COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

MINI PROJECT REPORT

ON

LINE FOLLOWER ROBOT

Submitted in partial fulfillment of the award of

the degree of Bachelor of Technology

in

ELECTRONICS AND COMMUNICATION ENGINEERING

At

COCHIN UNIVERSITY COLLEGE OF ENGINEERING KUTTANAD

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CERTIFICATE

*Certified that this is the project report entitled "***LINE FOLLOWER ROBOT***" is a bonafide record of the Miniproject presented by* **ANOOP ASHOK (Regno:20318506) G S GOPIKA(Regno:20318517), PRAFUL RAJ(Regno:20318525),RUGMINI.K.S (Regno:20318530)** *in partial fulfillment of the requirements for the award of the degree in ELECTRONICS AND COMMUNICATION ENGINEERING under Cochin University of Science and Technology during the year 2020-2021.*

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ACKNOWLEDGEMENT

I thank the Supreme Lord for imparting me with the spiritual energy in the right direction which has led to the successful completion of this mini project. I would also like to thank the principal, Dr. Joseph Kutty Jacob, for the facilities provided by him during the preparation of the report. I am extremely thankful to the Head of the department Electronics and Communication engineering, Dr. Manoj V J, for giving me all the support and valuable directions in overcoming the difficulties faced during the preparation of the report. I express my sincere thanks to my mini project coordinator, for giving me innovative suggestions, timely advice, correction advices and suggestions during this endeavor. I also express my gratitude towards all staff members of Electronics and Communication department and faculties of CUCEK for their encouragement. I also express my deep sense of thanks to all my classmates and friends for their support, constructive criticism and suggestions.

ABSTRACT

A robot is a machine capable of carrying out a complex series of actions automatically. The idea of robots originates in the mythologies of many cultures around the world. Engineers and inventors from the ancient civilization attempted to build selfoperating machine resembling animals and humans. A mobile robot is a robot that capable of moving in surrounding. During World War II the first mobile robot emerged as a result of technical advances on a number of relatively new research fields like computer science and cybernetics. Mobile robots have more common place in commercial and industrial fields. Some of the earliest Automated Guided Vehicles (AGVs) were line following mobile robots. They might follow a visual line painted in the floor. Most of these robots operated a simple "keep the line in the center sensor" algorithm. They could not circumnavigate obstacles; they just stopped and waited when something blocked their path. Many examples of such vehicles are still sold, by Transbotics, FMC, Egemin, HK Systems and many other companies. These types of robots are still widely popular in well-known Robotic societies as a first step towards learning nooks and corners of robotics.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

Since the inception of computers, automation and robotic technologies have been utilized to create consumer products that increase life quality. The line following robot carriers aims to utilize such technology to solve another common issue: carrying heavy items. Line follower robot is a behavior based robot which follows a certain path controlled by a feedback mechanism. This simple robot is designed to be able to follow a black line on a white surface or vice versa without getting off the line too much. The robot uses interface with the sensors to make the behavior of the robot ass versatile as possible. The follower robot therefore eliminates problems associated with carrying heavy items by being a helpful robot that can carry almost any kind of item whilst following the user in an accurate and unobtrusive manner. The line following robot technology has also been suggested to be used in running buses and other mass transit systems.

1.2 ADVANTAGES

- ✓Automatic movement.
- ✓Easy to build.
- ✓Relatively cheap.
- ✓Can be used for long distance application

1.3 DISADVANTAGES

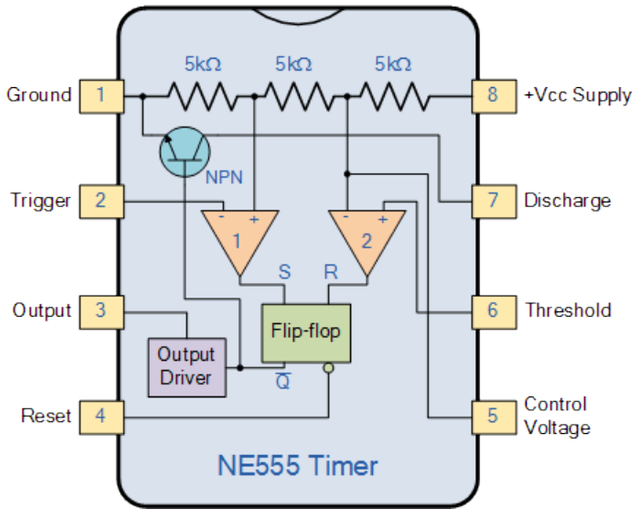
- o Lack of speed control makes the robot unstable at certain times.
- o LFR can move only through a fixed line or path.
- o It requires a power supply.

1.4 APPLICATIONS

- ❖They can be in industries as automated equipment carriers or transfer of things.
- ❖Used in public places like shopping malls, museums, etc. to provide path guidance.
- ❖Used for domestic purposes like floor cleaning.

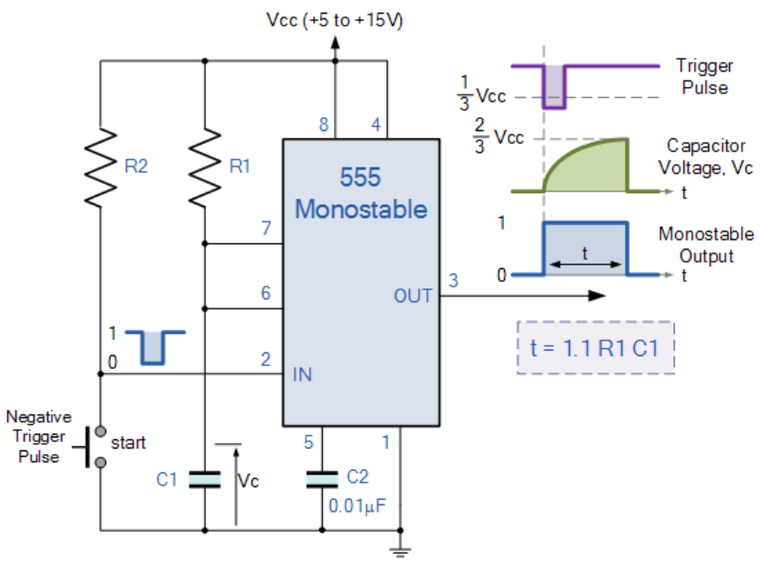
CHAPTER 2
COMPONENTS REQUIRED

2.1. 555 TIMER IC



555 timer IC is one of the most versatile linear IC. This IC is a monolithic timing circuit that can produce accurate and highly stable time delays or oscillation. Like other commonly used op-amps, this IC is also very much reliable , easy to use and cheaper in cost. The timer basically operates in one of two modes either as a monostable (one shot) multivibrator or as an astable (free-running) multivibrator. The SE 555 is designed for the operating temperature range from –55°C to 125° while the NE 555 operates over a temperature range of 0° to 70°C. It has a variety of applications including monostable and astable multivibrators, dc-ac converters, digital logic probes, waveform generators, analog frequency meters and tachometers, temperature measurement and control devices, voltage regulators etc.

2.1.1 MONOSTABLE MODE OF NE555

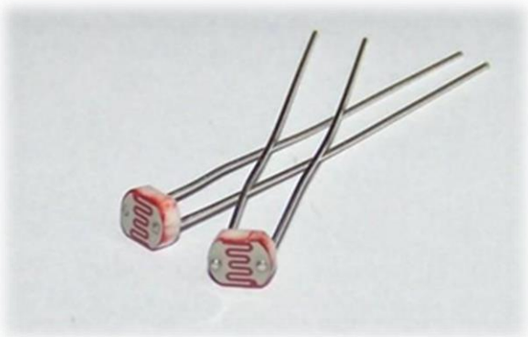


A Monostable multivibrator often called a one shot multivibrator, is a pulse generator circuit in which the duration of the pulse is determined by the RC network connected externally to the 555 timers. In such a vibrator, one state is stable while the other is quasi-stable state (unstable). In LFR, 555 timers are configured in monostable mode (One-shot mode).It conveys the idea that when triggered, the 555 gives one and only one output pulse. In monostable mode trigger voltage is required in order to switch states.

2.2. DC GEARED MOTORS

DC geared motor is a rotating electrical device that coverts electrical energy into mechanical energy. Geared motor is an all-in-one combination of a motor and a gearbox. The addition of gear head to a motor reduces the speed while increasing the torque output. In LFR, DC geared motors must be used since ordinary motors do not have enough torque to carry the weight of the structure. DC geared motors are controlled by transistors in LFR. Voltage: 9/12V, Speed: 60-300 RPM.

2.3. LIGHT DEPENDENT RESISTORS



LDR or Photoresistor is a passive component which decreases resistance with respect to receiving luminosity on the component's sensitive surface. It exhibits photoconductivity i.e., resistance of photoresistor decreases with increase in incident light intensity. In LFR, LDRs will sense the reflections of LEDs. When LEDs are on white area, there is reflection, LDRs sense light and motor turns OFF. When LEDs are on dark area, there is no reflection, LDRs doesn't sense Light and motor turns ON.

2.4. BRIGHT WHITE LED

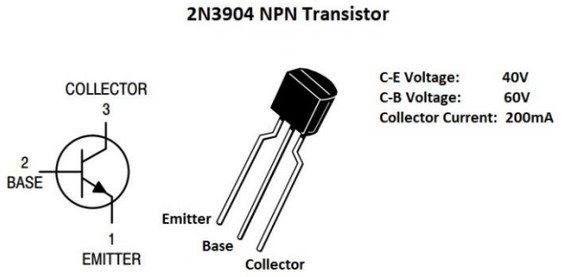
A light emitting diode is a semiconductor diode which glows when a voltage is applied. In LFR , we use bright white LEDs for the proper sensing action of LDR. LEDs are kept all time ON. The reflection of LEDs are sensed by the LDRs.

2.5. POTENTIOMETER

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage driver. Used for measuring electrical potential. The 3 pins are two Fixed end (connected to both the ends of resistive track) and Variable end(connected to wiper, to provide variable voltage). In LFR, we use 10k potentiometers, the resistance between fixed ends are 10k. Potentiometers are used to set the sensitivity of LDRs in the LFR.

2.6. 2N3904 TRANSISTOR

2N3904 is a common NPN BJT used for general purpose low-power amplifying or switching applications. It is a low current (200 mA), low power (625 mV) and medium voltage (40 V) transistor and can operate at moderately high speeds. In LFR, 2N3904 is used as a switch circuit



for the DC geared motors. The output pulse of 555 timers are feed as the input to the transistors. Whenever input is high, transistor act as a closed switch and whenever input is low, transistor act as an open switch.

2.7. 1N4148 DIODE

Diode is a two terminal electronic component that conducts current in one direction. 1N4148 is a standard silicon switching signal diode. It's popular due to its dependable specifications and low cost. It's used for extremely fast switching operations. In LFR, 1N4148 will control the current flow through the circuit. It provides trigger input to the central 555 timer IC.

2.8. RESISTORS

Resistor is a passive two terminal electrical component that implements electrical resistance. In LFR, we use four 1k, a 4.7k and a 180 ohm resistors. Two 1k resistors are connected in series with LED since it's likely to be destroyed by excessive current passing through it. Two 1k resistors act as the base resistor for the transistors there by limiting the current flow. 4.7K resistor is used to configure 555 timer in monostable mode and the width of output pulse is determined by this resistor along with capacitor. 180 ohm resistor is connected in parallel with diode, thereby protecting diode from excess current flow.

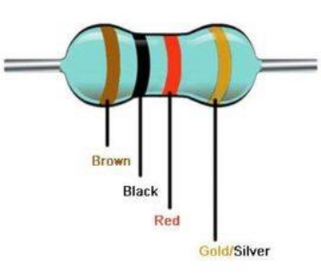


Fig. showing color code of 1k Ohm resistor

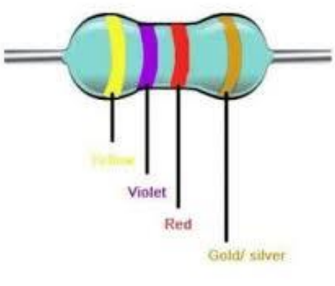


Fig. showing color code of 4.7k Ohm resistor

2.9. CAPACIOTOR

Capacitor is a passive two terminal electronic component that stores electrical energy in an electric field. In LFR, we use three 10 microfarad capacitors. These 3 capacitors are used to configure 555 timers in monostable mode. The width of the output pulse of the timers are determined by these capacitors along with the resistors.

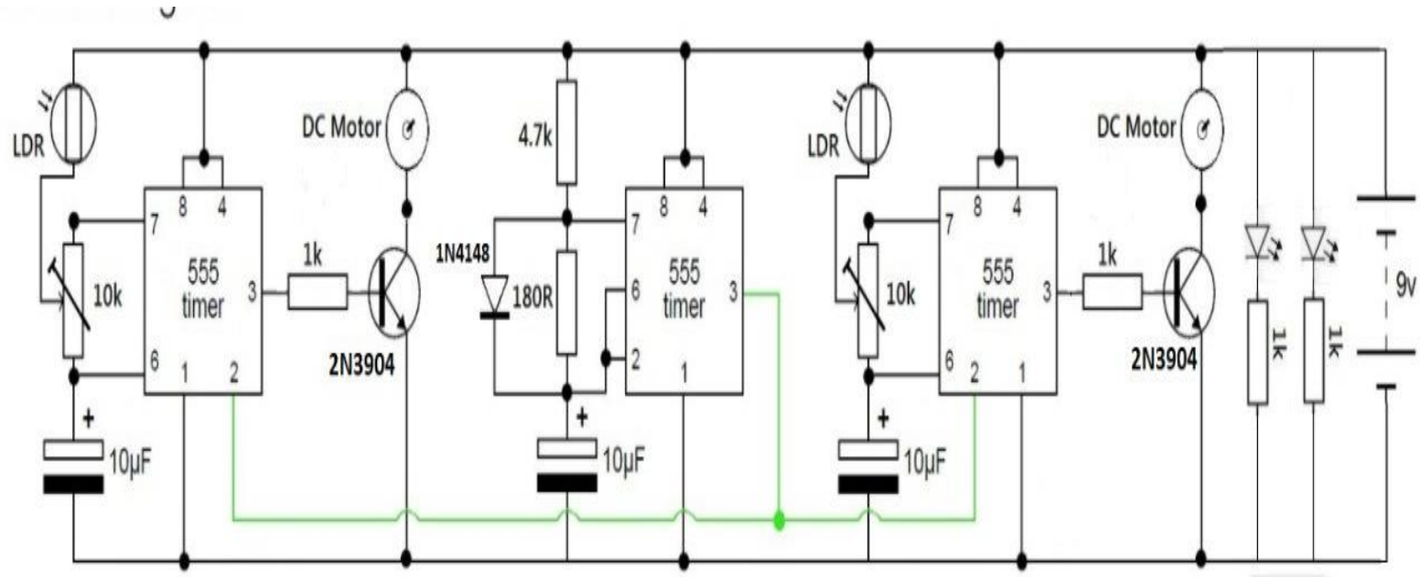
2.10. SOFTWARE USED

TINKERCAD was used for the software simulation of line follower robot. Tinkercad is a free, online 3D modelling program that runs in a web browser known for simplicity and ease of use TINKERCAD circuits is an excellent resource for implementing electronics lesson virtually.

CHAPTER 3
METHODOLOGY

3.1 CIRCUIT DIAGRAM

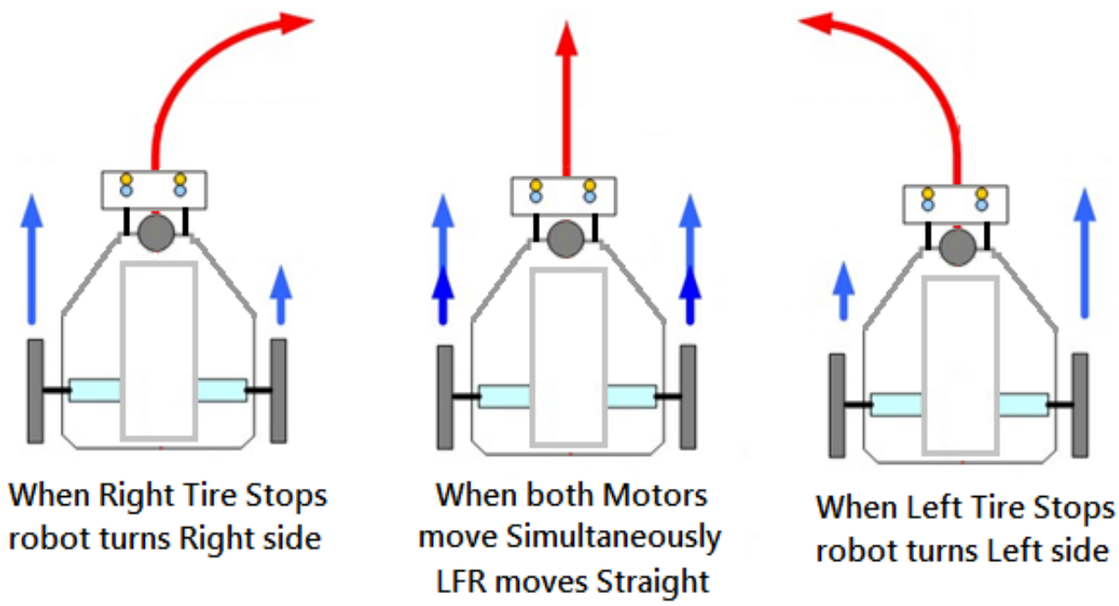
This is the whole circuit for the line follower robot. It is a basic circuit on three 555 timers. 555 timers are configured in monostable mode. Except the center one, both 555 timer circuits are same and it controls both of them. LDRs are the most important part of the LFR. LDR sense light and drive the dc geared motors. To sense light the LEDs are turned all time ON. Two 2N3904 transistors are used for switching the motors. The 1N4148 diode controls the current flow through the circuit. The direction of Movement of LFR is determined by the state of the dc geared motors.



3.2 WORKING PRINCIPLE

The three 555 timers are configured in the monostable mode that means when they are triggered they give a pulse on the output pin. The middle 555 timer is provided by a trigger input from the diode. The output pin (pin 3) of it is connected to the trigger input pin (pin 2) of both 555 timers on its Sides. The output of these two timers act as the input of the transistor. Transistor acts as the switch circuit for dc geared motors. Since the timer is configured in monostable mode, the resistor and capacitor value will determine the astable

time period of the 555 timer. For the center timer IC, 4.7K resistor and 10µF capacitor is given. Hence the output waveform of this timer will be determined by them. For the timers controlling the motors, LDR and 10µF capacitor is used. That means the value of LDR will determine the output of timers. When no light is sensed LDR remains high i.e. unstable time period (output=1) increases so transistor switch is ON and in turn motor is turned ON. When light is sensed by the LDR resistance decreases so unstable time period decreases means output=0. So transistor acts as an open switch and hence motor turns OFF. Thus the timer circuits on both sides acts as twin circuits controlling the oscillation of dc geared motors with the help of LDR and the middle timer will control both the twin circuits. The direction of movement of the line following robot solely depends on the state of the dc geared motors.



CHAPTER 4
RESULT

The circuit was implemented on both software and hardware and result was obtained.

PHASE 1- SOFTWARE IMPLEMENTATION

The circuit was created on a software called TINKERCAD. The connections were given and it was simulated. Output was obtained successfully as the LEDs glowed and both dc geared motors also worked simultaneously at the rate of 266RPM.

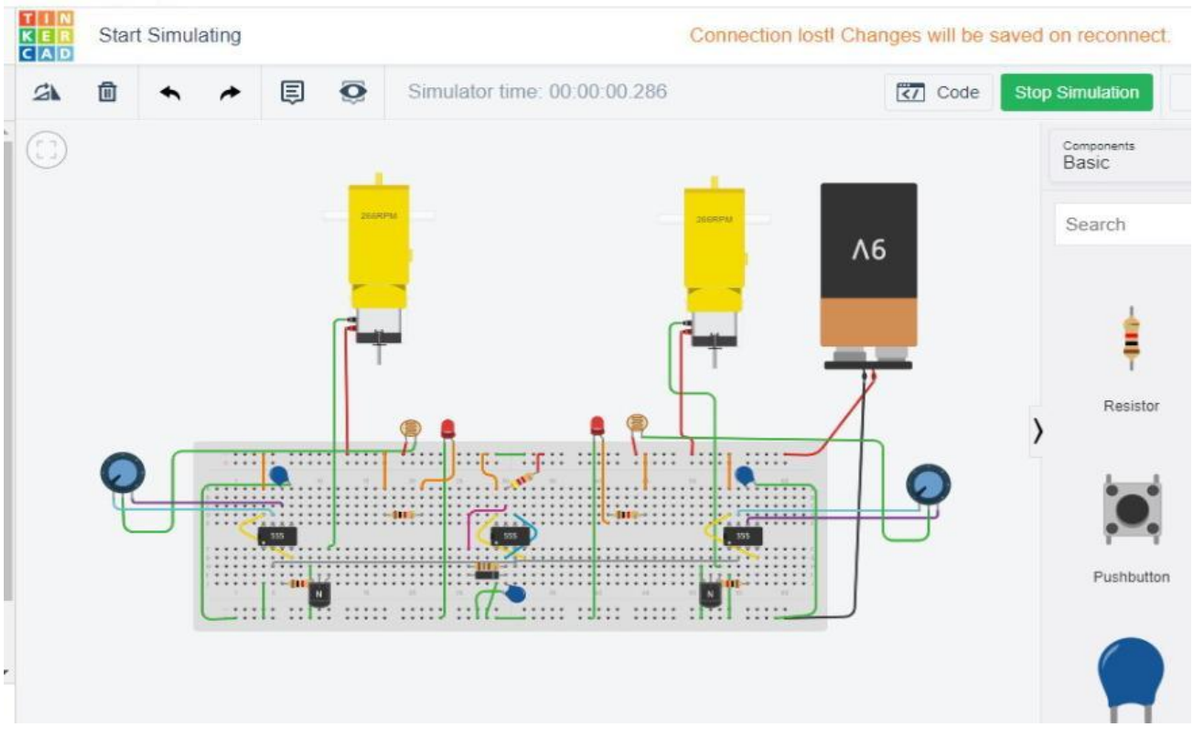
PHASE 2-HARDWARE IMPLEMENTATION

Circuit was implemented using the required components on breadboard and the connections were given accordingly. Proper working of the components were checked in this phase.

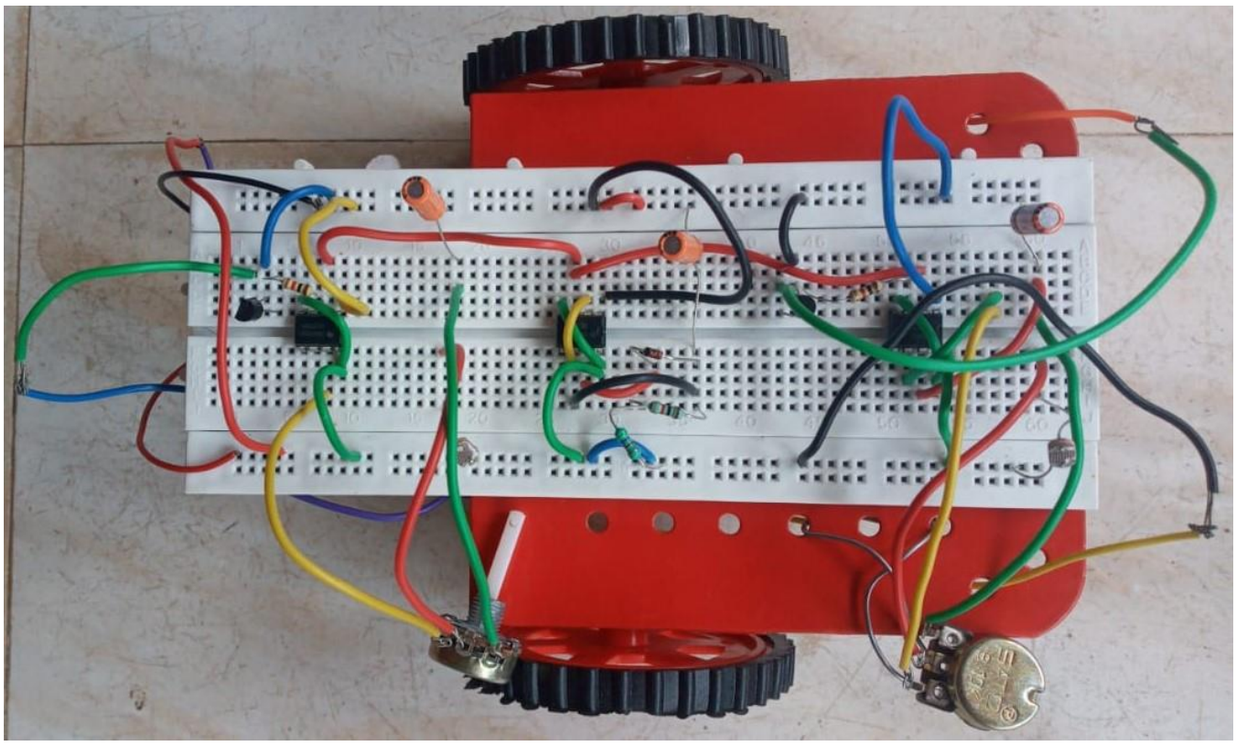
PHASE 3

The line follower robot was completed. Upon giving power supply the robot started working. The robot successfully followed the path that was given without any error.

SOFTWARE IMPLEMENTATION



HARDWARE IMPLEMENTATION



CHAPTER 5
CONCLUSION

A line follower robot which could follow a black line given on a white surface was successfully built. Line following robots are also a subject of discussion for the future technological developments. They have paved their way into public transport, industries as well as in the health care system. This prototype implies that the number of traffic accidents can be minimized with the use of computer interactive line follower robots in public transport. With the use of computer interactive robots in public transport, the problems such as snoozing drivers because of the stressful and busy work hours will be eliminated.

The rapid transformation and advancement in the **robotics** sector in **India** comes as a refreshing development in the technological landscape. The advancement in robotics is great news for humans as robots will take care of their repetitive, boring and physically draining tasks. Human workers can, therefore, focus on more creative, skill-based roles that will contribute to their pool of knowledge and fast-track their career growth. As far as the future of robotics in India is concerned, the picture looks bright and replete with potential. Tremendous research is going into the sector.

Line following robot's application over electronics engineering can't be underestimated.

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