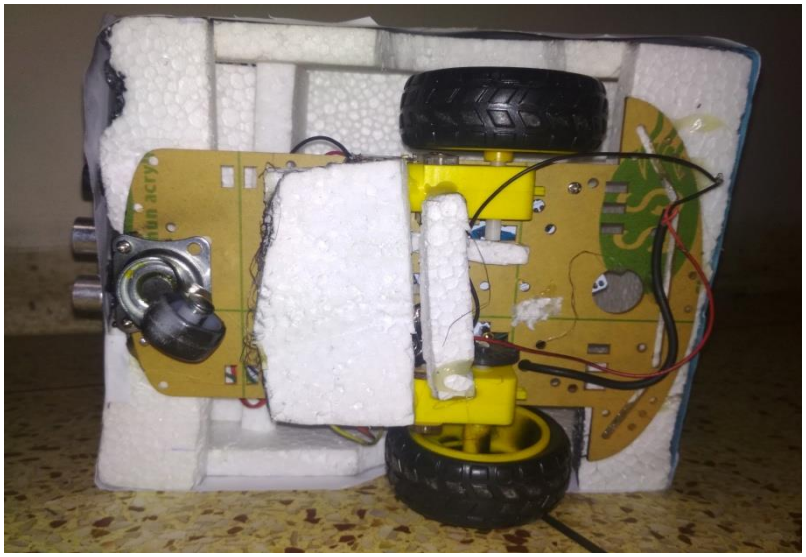


Fig. 5.2 Final projects (Down view)

5.3 Cost Analysis

Table 5.1 Costanalysis of the project

Serial No.	Name	Quantity	Price (BDT)
1.	Arduino UNO	1	500
2.	Microcontroller (ATMEGA328P)	1	250
3.	2 Cell Lipo Battery DC Motor	1	900
4.	Ultrasonic Sensor	1	230
5.	Robot Chassis	1	530
6.	Metal Gear DC Motor (800rpm)	2	900
7.	Rubber Wheel	2	180
8.	Caster Ball	1	95
9.	L293D IC	1	120
10.	Board	1	150
11.	U-clamp motor holder	2	40
12.	Male-Female jumper wire		150
13.	Others		500
	Total		**4545**

5.4 Summary

At last completing this chapter and the project is ready to use.

CHAPTER 6
CONCLUSIONS

6.1 Conclusions

Today we are in the realm of mechanical technology. Intentionally or accidentally, we have been utilizing diverse kinds of robots in our day by day life. In this venture, we have arranged an article adherent robot. This robot does not require any remote controller like GSM, Wi-Fi, Bluetooth, driver and so forth. It will consequently be kept running with following an article or human. This robot is reasonable yet exceptionally compelling for the distinctive reason. Our venture can be used in numerous regions like conveying medication in healing facilities, conveying items in a few spots, spying, and review, etc. Later on, we can join different sensors and cameras to get more highlights. Along these lines, we trust that our undertaking will be useful for some reasons and subsequently our motivation will be fruitful.

6.2 Limitations of the Project

Since we utilize three wheels to move the robot, Robot moves left or right that isn't possible. On the off chance that we utilize four wheels, the robot can push ahead and in reverse exactly. We confronted trouble to supply source by battery. When we run the robot, battery control decreases rapidly. The guiding instrument isn't just cultivated in colossal vehicles and troublesome for non-electric vehicles as like petroleum fueled. Absence of a three wheel drive, makes it not appropriate for an unpleasant landscape. Absence of speed control makes the robot insecure now and again.

6.3 Further Improvements & Future Scope

There are immense helpful employments of this undertaking in different fields whether restorative or military reason. A remote imparting framework can be added with the robot to make it progressively complex and control it from an especially substantial separation. This capacity of a robot could be appropriated for military

purposes. We can watch the conditions by essentially sitting in our rooms by appending a continuous video recorder. We can change a few redresses in the calculation and the development also to suit it for some other reason e.g. a vehicle adherent. Likewise, it can utilize the general population in shopping centers. So it can act as a gear transporter henceforth no necessity to convey up the heaps and force that. The robot will naturally be pursued that individual utilizing this calculation. [15]

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APPENDIX

```
int trigPin = 9;

int echoPin = 10

int led = 7;

int led2 = 2

int led3 = 3;




void setup() {

Serial.begin(9600);

pinMode(led,

OUTPUT);

pinMode(led2

OUTPUT)

pinMode(led2,

OUTPUT);

pinMode(trigPin,

OUTPUT);

pinMode(echoPin,

INPUT);

// put your setup code

here, to run once:
}

void loop() {

long duration,

distance;

digitalWrite(trigPin,HIG
```

```
H);

delayMicroseconds(10
00);

digitalWrite(trigPin,
LOW);


duration=pulseIn(echo
Pin, HIGH);

distance =

(duration/2)/29.1;

Serial.print(distance);

Serial.println("CM");

delay(10);

if((distance>=40))
{

digitalWrite(led,
HIGH);
}

else if(distance>40)
{

digitalWrite(led,
LOW);
}

if((distance<=30))
{

digitalWrite(led2,
HIGH);
}

else if(distance>30)
{

digitalWrite(led2,
LOW);
}

}
```