CAR OVERTAKING ASSISTANT

Anuradha B. Parvate, Shreeya M. Palsule, Shrinivas A. Patil

B. Tech Student, Professor
Department of Electronics & Telecommunication Engineering,
DKTE Society’s Textile and Engineering Institute, Ichalkaranji, Maharashtra, India

Abstract: In Indian roads, traffic is highly mixed in nature. Overtaking and lane changing maneuver on a road traffic facility occur when traffic does not move at the design speed. Overtaking is considered to be hazardous subtask. Possible solutions to make overtaking maneuvers safer are lanes and intelligent systems in the vehicles that can assist drivers with the overtaking maneuver. These operations become essential when some vehicles in the traffic stream move fast while others move slowly. To be able to design or develop these solutions, accurate overtaking maneuver data are required. The task of this system is collecting all information about the overtaking process to prevent overtaking accidents and to reduce the collision risk of overtaking.

Keywords: Raspberry Pi, Overtaking, road accidents, live streaming.

1. INTRODUCTION:
Of the 19 countries with available data, Japan reports the highest estimated monetary loss due to road traffic crashes-nearly $64 billion-followed by India at approximately $58 billion, according to a United Nations Economic and Social Council 2018 study. Due to complexity of overtaking and the overlay of unfavorable factors of drivers, vehicles and driving environment there are numerous ways in an overtaking maneuver can lead to errors and accidents. This system will have continuous monitoring that helps driver while overtaking. Video information from the front large vehicle (eg. Truck, car, etc.) is send to the overtaking vehicle. The most popularly used microcontroller Raspberry pi is used with webcam for recording the video information and transmitting that video to overtaking car or other vehicle. The Raspberry pi is constructed with Wi-Fi and Bluetooth.

This paper is organized as follows section 2 gives an overview of Overtaking Assistant System. The section 3 gives the proposed method of Overtaking Assistant system. Finally conclusions and future enhancements are given in section 4.

The main aim of the project is to reduce the complexity in overtaking and provide possible solution for preventions of road accidents.

Fig.1.1 Overtaking
Fig.1.2 Mixed traffic

Objectives of developed work are,
1. To reduce complexity in overtaking and estimate the overtaking scenario.
2. To prevent road accidents happening while overtaking.
3. To develop relationship between overtaking car and vehicle next to it.
4. Create a local network to transmit this video to all the connecting and overtaking nodes

2. BLOCK DIAGRAM:
Fig 2.(a) represents the block diagram of the prototype. Node 1 represents the front car or we can say the streaming car. Node 2 represents the rear car or the car which wants to overtake the front car. The connection between the two cars is established with the help of standard TCP/IP protocol. The system works on the server client environment. Front car id the server and rear car or overtaking car is the client. When the overtaking car sends a request to the front car or the server it is recognized by it and it starts continuous streaming of the video to the rear car. The video is shown on the mobile of the driver of the overtaking car. To access the video driver will enter the IP address of the raspberry pi at the server side along with TCP/IP port number 8081 on the web browser.
Ex: 192.168.43.11:8081
The advancements can be made by using QR code scanner at the camera unit to correctly connect the hotspot of the front car required.
Here the Raspberry pi used is Raspberry pi 0 w. the display unit in our case is a mobile is wirelessly connected to the raspberry pi. Here the Pi, the server and the client form a LAN connection. The camera unit we have used is a Quantum PC camera. It is more convenient to use a pi camera along with raspberry pi as it gives a good video quality. In our case of PC camera we installed the drivers of the camera on the raspberry pi which requires motion software. The commands to start streaming of the video is: “sudo nano motion start”. And the command to stop the streaming is: “sudo nano motion stop”. the algorithm is designed such that when a specific bit is transmitted by client and if matches the server’s condition then “sudo nano motion start” command is given to motion software on the raspberry pi and the streaming is started. When these two nodes come in vicinity and get connected to the network the program on the pi will get triggered and will continue to stream the video to the overtaking car based on the video received by front car the driver of the overtaking car can take the decision accordingly whether to overtake or not and hence the accidents are prevented.

3. DESCRIPTION OF COMPONENTS.

3.1 Raspberry Pi 0W:
From the figure 3.1, At the heart of the Raspberry Pi Zero W is a 1GHz BCM2835 single-core processor with 512MB RAM. this Pi is about four times faster that the original Raspberry Pi and is only a fraction of the cost of the current RPi3. The setup for the Raspberry Pi Zero W is a little more complicated than on other Pi. Because of the small size, many of the connectors on the Pi Zero are not standard. For starters you will want a Mini HDMI to HDMI cable or adapter to connect to your monitor. You will also need a USB OTG cable to connect a USB device, as well as a unique CSI camera cable. No matter how you want to use your Raspberry Pi Zero W, you will need a micro SD card with an operating system and a high-quality 5V power supply to power your board.

Fig.3.1: Raspberry Pi 0W board.
Features:

- 3.3V (4.75V to 5.25V the USB acceptable voltage range)
- 1GHz single-core ARMv6 CPU (BCM 2835)
- Video core IV GPU, 512MB RAM
- Mini HDMI and USB and Micro USB power
- HAT compatible 40 pin header
- CSI camera connector
- 802.11n wireless LAN
- Composite video and reset headers
- Bluetooth 4.0

3.2 USB camera/webcam:
Webcam is a video camera that feeds or streams an image or video in real time to or through a computer network, such as the internet. Quantum QHM495LM 25MP webcam bridges the distance with life like picture quality and excellent sound reproduction. It has a built-in microphone that helps you to chat with them online and enjoy clear conversation in a video call. Simply clip this 6 led webcam on your PC or laptop and start chatting without downloading any drivers. The web camera also has six lights effects for added fun. Clean pictures, clear sound. This USB webcam with mic comes with high speed USB 2.0 interface. The webcam also offers some advanced features like brightness control, sharpness control and adjust that help you get expected high quality image output. With CMOS sensor incorporated in this webcam, the images are rendered with supreme quality.

4. SOFTWARES REQUIRED.

4.1 PuTTY:
Putty (software) generally has two purposes first used as a “File Transfer Protocol” and second used to generate Hash key. Most of the hosting services, both online and offline are built on LINUX OS, rightly so because it provides better safety for client data. Especially when thousands of clients data stored in a single place safety is the first priority. However this poses a greater challenge for non LINUX OS users to deal with. Hear comes the third party applications like PuTTY which enables non-Linux users install this particular software (PuTTY), And interact with Linux servers from a non-Linux OS Interface of PuTTY is similar to windows terminal, However user need to be aware of Linux commands to interact with it. PuTTY provides various File transfer features like FTP and SFTP depending on users security requirements. PuTTY also used to generate SSH key. Now a days using passwords are prone to security threats specially when you are dealing with lot of confidential data online. PuTTY allows you to generate a series of keys. which is a combination of hundreds of Alpha-Numeric and special characters, Which is almost impossible to crack. SSH generates two types of key combinations. Public key which is used to access the terminal by authorised people, And Private key which should not be shared with anyone . Private key is encrypted into the particular server of the user which can only be opened with a public key. When your using a particular system to access a server you can just point to the public key and you can login to the server any time without entering any password or user name. In our project putty is used to operate the raspberry Pi wirelessly and also the program for network establishment and command operation is written in the raspberry pi with the help of putTY. In simple words we can operate raspberry pi via putTY software.

4.2 Pycharm (Python IDE for testing purpose):
PyCharm is an integrated development environment (IDE) used in computer programming, specifically for the Python language. It is developed by the Czech company JetBrains. PyCharm is cross-platform, with Windows, MacOS and Linux versions.

5. TEST RESULTS:
From the fig 4.1, The implemented prototype is tested for real time systems. In the Fig. 4.2 and Fig. 4.3 raspberry Pi and camera setup is put in the front car (maruti 800). In the Fig. 4.4 streamed video is shown on the mobile held in the overtaking car.
An overview of the video codification and transmission process is illustrated in Fig. 5. The process starts with the request of the video images, that corresponds to an HTTP get of the video data. The request is relayed via IEEE 802.11n. When overtaking car comes in the vicinity of the front car (which has created Hotspot) it may connect directly to that Hotspot. In our prototype we have set SSID and Password in Raspberry Pi matching to the SSID and Password of the Hotspot, so that it can connect directly. After network establishment we send request from overtaking car to the front car to stream video. Raspberry Pi0W has integrated 802.11n wireless LAN and Bluetooth 4.1. Once the CPU starts receiving the video frames it initiates the encoding process, replying to the requested vehicle the real-time video.

6. FLOW CHART

[Flow Chart Image]
Fig. 5. Flow chart of proposed project

Video capturing is done through the camera of 0.5MP video sensor resolution connected to the Raspberry Pi through USB. We can achieve maximum 30 frames per second. It is possible to stream this video on the cell phone of the overtaking car’s driver if that cell phone is also connected to that Hotspot. There is no need of storing data on receiver side as in our application we are not going to either store or process that information. Capturing and streaming video to overtaking car don’t disturb to driver of either front car or overtaking car. Whenever there is a request from another vehicle, the image data is relayed to the raspberry Pi which will transmit it to the vehicle.

As it is a real-time service that can ideally be used in emergency scenarios, we consider the communication delay as one of the most important metrics to be evaluated. Thus, comparisons are made between the communication delay and the speed of each vehicle, as well as with the quality of the IEEE 802.11n link.

7. CONCLUSION:

The goal of this service is to be part of a wider driver assistance framework to assist in the car-overtaking decision. When two vehicles are moving with more or less speed, it becomes difficult for the overtaking immediately as the driver has to maintain a gap with the leader in order to avoid collision. In order to provide safety against road accidents our project has made use of advanced technology. This system needs to be embedded inside a car during its manufacturing process only. If all the modern cars make use of such systems it will be of tremendous use. The video transmission is based on a server client connection here. So if the client gets the video that it has requested for then the decision whether to overtake or not can be easily taken by the driver safely.

We can further use this data to estimate overtaking timing and distance between two vehicles. Overtaking distance is higher for heavy vehicles (145.0m) whereas it is lesser for two-wheelers (101.6m). It was observed that total overtaking distance linearly increases with increase in time. The result will be useful in the development of traffic simulation models for undivided roads and thereby for estimation of capacity.

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