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Smart Vehicle and Anti-Theft System Using IoT

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Abstract: *A new security system is presented to detect vehicles theft. This study aims to design and implement a security system that based on internet of things technology (IoT). The system provides the owner to control and communicate with the vehicle. Accident detection and anti-theft systems are introduced in smart vehicles by using sensors and camera connected to Raspberry Pi. GPS and GSM/GPRS modules are used to find vehicle location and send it to the owner phone through IoT system. The main objective of this system for vehicles is to anti-theft and establish a connection between vehicle and its user. When any person except the owner tries to switch the vehicle on, the security system will send an alert message to the owner with the vehicle location. Moreover, the system will lock the vehicle and turn off the power. This design introduces an efficient system with simple implementation and low cost.*

Keywords*: IoT, Raspberry pi, GPS, GSM, Anti-theft, detecting accidents.*

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I. INTRODUCTION

Internet of things (IoT) is a new technique that provides interconnection of objects using networks such as 5G network. In this technique, the objects (things) can cooperate with each other and can also communicate with the users [1]. It operates by using hardware such as sensors to collect the data from the system, and using software to analysis and process these data in order to use it for the connectivity between different systems. IoT has several applications such as interaction between vehicles, tracking vehicle system, navigation, accident detection, smart parking, traffic control security and safety [2-3]. One of the main issue of using IoT in smart vehicles is anti-theft. Recently, the stolen vehicles have been increased due to the economic problems. So anti-theft system is urgent to prevent valuable things to be stolen. In addition, there has been extensive study in the field of transportation especially in accident detection and prevention as the number of vehicles is increased widely.

In this paper, accident detection, localization, remote control and anti-thief system are discussed. Section II discusses the proposed system architecture. In section III and IV, algorithms used in the paper and the hardware components are introduced respectively. The implementation and results are presented in Section V. Finally, section VI discusses the conclusion of this work.

II. SYSTEMARCHITECTURE

Two steps are used to design this structure. The first one is implementing the system to provide vehicle tracking in real time. Then, a design mechanism is designed to detect theft and notify user of theft [4-5]. The system includes Raspberry Pi accompanied by camera, GSM/GPRS module, GPS module, ultrasonic, vibration and different sensors. Figure 1 shows the framework of the system. In this system, high definition (HD) camera is used to take photos for the driver of the vehicle, and then data are transmitted to Raspberry pi by USB channel. The user database is stored in the Raspberry Pi memory unit. Image processing and detection processes are performed within the Raspberry Pi. It is also used as a control platform for this system. GSM/GPRS module is used for communication between the owner and vehicle. GPS module is used to track the current location of the vehicle. If an unauthorized person tries to drive the vehicle, his photo and the location of vehicle will be sent to the owner's phone through the GSM module. The vehicle is also locked and the electrical circuit of the vehicle is disconnected.

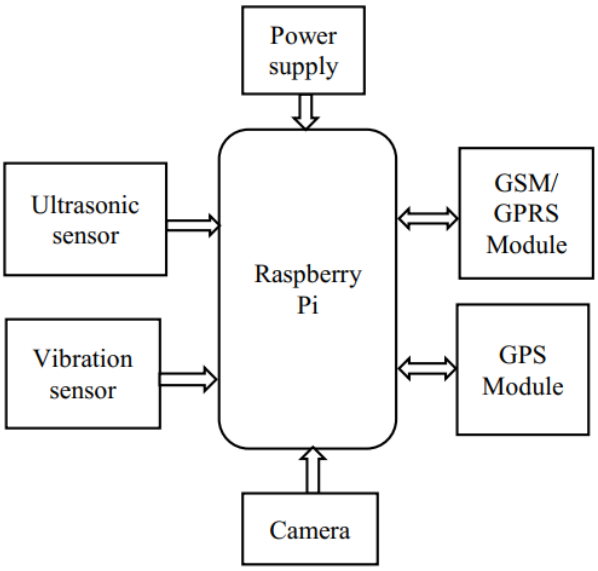

Fig. 1: System Architecture

III. ALGORITHM FOR THIFT DETECTION

The algorithm in Fig.2 illustrate our system behavior to recognize the person who try to drive the vehicle. If the person is not the owner then a message will be sent to the owner and take an action such as turn off the motor of the vehicle, close the door lock, and send its location.

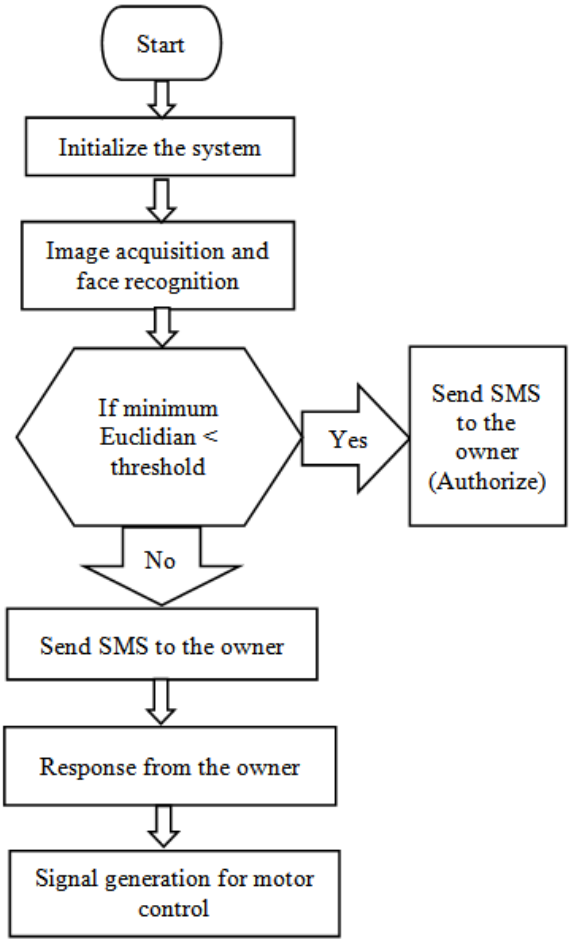

Fig.2 Algorithm for theft detection

IV. HARDWARE COMPONENTS

Raspberry pi: These controller boards provide the users with various I/O sticks to be used in development of their circuits. The model is shown in Fig.3.

Fig.3 Raspberry pi 3 model b+

GSM/GPRS module: SIM800L GSM/GPRS Module is shown in Fig.4.It is used for sending, receiving SMS, making and receiving voice calls.

Fig.4 SIM800L GSM/GPRS Module

GPS module: It works on the basis of satellites that help us detect geo areas, and time information to the person using the GPS module. NEO-6M GPS module is shown in Fig. 5. It gives the best possible positioning information and includes a larger built-in 25x25mm active GPS antenna with a UART TTL socket.

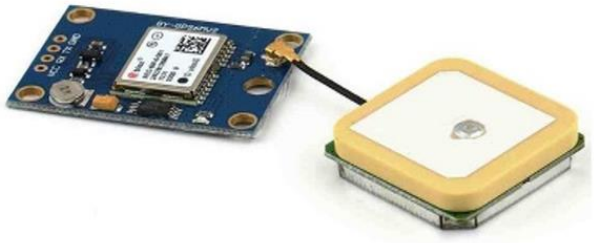

Fig.5 NEO-6M GPS Module

SENSORs: In this system, some sensors are used such as vibrating sensor and ultrasonic sensor as shown in Fig.6 which are mainly used for detection early accident.

Fig. 6: a) High Sensitivity Vibration Sensor, b) HC-SR04 Ultrasonic sensor

V. IMPLEMENTATION AND RESULTS

The IoT device is built with Raspberry-Pi with ultrasonic and vibration sensor. The Raspberry-Pi is also connected with GSM/GPRS and GPS modules. It was also equipped with a camera directly on the board. Firstly, a training images are added to the system as shown in Fig.7.Then, the system is run to make face detection and extract 128-d embedding. Three images are entered to make a test and check the results. The

system can recognize the person if he is the authorized person and gives his name or not. Figure 8 shows two authorized persons and Fig. 9 shows unknown person. For unknown case, GSM module will send a message to the owner which contains person's photo and location of the vehicle. An example of the message text that will be sent is shown in Fig.10.

(a)

(b)

Fig.7 Training images for (a) Ahmed, (b) Moaz.

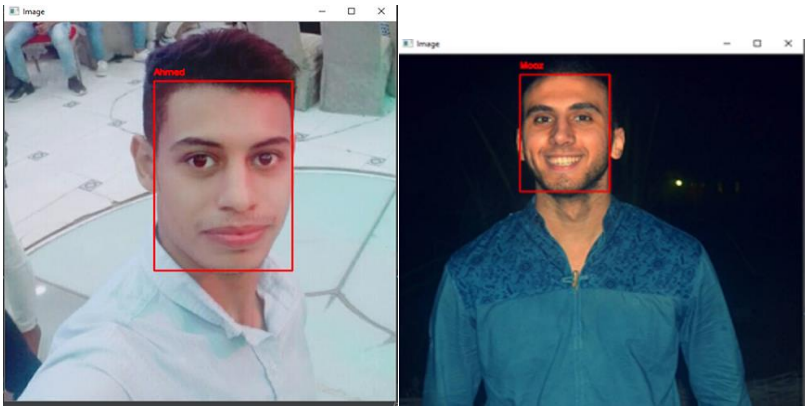

Fig.8 Result image for owners

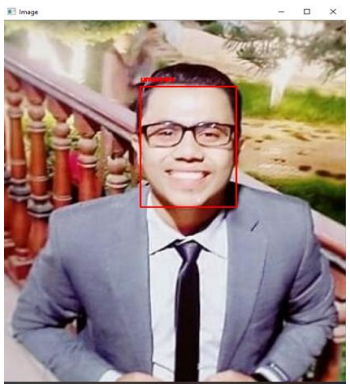

Fig.9 Result image for unknown person

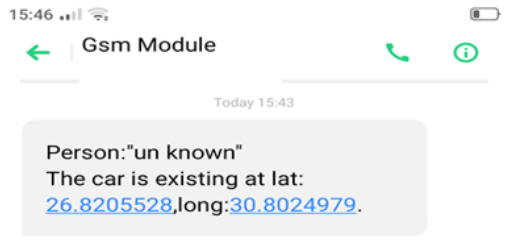

Fig.10 An example message from GSM

VI. CONCLUSION

The developed system effectively provides an application of connected devices or internet of things in vehicle anti-theft. The system includes a Combined GPS+GSM Module which can track the location of the vehicle via the GPS antenna implanted in the vehicle. Thus, this system is an integration of several modern embedded and communication technologies.

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