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Research Article

Clearing Pathway for Ambulance using YOLO and Raspberry Pi

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Abstract

In recent times, traffic congestion has been one of the most concerning factor. It not only affects our scheduled lives but also brings about a major threat to patients in need. Vehicle blockage could be a factor deciding the fate of one's life. The goal of the project is to help the ambulance reach the nearest hospital in the least possible time quickly and safely. In order to achieve this traffic signals are being monitored and controlled, using microphone which distinguishes sound decibel level of ambulances to that of other vehicles. In addition to this, a camera takes pictures of jammed traffic signals for further verification. On successful detection, the signal will be made to turn green, hence clearing a pathway for ambulance.

***Keywords*—**Internet of things (IoT), Raspberry Pi, YOLO Algorithm, Mobile Notification

I. INTRODUCTION

Today's modern world requires fast processing of almost everything. With this busy life accidents occur from time to time and place to place. Ambulance is the only emergency vehicle that saves the affected one's life. There are people who do not care much to clear a path for the ambulance to move further. In this regard, we create a model where ambulances are detected from long distances in a traffic signal or a junction and clear path for them, so that they could move towards their desired destination without any delay. The main objective of this system is to help emergency vehicles reach their destination in time. Traffic congestions are the primary reason for ambulances not reaching their destination in time. To rectify this issue, the project proposes a system that will help clear traffic immediately when an emergency vehicle is detected.

II. TECHNOLOGIES

A. Raspberry Pi

Raspberry Pi is a progression of little single-board PCs created in the United Kingdom by the Raspberry Pi Foundation in relationship with Broadcom. The Raspberry Pi project initially inclined towards the advancement of showing fundamental software engineering in schools and in creating countries. The first model turned out to be more famous than anticipated, selling outside its objective market for utilizations like mechanical technology. It is broadly utilized in numerous regions, for example, for climate monitoring, in view of its minimal effort, seclusion, and open plan. It is normally utilized by PC and electronic specialists, because of its appropriation of HDMI and

USB gadgets. There exist a 5 Generations in the Raspberry Pi family which are the Raspberry Pi, Raspberry Pi 2, Raspberry Pi Zero, Raspberry Pi 3, Raspberry Pi 4, Raspberry Pi Pico.

B. Machine Learning

Machine learning model predictions allow businesses to make highly accurate guesses as to the likely outcomes of a question based on historical data, which can be about all kinds of things – customer churn likelihood, possible fraudulent activity, and more. Both machine learning and predictive analytics are used to make predictions on a set of data about the future. Predictive analytics uses predictive modeling, which can include machine learning. Predictive analytics has a very specific purpose: to use historical data to predict the likelihood of a future outcome

C. Raspberry Pi Camera

The camera board appends to the Raspberry Pi by means of a 15-way lace link. There are just two associations with make: the lace link should be appended to the camera PCB, and to the Raspberry Pi itself. You need2 to get the link the correct route round, or the camera won't work. The Best preferred Raspberry Pi Camera of 2021 is the AUKEY PC-LM1 1080p Webcam. The Raspberry Pi High Quality Camera addresses a jump forward in quality, clearness and definition. It additionally opens up conceivable outcomes to utilize proficient DSLR focal points, for example, the Canon EOS EF line, I found a connector for around 50 GBP, in the event that you get one, discover one with gap control.

D. Raspberry Pi Microphone

USB Microphones are the least demanding method of getting an amplifier working with your Raspberry Pi. Perhaps the main benefits of utilizing a USB amplifier is that it is fitting and play. The Raspbian working framework will naturally recognize the receiver when it’s connected.

E. OpenCV

OpenCV (Open Source Computer Vision Library) is a library of programming capacities for the most part focused on on going PC vision. Originally created by Intel, it was subsequently upheld by Willow Garage then Itseez (which was subsequently procured by Intel). The library is cross-stage and free for use under the open-source Apache 2 License. Beginning with 2011, OpenCV highlights GPU speed increase for continuous activities.

F. YOLO Algorithm

YOLO (You Only Look Once) is a viable on going item acknowledgment calculation, first portrayed in the fundamental 2015 paper by Joseph Redmon et al. Picture grouping is one of the many energizing uses of convolutional neural organizations. Beside straightforward picture arrangement, there are a lot of captivating issues in PC vision, with object recognition being perhaps the most intriguing. It is ordinarily connected with self-driving vehicles where frameworks mix PC vision, LIDAR and different innovations to produce a multidimensional portrayal of the street with every one of its members. Item location is additionally ordinarily utilized in video reconnaissance, particularly in swarm observing to forestall fear based oppressor assaults, tally individuals for general insights or examine client experience with strolling ways inside malls.

III. EXISTING SYSTEM

Sensors were used for measurement of traffic density using RFID technique. The ambulance driver carries an android phone with the software installed in it and sends a message to traffic signal controller at the traffic junction.

A system which finds the quickest path by controlling traffic light signals in favour of ambulance. The time delay is reduced by applying the RF technology that controls the traffic signals

System uses sound detecting instruments that are trained with various vehicles' sounds. On detection of an emergency vehicle, the traffic controller is alerted and is asked to change the traffic signal accordingly

A. Disadvantages Of Existing System

- Cannot be used to identify the density of the traffic beyond a particular distance [8].
- Ambulance driver has to take his hand held device to send notification. Requires presence of a human to change signals [9].
- Requires presence of a human to change signals [6].
- System requires to be recharged after every 4 hours [7].
- Sound of siren detected is not necessarily that of an ambulance.

IV. LITERATURE SURVEY

This project uses ultrasonic sensors to detect traffic in roads and intimates the drivers to take alternative routes. This system can detect traffic of up to 3 kilometres [1].

The system detects the presence of an ambulance by observing the sound pattern of the traffic. The sound of a siren would alert the system to take necessary actions [2].

This system uses a GPS module that keeps track of the location of the ambulance. The system alerts the ambulance driver about the traffic ahead of him by comparing his location to the live traffic feeds of the city [3].

This system uses sound detecting instruments that are trained with various vehicles' sounds. On detection of an emergency vehicle, the traffic controller is alerted and is asked to change the traffic signal accordingly [4].

This system uses a combination of image processing and RFID. The image detects the presence of a vehicle and intimates the traffic controller. The emergency vehicle driver has to use his RFID to pass the information to the next signal that he is approaching them [5].

This article summarizes the various types of telemedicine and mobile health (mHealth) tools and their practical applications and benefits for patient care. Artificial Intelligence pursues building the computers or machines as brainy as human beings [6], FastConvolutional Neural Network the algorithm will not look at the image completely but in YOLO the algorithm looks the image completely by predicting the bounding boxes using convolutional network and the class probabilities for these boxes and detects the image faster as compared to other algorithms [7]. The system uses RNN and CNN network for action recognition either in the form of images or signals. Combining CNN and RNN will enhance the ability to recognize different actions at varied time

span [8], The system uses RNN and CNN network for action recognition either in the form of images or signals. Combining CNN and RNN will enhance the ability to recognize different actions at varied time span [9].

V. PROPOSED SYSTEM

The proposed system automatically controls traffic signals when the presence of an ambulance is detected. The system receives data in the form of sound and image. It is trained to recognize if the sound received is of an ambulance's siren or not. The system double checks this through visual feed where pictures of the ambulance are taken and checked using image processing. On successful detection and confirmation, the system immediately turns the signal green in the direction in which the ambulance is travelling, leaving all the other signals red.

A. Proposed System Advantages

- Double verification to check the presence of an ambulance.
- Intimates the other drivers to give way for the emergency vehicle immediately.
- Does not require any physical presence to control signals.
- Driver and police men get instant notifications on their mobile phones.

VI. MODULES

The project "Clearing Pathway for Ambulance" aims at providing added functionalities to the already existing traffic signal systems. The addition of this system will enable the traffic signals to change signals automatically and help the emergency vehicle cross the signal without having to wait in long and congested roads.

A. Detection of Ambulance

This module contains a microphone and a camera that is on alert mode. The microphone picks up live traffic sound feeds and monitors the decibel level. If the decibel level matches an ambulance's siren, then the Raspberry Pi system is alerted for further actions. The camera picks up live traffic feeds and looks for a potential presence of an ambulance. If confirmed, a signal is sent to the system which will alter the traffic signals accordingly.

B. Traffic Light Control

This module controls the 4 way traffic signal. The traffic lights of all the four lanes are controlled with specific sleep timers. Each signal transition occurs with a pre-defined buffer time to avoid vehicles over speeding to try cross the signal before the lights turn red. The signals turn green on the lane the ambulance is travelling when the system successfully detects an emergency vehicle.

C. Mobile Notification

This module consists of a mobile application that traffic policemen and ambulance driver could use. This app is designed with the intention of passing information related to the particular traffic signal to the user. The application delivers a notification to the user when an ambulance is detected and that the signal has turned green. This is done to ensure that the traffic police on duty is aware of the situation and is able to change signals manually if the signal in not under automatic transition mode.

VII. ARCHITECTURE DIAGRAM

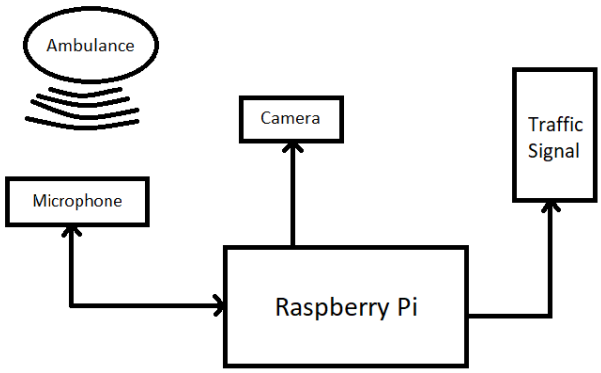


Fig: 1.1 Architecture Diagram

VIII. WORKFLOW DIAGRAM

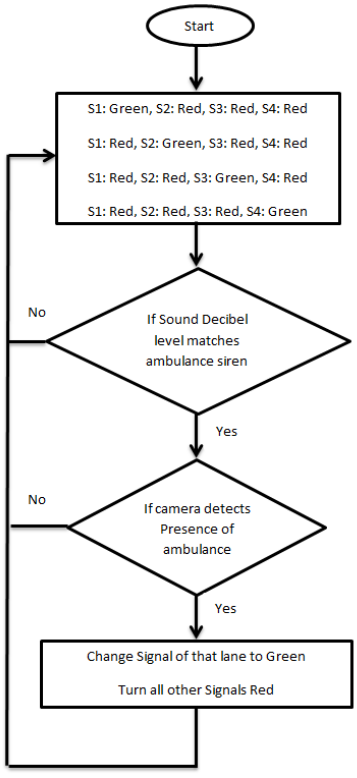


Fig: 1.2 Workflow Diagram

IX. MODEL ARCHITECTURE

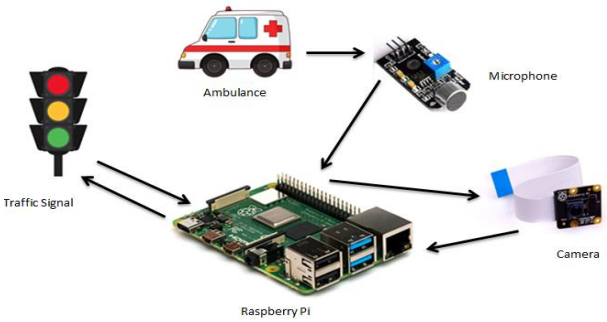
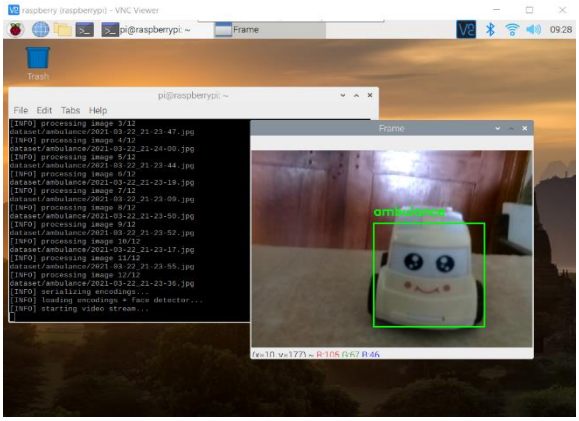


Fig: 1.3 Model Architecture

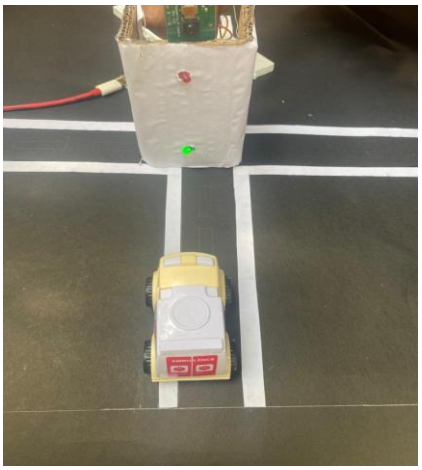
X. EXECUTION IMAGES

This section contains some of the execution images for better understanig for the end uses

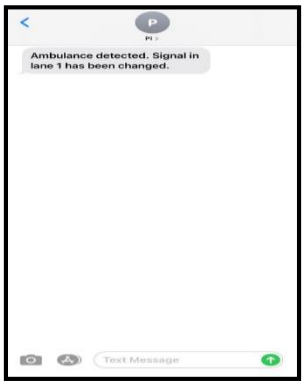
A. Detection of ambulance



B. Traffic Light Control



C. Mobile Notification



XI. CONCLUSION

Traffic jam is one of the most common problems faced in our day to day lives. It plays a crucial part of saving people's life in one way or the other. In our country, emergency vehicles like ambulances travel in the same track way as the public do. Traffic congestions in these routes are directly or indirectly responsible for the life of the patients travelling in the emergency vehicle to a greater extent. Ambulances are lifesaving vehicles that should save life in minimal time. Clearing pathway for ambulance is a system developed in order to give a solution to this problem. In this system, siren sound of emergency vehicles is detected from up to 250m and images of ambulance are verified with the help of camera installed in the traffic lights. Hence, the road in which the ambulance travels is cleared by making signals automatically switch to green, ensuring that the emergency vehicles cross the signal without any delay. In future, the above system can be enhanced by updating the android app that can serve the ambulance driver with the nearest hospital location and also if that particular hospital can treat the patient who is travelling in that ambulance or not. The system can also be trained to achieve better accuracy and handle situations with multiple ambulances

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