Road Safety Monitoring System

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Abstract— **Accidents have been a major cause of deaths in India. More than 80% of accident-related deaths occur not due to the accident itself but the lack of timely help reaching the accident victims. In highways where the traffic is really light and fast-paced an accident victim could be left unattended for a long time. The intent is to create a system which would detect an accident based on the live feed of video from a CCTV camera installed on a highway. The idea is to take each frame of a video and run it through a deep learning Tensorflow module which has been trained to classify frames of a images into accident or non-accident and passes the information to rescue system through system through Raspberry pi and the particular path of ambulance signal will be changed to green accordingly.It also provides alternate path stipulation incase of path blocks. Tensorflowhas proven to be a fast and accurate approach to classify images.**

I. INTRODUCTION

Over 1.3 million deaths happen each year from road accidents, with a further of about 25 to 65 million people suffering from mild injuries as a result of road accidents. In a survey conducted on road accidents based on the income status of the country, it is seen that low and middle-income or developing countries have the highest number of road accident related deaths. Developing countries have road accident death rate of about
23.5 per 100,000 population, which is much higher when compared to the 11.3 per 100,000 population for high-income or developed countries . Over 90% of road traffic related deaths happen in developing countries, even though these countries have only half of the world's vehicles. In India, reported that 13 people are killed every hour as victims to road accidents across the country. However, the real case scenario could be much worse as many accident cases are left unreported. With the present data, India is on the way to the number one country in deaths from road accidents due to the poor average record of 13 deaths every hour, which is about 140,000 per year. An accident usually has three phases in which a victim can be found.

First phase of an accident is when the death of the accident victim occurs within a few minutes or seconds of the accident, about 10% of accident deaths happen in this phase.

Second phase of an accident is the time after an hour of the accident which has the highest mortality rate (75% of all deaths). This can be avoided by timely help reaching thevictims. The objective is to help accident victims in this critical hour of need.

Third phase of an accident occurs days or weeks after the accident, this phase has a death rate of about 15% and takes medical care and resources to avoid.

The main objective is to incorporate a system which is able to detect an accident from image provided to it using a camera. The focus is to detect an accident within seconds of it happening using advanced Deep Learning Algorithms which use Tensorflow module to analyze frames taken from the image generated bythe camera.

We have focused on setting up this system on highways where the traffic is less dense and timely help reaching the accident victims is rare. On highways we can setup CCTV camera's placed at distance of about 500 meters which act as a medium for surveillance, on this camera we can set up the proposed system which takes the footage from the CCTV camera's and runs it on the propsed accident detection model in order to detect accidents.

In this system, we have a Raspberry Pi Model which acts as a portable and remote computer to be set up on a CCTV camera. For demonstration purposes, we will be using a Pi Camera which can be directly set up on a Raspberry Pi. We have pre-trained model to be able to detect accidents by training it on two different sets of images and sequence of image frames. The images and video frames are 10,000 severe accident frames and 10,000 non-accident frames. The Open CV algorithm can now detect an image or frames of a video to be an accident frame by up to 98.5% accuracy. This model was then implemented on a Raspberry Pi using TensorFlow, OpenCV and

python.

When a image is shown to the Raspberry Pi through the Pi camera, it runs each frame of the image through the model created and then predicts whether the given frame is an accident frame or not. If the prediction exceeds a threshold of 60% or 0.6 the Raspberry Pithen initiates the GSM module setup with it to send a message to the nearest hospital , informing them about the accident which has been detected with the timestamp of when it occurred, the location of where it occurred, and the frame at which the accident was detected victims. The objective is to help accident victims in this critical hour of need.

II .RELATED WORK

In this section, we have tried to compare our work with other accident detection techniques. Most of the studies in this field revolve around the enhancement of tangible infrastructure rather than on Intelligent Transportation Systems (ITS) which include traffic congestion detection, accident detection, detecting the occurrence of an event etc. Even the few existing studies in the domain lack implementation details and are terrain specific i.e. there are constraints both in the geographical as well as demographic aspects. These techniques have been discussedbelow:

We have come to notice that most accident detection systems make use of expensive sensors placed on the body of the vehicles or it makes use of existing sensors on a smartphone. This dependency of sensors makes this method expensive and less effective as compared to the proposed accident detection system.

To maintain a smooth traffic flow and to ensure safety, comfortable and efficient transportation the system has developed and expanded. We have installed four television cameras at a curved area on the expressway where motor vehicle accidents frequently occur, to experiment and verify whether accidents can be detected by processing the images taken by these cameras. As a result, we have found an effective method for detecting accidents or stationary vehicles.

Contemporary research on accident detection systems is focused on either decreasing the reporting time or improving the accuracy of accident detection. Internet-of-Things (IoT) platforms have been utilized considerably in recent times to reduce the time required for rescue after an accident.This work presents an IoT-based automotive accident detection and classification (ADC) system, which uses the fusion of smartphone's built-in and connected sensors not only to detect but also to report the type of accident.

If the Emergency Vehicles do not reach at its destination point in time it causes human health and wealth. So by using a Phenomenon that clearing the traffic signal before an Emergency Vehicle Reaches to the signal using IOT will resolve the problem and also can use Micro-controllers, processors, sensors, GPS, GSM, RF, Zigbee, and IoT concept to build a system which can mainly use to avoid the traffic jam condition . GPS based system is mainly used for the developing because it is soft to develop and the main thing is it doesn't require any input from the person who is driving the emergency vehicles.

II. BLOCK DIAGRAM

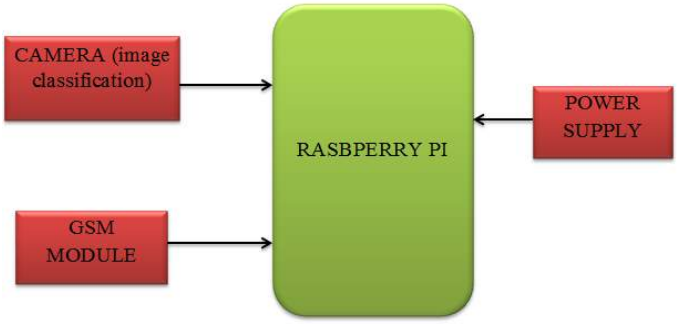

Fig1. Accident detection process

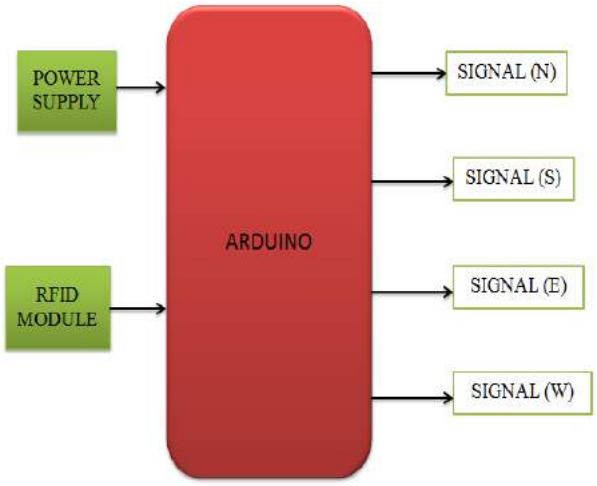

Fig2,Traffic control for emergency vehicle

III .COMPONENTS USED

A. Raspberry Pi 3 Model

Raspberry Pi 3 Model is a very small-sized portable computer created by the Raspberry Pi foundation in the United Kingdom to provide a low-cost experience for programming enthusiasts and helping them to understand the basics of computer science. The Raspberry Pi comprises of a 1.4 GHz 64-bit quad-core processor, a dual-band wireless LAN, 4 USB ports along with other features like Bluetooth 4.2, faster Ethernet and is originally shipped with 1GB of RAM. It consists of 40 GPIO (General Purpose Input Output) pins which helps us to easily interface the required hardware with the pi. It does not consist of massive storage like the built-in hard drive, but it does consist of microSD card used for light storage and booting applications. The operating system that the Pi works on is known as Raspbian installed NOOBS. The various programming languages supported in Pi are Python, Wolfram etc. The two key application areas are:

- Interfacing of various hardware components
- Understanding of basic programming concepts

B. GSM Module SIM900A

Global System for Mobile Communication is one of the most widely used mobile telephony systems. SIM800L helps to connect onto any global GSM network using a 2G SIM. GSM uses the concept of Time Division Multiple Access. Data is digitized and compressed which is later sent down a communicating channel along with two streams of the user's data each of which has its own unique time frame. SIM800L is quad-band..

SIM900A GSM Module is the smallest and cheapest module for GPRS/GSM communication. It is common with Arduino and microcontroller in most of embedded system. The module offers GPRS/GSM technology for communication with the uses of a mobile sim. It uses a 900 and 1800MHz frequency band and allows users to receive/send mobile calls and SMS. The keypad and display interface allows the developers to make the customize application with it. Furthermore, it also has modes, command mode and data mode. In every country the GPRS/GSM and different protocols/frequencies to operate. Command mode helps the developers to change the default setting according to their requirements.

Communication is achieved using the UART port using the various AT commands. Additional features include scanning and reception of FM radio broadcasts.

C. Pi Camera

The main task of a Pi camera is to take still photographs and high-definition videos. The module consists of a five- megapixel camera capable of capturing stills as well as support for the 1080p30, 720p60, and VGA90 video modes. It is attached to the CSI port of Pi using the 15cm ribbon cable. The images obtained are generally in JPEG or JPG format. The camera module can be altered to implement various additional effects like time-lapse or slow-motion. Additional libraries can be used to create effects as well.

It can be accessed using the Pi camera Python library. The camera module is used for a wide range of home-security applications as well as in wildlife camera traps.

IV.SOFTWARE USED

A.OpenCV

OpenCV (Open Source Computer Vision Library) is an image processing library containing programming functions in order to facilitate research in the domain of computer vision and to provide support for advanced CPU-intensive projects. It supports programming languages like C++, Java and Python as well as the common operating systems like Windows, Mac OS, Linux, iOS and Android. OpenCV was primarily designed in order to provide computational efficiency along with the creation of real time applications.. The main application areas involve echo motion estimation, facial recognition systems, gesture recognition, mobile robotics and augmented reality.

For the scope of the proposed system, there were several challenges we had to face with the images.Thus, random noise was being accounted during the prediction since not all the accident images were of high clarity.

B. Tensorflow

Tensorflow is a free and open-source software library for machine learning.It can be used across range of a tasks but has a particular focus on training and inference of deep neutral network .It is a python library for fast numerical computing created and released by Google.It is

a foundation library that can be used to create Deep Learning models directly or by using wrapper libraries that simplfy that process built on top of Tensorflow.

Image Recognition using Tensorflow is a special feature of image recognition and these images are stored in a specific folder.With relatively same images, it will be easy to implement this logic for security purpose. The dataset image includes the related images, which need to be loaded.We will focus on image recognition with our defined in it. The images are loaded with script, which helps in keeping a note on various image recognition modules within them.

C . Python:

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant indentation . Its language constructs and object-oriented approach aim to help programmers Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured(particularly, procedural), o bject oriented and functional programming. Python is often described as a "batteries included" language due to its comprehensive standard library oriented and functional programming

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V PROPOSED SYSTEM

We have come to notice that most accident detection systems make use of expensive sensors placed on the body of the vehicles or it makes use of existing sensors on a smartphone.This dependency of sensors makes this method expensive and less effective as compared to the proposed detection

system.This model was then implemented on a Raspberry Pi using TensorFlow .

When an accident takes place the camera detects the frame and after the image classification process that is being executed in the raspberry pi .It sends the message to the emergency number along with the geographical coordinates. Along with the coordinates the shortest route of the accident to the ambulance driver will be sent.Now the ambulance will start to rush to the location of the accident but most of the times at this scenario,the ambulance will be delayed to reach the destination due to the traffic. Here we use a special method,where we have integrated the microcontroller and traffic signal to control the signals.The rasbperry pi will find the shortest route for the ambulance to reach the destination and turns the traffic light to green throughout the route.Hence the road will be free to move and also the adjacent road's signal will be red untill the ambulance clear away from the traffic in order to prevent intervention of other vehicles

VI. RESULTS

Once the system starts running it takes into account each frame of the video that it is capturing from the Pi-camera and runs it through the proposed model and when it detects an accident the system immediately sends a message using the GSM module. It also sends the frame at which it detected an accident and what percentage of accident it is. It also shows the time stamp as to when the accident was detected. Fig.3 shows an accident frame

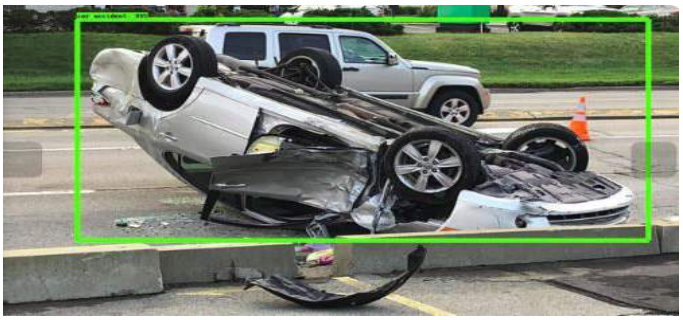

Fig 3.Accident detection by image processing

The below frame is of a Non-Accident situation where only the percent of No Accident is shown:

Fig.4 Time stamp of Accident detection

The performance of the model was evaluated using

$$\text{Accuracy} = \frac{\text{Number OF correct prediction}}{\text{Total of all cases to be predicted}}$$

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VII CONCLUSION

Accidents are one of the most common problems that humanity faces on a daily basis leading to loss of both life as well as property The proposed system provides a very viable and effective solution to this problem. The proposed vehicle accident detection system can track an accident at its moment of occurrence and sends an instantaneous alert SMS regarding the accident to the nearby hospitals and police stations which includes details like timestamp and the geographical location. Unlike other systems in use, which consists of expensive sensors and unwanted hardware, the proposed system is much more cost effective and foolproof with a much-improved accuracy rate

than its counterparts mainly due to a model-based approach. The experimentation, testing and validation has been carried out using images and the results show that higher sensitivity and accuracy is indeed achieved using this method, henceforth, making it a viable option for implementing this system in most of the state and national highways of the country.

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VIII. REFERENCES

1. M. S. A. Hadi, A. Saha, F. Ahmad, M. S. Hasan and M. H. Milon, "A Smart Accident Detection and Control System in Vehicular Networks," 2018 5th International Conference on Networking, Systems and Security .
2. F. B. Basheer, J. J. Alias, C. M. Favas, V. Navas, N. K. Farhan and C. V. Raghu, "Design of accident detection and alert system for motor cycles," IEEE Global Humanitarian Technology Conference: South Asia Satellite.
3. N. Prakash, E. Udayakumar and N. Kumareshan, "Arduino Based traffic congestion control with automatic signal clearance for emergency vehicles and Stolen Vehicle Detection," 2020 International Conference on Computer Communication and Informatics
4. Prabakar, S., et al. "An enhanced accident detection and victim status indicating system: Prototype." India Conference (INDICON), 2012 Annual IEEE. IEEE, 2012.
5. A. Meena, S. Iyer, M. Nimje, S. Joglekar, S. Jagtap and M. Rahman, "Automatic Accident Detection and reporting framework for two wheelers," IEEE International Conference on Advanced Communications, Control and Computing Technologies.