IOT Based Driver Authorization Vehicle Security System and Accident Detection and Vehicle Tracking using Android App

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***Abstract*— Now a days rate of vehicle theft is high throughout the world and the situation is even worse in developing country. Therefore protection of vehicles with an intelligent, reliable, effective and economical system is very important. Today theft is happening in the parking areas or in some insecure places. The safety of the vehicle is essentially important. The existing technologies for vehicle security have a number of limitations including high false alarm rate, easy deactivation and high cost. The proposed work is an attempt to design an advance vehicle security system that aims to provide a complete safety to the vehicle. The system can trace the path of the vehicle using an Android app and recognize the authorized user and grant access while blocking any unauthorized access of the vehicle. The system will also monitor the status of the vehicle in case of any mishappening. The system uses Global Positioning System (GPS) to determine the exact location of vehicle. The system contains GPS module, Camera module, Vibration sensors and an Android phone. The Raspberry Pi is the central controlling unit and all other components are interfaced to it. The concept of image processing is used in face detection to identify the authorized drivers. The scanned face is then matched with the entries available in the database created by the owner to maintain authorized access of the vehicle.**

***Index Terms*— Face detection, face recognition, GPS, image processing, Raspberry Pi, vibration sensor.**

I. INTRODUCTION

The need for efficient transport system has rapidly increased due to the increase in population. These days' vehicle robbery cases are more compared to earlier days. For a situation like accident, where the victims are supposed to get quick help, technology can play a vital role to minimize the loss. With a rising progression of advanced technologies, the fate of vehicle security framework is changing into frameworks of different advantages. With this constant headway, web has turned into a fundamental piece of everyone's life where Internet of Things (IoT) is the most recent and rising web innovation that has changed the way one takes a glance at things.

In this work, the rider has to go through the process of face recognition to get the access of the vehicle. The android app helps in providing the map type representation of the vehicle movement. In case of any mishappening, a notification will be generated on the app.

The aim of the proposed work is to provide a vehicle security system which would minimize the theft of vehicle. Besides it also provides the additional safety of the driver in case of any emergency.

The persons who are authorized would be able to access the vehicle. The photographs of all the drivers who would be authorized to drive that vehicle would be stored in the database. There is a camera module placed in front of the driver to take the image, when the driver sits on the seat, his photograph would be taken and scanned with the database and if the photograph matches then he would be able to start the vehicle. Image processing is used as a tool here for the purpose of face recognition. The route covered by the vehicle would be stored in the database and can be accessed using the android application. The proposed system will also be detecting accidents and would notify the specified person. The camera module would be powered by a power supply using Raspberry pi. The setup then would be interfaced with Raspberry Pi.

This paper is organized as follows. Section II discusses previously published related works. The proposed system overview is presented in Section III. The proposed face recognition and vehicle ignition is discussed in Section IV. In Section V proposed vehicle real time tracking and detection is discussed. In Section VI results are presented. Finally section VII deals conclusion.

II. RELATED WORKS

In [1], an internet-based intelligent robot security system automatically verifies an intruder in a restricted area. It proposes face recognition approach having invariant such as facial expression, viewing perspective and individual appearances. It ensures that authorized persons can effectively use internet to control a mobile robot to track and identify an intruder but it did not do anything to catch the intruder. In [2], a smart vehicle accident detection and alarming system used an android app that detects an accident and sends an alert message to the nearest police station and health care centers. However it does not measure the tilt angle which considerably affects the accident detection. In [3], an intelligent transportation system is developed to monitor the traffic flow at intersections. Rather than being based on global flow analysis, this automatic monitoring system focused on local analysis of the behavior of the vehicles. However, it could not differentiate between smaller vehicles in traffic leading to full or partial blockage at intersection. In [4], the Local Binary Pattern Histogram (LBPH) is the algorithm used to recognize the face of the person. However, the LBPH algorithm faced challenges that

it could work under the conditions of illumination, expression variation and environmental condition. In [5], the face detection is made more secure than in [4] by using Haar cascade algorithm. This paper introduced more accuracy but it involves many intermediate steps for facial recognition as a result of which it introduced considerable amount of delay.

From the survey, it is evident that the methods addressed by the cited papers highlights the drawbacks of recognition of face efficiently in low light and location accuracy. This work aims to overcoming the drawbacks by implementing efficient face recognition algorithm and increasing the accuracy of the locations traced.

III. System Overview

An insight of the project is represented through block diagram, flowchart and system hardware.

A. Block Diagram

Fig. 1 shows the block diagram of the proposed system. The block diagram consists of Raspberry pi as main controlling unit, GPS module, Camera module, Vibration sensor, Arduino Uno, MPU 6050 gyro sensors, relay switch, vehicle power starter plug and an android phone [5].

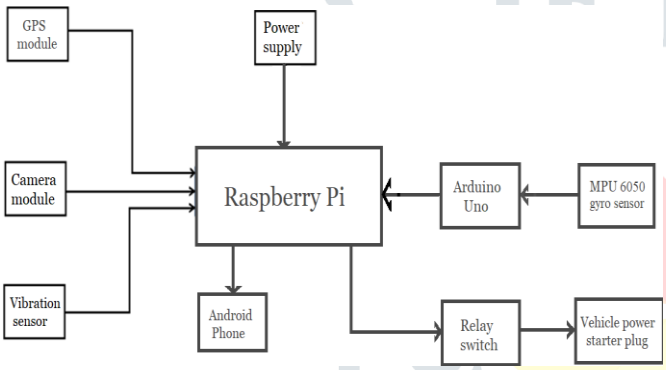

Fig.1. Block Diagram of the system.

B. Flowchart

Fig. 2 shows the flowchart of the project. The engine is turned OFF initially. When the driver sits on the vehicle, his/her face is scanned using the camera module installed on the vehicle. If his/her face matches with the authorized drivers stored in the database then the vehicle is ignited else the driver would not be able to start the vehicle. Once the vehicle is started, the entire journey travelled by the driver is tracked using GPS. This location is sent to the care taker using android app. In case of detection of an accident the exact location is sent to the care taker android app for help. If it does not detect any accident it does not send any notification regarding the accident but keeps on tracking the location of the vehicle. Finally the ignition is turned OFF at the end of the journey.

Therefore the proposed system checks the authenticity of the driver's face which turns ON the ignition of the vehicle. As the vehicle starts moving, its travelled path is tracked through the app.

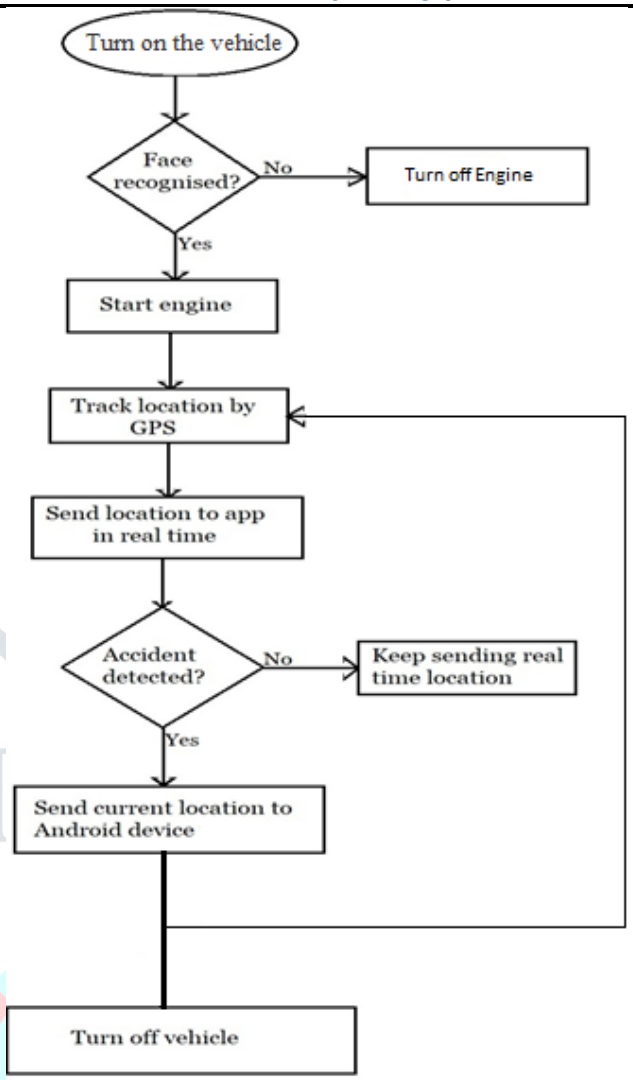

Fig. 1. Flowchart of the system.

C. System Hardware

The important hardware modules are discussed along with their role in this paper. It discusses about the Raspberry pi, GPS module, Camera module, Vibration sensor, Arduino Uno, Gyro sensor, Relay switch and Android phone [6].

1) Raspberry Pi

Raspberry pi is employed as a main controlling unit. Its function is to control other unit as well as communicate with android phone for data exchange.

2) GPS module

This module is used to get the real time location of the vehicle and track the vehicle if it gets stolen.

3) *Camera module*

It is used here for facial recognition of the driver to check whether there is authorized person or not at the driver seat. If it comes out to be an unauthorized driver, main controlling unit will turn OFF the vehicle engine.

4) Android phone

An Android phone is used here for the tracking the vehicle and display it on the map. In case of accident the vibration sensor will detect it and send location using GPS module from raspberry pi to the mobile phone [6].

5) Vibration sensor

This sensor is used for detection of the accident of the vehicle in case of accident.

6) Relay module

A relay switch of 5 V is employed here for the purpose of turning engine OFF. For authorized entry it switches ON the vehicle and for any unauthorized access it switches OFF the engine.

7) Arduino Uno

Raspberry Pi does not have analog pins. Here Arduino uno is used to interface gyro sensor through analog pins which is then transmitted to Raspberry pi serially.

8). MPU 6050 Gyroscope sensor

Gyroscope sensor is used here for detecting accident. If the vehicle tilts more than the specified threshold angle, Raspberry pi would alert the user through the app for the accident.

D. System Software

This tells about the software used in this project. The software used in this project is Android Studio, Putty software and Open CV. In this, each one is discussed in brief with their specific contribution toward the system.

1) Android Studio

Android Studio is the official integrated development environment (IDE) for Google's Android operating system. It is available for download on Windows, mac OS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as the primary IDE for native Android application development. This software is used for development of android app required for this project.

2) Putty Software

Putty is a client program for the Secure Shell (SSH), Telnet and Rlogin network protocols. It is open source software and used to run a remote session on a computer over a network. It allows control of the SSH encryption key and the protocol version. It is being used here for accessing the raspberry pi.

3) Open CV

Image processing toolbox (IMT) provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization and algorithm development. It performs image segmentation, image enhancement, noise reduction, geometric transformations, image registration and 3D image processing.

IMT apps automate common image processing workflows. It segments image data, compare image registration techniques and batch-process large data sets. It has C++, Python, Java and MATLAB interfaces and supports Windows, Linux, Android and Mac OS.

IV. PROPOSED FACE RECIGNITION AND VEHICLE IGNITION

This explains how to disconnect with a vehicle engine. It only gives access to those who have the authority to drive. The face is recognized here using an Open CV. Open CV provides a new face recognition category for face recognition. Face recognition system encompasses three main phases which are face detection, feature extraction and face recognition. Fig. 3 shows the face recognition system [4].

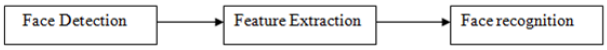

Fig. 2. Face recognition system.

A.Face Detection:

Face acquisition and localization from a human faces are separated from the objects present in an image.

B.Feature Extraction:

From the detected face the features are extracted through Local Binary Pattern Histogram. In LBPH, first the local binary pattern images are computed and then histograms are created.

C.Face Recognition:

The extracted features are fed to the classifier which recognizes or classifies image by using LBPH face recognizer present in Open CV. The classifier compares the test image with the images saved in the datasets.

D.Face detection using haar classifier

The face area is detected using the haar detect objects () function for which the face classifier xml file is passed as a parameter to the function. The number of detected faces is stored in a vector. Rectangular region of interest are then marked for the detected faces.

Creating the dataset:

The datasets are created using the webcam or the camera attached to the computer. The hundred samples per person are taken and stored in the dataset. One unique identity number to each person in the dataset is assigned.

E.Feature Extraction

From the detected face, extraction of the features is done using LBPH that is shown in Fig. 4.

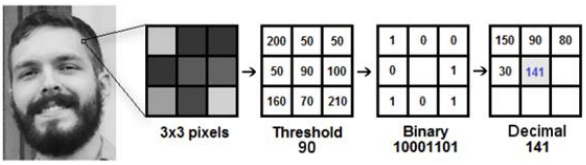

Fig. 3. Recognizer of LBPH.

The LBPH feature vector is computed which is given below:

i. It divides the examined window into cells (e.g. 3x3 pixels for each cell).
ii. For each pixel in a cell keeping center pixel value as the reference, it compares the pixel to each of its 8 neighbors' (on its left-top, left-middle, left-bottom, right top, etc.).
iii. When the center pixel's value is greater than the neighbor's value, assign "1", otherwise assign "0".This gives an 8-bit binary number (which is usually converted to decimal).
iv. It computes the histogram, over the cell of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center) is as shown in Fig. 5.

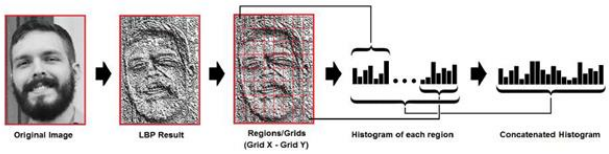

Fig. 4. Feature extraction and histogram plotting.

F. Training the dataset:

The datasets are trained for the images of each person along with their labels by LBPH, faces are detected from each image and each detected face is assigned an integer label of the person whom it belongs.

G. Face recognition

The extracted features are fed to the LBPH face recognizer and then face recognizer classifier is trained for those extracted datasets. Now, feed a new image to the recognizer for face recognition. The recognizer generates a histogram for that new picture. It then compares that histogram with the

histograms it already has. Finally, it finds the best match and returns the person label associated with that best match.

V. Proposed Vehicle Real Time Tracking and Detection

This deals with the concept of real time tracking and accident detection using GPS module and vibration sensor.

A. Real time tracking

In this section implementation of GPS tracking is explored using MQTT protocol.

MQTT Protocol:

Message Queuing Telemetry Transport (MQTT) is a messaging protocol based on standard publication ISO standards. It works on the TCP / IP protocol. It is designed for connections to external locations where a "small code footprint" is required or the bandwidth of the network is limited. The publication subscription notification pattern requires a message broker.

The GPS module is interfaced with the Raspberry pi. As soon as vehicle starts moving, the exact co-ordinate of the location is sent to the app. As the vehicle proceed the new co-ordinate are updated and the last co-ordinate is sent to the previous node. The function is implemented in a loop. The two locations are added and the process continues till the vehicle reaches the destination. The path traced by the vehicle reflects on the app.

The occurrence of an accident is detected if both the phenomenon of the vibration sensor and the gyroscope sensor satisfy the condition.

B. Accident Detection

Vibration sensors are sensors that work when a mechanical response is detected to observe the vibrations of a system. LM393 is the vibration sensor used in the work. The LM393 IC is a differential comparator, low power, single-source, low-voltage compensation. It is used to calculate the voltages at two different terminals and the voltage difference. If this change in voltage value exceeds the threshold, the buzzer begins to sound to indicate that an accident has occurred.

This will also be listed for the gyroscope sensor if the angle of rotation per second exceeds 60 degrees along with the condition of the previous vibration sensor.

Therefore, an accident can be detected if it meets both conditions.

VI. RESULTS AND DISCUSSION

In this results of this proposed work are discussed using snapshots. Fig. 6 shows the model of the project with all the connections.

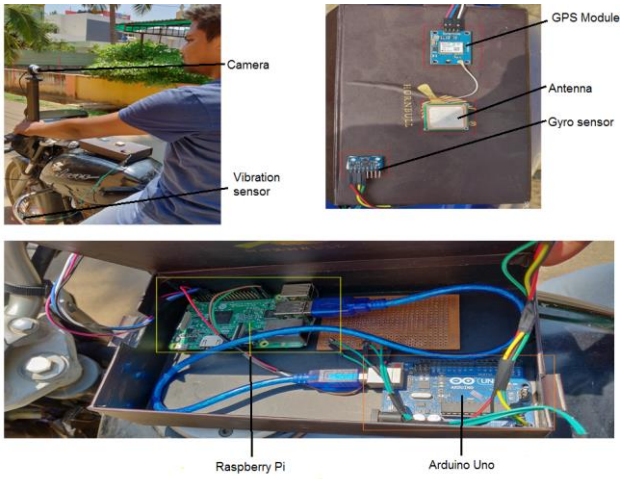

Fig. 5. Model of the proposed work with all the connections.

A. Face recognition and vehicle ignition

Fig. 7 shows the input image in which face is detected using Haar cascade classifier.

Fig. 6. Face detected using Haar classifier.

After face detection dataset is created. Different image is fed and its data set is created in day light as shown in Fig. 8 and in dark light shown in Fig. 9.

Fig. 7. Face detection and creating of dataset in day light condition.

Fig. 8. Face detection and creating of dataset in dark light condition.

Now LBPH classifier is trained for given datasets taken in previous step. After training new image is fed and it gives matched label associated with input image which is shown in Fig. 10 and Fig. 11 for day light and dark light conditions respectively. After successful recognition of face vehicle ignition is turned ON.

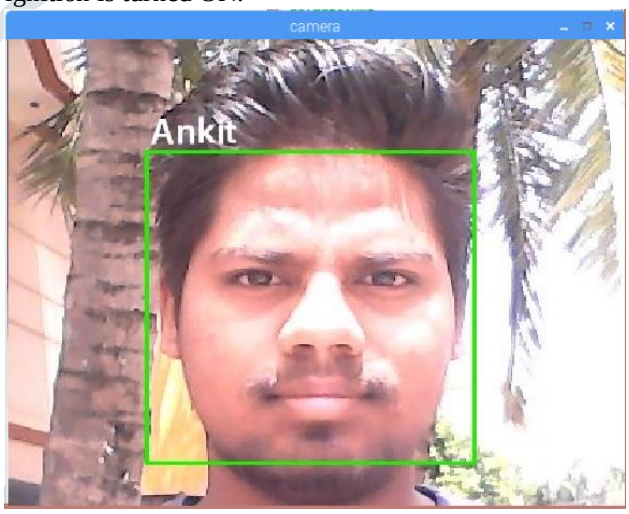

Fig. 9. Face recognized in day light condition.

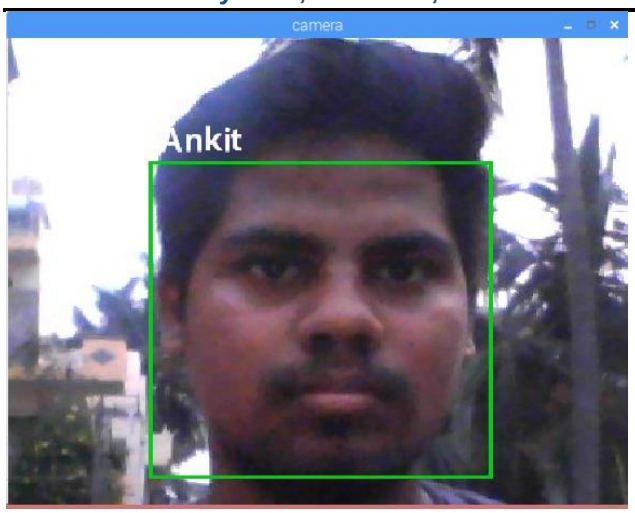

Fig. 10. Face recognized in dark light condition.

B. Real time tracking of vehicle and accident detection

The GPS is sending the data to android app and its location is indicated on the map. As the vehicle starts moving, the path is traced by the vehicle during its journey which can be seen in the app as shown in Fig. 12.

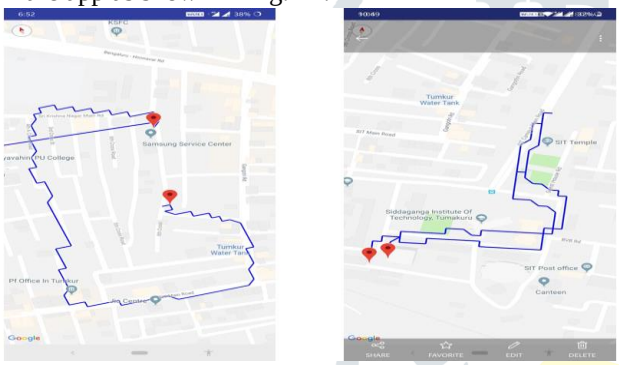

Fig. 11. Path traced by the vehicle.

In case the accident happens, accident would be detected and notification would be sent to the app. Fig. 13 shows such a situation.

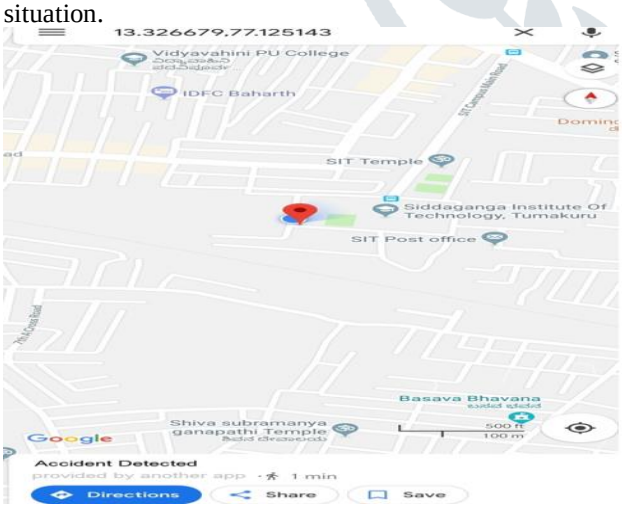

Fig. 12. Accident location sent to the app.

VII. Conclusion

The primary goal of the proposed work is to prevent the possibility of theft of any vehicle. A system is created which aims at making the transportation more secure with the help of current technologies. After the successful implementation of proposed work, the ignition of the vehicle is controlled through image processing algorithm. The vehicle doesn't start if face of the driver does not match with the authorized drivers in the database. In case the new driver has to access the vehicle then owner can add picture of the new user to the database and allow the user to use the vehicle instantly. In case the vehicle is moved to some other place then the app facilitates to track the vehicle in real time which is done with the help of GPS. Moreover, it sends the notification to the remote server in case of accident which has been achieved with the help of vibration sensor.

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