Implementation of a Vehicle Safety Monitoring System for Security Enhancement using Internet of Things

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Abstract: Vehicle theft has become an issue of major concern during the recent times. Even though many measures are taken by the police to curb this menace and grab the culprits promptly, the number of thefts occurring are on the increase. This is due to the rapid technological development which has made it easier to commit the crime. Hence this paper proposes a method to accurately track the vehicle and the intruder so that appropriate action can be taken. Internet of things is used **t**o communicate the location and the details of the intruder to the user.This paper also discuss the advantages of using Raspberry PI as the controller for developing this product.

Keywords: Theft detection, Raspberry PI, Internet of Things

I. INTRODUCTION

Technology is developing at a rapid pace and the occurrence of relevant social evils along with it. Private transport has become one of the most essential commodities for human existence. With the economic growth of our country the quality of life of the people has also improved. Almost all people have their own vehicle for transport. With this development one of the most distressing issues faced is the rising vehicle theft .To curb this evil several vehicle theft monitoring systems have been developed in the past. All these systems help in tracking the vehicle, but they fail to provide a clear picture of the intruder.

The main aim of installing a vehicle theft monitoring system is to keep track of the vehicle's location and be able to take immediate action if any unfortunate event occurs. Sensors and controllers play a very important role in developing such a system. With the development of several microcontrollers, the development of theft monitoring systems has been on the rise. Proximity and vibration sensors help in detecting any unusual presence. This system can be upgraded to monitor the emission level of the vehicle to limit air pollution. This system has been developed separately. In this paper integrating both these systems has been considered so that it provides maximum benefits to the user.

II. EXISTING SYSTEM

This section presents an overview of the existing vehicle theft monitoring systems that have been developed over the years.They have been identified from the literature available.

A. System Description

The existing system includes a GPS modem which collects the location of a vehicle in terms of its coordinates. This data is given to the microcontroller which is interfaced with a GSM modem.

Microcontroller used which may be Arduino or PIC obtains the location details from the GPS and sends it to the user in the form of an SMS over GSM modem on intervals so set by the user.

B. Drawbacks of the Existing System

The main disadvantage of using the above system for theft monitoring is that it does not provide any details about the intruder. The location of the vehicle is tracked and sent as a message to the user. With several technological developments the intruder would be able to easily steal the vehicle without being caught. Hence to avoid this and to make the work of tracking the intruder easier for the police, the system should include a mechanism to collect the details of the intruder and send the same to the user.
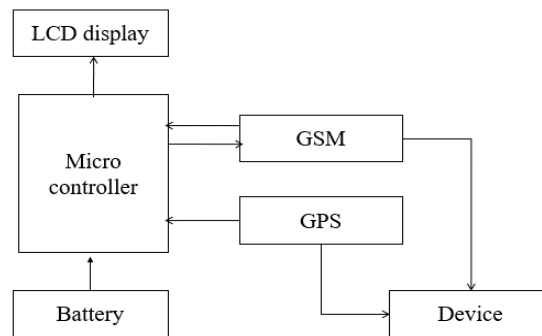
Fig. 1 Block Diagram of the Existing System

III. PROPOSED SYSTEM

This section presents the operation of the proposed system and the details of the components used to develop the system.The block diagram of the proposed system has been represented in Fig.2

A. *Overview of the system*
The system proposed in this paper has been designed to meet the following objectives.
- The main objective is to implement a theft detection system to reduce the menace of vehicle theft.
- To provide accurate details of the intruder by sending images and location to the user through IOT and GSM via e-mail and personal message respectively.
- To monitor the CO emission level of the vehicle.

B. *Selection of components*
The main components involved in developing this system are the sensors, microcontroller and the location tracking devices.

1) Sensors:
To meet the objectives of the proposed system sensors must to be used to detect the presence of any object or human near the vehicle.Three types of sensors are used.
PIR Sensor:
This sensor being sensitive to heat and infra-red radiations help in the detection of human presence near the vehicle.
Vibration Sensor:
This sensor is used to detect any unusual movement the bike may be subjected to. The piezoelectric transducer in the sensor help in the detection of abnormal vibrations. A threshold level has been set for the sensor. If the vehicle is subjected to movement above the provided threshold the user is alerted.
Gas Sensor:
In addition to detection of the vehicles location and condition,this proposed system also helps in the detection of the amount of CO emitted.The MQ7 Gas sensor has been chosen for this application due to its high stability and sensitivity.

2) Raspberry PI
The Raspberry PI 3 module has been used in this application owing to its compact size and user friendly interface.This module collects the output of the sensors and provides the appropriate output to the GSM and GPS module.Another important feature utilised is the Raspberry PI camera module which is used to capture the face of the intruder.This is sent to the user for further action to be taken.As this camera module is extremely small in size its presence is unnoticeable which is highly advantageous in this case.

3) GSM and GPS
The GPS module is used to track the location of the vehicle according to the output from the Raspberry PI module.This is communicated to the user via text message and e-mail.In order to send the coordinates of the vehicle as a text message the GSM module is used.The GPS module used is the U BLOX_G7020 withTTL which has an inbuilt antenna and an output baud rate of 9600 bps.The GSM modem is interfaced with the controller via a USB port.

C. *Software Description*
Python has been used to program the microcontroller as this platform is extremely easy to code.The Internet of things technology is used to send the captured image and the location to the registered mail id of the user.The user can also

access the information about the vehicle and the intruder any time after the occurrence of the incident via a weblink that will also be sent to his mail.
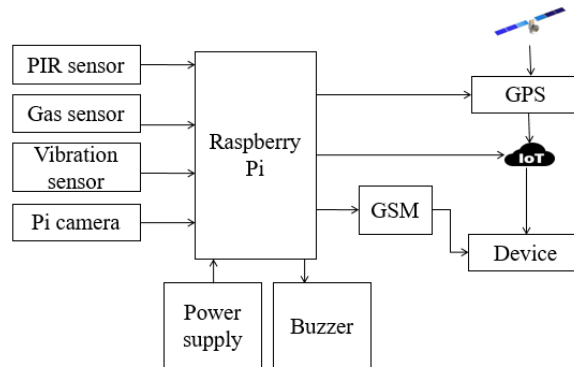

Fig. 2 Block Diagram of the Proposed System

D. *Operation*

This module operates in two modes.Once the vehicle is parked by the user ,he/she can put the vehicle in THEFT MODE by operating a switch.When in theft mode,the sensors used in the system will detect the presence of any object or human and send the signal to the controller. the controller then acts as a processor.If the PIR and Vibration sensors output is high then the signal is sent to the Raspberry pi.

The intruders face is detected with the help of the pi camera which gets on as soon as the PIR sensor in the automobile senses the motion or vibration sensor detects the vibration level and then information is sent as an alert message to the user through mail with the intruder's image being attached which will be helpful in catching the intruder.The amount of CO emitted will also be sent to the user as a text message which helps in regulating it.

When the vehicle is being used by the user,he/she can put the vehicle in USER MODE.

IV.RESULTS

Case (1); Normal mode
      When the bike is in normal condition, the module does not take an any action.

Case (2); Theft mode
      When the bike is in theft mode, then the three types of sensor will act and the pi camera capture the image which will be mailed and the coordinates will be sent as a message to the user.

Fig.3 &4 represent the e-mail and message received by the user.The email contains the image of the intruder and details about the location .The text message has details of the coordinates and the CO emission level.
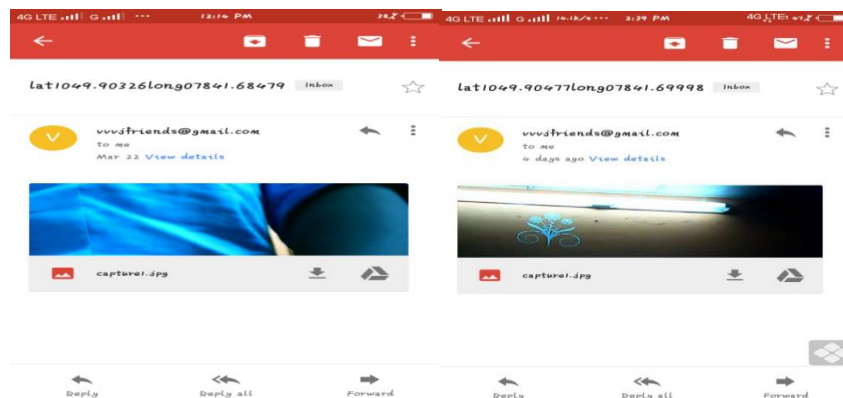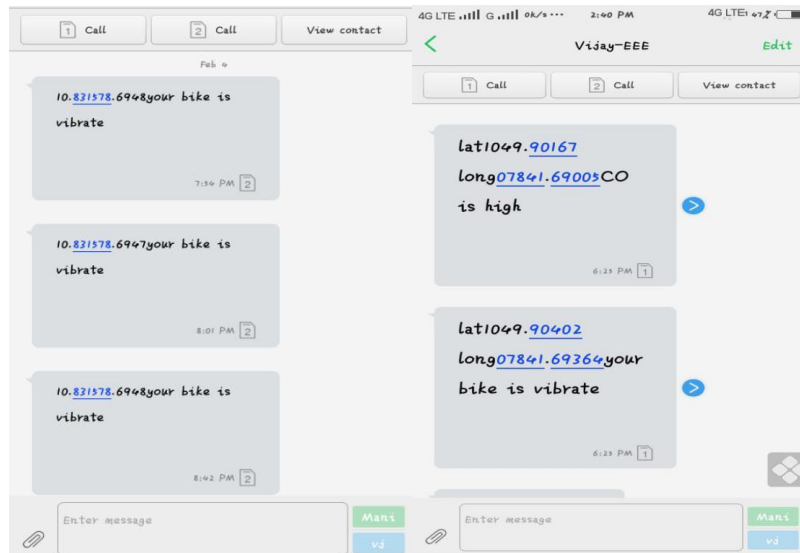

Fig. 3 E-mail received by the user

Fig. 4 Text message received by the user

V. HARDWARE IMPLEMENTATION

The proposed system has been implemented in real time and the output displayed in the previous section has been obtained. Fig 5 & 6 represent the hardware implementation of the proposed system.
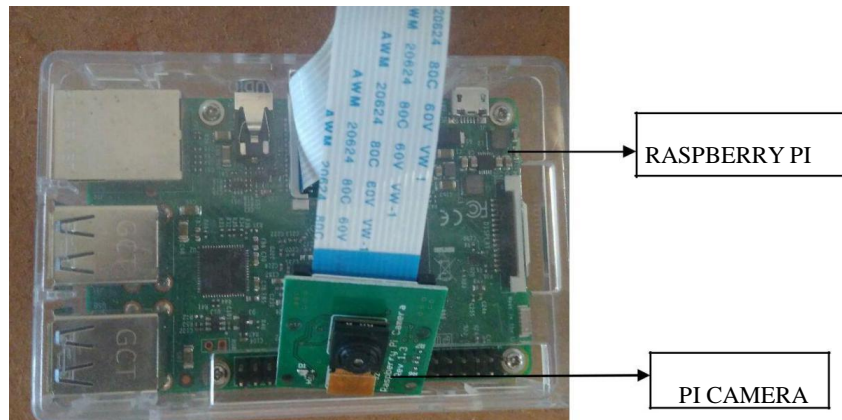

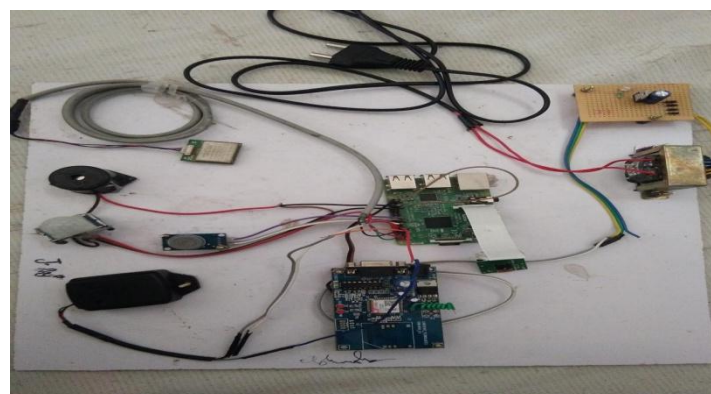Fig. 3 Raspberry PI module along with the PI camera

Fig. 4 Block Diagram of the Existing System

VI. CONCLUSION

In the present world, safety of is a matter of great concern. The implementation of a vehicle theft detection system has been discussed in this paper.The striking features of this system is its ability to capture the face of the intruder and provide the details to the user.Another important advantage is the ability to operate in two different modes so that it does not cause inconvenience to the user. When compared to the previously developed systems the time delay after which the user receives the message is extremely less as the processor used is Raspberry PI. This system can also be extended to provide industrial and domestic security by including face recognition.

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