

# Design of an Automatic Guided Vehicle or an Autonomous Robotic Car to Avoid Accident on Highway

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**Abstract**—Robotics has become most important and talked advance science, engineering and technology in today's world. In today's world robotics becomes a fast growing and interested field. Most of the people are talking a serious interest in this subject, either as a career or as an absorbing hobby. By using robotics technology we can build a world where we reduce human work. Mobile robot takes an important role in today's changing world. Automatic guided vehicle (AGV) or autonomous vehicle (AV) is such types of mobile robots which can be used for travelling, luggage carrying etc. that they are automatically controlled. For an autonomous robotic car/vehicle (ARC/ARV) it must require an infrared sensor for sensing something surrounded by it which consists of transmission and receiving, an AVR microcontroller for controlling purpose, gear motors, castor wheels, wheels, chassis, regulated power supply etc. Autonomous vehicle also can be designed by using light sensor, ultrasonic sensor; but we have used IR sensor to design automatic guided vehicle/robotic vehicle. This vehicle can be guided automatically based on sensors output to the microcontroller. If sensor gives high o/p to the microcontroller or the sensor detects obstacle it implies that there is an obstacle along the car movement direction and then the direction of the car movement changed. If there is no obstacle to be detected then the car runs forward. We have used four sensors for controlling car movement directions they are using in the left, right, front and back position. These kinds of vehicles are most suitable for physical handicap person, for carrying luggage, mail etc. by using this kind of technique we can avoid or reduce accident on highway.

## 1. INTRODUCTION

Mankind has always strived to give life-like qualities to its artefact's in an attempt to find substitutes for himself to carry out his orders and also to work in a hostile environment. The basic concept of a robot is of a machine that looks and works like a human being. This humanoid concept has been inspired by science fiction stories and movies of twenty century. The industrial robots of today may not look the least bit like a human being although all the research is directed to provide more and more anthropomorphic and human-like features, which can be able to control itself and its own feelings.

Machines that can replace human beings as regards to physical work and decision making are categorized as robots and their study is referred as robotics.

The term ROBOT is derived from the CZECH word ROBOTA, which means forced labour or compulsory service. Robots are general purpose mechanical machines and they are programmable to perform a variety of work automatically within their mechanical capabilities. Robotics is the sciences that deal with robots.

The robot technology is going to be advancement day to day due to its popularity. The industry is moving from the current state of automation to robotization, to increase productivity to deliver uniform quality. Robots and robot-look like manipulators are commonly employed in hostile environment, such as at various places in an atomic plant for handling radioactive materials. Robots are being employed to construct and repair space stations and satellites. There are now increasing number of applications of robots, such as nursing and aiding a patient. Micro robots are being designed to for performing damage control inside a human's vein. Robots like systems are employed in heavy earth-moving equipment. One type of most widely used robot in industry is a robotic manipulator or a robotic arm. Another one of the most widely used robot is autonomous vehicle. These kinds of vehicles are used in industries to carry different components. Now a day, autonomous vehicle are able to run on highway to carry different things, human, mail and other information's from one place to another place. Those types of vehicles are controlled itself based on obstacle avoiding sensor. So, these types of vehicles are called automatic guided vehicle.

## 2. LOWS OF ROBOTICS

ISSAC ASIMOV conceived the robots as humanoids, devoid of feelings, and used them in a number of stories. His robots were well designed; fail safe machines, whose brains are programmed by human beings. Anticipating the dangers and havoc such a device could cause, he postulated rules for their

ethical conduct. Robots were required to perform according to three principles known as “three lows of robotics”, which are as valid for real robots as they were for ASSIMOV’S robot. They are-

- A robot should not injured a human being or, through inaction, allow a human to be harmed.
- A robot must obey orders given by human’s concept when that conflicts with the first low.
- A robot must protect its own existence unless that conflicts with the first or second low.

These are very useful and general lows are applied even to other machines and appliances. They are always taken care of in any robot design

### 3. PROGRESSIVE ADVANCEMENT OF ROBOT

The growth in the capabilities of robots has been taking rapid strides since the introduction of robots in the industry in early 1960s, but there is still a long way to go to obtain the super humanoid anthropomorphic robot depicted in fiction. The growth of robot can be grouped into robot generations, based on characteristics breakthroughs in robots capabilities. These generations are overlapping and include futuristic projections.

- First generation robot
- Second generation robot
- Third generation robot
- Fourth generation robot

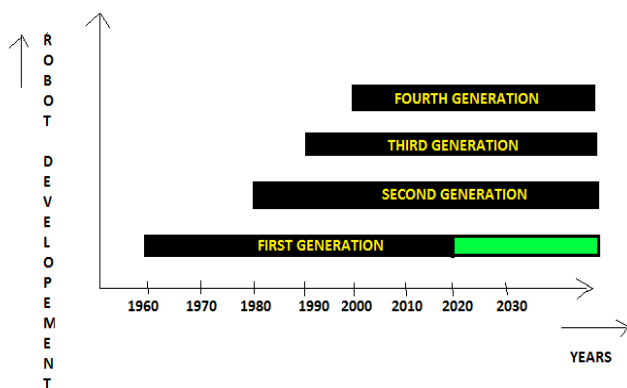


Fig. 1: The four generation of robot

### 4. MOBILE ROBOT

A mobile robot is an automatic machine that is capable of locomotion. Mobile robots have the capability to move around in their environment and are not fixed to one physical location. Mobile robots can be "autonomous" (AMR - autonomous mobile robot) which means they are capable of navigating an uncontrolled environment without the need for physical or electro-mechanical guidance devices.

Alternatively, mobile robots can rely on guidance devices that allow them to travel a pre-defined navigation route in relatively controlled space (AGV - autonomous guided vehicle). By contrast, industrial robots are usually more-or-less stationary, consisting of a jointed arm (multi-linked manipulator) and gripper assembly (or end effectors), attached to a fixed surface.

Mobile robots have become more commonplace in commercial and industrial settings. Hospitals have been using autonomous mobile robots to move materials for many years. Warehouses have installed mobile robotic systems to efficiently move materials from stocking shelves to order fulfilment zones. Mobile robots are also a major focus of current research and almost every major university has one or more labs that focus on mobile robot research. Mobile robots are also found in industrial, military and security settings. Domestic robots are consumer products, including entertainment robots and those that perform certain household tasks such as vacuuming or gardening.

### 5. CLASSIFICATIONS OF MOBILE ROBOTS

Mobile robots may be classified as:-

- The environment in which they travel:
  - Land or home robots are usually referred to as Unmanned Ground Vehicles (UGVs). They are most commonly wheeled or tracked, but also include legged robots with two or more legs (humanoid, or resembling animals or insects).
  - Delivery & Transportation robots can move materials and supplies through a work environment
  - Aerial robots are usually referred to as Unmanned Aerial Vehicles (UAVs)
  - Underwater robots are usually called autonomous underwater vehicles (AUVs)
  - Polar robots, designed to navigate icy, crevasse filled environments
- The device they use to move, mainly:
  - Legged-robot : human-like legs (i.e. an android) or animal-like legs.
  - Wheeled robot.
  - Tracks.

### 6. OBJECTIVE OF THE WORK

The objective of the project is to design and implement a microcontroller based circuit for moving a autonomous robotic car by using IR sensor. We have used 4 sensors at various directions to detect obstacles. When the sensor detect



## Experimental observation

The experimental observation includes test of direction of movement of the autonomous robot car and obstacle detection capability of IR sensor whose are placed on the car.

### Directional movements

#### Sensor test

We are going to design two different types of sensor, from which we are selecting an IR sensor; that can be used for detecting longer distance. First we have designed an IR sensor by using NE555 based IR transmitter and SM0038 receiver, but it is not able to detect for a longer distance and sensitivity or responsivity is low. Therefore we have designed another sensor, whose sensing range is large and also responsivity is very high.

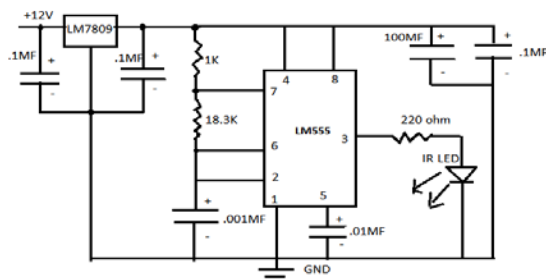


Fig. 6: IR transmitter circuit

#### ➤ SM0038 based receiver

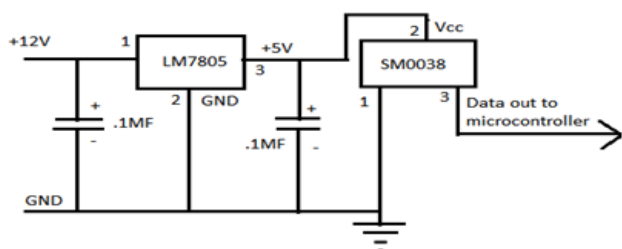


Fig. 7: Circuit diagram of IR receiver

#### ➤ Waveform



Fig. 8: waveform of the SM0038 based sensor

#### ➤ LM358 based IR sensor

IR sensor can be designed by using LM358 comparator. The transmitter and receiver are on the same circuit. For transmitter we used IR LED and for receiving we used photodiode. The intensity of the emitted light can be varied by using a potentiometer.

#### ➤ Circuit diagram

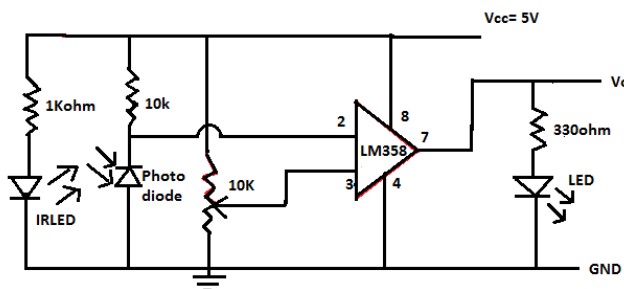


Fig. 9: LM358 based sensor circuit

#### ➤ Observation table

Serial no	Detection range in cm	Angle between incident and reflectance
1	.5	5 degree
2	2.5	10 degree
3	3.5	15 degree
4	4.5	20 degree
5	6.5	25 degree
6	8.7	30 degree
7	9.5	35 degree
8	14.2	45 degree
9	0	55 degree
10	0	60 degree

## 8. WORKING

1. Connect the sensor circuit with main circuit (microcontroller based circuit).
2. If obstacle is detected sensor output is high otherwise low
3. Based on sensor output, microcontroller controls the direction of movements of autonomous car

## 9. ADVANTAGES

Advantages of IR sensor that we are designed as-

1. Low cost.
2. More efficiency.
3. Better detection capability

## 10. OBSTACLE DETECTION

Controlling of the autonomous robotic car based on four sensors

Seven tests is done for controlling a four wheeler autonomous robot car based on four sensors by using a microcontroller.

### Working

- If sensors are detect obstacle then the direction of movement of the robot car is depend upon programming.
- If no obstacle is detected then autonomous robot car run forward direction.

## 11. LM358 BASED SENSOR

### Result and discussion

- It can be detect obstacle of a longer distance. Up to 14.2 meters.
- Circuit arrangement is simple.
- Photodiode provides better responsivity.
- Sensivity is higher.
- It is very difficult to determine the angle between incident and reflected light beam
- If obstacle is detected sensor output is high otherwise low.

## 12. AUTONOMOUS ROBOT CAR

### Result and discussion

- It is very complex to design an automatic guided vehicle.
- The autonomous robot car that we have designed can be able to detect and changes its running direction automatically.
- Programming part is so complex.
- First we have to design a theoretical model of an autonomous robotic car.
- When we have interface the microcontroller with the main circuit board sometime it will not work properly.
- The autonomous robot car that we have designed which can carry any load up to 5 kg.
- If we used stepper motor or servo motor in the place of gear motor the autonomous car may be become more flexibility.
- Those sensors that we have used in our automatic guided vehicle can detect red , white, black,blue, yellow, green etc.; But not able to detect light colour.
- When the autonomous robot car run, it will effect by sunlight; because sunlight has infrared radiation.
- Sometime the autonomous robot car run into a circular way because of the left sensor may not work properly.

- The sensing range of IR sensor that we have used is low, therefore the autonomous robot car may strikes to an obstacle while take a turn after detecting a corner.
- If we can used in this technique for design an autonomous robot car that can carry luggage, human from one place to another place on a highway road, this will avoid from accident and it will reduce the loss of time, money etc.
- Autonomous robot car can also can be designed by using light sensor, ultrasonic sensor etc.
- We have designed an autonomous robot car whose power supply is given from a rectifier therefore it will not become flexibility. For testing purpose it should be required to carry the power supply; if we used a battery to drive a autonomous car it will become efficient.
- We have designed the autonomous robot car only to give a demo; that an autonomous robot car can be made by using IR sensor.
- It will be able to designed an autonomous robot car based on GPS; that anyone can control the direction of movement of the autonomous car from different place.

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