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SMART AUTONOMOUS DRIVING SYSTEM

A Project Report of Capstone Project - 2

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report **"SMART AUTONOMOUS DRIVING SYSTEM"** is the bonafide work of "**SAURABH SUMAN (1613101652)"**who carried out the project work under my supervision.

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ABSTRACT

In today's world, vehicles are used almost by everyone in all corners of the world. The technical development on these vehicles are done extensively on a large scale. In this research, we will be using Arduino uno and related electronic device using which voice commands will be given to the vehicle and the vehicle will respond according to the commands received by it. From 1920s, when first radio controlled vehicles were designed to 1980s, when vision guide autonomous vehicles came into picture, there had been significant progress in the field of autonomous vehicle and much more is yet to be discover. Though the invention of fully autonomous vehicle is yet a dream , but the speed at which the growth of autonomous vehicles has increased, the time is not so far away when we will reach that goal too.

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1. INTRODUCTION

Smart Autonomous Driving System aims at reducing human intervention to some levels down and encouraging people to give a welcome hand to this technological era of advancement. Till date, various efforts have been made in the development of a fully autonomous systems but still it is a dream. Though, semi-autonomous systems have contributed a lot in the automation industry and have given significant amount of results as a response. With increasing number of technological products, the expectations has also risen up. Various developers from the world have collaborated with each other and has aimed at giving a new path to the technological industry.

1.1 Overall Description

This project describes the implementation of a smart autonomous driving system using Arduino. In this project, the user gives specific voice commands to the vehicle through an Android app installed on the smartphone. At the receiving side, a Bluetooth transceiver module receives the commands and forwards them to the Arduino on the vehicle. Arduino controls the movements of the vehicle according to received commands. The vehicle moves forwards, backwards, left and right, and stops according to the voice commands forward, backward, left, right and stop, respectively.

1.2 Purpose

The purpose of this project is to build an autonomous vehicle which could be controlled using voice commands. Generally these kinds of systems are known as Speech Controlled Automation Systems (SCAS). Our system will be a prototype of the same. We are not aiming to build a vehicle which can recognize a lot of words. Our basic idea is to develop some sort of menu driven control for our vehicle,

where the menu is going to be voice driven. What we are aiming at is to control the vehicle using following voice commands. The vehicle can do these basic tasks:-

1. move forward
2. move back
3. turn right
4. turn left
5. stop

1.3 Motivation and Scope

Autonomous Vehicle have been a challenging field since a long time. As the automation increases, the driving performance of the vehicle decreases alongby. So, its a tedious task to control and manage the proper and efficient functioning of the vehicle so that it could cope up with the existing technology and environment.

2. LITERATURE SURVEY

The development of autonomous vehicles have been grown a long since early 2000s. Nowadays the automotive industry makes a quantum shift to a future, where the driver will have smaller and smaller role in driving his or her vehicle ending up being totally excluded. Since most of the traffic accidents are caused by human error or omission, it is expected that the emergence of the autonomous technologies will reduce these accidents in their number and gravity, but the very few currently available test results have not been able to scientifically underpin this issue yet. A systematic emergence of autonomous vehicles have been seen and presented below:

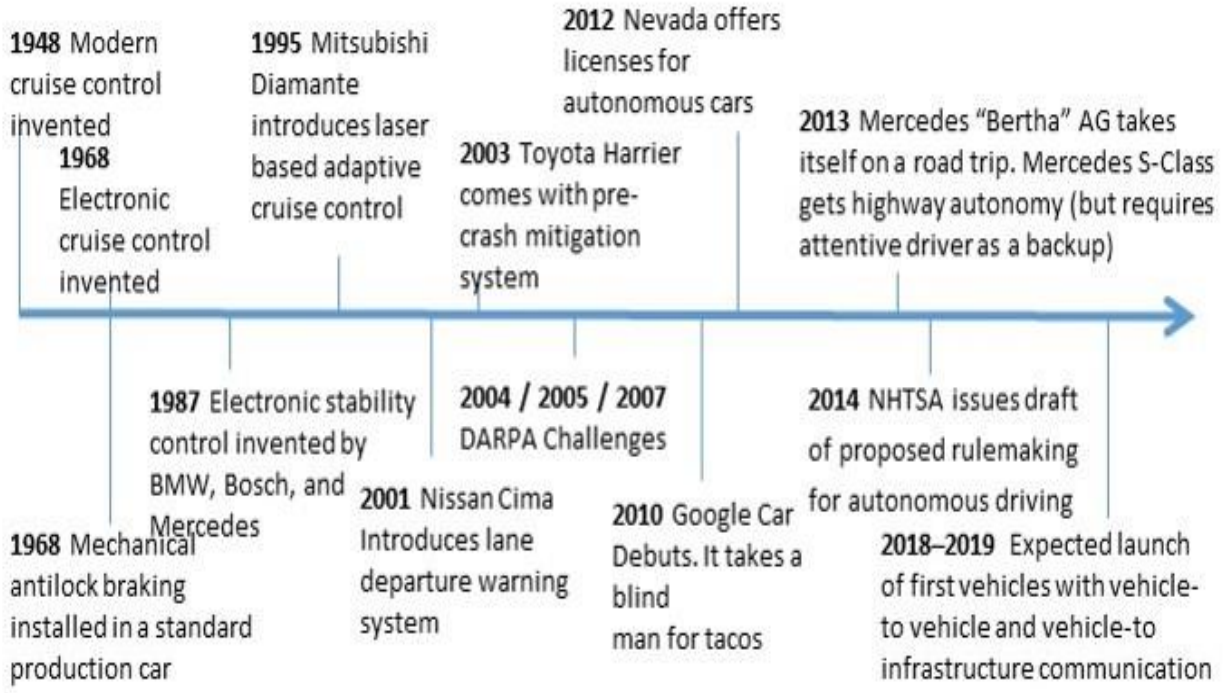


Figure 1 Systematic Emergence of Autonomous Vehicles

3. PROBLEM STATEMENT

Our problem is to look at the implications of utilizing autonomous vehicles in everyday use to reduce negative impacts on society caused by manual transportation. Autonomous personal transportation includes land-based privately-owned personal transportation such as cars, trucks, and motorcycles. This does not include trains or subways. With the development of autonomous driving system the human effort would be minimized to a great extent.

We plan to determine what the most feasible system is by looking at the necessary infrastructural changes, the manufacturing costs, development/research costs, consumer costs, development time, and the desirability of the system. Desirability is defined as how likely the public is to accept the changes brought about by autonomous personal transportation.

We plan to determine the financial cost by taking into account the cost of infrastructural changes, cost of manufacturing, cost of research, and cost to the end consumer.

4. PROPOSED MODEL

When the app is running in the smartphone, user's voice commands are detected by the microphone present in the phone.

Commands are processed, and speech-to-text conversion is done within the app using Google's speech-recognition technology. Text is then sent to the receiver side (that is, vehicle) via Bluetooth.

Arduino Uno is an AVR ATmega328P microcontroller (MCU)-based development board with six analogue input pins and 14 digital I/O pins. The MCU has 32kB ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides the capability of serial communication via UART, SPI and I2C. The MCU can operate at a clock frequency of 16MHz. In this project, digital I/O pins 2, 3, 4 and 5 of Arduino are configured as output pins. Pins 0 and 1 of Arduino are used for serial communication with HC-05 Bluetooth module.

Text received via Bluetooth is forwarded to Arduino Uno board using UART serial communication protocol. Arduino program voice_ctrl.ino checks the text received and, if it is a matching string, Arduino controls the movements of the vehicle accordingly.

4.1 Components Required

4.1.1 Arduino Uno :

Arduino Uno is used because we can mount the motor driver shield in it. It is also cheap, easy to use and acquire less space as we have to place everything on the chassis.

Figure 2 Arduino Uno

4.1.2 Motor Driver Shield :

The Motor Driver Shield is based on the L293/298 IC, which is a dual full-bridge driver. This is used to drive inductive loads such as relays, solenoids, DC and stepping motors. It lets you drive four DC motors and 2 servos with your Arduino. We can control the speed and direction of each motor independently.

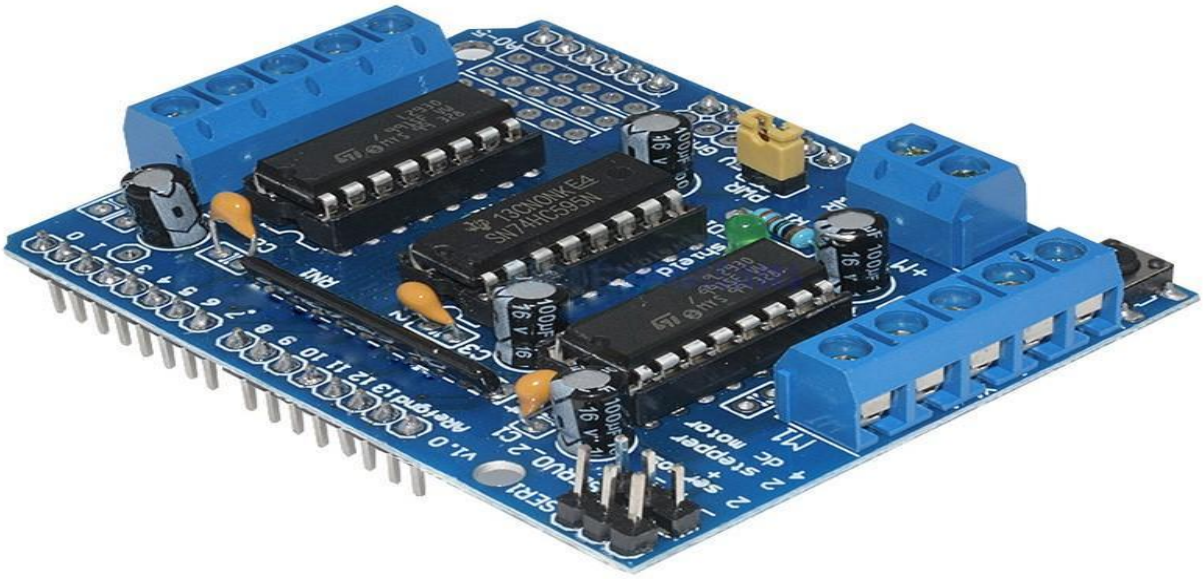


Figure 3 Motor Driver Shield

4.1.3 HC – 05 Bluetooth Module :

This is a class-2 Bluetooth module with Serial Port Profile, which can configure as either Master or Slave. We can use it simply for a serial port replacement to establish a connection between MCU, PC to your embedded project and etc.

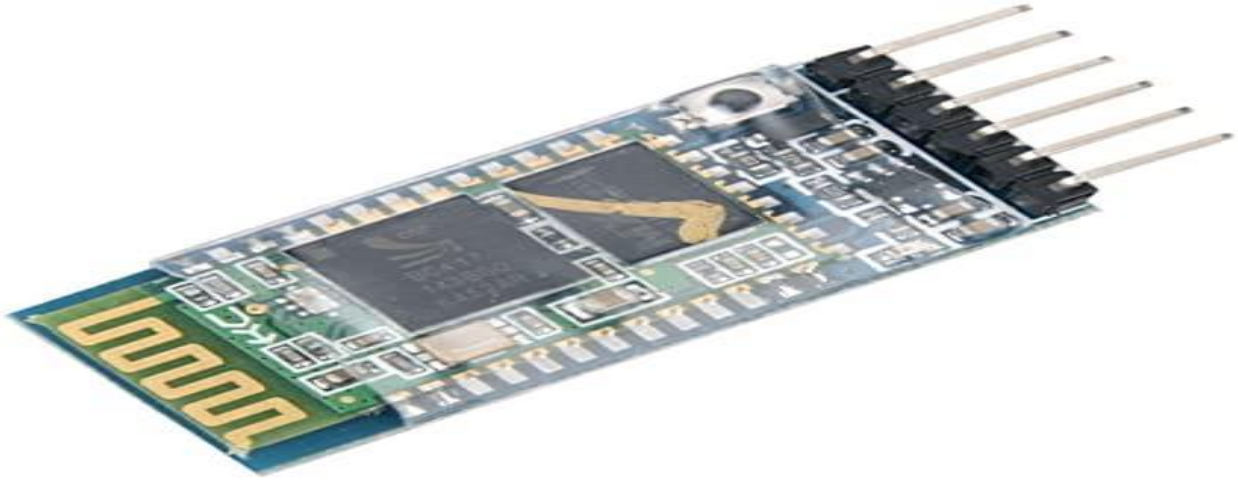


Figure 4 HC – 05 Bluetooth Module

4.1.4 DC Geared Motor :

A DC motor is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. An Inductor (coil) inside the DC motor produces a magnetic field that creates rotary motion as DC voltage is applied to its terminal.

Figure 5 DC Gear Motor

4.1.5 Metal Chassis :

It contains 2 platforms made up of acrylic. It contains 4 dc motor with speed encoders. It is easy to assemble and provide much space to place Arduino, Bluetooth module, and batteries pack.

Figure 6 Metal Chassis

4.1.6 Jumping Wires :

An electrical wire, or a group of wire in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or test circuit, internally, without soldering.

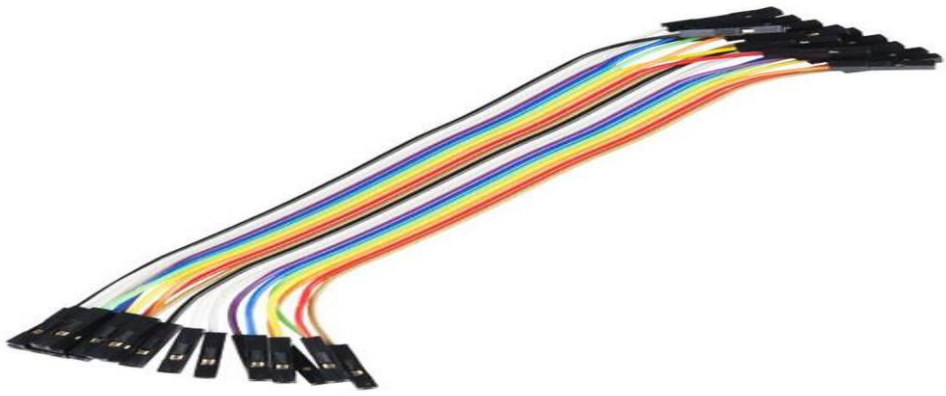


Figure 7 Jumping Wires

4.1.7 Battery :

Any battery of 9-12 V power supply.

4.2 Software Requirements

(i) Programming Language : C Language

(ii) IDE Used : Arduino IDE

4.3 Hardware Requirements

(i) Ram size : 1 Gb or above

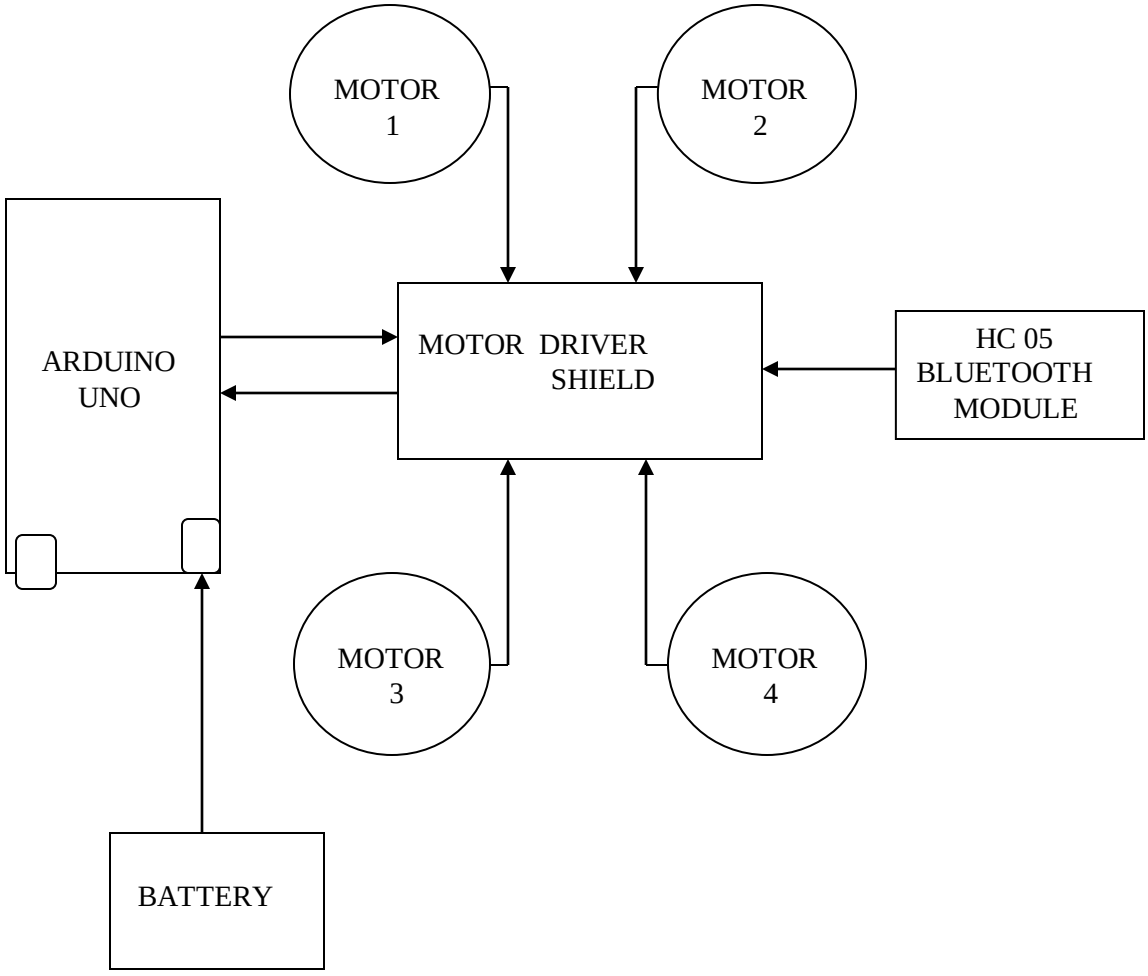
(ii) Processor : Intel Pentium or above

(iii) Windows : Windows 7/8/10 or any Linux System as well

(iv) Any Android smartphone

5. IMPLEMENTATION DIAGRAMS

5.1 Block Diagram



5.2 Circuit Diagram

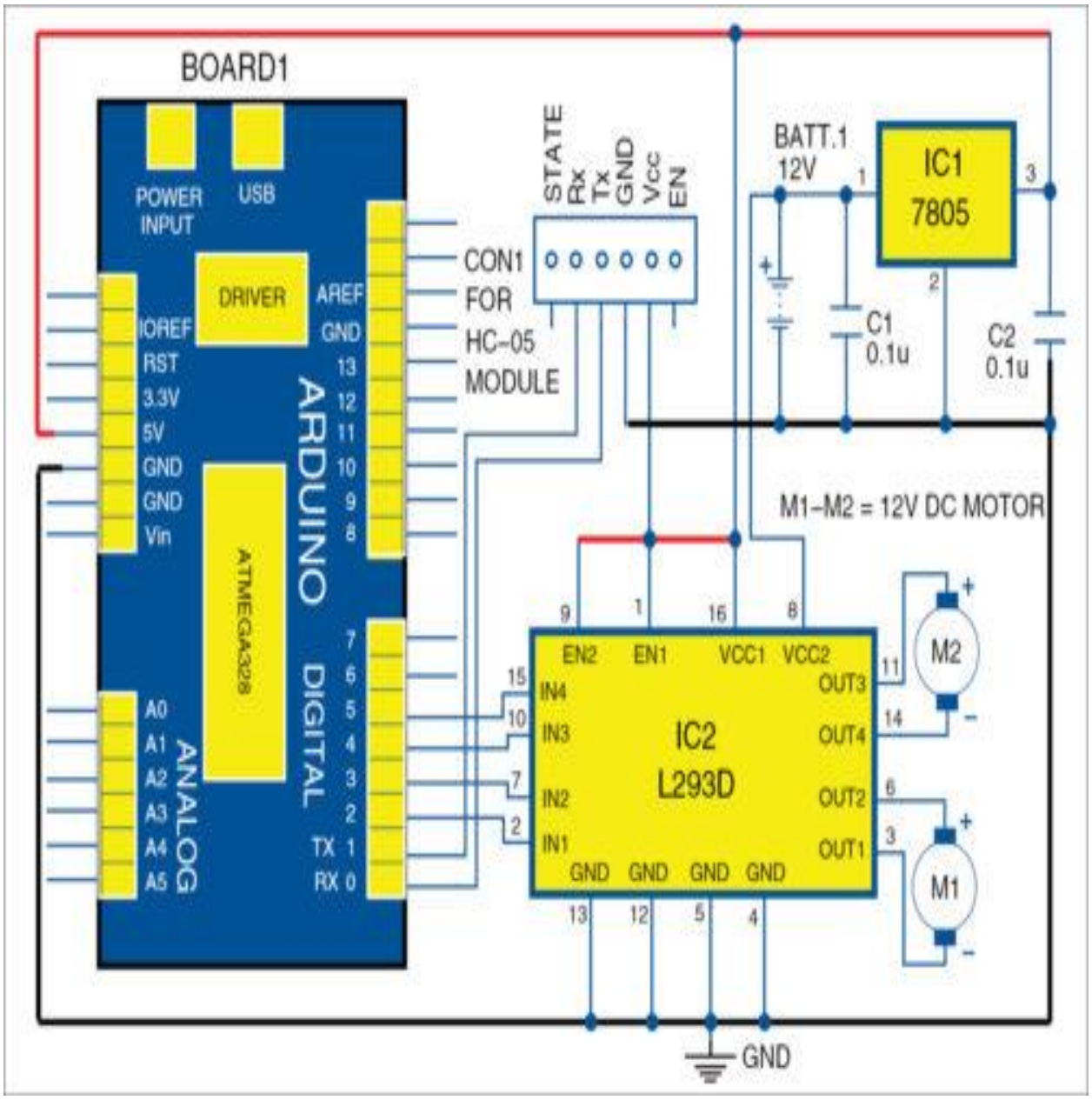
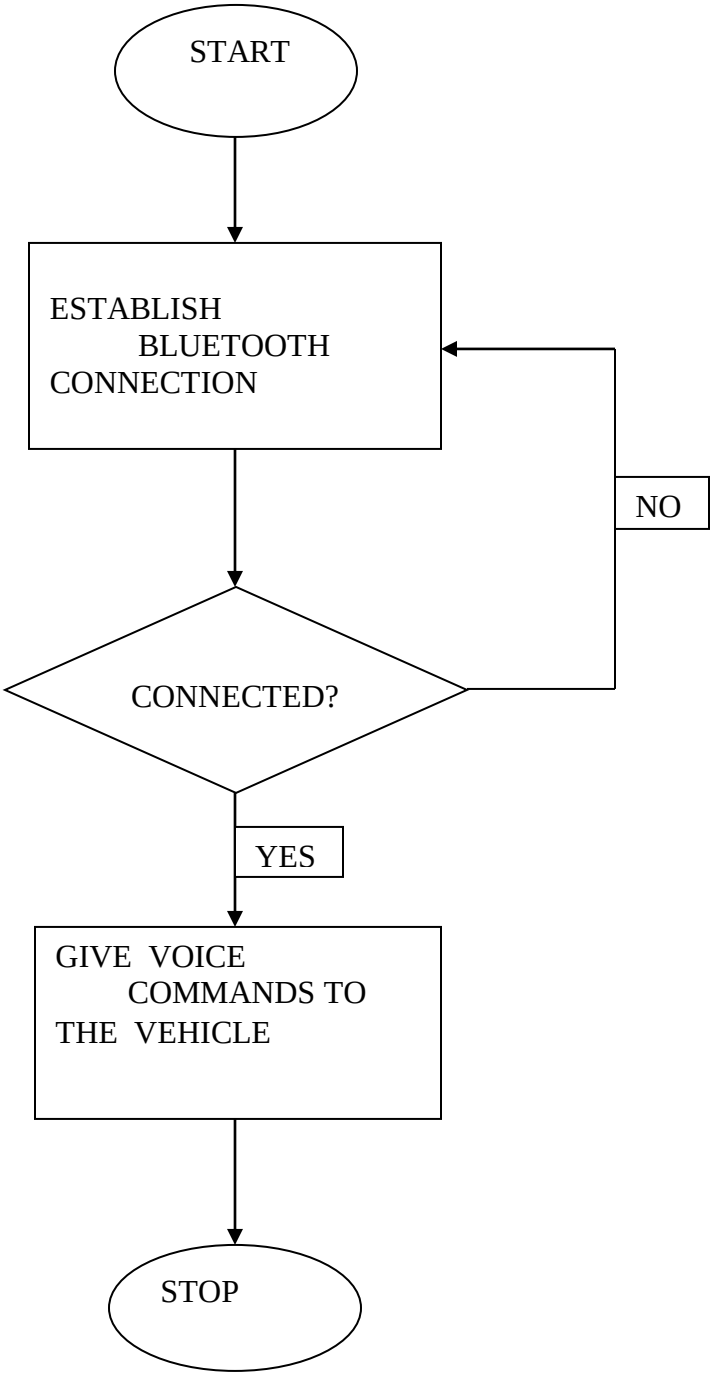


Figure 8 Circuit Logic Diagram

5.3 Flow Chart



6. TESTING

In computer hardware and software development, testing is used at keycheckpoints in the overall process to determine whether objectives are being met.

6.1 TestingObjective

(i) Finding the defects which may be created by the programmer while developing the software.
(ii) Gaining confidence and providing the information about the level of quality.
(iii) To prevent confidence.
(iv) To explore the bugs and report it and try to make software as bug-free as possible.
(v) To ensure quality of the product.
(vi) To find uncovered errors based on requirement.
(vii) To ensure that the product is bug-free before deployment.

6.2 Testing Principles

Software testing is an extremely creative and intellectually challenging task. When testing follows the principles given below, the creative element of test design and execution rivals any of the preceding software developmentsteps:-
(i) Testing must be done by an independent party. Testing should not be performed by the person or team that developed the software since they tend to defend the correctness of the program. Thus we asked some of our colleagues to use the software and report to us any bugs they found.
(ii) Assign trained personnel to the task. Because testing requires high creativity and responsibility, only a trained and highly efficient personnel must be assigned to design, implement, and analyze test cases, test data and test results. Thus we have put our best coders on the job.

(iii) Testing should not be planned under the tacit (implicit) assumption that no errors will be found. Since we have developed the project we understand that there will be many errors that may have escaped our eye.

(iv) Test for invalid and unexpected input conditions as well as valid conditions: The program should generate correct messages when an invalid test is encountered and should generate correct results when the test is valid.

(v) Probability of Errors: The probability of the existence of more errors in a module or group of modules is directly proportional to the number of errors already found.

(vi) Keep software static during test. Any modifications done while the testing process is on, can lead to incoherence. The system may produce unwanted errors due to the ongoing maintenance 46 work/updation in the application. One way to avoid this is to bounce the servers so that no one can tamper with the system being tested.

(vii) Provide expected test results if possible. A necessary part of test documentation is the specification of expected results, even if providing such results is impractical.

(viii) Document test cases and test results. This is an essential and the most crucial part of the Testing Process. Documentation helps assess the overall functioning of the application at any point of time.

6.3 Types of Testing

There are various types of testing. Some of them are as follows:-

(i) Unit Testing

(ii) Integration Testing

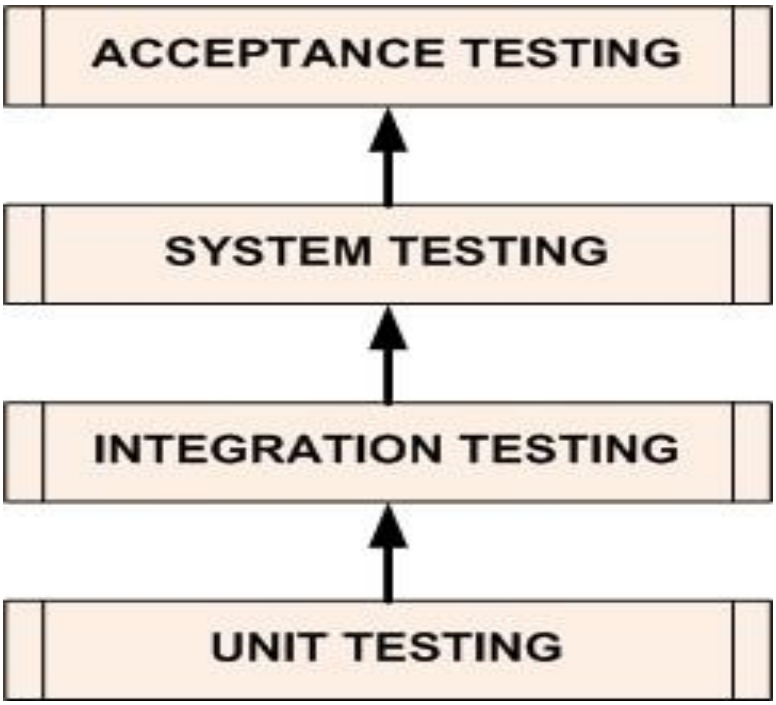


Figure 9 Levels of Testing

6.3.1 Unit Testing

The purpose of unit testing is to test each module/service or component developed in isolation to ensure that the defined modular functionality is met. This will ensure that the delivered application is of an acceptable operational level and functions in accordance with functional and integration tests entry criteria. The Development team lead will be responsible for planning and coordinating the Unit test activity. At the end of the Unit test phase, the development lead generates the Unit test completion report. This report will consist of a summary of activities carried out during Unit testing and the test results. The specifics of the Unit test completion report will be present in the Unit test plan. The Unit test completion report can be in the form of a document template.

6.3.2 Integration Testing

Integration testing is the testing of combined parts of an application to determine if they function together correctly. It is usually performed after unit testing. Integration testing identifies problems that occur when units are combined. Each unit of the application, which is tested in unit testing, might produce some minute bug or affect the entire applications control flow. Here the testing is done to ensure that application functions effectively. The application is tested as whole to check if all the enhancements or changes are consistent after their integration in to the actual system. This testing is done at the development server; if it is successful the changes are transported to the quality server.

6.4 Testing Strategy

A strategy of software testing is shown in the context of spiral.

(i) Unit testing : Unit testing starts at the centre and each unit is implemented in source code.

(ii) Integration testing : An integration testing focuses on the construction and design of the software.

(iii) Validation testing : Check all the requirements like functional, behavioral and per- formance requirement are validate against the construction software.

(iv) System testing :System testing confirms all system elements and performance are tested entirely.

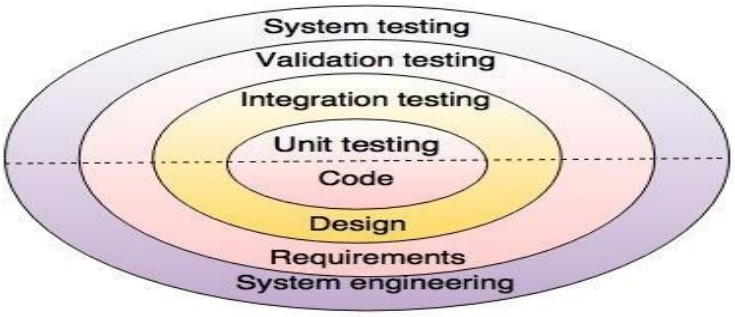


Figure 10 Testing Strategy

7. OUTPUT/ RESULT/ SCREENSHOT

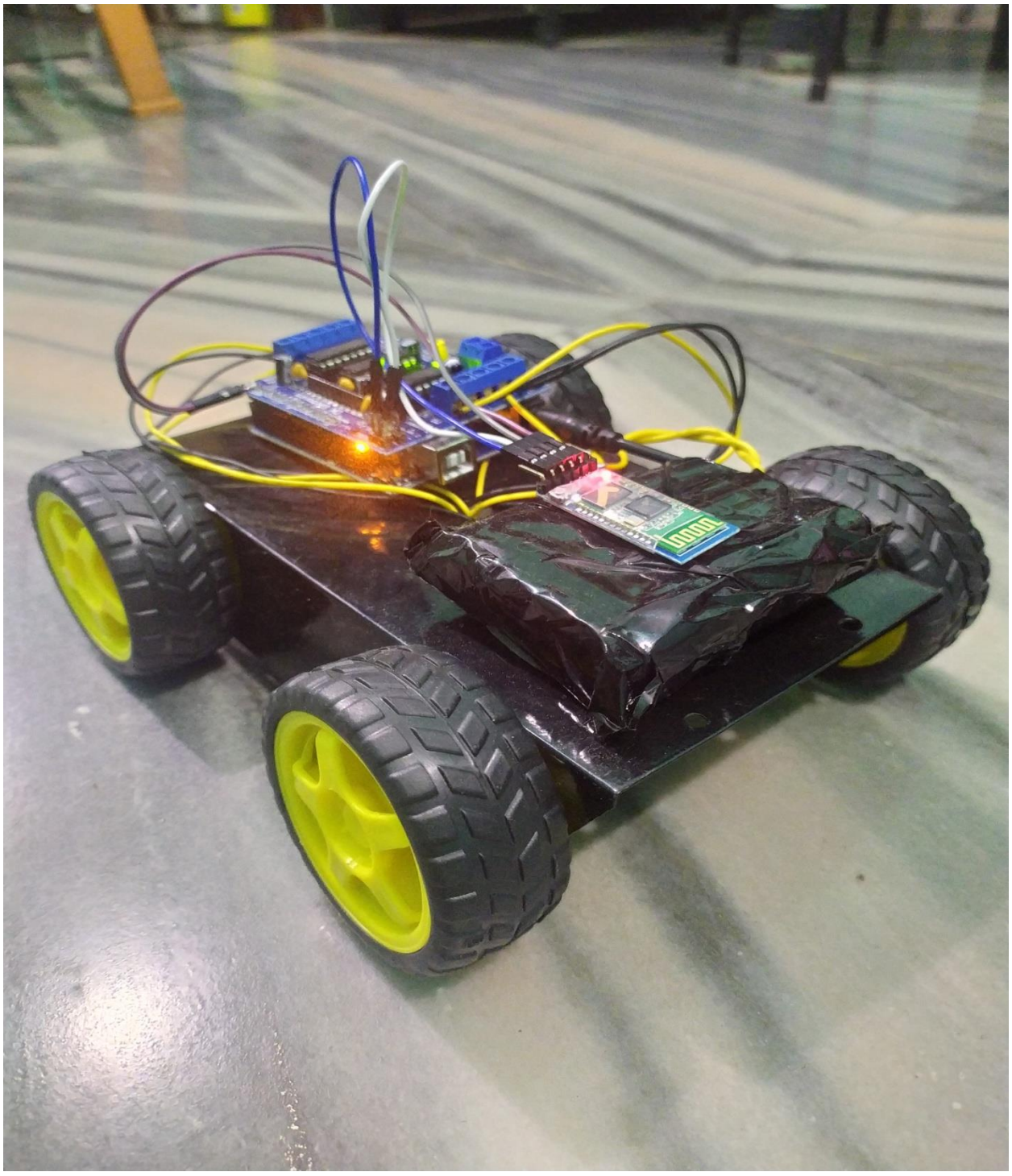


Figure 11 Output 1

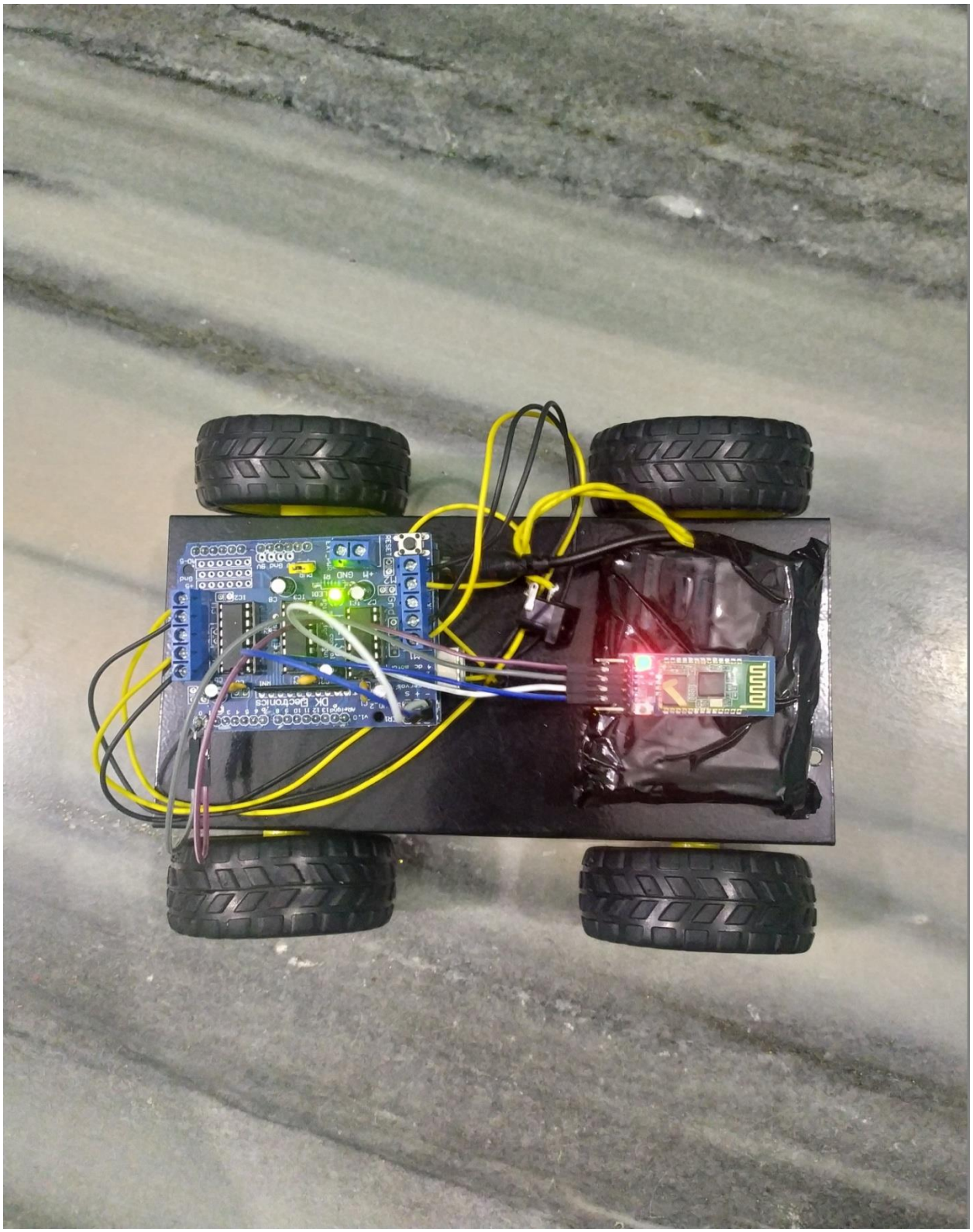


Figure 12 Output 2

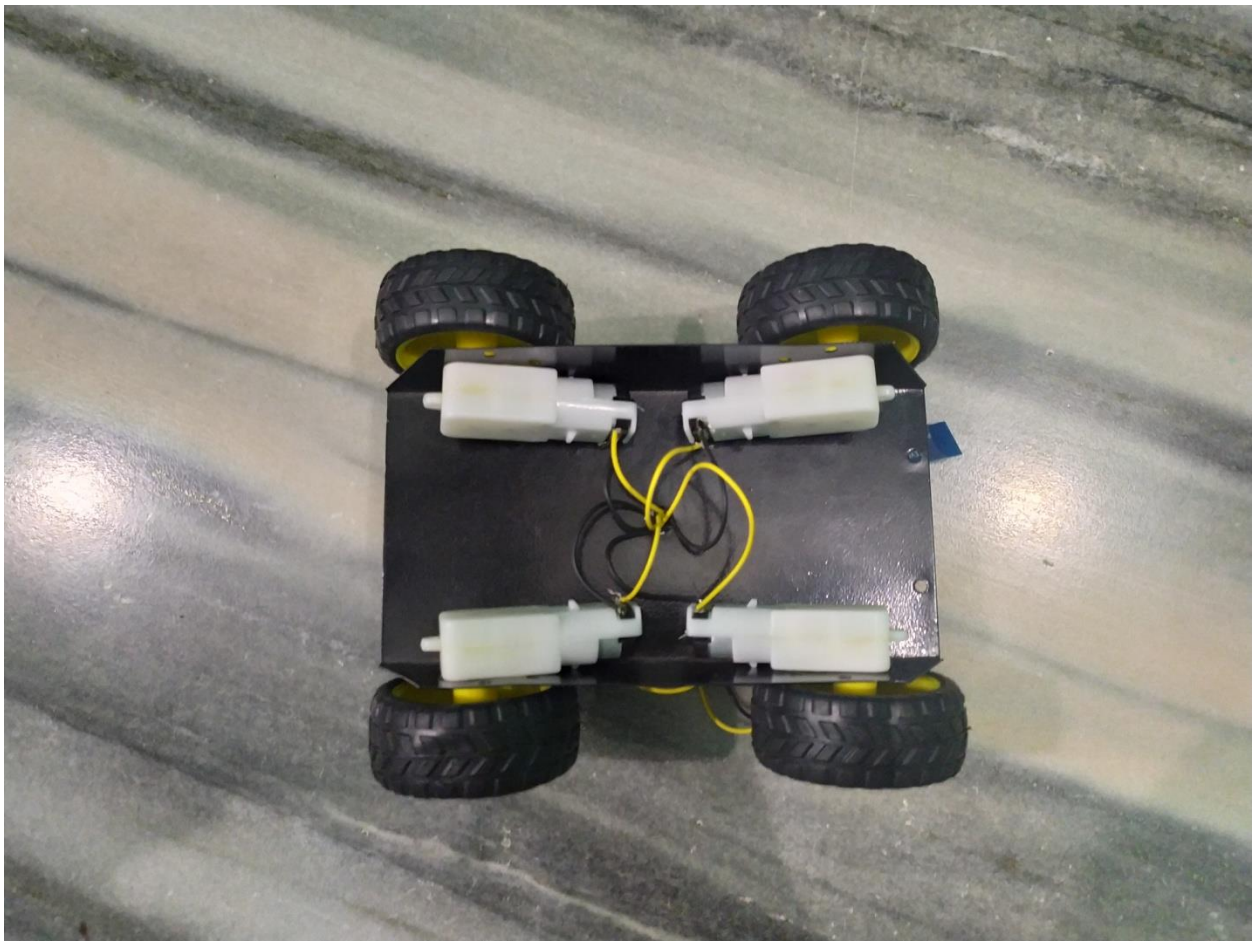


Figure 13 Output 3

8. CONCLUSION AND FUTURE ENHANCEMENT

8.1 Conclusion

All the commands have been successfully tested on the device and the device responds perfectly. This can reduce human intervention to a great extent if used correctly. It can be carried down to the outer world environment such as industries or for research purposes.

8.2 Future Scope

Further enhancement in project can be used for Home security and military purposes where the commands can be given to robot without risk by increasing the range and by installing cameras.

9. REFERENCES

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[5] https://en.wikipedia.org/wiki/Chassis

[6] https://en.wikipedia.org/wiki/Jump_wire

[7] https://www.youtube.com/results?search_query=introduction+to+arduino+programming

[8] https://www.youtube.com/watch?v=VQmxU7CV9bM

[9] https://www.youtube.com/watch?v=OhnxU8xALtg

[10] https://www.youtube.com/watch?v=sfMgEsRsN4U