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Implement AI to Reduce Accidents using Jetson Nano

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Abstract: ***Accidents due to drowsiness have increased gradually over the past few years and almost 40% of the accidents occur due to drowsiness. Apart from the obvious causes, there is a more subtle evil of blind spots. Blind spots are areas on a road that are obstructed from the visibility of a driver. So we propose a method, to create a system that will be able to detect a person's drowsiness level and at the same time detect objects through blind spot. To detect drowsiness, it will measure the driver's attention to check if he is falling asleep while driving. Images of the face are collected and If it positively detects that state (that he is getting drowsy) and with the help of HAAR cascade algorithm, the output of the system gives alarm that will alert the driver. Jetson nano takes care of running with the help of PY-torch powered computer vision applications and PY-torch performs the needed AI. If an object approaches the blind spot of the car, YOLO v3 algorithm detects the object and with the help of Esp 32 module displays the image in OLED and indicates at which side of the car.***

Keywords: Drowsiness detection, Jetson Nano, YOLO v3, Esp-32, MQTT.

I. INTRODUCTION

Among which 40% of the accidents that occur is due to fatigue or drowsiness. many migrant workers have lost their lives, while walking, cycling back home, travelling in HMVs (heavy motor vehicles) and LMVs (light motor vehicles)..., and in mass fatality crashes involving state-organized buses. So to reduce the amount of accidents to be prevented before occurring is the motivation to this project.

The background for this project to choose Ai route for the problem is to get a efficient and simple working method to be proposed and it comes to use in real life application. Since Ai is booming in the real world applications it is a good learning curve for me and my teammates in Longevity of our career. This project comprises of two simple yet effective algorithms that is been used they are i) HAAR-CASCADE algorithm and ii) YOLO v3 algorithm. The haar cascade algorithm uses feature extraction process to detect the eyes and face of the driver.

Then the neural network model which is trained with our dataset will be used to detect whether the driver is drowsy or distracted or normal state. Similarly the Yolo v3 algorithm will be used to detect the objects that are coming in the blind spot of the vehicle to avoid accidents in that location while changing lanes or turning the vehicle. A blind spot accident can occur if a vehicle is in your blind spot when you change lanes to pass or make a turn. Blind spots are areas on a road that are obstructed 2 from the visual range of a driver, Most of the unfortunate accidents occur because of these blind spots. Accidents due to blind spot is not often spoke about in India.

II. EXISTING SYSTEM

Existing technologies of driver's drowsiness detection and warning can be separated in two types: 1) using images processing and 2) using signal processing and are presented about different type of input data or image from infrared camera and using bio-signal. It uses Raspberry pi3 with extension camera for detecting eyes closure and calculate rate of drowsiness and alarm when variable gets too high. For signal processing, Electroculogram (EOG) can be used for detecting driver drowsiness. The method is using EOG signal and image from high frame rate camera for calculating.

A. Drawbacks of Existing System

1) Have to be attached to driver's body which causes discomfort while driving.
2) The accuracy of this method is very less.
3) Too much to process for raspberry pi3 and it can't run everything.

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III. PROPOSED SYSTEM

The proposed system works on 2 algorithms each having their own use cases; they are HAAR-cascade eye and YOLO v3 face detection. HAAR-cascade algorithm is used to detect the face reaction and eye movement with which the person's state is determined. YOLO v3 algorithm is used to detect the various objects that can move in the blind spot region while driving a car. The haar-cascade algorithm uses open cv package to detect the driver face and eye from the given input source. The input image is used to detect whether the driver is sleeping or not with the help of pre trained model. If the model detects any drowsiness in the driver it will give a alarm sound to prevent any accident from occurring.

Advantages of proposed system

1) In this method with the use of AI, it detects the face and the object through the blind spot to emit sound or display the image.
2) Results are more accurate with help of AI.
3) The driver is comfortable while driving since it is placed facing the driver's face.

A. Block Diagram

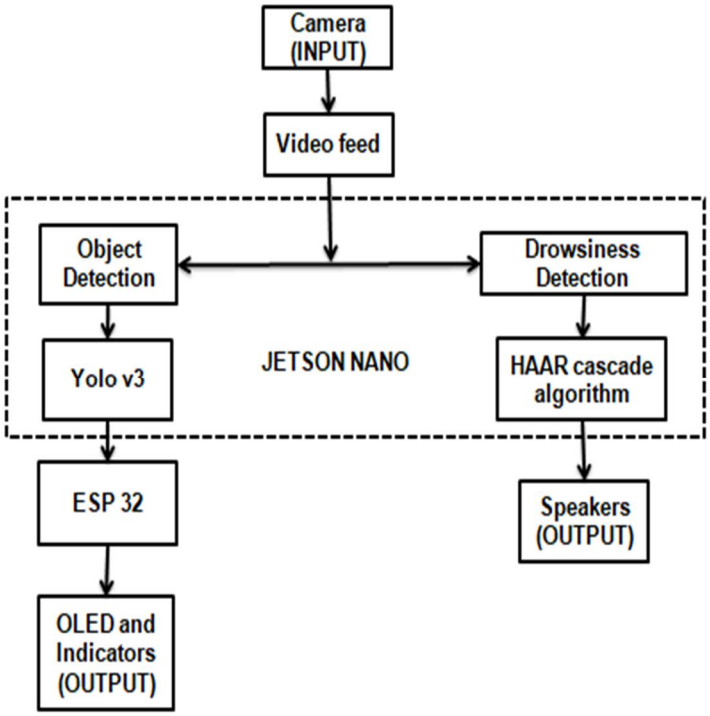

Figure 1 Block diagram of the system

The above Figure 1 represents the overall block diagram of the system. Here, the jetson nano is SOC which is capable of doing all the process within itself is an added advantage. The outputs from the JETSON NANO are given to the appropriate portion of the system using other communication protocols like Bluetooth and MQTT protocol, to improvise the user experience and provide a cable free system.

The proposed work on python library pytorch which is a open source machine learning library, this library is used in various real world machine learning and AI based applications. The proposed system comprises of two main programs each running different algorithms to detect the results required. The first algorithm is Haar cascade classifier along with neural network which detects the drowsiness of the driver and the second algorithm is yolo v3 algorithm which is a object detection algorithm used to detect the object in the blind spot region of the car. The found object is displayed in an OLED display using esp32 and MQTT protocol to transfer the message from the jetson nano to the esp32. The drowsiness model alerts the driver with an alarm when the driver goes sleeping. The below figure 2 shows the flowchart of the proposed system.

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B. Flowchart

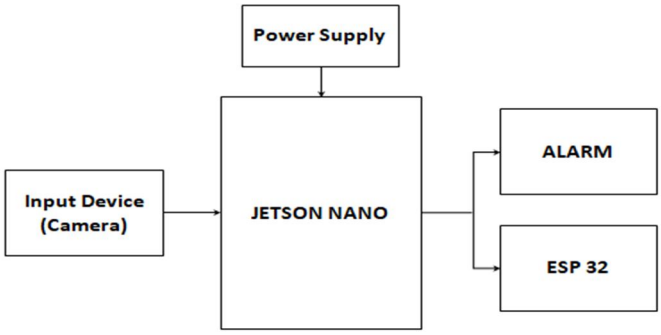

Figure 2 Flowchart of the system

IV. RESULTS AND DISCUSSION

The software that is used in the project is mainly python based pytorch and openCV.

A. Input Image

The input image for both the algorithms that is used in this system comprises of normal RGB images from a webcam which is directly connected to the jetson nano through USB connection which is seen in the figure 3 below. The video is captured from the code using open CV. The video feed is taken and used in image by image basis for the algorithm.

Figure 3 Input image for the system.

B. Haar Cascade Algorithm

The Haar cascade classifier is a open CV algorithm which is uses feature detection techniques to differentiate specific aspects of object with certain filters. In our system the algorithm is used to detect face and eyes which will be used detect the eyes for verifying that driver is awake

The output of the haar cascade classifier (figure 4) is used as the input for the next process that is the drowsiness model that has been trained to detect the drowsiness of the driver when the driver falls asleep the system detects and gives an alarm sound which will alert the driver. The below figure (figure 5) shows the output when the driver drowses.

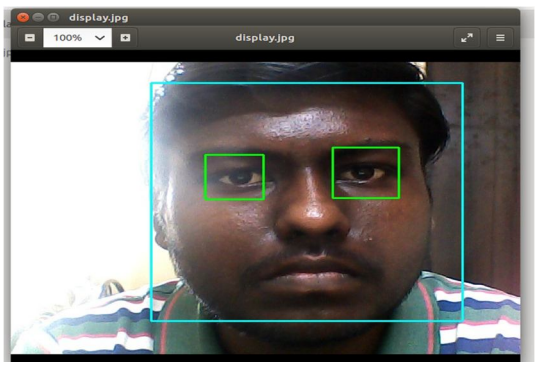

Figure 4 output of haar cascade classifier

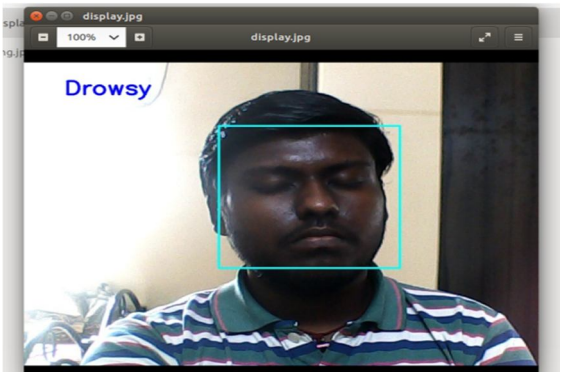

Figure 5 output of Drowsiness model

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C. Yolo v3 Algorithm

The yolo v3 algorithm is an object detection algorithm that is used in this system to find the object that appears in the blind spot area of the car while driving and turning around corners. The yolo algorithm takes input in the form of video feed from the webcam straight to the jetson nano. The video feed is taken and used frame by frame to detect the objects in the image. The pre trained weights are used for the detection of the item in the blind spot.

Figure 6 Person detected from yolov3

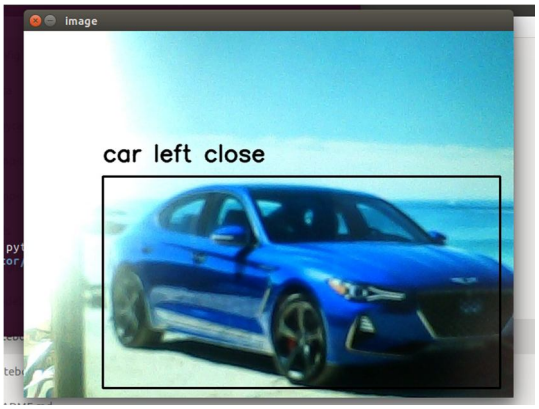

Figure 7 Car detected from yolov3.

The above figures 6 and 7 show the output of yolo algorithm for a person and car at the blind spot. The detection is done with the help of pre trained yolo weights that has been used in this system for optimum output and consistent results from the system.

D. OLED Display Output

The detection of the object is done the information must be transferred to the esp-32 module to display the output of the yolo algorithm. This where the MQTT protocol comes to action, the object detected is taken as message payload from the jetson nano and it is published in a topic on MQTT broker.

When the ESP 32 is subscribed to the topic where the jetson nano published the message the will be received by the ESP-32 as a payload. The received payload will be used to display the image of the object in a OLED display connected to the ESP -32 module.

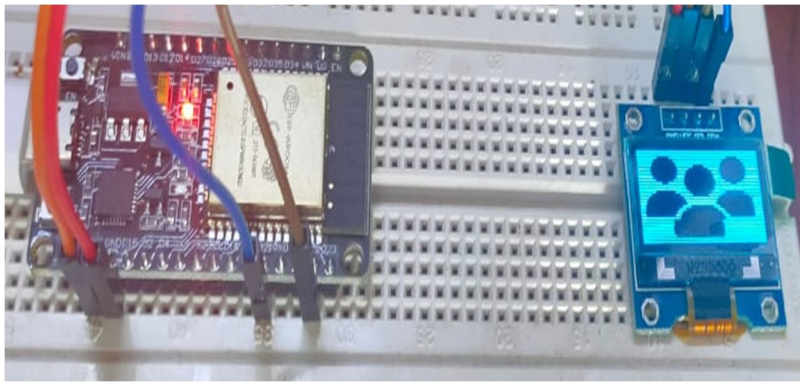

Figure 8 OLED output from MQTT message

The above figure 8 shows the output from the MQTT message to the Esp 32 from the Jetson nano.

V. CONCLUSION

In this proposed work, 2 algorithms are presented. HAAR-cascade algorithm and YOLO-v3 algorithm, which are used to detect drowsiness and blind spot objects respectively are used to prevent accidents.PY-torch performs the needed AI and webcams acts as the sensor to carryout CV and detect face and objects. The proposed work and the comparison results show how it can run everything simultaneously and the evolution of techniques with the help of jetson nano and how the results are more accurate compared to the other existing works.

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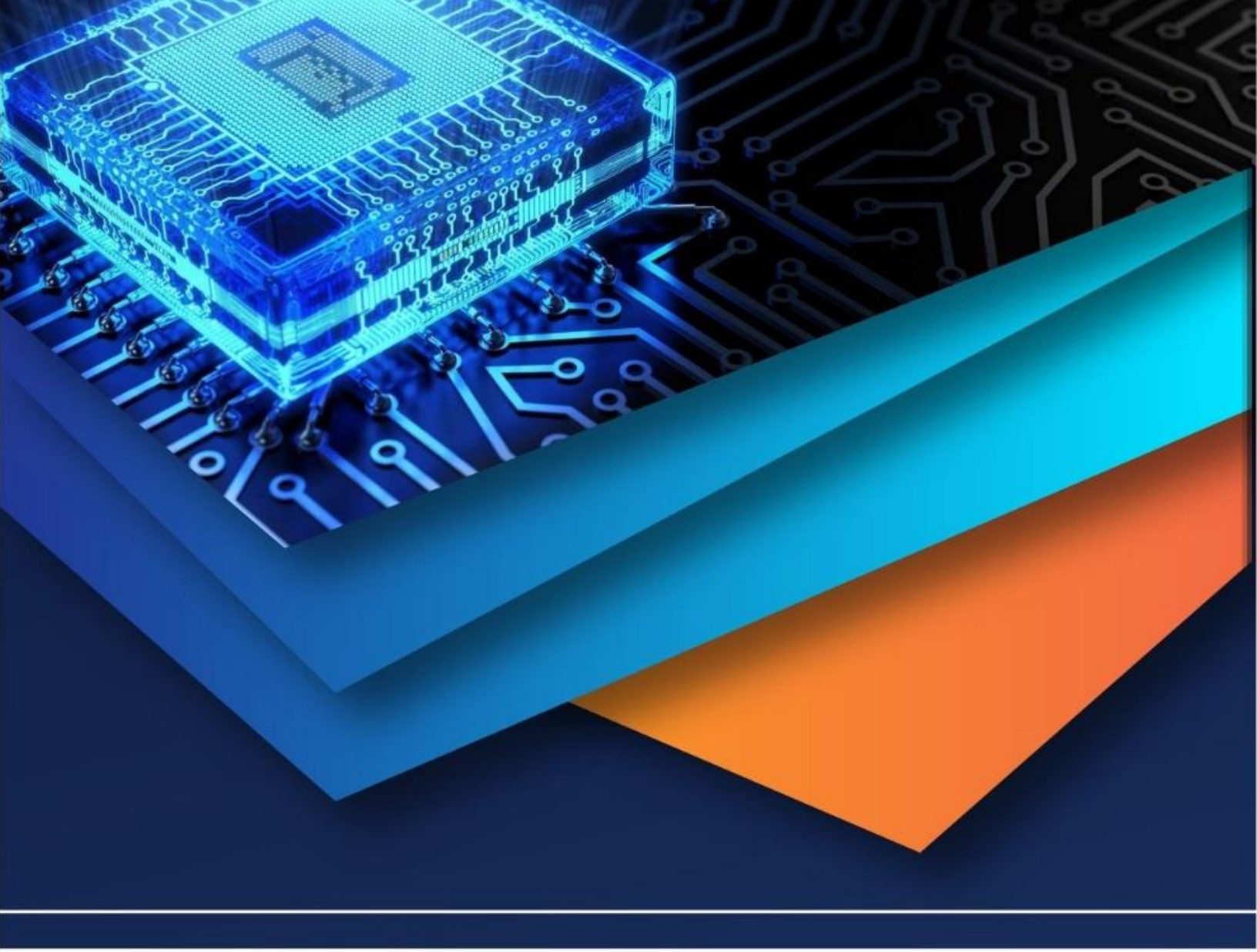

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