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Solutions for Railway Platform Accidents

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Abstract: Railway accident prevention and protection are a key a part of a wider picture of transport safety. The rail sector thus needs to improve its knowledge of breaching and suicide, including at grade crossing, so as to figure out suitable responses by analyzing measures already taken in various countries. Governments, the rail industry and road organizations are implementing a spread of countermeasures for several years to enhance railway safety. These actions are substantial and have resulted during a continuing decrease within the number and therefore the severity of accidents. This paper presents existing suitable techniques that are utilized in the preventative measures targeted to scale back railway suicides, breaching and grade crossing casualties. It reports them in terms of their potentiality to effectively minimize accidents, their cost-effectiveness and their incorporation within the railway transport system as a whole.

Keywords: Railway, safety, incorporation, grade crossing, breaching, etc.

I. INTRODUCTION

The rail transport mode is formed simpler and efficient by the very fact that it connects the foremost populated areas at increasingly high speeds, providing social bond at local level and establish an important think about land use planning at the national, European and international levels. The rail sector thus needs to ensure its security against accidents and suicides occurring on its property so as to supply continued service and maximum reliability. An important means to realize this goal is that the analysis of the initiatives already taken in different countries to address these events. Responses can't be easily transposed from one country to a different as they take into account specific cultural and sociological phenomena; Furthermore, they depend upon the socio-political organization of a rustic and therefore the resultant allocation of responsibilities and competences. This paper describes general preventative measures targeted to scale back railway suicides and trespassing accidents, and it describes them in terms of their capability to effectively minimize accidents, their cost-effectiveness and their incorporation within the railway transport system as an entire.

A particular case is that the grade crossing, which is the interface between two very different transport modes. Moreover, accidents at level crossings are mostly linked to human errors committed by road users. It is thus arduous to define the responsibilities' borders in this case, and therefore the approaches wont to ensure safety are somewhat different from those used at other parts of the railway infrastructure [1-4]. The paper is organized as follows: (1) In Section 2, some relevant statistics on railway safety are presented and analysed so as to spot the most trends; (2) In Section 3, the measures wont to protect railway infrastructure and avoid accidents are presented and discussed; (3) Section 4 details the particular case of level crossings and therefore the specific measures dedicated to them; (4) Finally in Section 5, we conclude the study while exposing the most prospects of our add this field.

II. LITERATURE REVIEW

We read a lot of research papers that were pertinent to our subject as part of the literature review. The system was created by N. Pavithra, K. Tamil selvi, and M. Kowsalya [1] and is based on collision detection technology that uses an embedded system and ultrasonic sound. To stop the train before a collision, this technology can identify the impediment and gradually reduce speed by activating the air brake..

By employing the tunnel monitoring system put on trains and railway vehicles, Donghee Shin, Jangwon Jin, and Jooyoung Kim [2] aimed to create a better safety system for maintenance personnel on the tracks. PTZ (Pan-Tilt-Zoom) cameras mounted throughout a train are used to collect image data for the tunnel monitoring system. Electric car lines and railroad tracks are immediately detected by the tunnel monitoring system while the train is moving. This study involved constructing an algorithm for extracting images of railway signs, tracks, and track workers from the image data of a tunnel monitoring system by means of Computer Vision OpenCV library and recognizing those images. As the proposed method can detect track workers, tracks, and work zone signs as objects, it is expected to provide train or railway vehicle drivers with track information in advance, thus alerting them to the possibility of an accident..

Rohini Temkar and Rinkeshkumar Yadav made a strong effort as well [3]. In this research, they suggest a cloud computing-based IoT-based railway catastrophe avoidance system. This accident prevention system is based on cloud computing, which connects to the Internet and IoT devices.

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III. METHODOLOGY

In this project OpenCV for person detection in the given camera frame. If the object is a person, then the person is marked by rectangle using its co-ordinates with the help of 'NumPy' library in python. 'Centroid Tracker' library is used to track the 'person' through the co-ordinates by calculating it's centroid. As we are detecting the 'person' in the frame, we are tracking the 'person' by anticipating its relative position in next frame. If the 'person' goes beyond that limit, then it is assumed that 'person' is no more in the frame. Non-maximum-suppression algorithm is also used to remove unnecessary rectangle showing the same objects. 'datetime' library is used to calculate the frame's processing start & end time to calculate the FPS count. 'imutils' library is used to adjust the frame, to enhance the FPS count of the algorithm. 'common.py' is a python file used to interface the software algorithm with microcontroller.

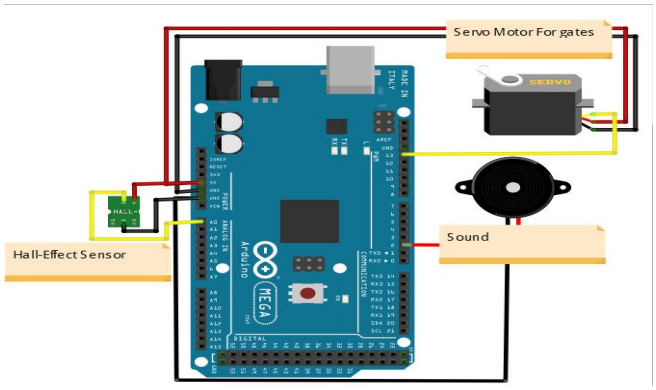


Figure 01. Schematic of the hardware components

At first, the video clip is been accepted by the algorithm. This video clip is read by frame by frame. The object in the frame is detected on the basis of confidence level (how much percent its characteristic match with original object defined in the model) of the model on the object. If the algorithm finds 50% or more resemble lance in characteristic, then that object is from model. After that the value if been validate in class in which all objects from the model are define. If that index indicates the 'person' then the co-ordinates of the same object are passed with the help of NumPy to the 'bounding_box ()' function to mark that object by rectangle with the help of given co-ordinates.

CeneterTracker library is used to take the co-ordinates from bounding_box () and return its centroid value.

Non-maximum-suppression is also used to remove unnecessary boxes pointing the same object which acts like noise in this case. If two or more boxes overlaps on each other for >= 30% are represented by only one.

The object is tracked by feeding the 'tracker ()' function updated centroid coordinates of the object. If some object is missing for some frames, then the tracker waits for some frames, but after threshold frame number considered as missing object. Not only this but even if the object appears from nowhere in the frame at an anticipated location for another object, then the algorithm gives that object new if and start tracking that object.

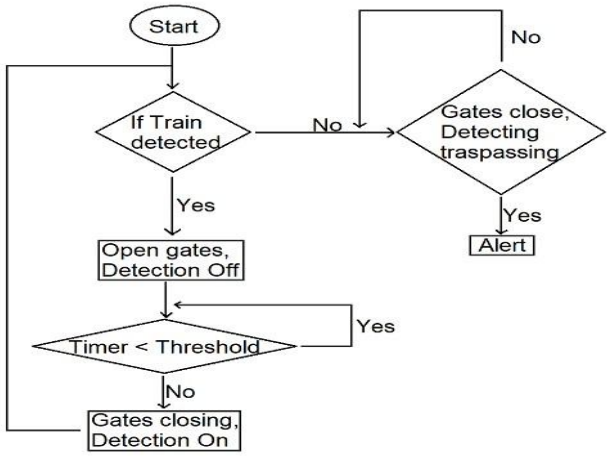


Figure 02. Flowchart of the algorithm

A. Tools and Components

1) Arduino Mega – Used to communicate between software and hardware.
2) Hall-effect Sensor – For detection of train.
3) Servo Motors – Used to open and close the gates.
4) Arduino IDE software
5) Computer vision related libraries like OpenCV, NumPy, etc.

A miniature model with all the advanced solutions was created. According to the rough sketch all components were assembled, programmed and debugging issues were resolved.

IV. ALGORITHM FOR SYSTEM

1) Start
2) Close the gates and start trespassing detection.
3) If trespassing==True
4) Show Alert
5) Detect train with sensor.
6) if Train_detection == True
7) While Timer<Threshold
8) Open Gates and shut down trespassing detection.
9) Go to step 2
10) End

V. RESULT AND DISCUSSION



Figure 03. Person detection is OFF while passengers get onboard and deboard

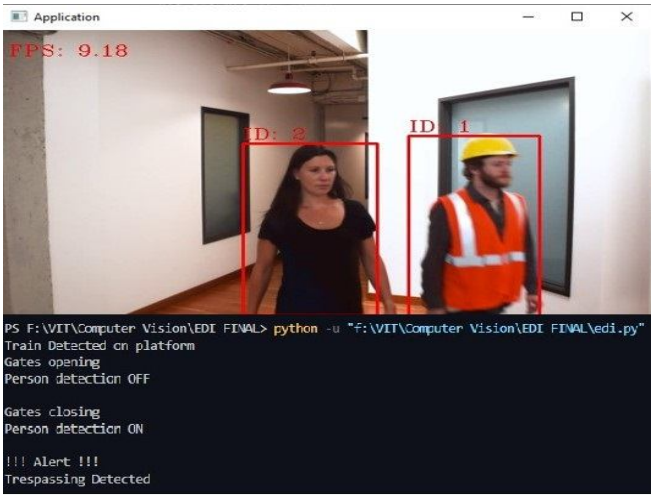


Figure 04. detecting trespassing in specific region of the frame

As shown in the fig.03, person detection algorithm is off for while the passengers getting onboard and deboard on when. This is done when the train is detected on the platform and made sure the train is stopped at appropriate position such that gates open in front of the passenger bogie. As train stops at platform according to their type, so we are allowing railway officials to set the threshold time according to that. As the threshold time is up, i.e. when the train is about to leave the platform, the gates are closed and trespassing algorithm is turned on again. The closed gates will make sure that no one will attempt risky onboarding always as any trespassing in the absence of the train platform will be detected.

VI. LIMITATION

The working principal of this project is detecting the trespassing of passenger on railway tracks. But there are some limitations of this project. First limitation is FPS of algorithm. We get only 6-10 FPS using OpenCV. And this rate decreases with increase in frame size. As the algorithm increases, processing time increases as Python is interpreter language. Object can be detected with precision but algorithm can't get appropriate speed. Also, non-maximum-suppression need to be done on frame to remove unnecessary multiple bounding-boxes showing indicating the same object. Second limitation of this project is that when trespassing is detected, RPF personnel will be informed by alerting him with sound, this can lead to chaos in passenger. Along with this, exact location of the incident is not shared with officer may lead to accident on platform.

VII. FUTURE SCOPE

In this project, as we are having less FPS, i.e., processing of the frames is about 6-10 FPS, but on an average FPS > 15-20 is preferable for good algorithm. This problem can be solved by interfacing this algorithm with other algorithms like 'YOLO' or using frameworks like 'openvino' which can enhance the frame rate by 1.5x to 2x. Along with this, in this project we are detecting the trespassing and alerting the responsible person about the same using the sound. This can be improved by using RF module, which will not only stop chaos on platform but also the specific location of the incident will help to stop the trespassing on time.

VIII. CONCLUSION

In this project we have successfully implemented person detection with precision at specific region in the camera frame. Automation in the railway platform gate will help RPF personal to stop any trespassing on the railway tracks in the absence of train. Any attempts of trespassing will be detected with computer vision and informed about the same. Although the algorithm is operating but the FPS count is less, hence this is a drawback in this project. But this issue can be addressed in future scope with integrating the algorithm with latest YOLO version which is good with FPS processing speed. Counting the passengers on platform will also helpful to assist the crowd in case of any disaster.

IX. ACKNOWLEDGEMENT

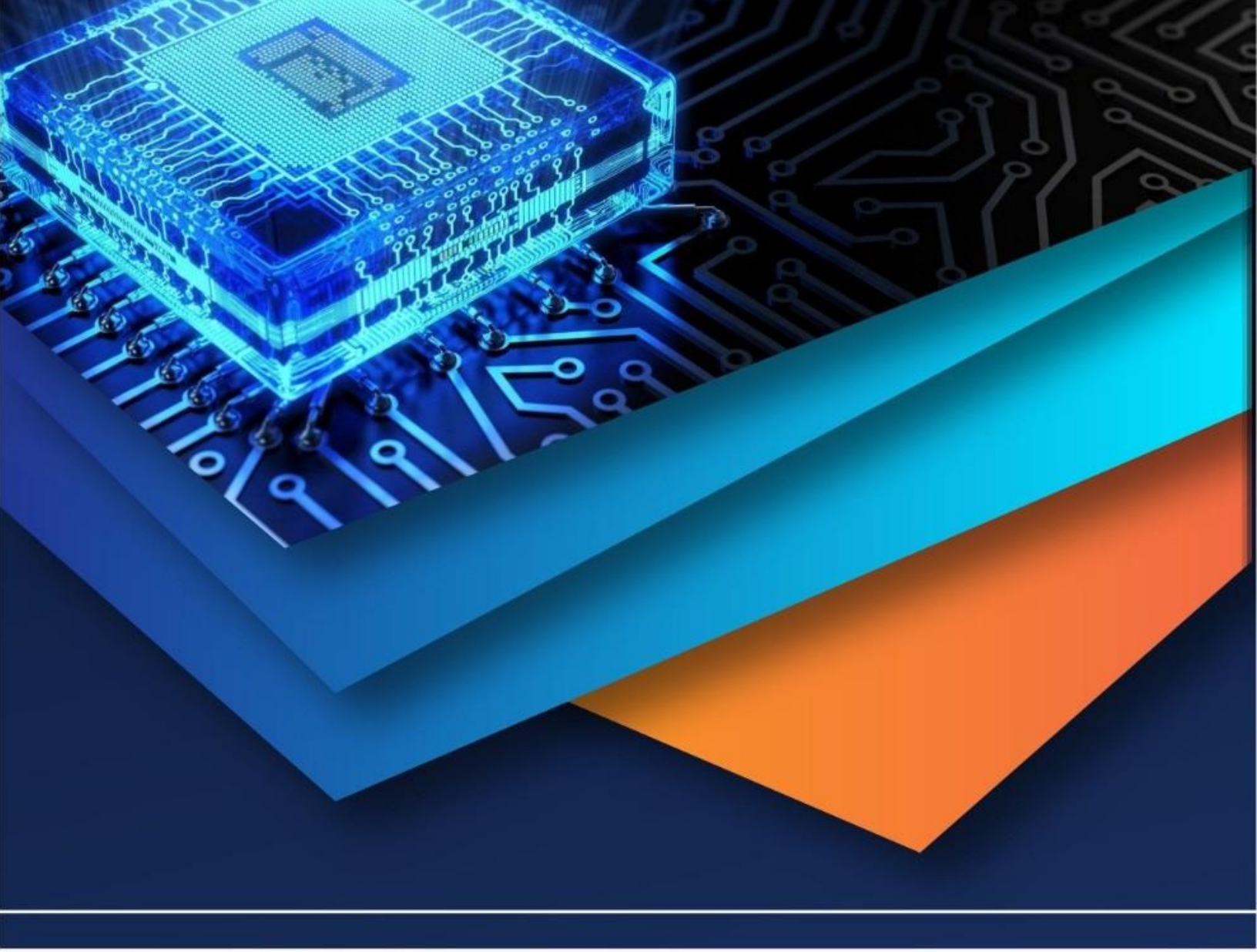
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