OVERTAKING DETECTION SYSTEM FOR VEHICLES

Khushali Rathi	**Prof. Rahul Wantmure**
Student, NCRD's Sterling Institute of Management Studies, Nerul, Navi Mumbai	Assistant Professor, NCRD's Sterling Institute of Management Studies, Nerul, Navi Mumbai
khushalirathi23@gmail.com	rahul_wan2003@yahoo.co.in

ABSTRACT:

All the metropolitan cities face traffic problems especially in the industrial area. Normal Cities can be transformed into "Smart cities" by exploiting information and communication technology. The purpose of this paper will give us brief introduction about how we can integrate some smart devices with the vehicle's system to analyze the traffic and to control the speed of vehicles. In this system Infrared Sensors are also used. These sensors will be place on left and right side of the car. The work of these sensors is to throw infrared rays at both side of the car. If any other car tries to overtake the car which have infrared sensors, then infrared rays detect the car which is overtaking and alert the processor about it. If any object/car is close, then the intensity of the light is more which help the Raspberry pi to take the decision. The processor detects the overtaking of the car through the infrared sensors message then it will decrease the speed of the car accordingly. This system is an approach towards the idea of coordinated work between a human and a machine as this system will not replace human drivers but at the same time make their task easy by controlling the speed of car if there is any danger. There are rules for overtaking which mentions that overtaking must be done from right side only. If a car in front wants to turn on right side, then overtaking from left side is allowed. Youngsters or people who love to drive in speed and many times their speed of the car is not controlled, or the guessing may go wrong while other car is overtaking. The overtaking car may also not follow the rules of traffic and may overtake other car from wrong side that is Left side. At such time this system will decrease the speed of the car when the vehicle starts or tries to overtake. This will reduce the accidents which happen due to overtaking.

Keywords: *Overtaking Detection System, Raspberry Pi Processor, Infrared (IR) Sensors, Automated Car, Jumper Cables.*

1. INTRODUCTION

The growth of industrialization and urbanization causes the tremendous increase in the traffic. Traffic management has become one of the severe problems today. With the increase in traffic there arise several problems such as heavy traffic jams, violation of traffic rules, road accidents etc. It is therefore necessary to have an easy and efficient control on the speed of cars.[5]

The paper presents the overtaking detection System for vehicles to avoid accidents. Kanwaldeep Kaur, Giselle Rampersad (2018) in their article has discussed about the barriers of Driverless cars and also the factors influencing it. The articles say that "One of the key disruptors in the next technology revolution are driverless cars. However, the lack of public trust is the main barrier to adoption." [3] In a survey of American Automobile Association, a whopping 71% of Americans claim to be afraid to ride in a self-driving car, an increase from 63% in 2017.[6]

So, the system does not replace human driver instead the system will give a supporting hand for controlling of speed. This will maintain people's trust in vehicle system and there will be speed controlling machine that we will get a partial automated vehicle system.

2. LITERATURE REVIEW

Bimbraw, Keshav (2015) in his paper of Autonomous Cars: Past, Present and Future has reviewed the trends in autonomous vehicle technology for the past, present, and future. There seems to be a drastic change in autonomous vehicle technology since 1920s. It came into picture about autonomous cars having similar electronic guide systems, by 1960s. Till date we use similar or modified forms of vision and radio guided technologies which was seen in 1980s as vision guided autonomous vehicles, which was a major milestone in technology. [4]

Qudsia Memon, Muzamil Ahmed, Shahzeb Ali, Azam Rafique Memon, Wajiha Shah in their article has focused on two applications of an automated car; one in which two vehicles have same destination and one knows the route, where other don't.[2] Till date also there are people who do not have trust on fully automated car. The car can be made partially automated.

Zheng Wang in his project of 2015 has modified a RC car to handle three tasks: self-driving on the track, stop sign and traffic light detection, and front collision avoidance using Ultrasonic Sensor. This project is a motivation for my research paper [1].

Kanwaldeep Kaur, Giselle Rampersad (2018) in their article has discussed about the barriers of Driverless cars and also the factors influencing it. The articles say that "One of the key disruptors in the next technology revolution are driverless cars. However, the lack of public trust is the main barrier to adoption".[3]

3. PROBLEM DEFINITION

Due to high speed there are more chances of accident on roads. Many times, suddenly any object/car can come in front of other car or while crossing the road or overtaking. At such time, if a car's speed is not controlled by the driver it will lead to an accident. Heavy Vehicles which mostly runs at night can also hit to other car due to less density of light at night and the driver's guessing may go wrong at times.

According to the report on country's road accidents and deaths, over 48,000 people died in crashes caused due to overtaking and diverging during 2014. These accidents are directly linked to speeding.[13] Zheng Wang in his project of 2015 has modified a RC car to handle three tasks: self-driving on the track, stop sign and traffic light detection, and front collision avoidance using Ultrasonic Sensor. [1] There is no system which would avoid accidents that happens dur to overtaking. To overcome the problem of accidents that happens due to overtaking this system is made.

4. OBJECTIVE

The main objective of this partially automated car system is to ease the work of the human driver as driving for long distances can be really tiring as well as unhealthy for the driver. This system is an approach towards the idea of coordinated work between a human and a machine as this system will not replace human drivers but at the same time make their task easy by controlling the speed of car if it finds any danger of hitting other car while it is overtaking.

The objective of the paper is to show the concept of how an accident can be avoided during overtaking using infrared sensors. Accidents happen when people drive vehicles rashly especially while overtaking another vehicle. At such time this system will decrease the speed of the car when the vehicle starts or tries to overtake. This will reduce the accidents which happen due to overtaking.

5. RESEARCH METHODOLOGY

The architecture of this system contains a Raspberry Pi 3 Model Processor and Infrared sensors. The prototype car here will be controlled with a Raspberry Pi. The car will also have IR (Infrared) sensors attached at the bottom of the car on both left and right sides faces in those respective directions. These IR sensors would work to detect if any other car is trying to overtake so that our car will adjust its speed accordingly. There will be other components working together and sending data to the Raspberry pi for this system to work, those are Active IR (Infrared) Sensor and Jumper Wires
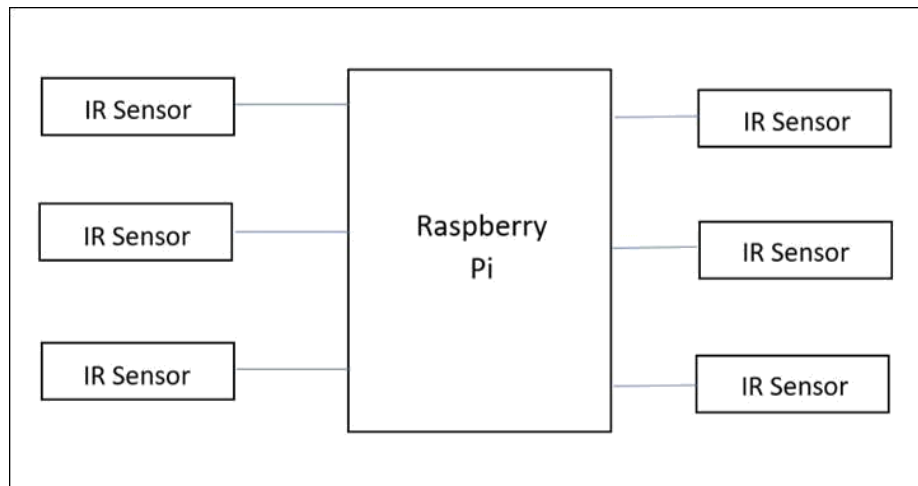
Fig.1: Block Diagram of Components Used in System

Infrared (IR) Sensor:

IR Sensor module has great adaptive capability of the ambient light, having a pair of infrared transmitter and the receiver tube, the infrared emitting tube to emit a certain frequency, encounters an obstacle detection direction (reflecting surface), infrared reflected back to the receiver tube, after receiving, the green LED lights up, while the signal output will output digital signal (a low-level signal), through the potentiometer knob to adjust the detection distance, working voltage of 3.3V-5V. The detection range of the sensor can be adjusted by the potentiometer.

Fig.2: Infrared Sensor [7]

In the project Active Infrared Sensors has been used which contains both transmitter and receiver. Infrared sensors will be placed on right and left sides of the car which will help to detect if any car is trying to overtake so that our car can adjust its speed accordingly. The Infrared Sensor has two components that work together to generate data if anything passes by. The first component is an Infrared LED which keeps sending Infrared light that reflects when it touches any surface and this reflected light is absorbed by the photodiode (receiver tube) which is the second component of this module. The Photodiode records the intensity of the light, if any object is close then the intensity of the light is more which help the Raspberry pi to take the decision of adjusting the speed. 3 sensors on both the sides will work together to help the Raspberry pi determine the position of the overtaking car.
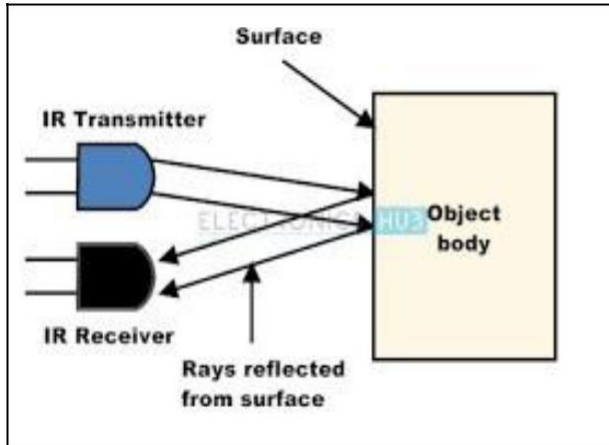
Fig. 3: Internal Working of IR Sensor [8]

Fig. 4: Jumper Cables [9]

Jumper Cables

Jumper cables will be used to connect the infrared sensors to the Raspberry Pi Processor. In this system Female to female jumper cables will be used for connections.
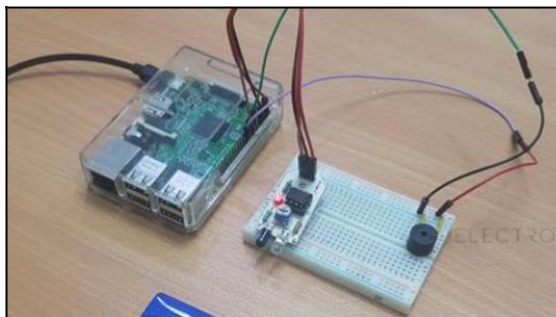

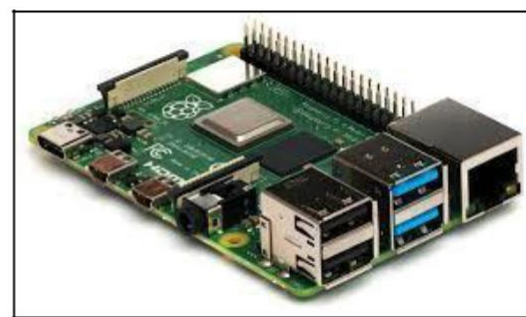Fig 5. Jumper Cables used for connection [12]

Fig.6: Raspberry Pi Processor [10]

Raspberry Pi Processor:

Raspberry Pi 3 model is the brain of this project as it will do every processing work like image processing, sensors data collection and decision making based on it. It is an ARM-cortex 64- bit processor-based development board which is also called a mini laptop as it has 4GB of RAM in it. It is operated on Linux operating system.
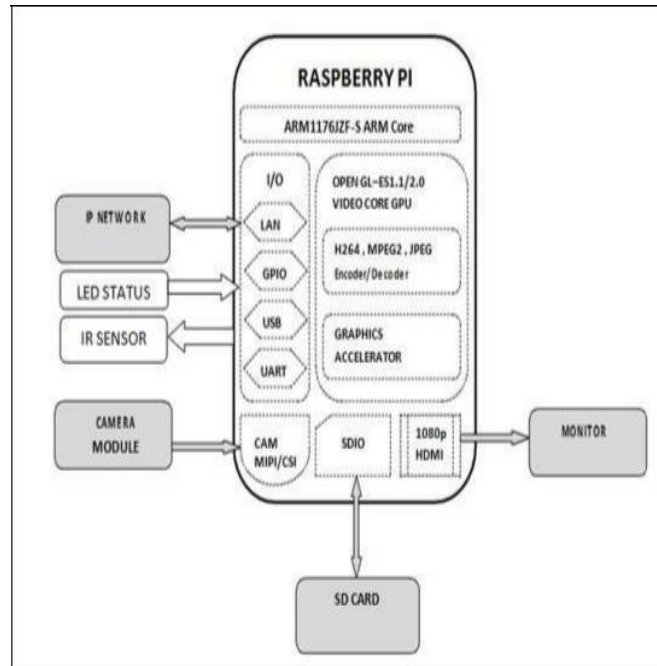
Fig. 6: Block Diagram of Raspberry Pi Processor [11]

Raspberry Pi is the brain of this project as it will do processing work. When the IR sensors will reflect the light through a surface / other car, the processor will get the signals from the sensors and it will process the intensity of light reflected by the surface. Based on the intensity of light it will take the decision for the speed of the car. If intensity is more then it will decrease the speed of the car. If the intensity of light is less, then it will not immediately decrease the speed of car.
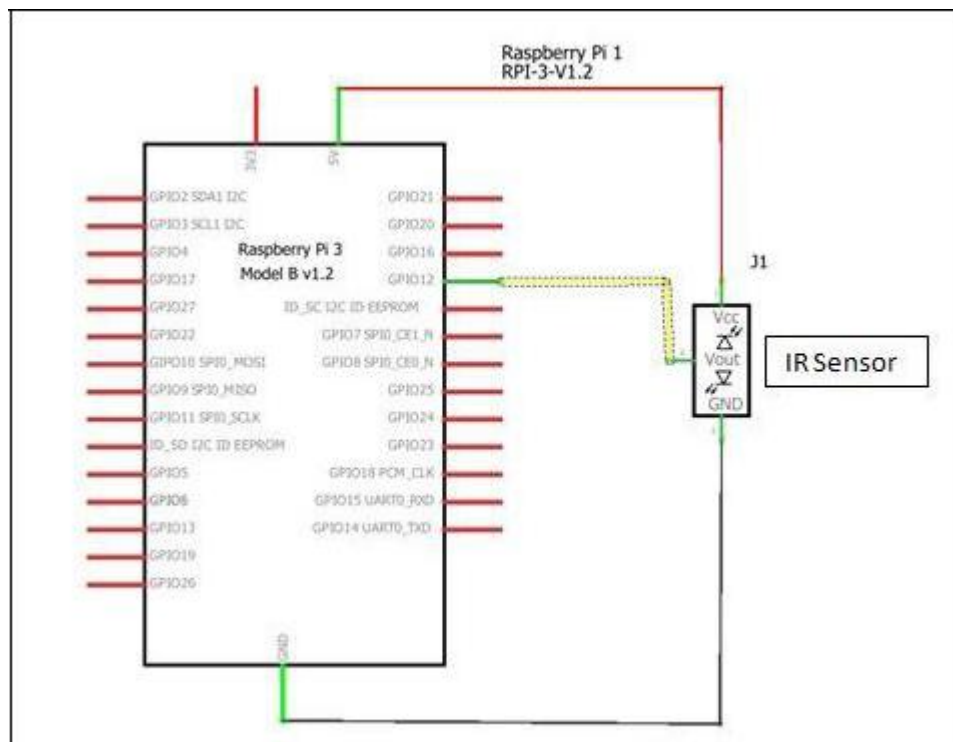

Fig. 8: Circuit Diagram of IR Sensor Connected to Raspberry Pi Processor

6. ANALYSIS & FINDINGS

Many times, suddenly any object/car can come in front of other car or while crossing the road or overtaking. At such time, if a car's speed is not controlled by the driver it will lead to an accident. Heavy Vehicles which mostly runs at night can also hit to other car due to less density of light at night and the driver's guessing may go wrong at times.

Vehicles have safety precautions like airbag, seat belts for the passenger but these are helpful after a vehicle is hit by a car or any object. So, these are after accident safety measures. Vehicles do not have any precaution before any accident happens. This system helps the people in the vehicle to remain safe before an accident could happen and at the same time make the task of a driver easy by controlling the speed of car if it finds any danger of hitting other car while it is overtaking.

The result of this system is based on the intensity of light it will take the decision for the speed of the car. If intensity is more then it will immediately decrease the speed of the car. If the intensity of light is less, then it will not immediately decrease the speed of car.

7. LIMITATION

This System is limited to detect the overtaking of the car. It does not detect if any object suddenly comes in front of a vehicle. It can only detect things of a specific height which is specified in the system. Object below that height cannot be detected by the IR sensors. It can only detect object or vehicles which are on the left and right side of the IR sensor. This project considers position of vehicle.

This system with other systems like fastest route detection, automatic traffic light detection system can be combined to have a car which is automated having human driver in it.

8. CONCLUSION

This project is working together to automate cars and reduce human effort. This approach is a prototype which demonstrates how partially automated cars can be designed. This project is helpful to reduce the accidents that happens by speedy overtaking of vehicles. It has shared the effort of a driver by reducing the speed of vehicle at emergency.

The goal here is to start this program which is an appropriate demonstration of the value of the lives of people who drives speedy cars and overtakes speedily and also the people those who are the victims caused by the accident by adding this system as safety feature in vehicles. This is especially important when it comes to the development of mechanisms that prevent accidents caused by overtaking. Therefore, it is important that engineers do have the ability to match the system in vehicles to control the speed of vehicle in emergency.

9. REFERENCE

1. Zheng Wang, "Development of a self-driving RC Car", Project for Bridgewater State University, May 2015.

2. Qudsia Memon, Muzamil Ahmed, Shahzeb Ali, Azam Rafique Memon, Wajiha Shah, "Self-

3. driving and driver relaxing vehicle", published in 2016 2nd International Conference on Robotics and Artificial Intelligence (ICRAI).

4. Kanwaldeep Kaur, Giselle Rampersad, "Trust in Driverless Cars-Investigating key Factor and

5. Influencing the Adoption of Driverless cars", published in 'Journal of Engineering and Technology Management', Volume 48, 2018, pp 87-96

6. Bimbraw, Keshav (2015), "Autonomous Cars: Past, Present and Future - A Review of the Developments in the Last Century, the Present Scenario and the Expected Future of Autonomous

7. Vehicle Technology", published in 12th International Conference on Informatics in Control, Automation and Robotics, Pp 191-198

8. Mrs. Vidya Bhilawade, Dr. L. K. Ragha, "Intelligent Traffic Control System", published in International Journal of Scientific and Research Publications, Volume 8, February 2018, Pp 571-574

9. https://www.weforum.org/agenda/2019/08/self-driving-vehicles-public-trust/

10. https://d3b8hk1o42ev08.cloudfront.net/wp-content/uploads/2018/07/ir-sensor.jpg

11. https://www.electronicshub.org/wp-content/uploads/2015/01/4.-Working-principle-of-IR-sensor.jpg

12. https://media.rs-online.com/t_large/F7916454-01.jpg

13. https://upload.wikimedia.org/wikipedia/commons/f/f1/Raspberry_Pi_4_Model_B_-_Side.jpg

14. https://www.pantechsolutions.net/raspberry-pi-based-agriculture-risk-monitoring-through-wireless-communication

15. https://www.electronicshub.org/wp-content/uploads/2018/02/IR-Sensor-with-Raspberry-Pi-Output-Image-1-760x440.jpg

16. https://timesofindia.indiatimes.com/india/Maximum-road-accidents-occur-when-overtaking/articleshow/48831373.cms