International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 06 | June - 2023 SJIF Rating: 8.176 ISSN: 2582-3930

Traffic Management System for Ambulance

Shubham Aditya[1], Harsh Amabaliya[2], Omja Shukla[3], Vijay Kumar Sahu[4], Pooja P. Raj[5]
Student B.Tech. Computer Science [1,2,3,4], Assistant professor in Computer Science Department
Kalinga University, Raipur (C.G), India 492101
Email-HarshAmbaliya2334@gmail.com

Abstract: Rapid urbanization and population growth have increased the number of vehicles on the road, causing traffic to surge dramatically. It takes a lot of work to control the enormous number of vehicles in traffic. Sometimes, an ambulance is caught between these vehicles and may have to wait at a traffic light for a very long period, which further saps patience. We also understand that once lost, life is valuable and cannot be recovered. To overcome this problem, we need a smart traffic control system, which dynamically adopts changing conditions. The main concept of this paper is to build a model which first captures the live feed of traffic using a camera and will try to detect the ambulance through computer vision and image processing on every frame of video. Once an ambulance is detected then it turns the traffic light to green and other red until the ambulance crosses the traffic light. This makes it possible to clear the way for an ambulance waiting at a traffic signal.

Keywords: detection of an ambulance, traffic signal, image processing, YOLO, python

1. INTRODUCTION

Life is valuable, and ambulances play a critical role in saving it in any life-threatening situation. However, rapid urbanization and rising PCI (per capita income) of the country's citizens have increased the number of vehicles on the road, resulting in heavy traffic. Sometimes ambulances have to wait a lot of time to cross the traffic light due to heavy traffic, which can become the cause of death of the patient. According to The Nation Thailand, More than 20% of patients needing emergency treatment have died on their way to the hospital because of delays due to traffic jams[1]. There have already been several cases where patients died as a result of traffic delays. A teenager died in Shamli when her ambulance became stuck in traffic[2]. In 2016 published in the Times of

India, 12 people died on their way to the hospital due to traffic jams[3]. There is a “Golden Theory " that has been framed by WHO which is followed all over the world, as per the said theory if a patient of a road mishap or heart patient is rushed to hospital within an hour, his chance of survival goes up by 70 to 80 percent. To overcome this problem we need a smart traffic light system, which recognizes or detects ambulances and changes the traffic light automatically.

There is already some work that has been done in the past to solve this problem like the use of RFID and Bluetooth for vehicle detection. However, there are a few drawbacks of this system:

- These devices has a very low range, That's Why it requires no of devices to be installed after a certain distance for better accuracy
- It increases the cost of installation

However we have proposed a different system, It requires only a piece of hardware which is a camera for capturing the live footage of traffic. Every frame of capture footage will be analyzed by YOLO and CNN algorithms to extract the ambulance. Once the ambulance is detected it will change the traffic light.

Here we used Arduino UNO in our demo model for controlling the traffic light, However, in practical use, we suggested a camera, cloud computing (where our computer vision program will work), and a microcontroller for controlling the traffic light, This whole process is further explained in later part of this Research paper.

2. LITRETURE REVIEW

Researchers Mohammad Wani, Samiya Khan, and Mansaf Alam published paper in April 2020, which proposed an IOT based traffic management system for Ambulances. The Proposed work is hardware based and uses Arduino Uno, GSM sim 900A and GPS neo 6M. GPS module sends the live location of the ambulance to the traffic control room and hospital. The traffic control room will help the ambulance to reach its destination on time by clearing the route for the ambulance by changing the traffic signal whenever and wherever needed.

Author S. Sharma[2] proposed in his paper that ambulance detection and traffic control system written by student of The National Institute of Engineering,Mysore[4], They proposed a system which uses a GPS module to transmit the location of the ambulance to the cloud using wifi module, which then transmitted to the smart traffic system which changes the traffic light according the situation. According to them they proposed low cost system which can be implemented throughout the city

In another Research paper Traffic light controlling For Emergency vehicle Line based on Tracking and position using GPRS Network published in the Journal of Physics[5], they proposed a system where Emergency vehicles were utilised with any GPS device. The emergency vehicle continuously sends its longitude, latitude and speed to the GPS server. Then the traffic light device then calculates straight distance to emergency vehicle based on its predefined longitude and latitude. If Emergency vehicle is located within

the user defined radius of the traffic light device, then the traffic light turns green to allow the ambulance to pass its line.

3. METHODOLOGY

Our proposed system requires only a piece of hardware which is a camera for capturing the live footage of traffic and all other work will be done by software. The main and most important part of this model is its computer vision software. The performance of this model depends on the accuracy of the trained computer vision model. More datasets we provide during training the better accuracy we get.

The proposed model is implemented by using python and following packages are used:

- Tensorflow
- YOLO
- Keras
- Open CV
- CNN

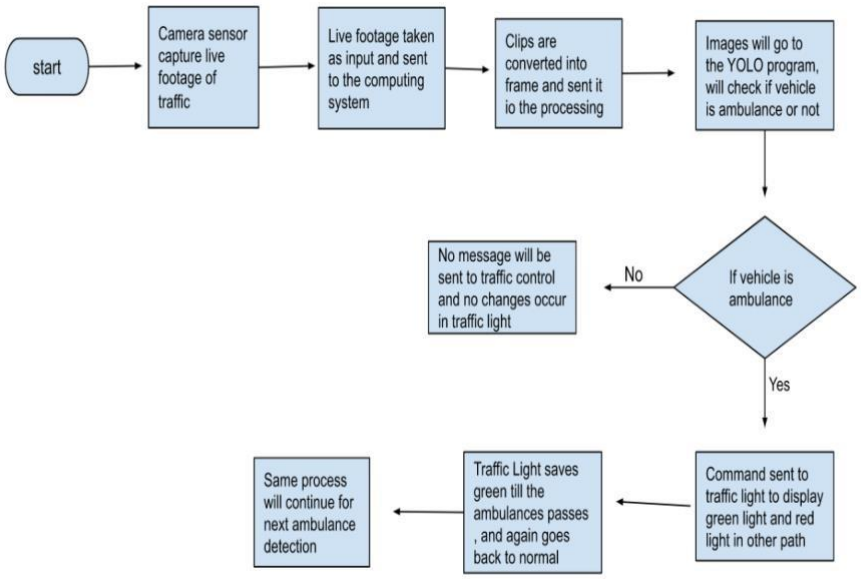

Fig 3.1:- System Block diagram

The given figure displays the whole process of this model. The camera captures the live footage, which then goes to the program to detect whether the vehicle is an ambulance or not.

3.1 Implementation

Project has been carried out in three phases, they are:

- Training
- Detection
- Change of traffic light

Training- Before the detection of the vehicle and giving output based on the result, the program or machine must be taught what an ambulance looks like. For this, we have created a dataset of ambulances. More than 1000 images of ambulances were downloaded from the internet. All photos are resized and saved in two folder, one is test and second is train folder. There is two is csv file for both the folder. Csv file of the train folder consists of every image name with 0 or 1 value. Images that have ambulances have values of 1 and others have 0. Batch size of for training data is set as 32 and images are resized as 224*224 pixels. After the pre-processing, the standard TensorFlow algorithm runs to train the dataset. The whole process runs 65 times (epochs = 65) and takes a maximum of 15 minutes.

Detection: Data labelling is a tedious and repetitive task that must be performed manually. You can use LabelImg[6] for labelling the image for the YOLO program. But here we have used a predefined algorithm that makes use of Microsoft's COCO dataset. The YOLO program is used to identify if the present frame contains a vehicle or not. Traffic is captured by a camera sensor, which is used as input by the computer system. This frame goes to the YOLO program and the bounding box is created around the vehicle. Afterword this image is sent to the main function where our trained model is there to identify whether a particular vehicle is an ambulance or not. If the main function returns 1 then it meets the criteria and the signal will be sent to an arduino or microcontroller which controls the traffic light.

Change of traffic light- In our demo model we used arduino Uno and arduino program to control the traffic light. The detection program is written in python and the arduino program is written in C language. That'sWhy we used cvzona to connect the arduino and main function. There is two version of light change

- First, if an ambulance is detected, the green light duration will change. Generally green light lasts for 90 to 160 seconds. So we can add an extra 30 to 60 seconds for semi urban areas, where there is not much heavy traffic.
- Second version is for metro cities, where the green light will remain ON until the ambulance crosses the traffic light. But It required more than one camera. It increases hardware dependencies.

3.2 Result:

We obtained the following result through our project.

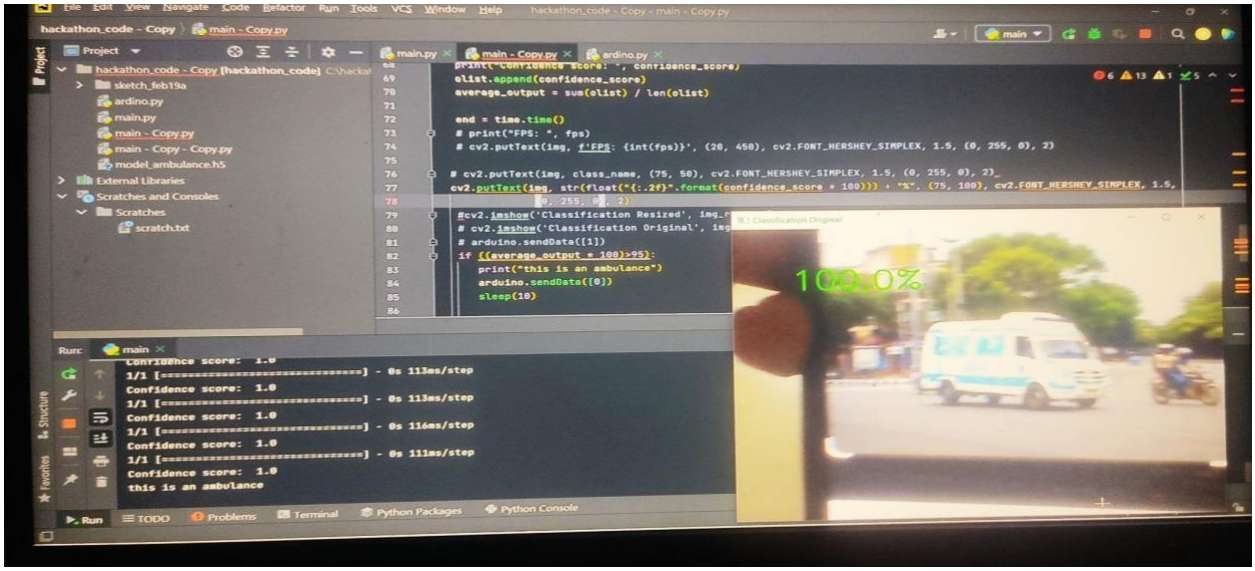

Fig3.2.1: Ambulance detection by the main function, without YOLO program

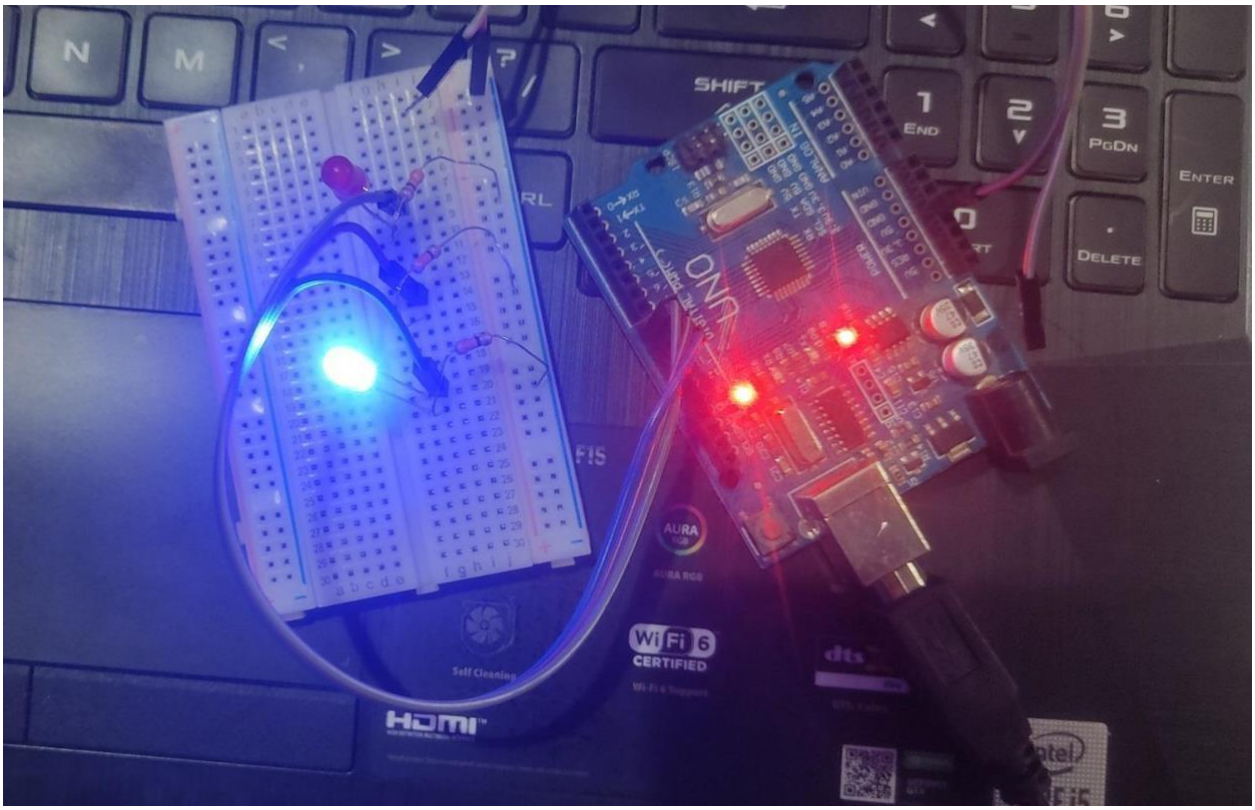

Fig 3.2.2: Traffic light control by Arduino uno

4. FUTURE WORK

This proposed method and the whole model are based on edge computing. We depend on hardware near the traffic light that can run the whole main program and can run to give the signal to change the traffic light. Here Raspberry Pi can be used for edge computing. But it increases the hardware dependencies and can become costly to put edge computing systems near every traffic light. That's Why we want to include cloud computing in future work. The first camera will capture the live footage and send the whole video to the cloud or near a local server (fog computing) where the live footage will analyse and find whether the ambulance is there or not in a given frame of that live footage. Once the ambulance is detected, it sends the signal which will be received by the smart traffic to change the light.

Advantages of cloud computing are:

- It decreases the hardware dependencies
- Decrease the cost of installation of our model in every traffic light
- We will get a large amount of data, which can be used for future data analysis to understand the traffic pattern of the city.

5. CONCLUSION

In this research paper and our demo model, we were able to:

- Build the dataset for software training and evaluation
- The h5 model was formed that can identify the ambulances
- We successfully created Arduino program to control the traffic light
- The timing of the green light can be decided based on the traffic pattern of the city. For the semi-urban cities, we can add 30 to 60 seconds extra in green light duration.

This model can be implemented for other emergency vehicles like fire fighting vehicles or police vehicles, but it needs to change in the dataset and need some more training but this is the future work. But before all of this, we need to work more in the present dataset to increase the accuracy of this model.

REFERENCES

[1]The Nation, "20 per cent of emergency patient deaths blamed on traffic jam delays," *nation Thailand*, Jan. 16, 2017 [Online]. Available: https://www.nationthailand.com/in-focus/30304268. [Accessed: Mar. 26, 2023]
[2]S. Sharma, "Teenager dies as ambulance gets stuck in traffic jam at Shamli," *The Statesman*, May 30, 2019. [Online]. Available: https://www.thestatesman.com/india/teenager-diesambulance-gets-stuck-traffic-jam-shamli-1502760441.html. [Accessed: Mar. 26, 2023]
[3]TNN, "Choking life: 12 on way to hospitals die in traffic jams," *Times Of India*, Oct. 18, 2016 [Online]. Available: https://timesofindia.indiatimes.com/city/raipur/choking-life-12-on-way-tohospitals-die-in-traffic-jams/articleshow/54910538.cms. [Accessed: Mar. 26, 2023] [4]K. B.V, M. M., and R. R. Kowshik, "Ambulance Detection and Traffic control system," Apr. 2019. [5]"ShieldSquare Captcha." [Online]. Available: https://iopscience.iop.org/article/10.1088/1742-6596/1566/1/012014. [Accessed: Mar. 27, 2023]
[6]heartexlabs, "GitHub - heartexlabs/labelImg: LabelImg is now part of the Label Studio community. The popular image annotation tool created by Tzutalin is no longer actively being developed, but you can check out Label Studio, the open source data labeling tool for images, text, hypertext, audio, video and time-series data.," *GitHub*. [Online]. Available: https://github.com/heartexlabs/labelImg. [Accessed: Apr. 01, 2023]