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IOT based Monitoring of Driver parameters for the Prevention of Accidents in a Smart City

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ABSTRACT

In India, the number of accidents has been at a steady increase over the past few years. There are almost 17 accidents that happen every hour. There are various reasons that cause accidents such as drunken driving, drowsiness, under age driving, and distracted driving as well as riding without helmet which is a very precious life saver. This system also prevents theft of the vehicle. The aim of this paper is to propose a new system which will help in tackling the afore-mentioned reasons and effectively help in preventing any accidents and help in saving lives. Along with preventive measures, the system will also detect an accident and inform the concerned authorities and people, so as to tackle the situation immediately. This system detects an accident using sensors such as an accelerometer and immediately informs the concerned people through a text message. The system provides a quirky counteraction and detection system that dispenses the definitive panacea for drivers which guarantees safety and prevents death toll by taking fitting measures in right time. This system integrates all the components in the existing systems and adds new functionalities. This system will also detect if the driver or rider is under the influence of alcohol and will take appropriate actions. The system is also equipped with a face recognition feature, where only an authorized person can use the vehicle, which helps tackle the problem of theft as well as under age driving. We have created a Vehicle-to-Vehicle (V2V) system, which works on IoT. It will help in avoiding vehicles coming to close proximity and also prevent mishaps caused due to sudden braking.

Keywords**:** *Internet of Things (IoT), Vehicle-to-Vehicle Communication (V2V), accelerometer, alcohol sensor, face recognition, ultrasonic sensor, drowsiness detection.*

I. INTRODUCTION

Gone are the days where roads use to be empty. There has been a surge in the number of vehicles on roads which has drastically increased the chaos as in traffic over the years. According to WHO's Global Status Report on Road Safety approximately 1.3 million people die each year on the world's roads, and between 20 and 50 million sustain non-fatal injuries. In India alone 4,64,674 accidents were reported causing 1,48,707 fatalities. This paper talks about integrating various technologies to prevent these accidents and save as many lives as possible.

According to NCAER, In India there is a middle-class population of 267 million. Such gigantic population does not have the financial ability to purchase a four-wheeler; consequently, they will in general purchase bike as they are reasonable. Four-wheelers have numerous parameters that take care of the safety of the driver, for example, safety belts, Airbags, Traction

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Control, Antilock Brakes and so on. While in case of bikes or two wheelers in general, whereas in two wheelers or bikes, the safety precautions like helmets are to be added externally. Many riders end up neglecting the usage of helmets. Some, drivers or riders also cause accidents due to distracted driving.

According to United Nations Road Safety Collaboration, driving after alcohol consumption is one of the primary reasons of road crashes around the world. In high-pay nations about 20% of lethally injured drivers have abundance alcohol in their blood, while in some low-and center pay nations these figures might be up to 69%. Another major reason identified is Drowsiness of the drivers or riders. Many drivers, commonly Truck Drivers cause accidents due to lack of sleep. This issue is usually observed in the highways.

Accidents also occur due to ineligible drivers, below 18 years of age. Teens in the age group of 13-18 years, go through their adolescence and are pumped up with emotions and adrenaline which leads them to rash and reckless driving with the inclusion of wheelies. Peer- pressure at times can be an added reason to this type of problem. Using data supplied by the United Nations Office on Drugs and Crime, the estimated worldwide auto-theft rate is 85.3 per 100,000 residents. We also intend to tackle the problem of theft with this system.

The Internet of Things (IoT) is the interconnection of remarkably recognizable embedded computing devices within the existing Internet infrastructure, which will help us in coordinating different parts of the system coherently This method has several advantages like high performance, user friendly even an incompetent can use it. This paper is to propose a device that helps tackle the afore-mentioned issues by creating an integrated system of technologies such as IoT, Face Recognition, V2V and Speech Output.

II. GOALS AND OBJECTIVES

• To learn and comprehend the working principle of sensors and technologies which will help carrying out this project.

• Various sensors such as accelerometer, alcohol sensor, vibration sensor, pressure sensor, etc. will be utilized in this system hence comprehending the working of each of the sensors is crucial from the development point of view of the project.

• To design a system that will contribute to the increased safety of the driver.

• After understanding the prerequisites, stipulations and specifications of all the modules we will finally start designing the system.

• To validate the driver using face recognition.

• To check whether the driver has consumed alcohol or not- Alcohol sensor will detect alcohol intake.

• To screen distances between adjacent automobiles and by communicating with neighboring vehicles over Internet

• Using V2V communication to avoid crashes.

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III. MOTIVATION

According to WHO's Global Status Report on Road Safety approximately 1.3 million people die each year on the world's roads, between 20 and 50 million sustain non-fatal injuries. In India alone 4,64,674 accidents were reported causing 1,48,707 fatalities. The prime motive behind this paper is to decrease the number of accidents and save lives.

The major motives are:

- People violating the traffic laws and driving recklessly and rashly.
- Many under-age automobile drivers causing chaos on the roads and putting their own and others' lives at risk.
- Drowsiness of driver's leading to major mishaps.
- Careless and mindless driving where some drivers do not see an approaching vehicle or sudden braking of the vehicle in front.
- Delays in rushing the inured to a nearby hospital and clearing the road to avoid further traffic.

IV. LITERATURE SURVEY

- Indranil Nikose and Tushar Raut [1] discuss a system which identifies the consumption of alcohol and whether the rider is wearing a helmet or not. This system also detects accidents by setting a timer of required duration. The system uses alcohol sensor and RF transmitter and receiver for preventing accidents, if the conditions set for both the sensors are satisfied only then the ignition occurs. If there is any occurrence of mishaps then, the timer is triggered and if the driver is not able to drive the bike again in the threshold duration specified then a text message is sent to ambulance and the enlisted contacts.
- The smart helmet proposed in [2] consists of a RF transmitter and RF receiver. The RF transmitter is placed on the helmet and the RF receiver is associated with the ignition switch of the bike. Unless and until the helmet is not worn by the driver the bike will not start which ultimately assists in preventing any lethal injuries in case of any accidents. Manjesh N and Prof.Sudarshan Raj [3] explain the design of smart helmet which is efficient of detecting accidents using a pressure sensor and a vibration sensor and also identify the site of the mishap using GPS module and impart that message to the enlisted contact numbers on the registered mobile phone using the GSM module.
- An insightful view in [4] deliberates about a system which helps drivers who have to travel often during the night time. Drivers might be prone to getting drowsy, tired or resting which in some cases prompts disaster. It utilizes Eye Blinking System (EBM) and accelerometer to identify if the driver is feeling lethargic or not if so, a caution is set off. EBM system works with the assistance of IR sensors which screens the flickering of the eyelids or the blinking patterns of the driver, on the grounds that the light gets more reflected when we close our eyes than when we keep our eyes open. The accelerometer checks whether the tilt angle is a bit beyond the threshold value.
- V2V communication is used in [5] which helps in communication of all kinds of vehicles with each other. One vehicle will communicate message remotely to another vehicle which lessens commotion contamination due to honking/blaring and furthermore informs

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both the drivers what distance they are keeping up between them which is detected by ultrasonic sensors.

- Unintended acceleration and pedal mix-up are likewise one of reasons causing lethal mishaps. The arrangements accommodated in [6] deals with such conditions. It checks if the driver is lethargic; done by image processing. The system monitors the acceleration patterns of the driver, if the person involuntarily triggers the acceleration pedal instead of the brake pedal the system configuration is equipped for transforming that speed increase into speed decrease gradually.
- The system discussed in paper [7] describes a system which maintains a client-server architecture where the driver's phone plays the role of client and the nearby hospitals, regional transport office (RTO), nearby vehicles, etc. plays the role of server. When a crash occurs the client-mobile takes the snaps of the real-time situation of the mishap location and sends to the server, validates the earnestness of the disaster and checks whether necessary measures are taken or not, etc.

V. BLOCK DIAGRAM

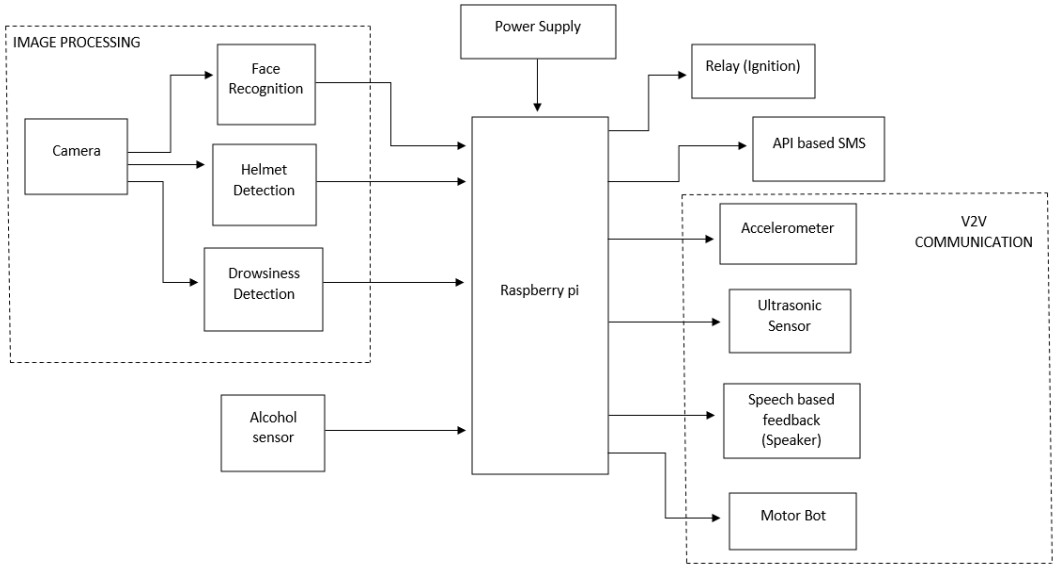

Fig 1. Block diagram of the system

V. METHODOLOGY

The system provides a quirky counteraction and detection system that dispenses the definitive panacea for drivers which guarantees safety and prevents death toll by taking fitting measures in right time. This system integrates all the components in the existing systems and adds new functionalities.

We have two main technologies in the project- Face and Helmet Recognition which falls under Image Processing and the integrated sensors along with V2V communication which falls under IoT. We use a Raspberry Pi.

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First, the system will go for Face Recognition to authenticate the user. We use a camera which will capture the face of the user and apply machine learning to recognize the face. The owner of the vehicle can register the faces of those he or she would allow to use the vehicle such as family, friends, etc. Now, the system will try to recognize if the user's face is among the registered members face. If the face is among the registered members, it will successfully authenticate and go to the next step. If the user's face is not recognized, the system will put up a voice message warning the owner and will not turn ON the ignition. So, this helps in avoiding theft and under-age driving.

Next, if the vehicle is a two-wheeler, the system will check if the user is wearing helmet or not using Image Processing. If the user is not using helmet, it does not turn on the ignition. If the user is wearing a helmet, system proceeds to next step.

After Face and Helmet Recognition, the system will check if the driver or rider is drunk. This is done using an alcohol sensor. If the driver or rider is not drunk, then the system goes to the next step.

Once these steps are done and successful, the ignition will be allowed to turn ON. Now, once ignition is turned ON, the drowsiness detection and V2V systems become active.

The Drowsiness Detection System continuously monitors the driver for signs of drowsiness and if drowsiness is observed then it immediately sets off a voice message to wake up the driver.

V2V communication which stands for Vehicle-to-Vehicle Communication, as the name suggests enables wireless communication between more than 2 vehicles. It helps prevent accidents due to absent minded driving and when vehicles come in close proximity. Ultrasonic sensors are used to keep track of distance between any two vehicles.

When the distance falls below the threshold it sets off a proximity alert and warns the driver with a voice output and simultaneously warns the other vehicle which is in close proximity using the V2V communication. V2V communication is very efficient. It also helps to avoid honking, which reduces the noise pollution levels. When vehicles are moving one behind another in traffic, then if a vehicle right in front suddenly stops, then V2V behind is immediately informed and quickly stopped to avoid an accident. Even in a scenario where there is a road block, V2V proves to be the way- when a vehicle enabled with V2V encounters a traffic jam, it can inform the other connected vehicles and their respective drivers can re-route and avoid the traffic jam.

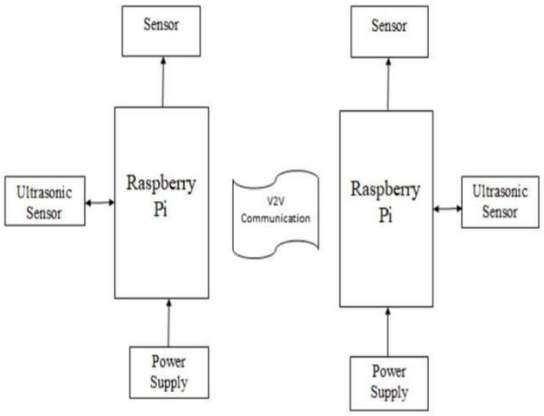

Fig 2. Block Diagram of V2Vcommunication between vehicles, using Raspberry Pi.

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The accelerometers are used for accident detection. The mobile numbers of the associated people and helpline numbers are stored in the system. If an accident occurs to the vehicle, then, the system will send a text message to the numbers stored and inform them, so as to enable quick action. All the outputs are in the form of Voice Outputs, so that the sound alerts the driver and also conveys the message. It avoids the problem of driver taking his eyes off the road and looking at the system. Instead, the driver should just listen to what the system says and can save precious time and also pay attention to the road.

VI. CONCLUSIONS AND RESULTS

This Accident Prevention System using IoT uses budding technologies such as Image Processing, Vehicle-2-Vehicle Communication and integrates multiple sensors and brings in Internet of Things. After analyzing the model, it is seen that it is an efficient system and has an upper hand due to multiple factors. The system prevents accidents by monitoring various conditions such as drowsiness detection and proximity detection, detection of drunken driving case and many more. Using this method we can track and ensure that our loved ones are safe. This also solves the problem of maintaining the traffic properly for the sake of their and others safety. It is efficient in terms of both the parameters as well as performance. The outputs and results obtained are shown below.

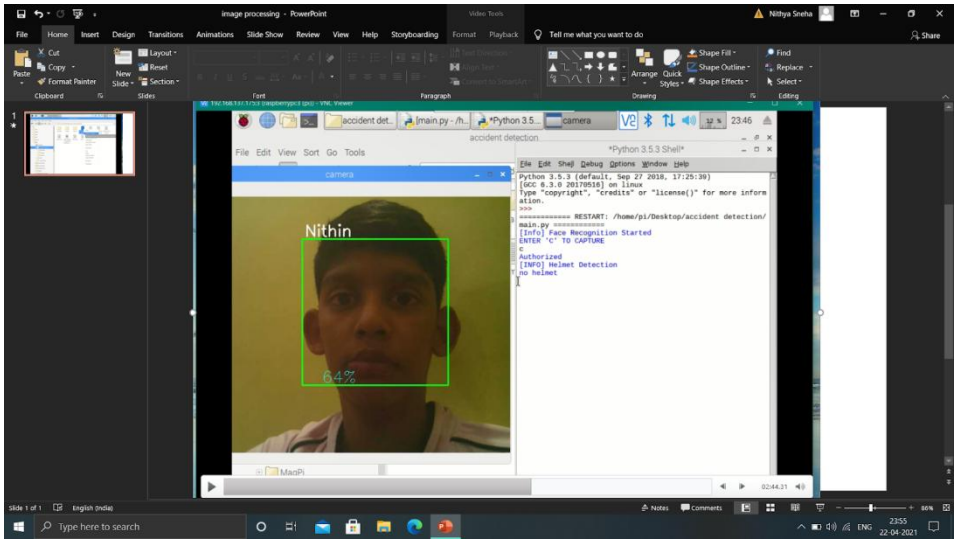

Fig 3. Face Detection Output

Before starting the vehicle, the system does a security check using face recognition. It matches the detected face with the face of the authorized users. If the face matches with one of the authorized users, then the next step is followed.

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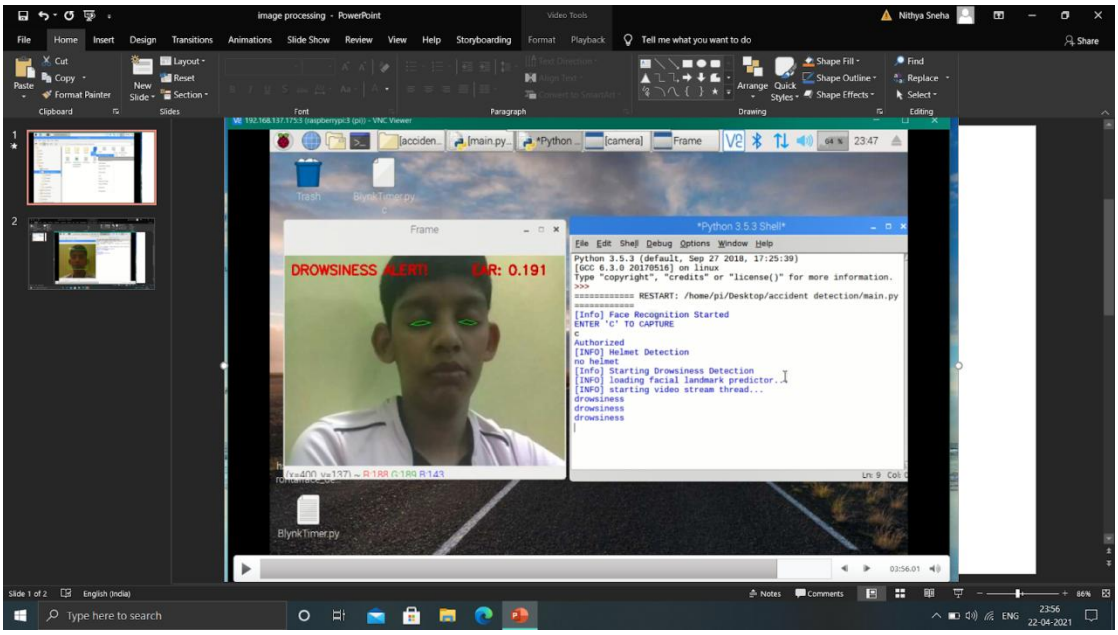

Fig 4. Drowsiness Detection Output

After face recognition, the system starts checking for drowsiness. If drowsiness has been detected it sends out an alert message in the form of voice output to the driver.

Fig 5. Accelerometer Sensor Reading

Table 1. Sensors and their Outputs

Parameters	***Description***	***Output***
Alcohol Detection Sensor	If alcohol has been detected then the ignition will be turned off	Alcohol detected
Ultrasonic Sensor	Detects for an object in close proximity (measure in cms)	3.69799 3.11 4.287
Accelerometer	Detects for accident	Accident

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From Table 1, when alcohol has been detected the relay turns off the ignition and the vehicle is not turned ON. If alcohol has not been detected then the vehicle is allowed to turn ON. Ultrasonic sensor measures and detects if an object has come to a close proximity and relays the information to the program. If the program has to brake the vehicle it informs the connected vehicles also using V2V technology.

Accelerometer sensor is used to detect accidents and a message is sent to the registered number in the case of an accident.

VII. APPLICATIONS

1. Ensures safety of riders by making sure they are wearing helmets.
2. Prevents the problem of drunken driving.
3. Prevents accidents due to drowsiness.
4. Overcomes the problem of vehicle robbery.
5. Prevents under-age driving.
6. Enables wireless communication between vehicles and increases efficiency.
7. Immediately informs concerned people in case of any mishap.
8. Main Functions are Accident Prevention and Security of Vehicles.

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