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Train Accident Prevention System

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ABSTRACT

Railway accidents are one of the major issues evident in India. The main objective of this study is to develop and implement an accident prevention system on railway track. The system developed is able to detect obstacles including crowd of humans, animals or any vehicle stuck on railway track. It is also useful in the hilly region where land sliding occurs. It detects the obstacles at a distance greater than the loco pilot's eye vision and notify or give an alert about the obstacle, giving sufficient time to the driver to prevent or control the situation. This study presents concluding remarks on the limitations of existing studies and provides recommendations for further research and appraisal practices

Keywords : Deep Learning, Neural Network, Object Annotation, Object Recognition, Python , TensorFlow Lite Tool

I. INTRODUCTION

We are currently developing Accident Prevention System in which we are detecting obstacles on the track using camera. This paper mainly describes a related method of detection using images captures by the camera and process them by using object recognition with Deep Learning

Deep learning is a subset of machine learning in Artificial Intelligence that teaches computers to do what comes naturally to humans. In Deep learning, models are trained by using a large set of labelled data and neural network architectures that contain many layers.

TensorFlow Lite is an open source deep learning framework which is used for on-device inference. TensorFlow Lite works as an accompaniment to TensorFlow by using Python Language. TensorFlow Lite takes the resulting model as an input, packages, deploys and then interprets it in the client application, that handles the resource-conserving optimizations along the way. In this we are accomplishing the task of Object Recognition. Object recognition refers to a set of related tasks for identifying objects in digital photographs. In deep Learning, object Detection is a subset of Object Recognition.

Object Detection combines two related tasks that are Image Classification and Object Localization which includes assigning a class label to an image and drawing a boundary box around one or more objects in an image respectively. This allows for multiple objects to be identified and located within the same image. The model developed by using above technology summarizes the following: 1. A rail detection algorithm which focuses on the characteristics of shapes such as edges, resulting in clipping of the image. 2. An image recognition algorithm that enable detection of obstacles in terms

of their shape and sizes. 3. Resulting processed image is further used for verification.

While verification, the processed image is matched with the images of an obstacles stored in system database. If the verification is successful then it will generate an alarm to alert the loco pilot so that loco pilot can be able to take quick action.

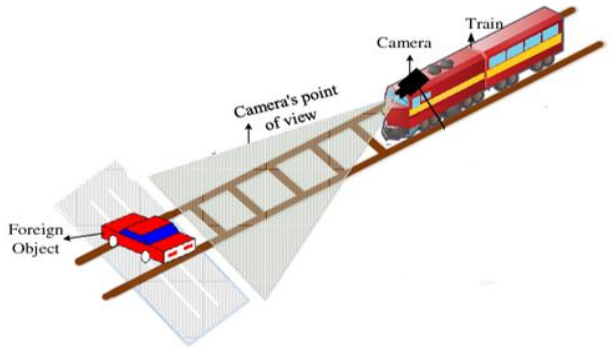

Figure 1: External Overview of the System

II. METHODS AND MATERIAL

A. DESCRIPTION OF HARDWARE

This model uses PiCamera, Raspberry pi, display that in all are connected and with each other.

1) Camera : The camera is placed in front of the engine and is used to capture the live video of the current track on which the train is running. Following are the specifications of the camera used-

- 15-pin MIPI camera Serial Interface which Plugs directly into the Raspberry Pi Board.
- Picture resolution: 2592 x 1944
- Video: supports 1080p @ 30fps,720p @60fps and 640 X 480p 60/90 recording
- Size: 20 X 25 X 9mm
- Weight: 3 gm

2) Raspberry pi : It is used for the overall processing of the system where the code is implanted within. Following are the specifications of Raspberry pi used-

- 64 GB SD card.
- 4 GB RAM.
- Raspbian OS.

3) Display : Display is used to show the exact obstacle on the track.

4) Voice module : It is used to give an alert signals.

B. DESCRIPTION OF SOFTWARE

1) TensorFlow Lite : It is an open source artificial intelligence library, using data flow graphs to build models. It permits developers to generate large-scale neural networks with many layers. TensorFlow is largely used for Classification, Perception, Understanding, Discovering, Prediction and Creation.

2) Raspbian Operating System

3) LabelImg **:** It is a graphical image annotation tool written in Python and uses Qt for its graphical interface. Annotations are saved as XML files in PASCAL VOC format, the format used by ImageNet.

C. METHODOLOGY

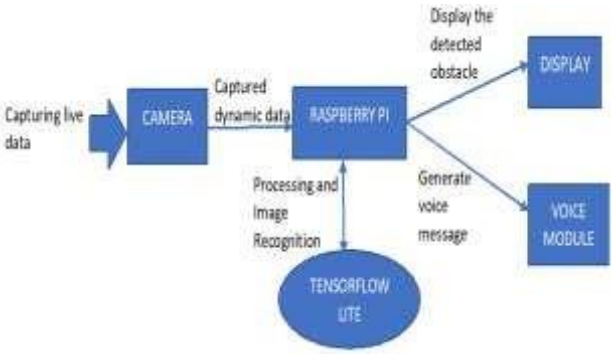

Figure 2: Work flow of the system

The camera is positioned in middle front side of our train engine. This camera is connected to raspberry pi. The camera captures live video that is dynamic data while train is running on the track. This data is processed in Raspberry pi by using TensorFlow Lite.

The TensorFlow lite is a tool which used in deep learning for Object Recognition in which the model is trained in such a way that the data captured by the camera is processed by comparing on track event with the stored dataset. For this to happen, the dataset is created using different images of obstacles that could be possibly present on track responsible for accident. This dataset folder contains two sub-folders images and annotation. The images folder contains at least 50 images of each obstacle. Annotation folder contains labels of each image stored in images folder.

All these results into obstacle recognition along with its label. This output will be displayed on the display provided. Meanwhile, the voice module used in the model generates a voice message to notify the loco-pilot.

III. RESULTS AND DISCUSSION

A. LITERATURE SURVEY

In the past few decades, the railway infrastructure has been widely expanded in urban as well as rural areas, making it the most compound medium of rail transport networks. Safe and comfortable travel on railways has always been a mutual goal for transportation engineers and researchers, and entails railways in excellent condition and efficient maintenance practices.

While having survey with the Central Railway, Nagpur, we had a talk with different loco-pilots about their running experiences. And it was found out that to accomplish above expectations, it is also necessary to create awareness among the loco-pilots about the events that can result to perilous accidents.

Most of the train accidents occur as a result of Derailment of rail tracks, Collision with other trains and vehicles, failure of signal light to provide adequate warning, human error, Mechanical failure, High Speed, Obstruction on the tracks etc.

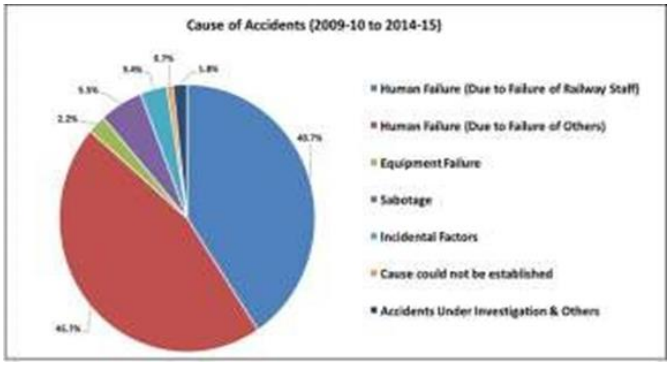

Figure 3: Pie-Chart of Causes of Railway Accidents

Out of these, our main focus is on the Obstruction on the tracks. In such cases, foreign objects such as vehicles or equipment may be left in the path of an oncoming train; if the loco-pilot fails to see them or if the train is going too fast, then he may not be able to avoid striking them, causing an accident The local train runs at a maximum speed of 140 Kmph but they do not exceed it above 110 Kmph as a cause of precaution. That is why, a system is to be developed to detect the presence of obstacles that corresponds to the above speed of the train, giving the train driver sufficient time to take further action as per the situation.

B. ANALYSIS

In India, it has been observed that about 607 people were injured or killed in 2016-17 due to train accidents and the number stood at 254 in 2017-18. In the 6 years period between 2009 to 2015, there was a complete of 803 accidents in Indian Railways during

which 620 people were killed and 1855 people were injured.

While on survey in Central Railway, it was found out that there are many reasons for train accident but one of them is obstruction of train.

C. EXPECTED OUTCOME

The camera placed in the middle front of the engine would capture the live data while train is in running state. This would be the input to the system that would detect and recognize the obstacle present on track.

If the obstacle is detected, the system would display it on the LED screen that is the part of our model, and generate an alert notification for the loco-pilot to be aware of the situation and take necessary action.

IV. CONCLUSION

The proposed work ensures the safety of passengers in railway transportation and of humans on Track if any. This Paper describes general preventive measures targeted to reduce Railway accidents because of obstacles on the track. It discusses the existing countermeasures for reducing accidents.

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