An IoT based Anti Theft Detection and Notification System for Two Wheelers

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Abstract - **In this paper, a new system is proposed for the security of two-wheelers from theft. This system is an attempt to design an advance vehicle security system to prevent theft and to determine the exact location of the vehicle. The safety of the vehicle is exceptionally essential. So, the system is designed using GPS and GSM technology. The preventive measure like ignition cut-off and also the fuel theft detection is installed in the vehicle which is controlled by the GSM mobile. This system can be accessible through a mobile Application.The system goes live using the command received from the application and all the sensors are activated. The sensors continuously monitor the vehicle and any change in the reading gives alert to the user application through GSM. There is an emergency button in mobile which sends the information regarding the vehicle that is been stolen to the police database.**

Keywords: **Two-wheelers,   GPS,   GSM,   Mobile Application, ignition cut-off**

whole system. The system receives commands from the application and all the sensors are activated. The ignition coil goes offline using relay to prevent the wire tampering and duplicate key usage. Thesensors continuously monitor the vehicle and any change in the reading gives alert to the user application through GSM. The ultrasonic sensor detects the uplift of the vehicle by stranger. The float sensor monitors the level of fuel in the tank. All these sensors are connected to Arduino which is in-turn connected to GSM that sends alert message and a buzzer fixed within the vehicle produce high noise to indicate vehicle theft. There is an external casing provided to protect the entire system. There is also an emergency button in mobile app which sends the information regarding the vehicle that is been stolen to the police database so that it is easy for the police department to find the vehicle in a shorter period.

I. INTRODUCTION

In this modern era, security for all the vehicles is reducing day by day especially two wheelers. Bike theft has become a major issue as bikes are typically stolen from streets or parking lots and by the time people realize the situation, the vehicles are sold or dismantled. Currently, the security systems available for two-wheeler are very costly. So, the bike companies are not able to implement the security system as it increases the total cost of a two-wheeler. Therefore, the device we have designed for the two-wheeler consists of mobile app that controls the

II. RELATED WORKS

In this paper, a system is proposed to provide greater safety in order to reduce the probability of vehicle theft. This paper introduces a smart anti-theft system for vehicles using mobile phones. It deals with controlling the vehicle engine via mobile phone through Short Messaging System (SMS).The main intention behind the system design is to provide communication between the owner and the vehicle so as to give him a remote access to control his/her vehicle's engine function. The proposed system is smart enough to detect the trusted owners. Every time the system senses an ignition, it makes an attempt to

authenticate the owner. In case authentication fails, the system immediately turns off the engine and prevents the vehicle from being stolen. It may pose some working problems due to heating concerns based on where the module is placed. The system did not address the worst-case scenario of fuel theft. It is not visible to the third person and hence cannot be damaged or tampered with. Its usage is not restricted to mobiles with Android platform. It can be implemented on all type of vehicles (with engine). It provides a remote access of engine control to the user. It is very cost-effective and cost-efficient. Since it senses the ignition, the vehicle does not get to go far from the parking space and can be easily located. It takes care of the worst-case scenario, i.e., when the user is unable to respond to theft alerts timely and shuts off the engine automatically. [1]

In automobile field, the security and theft prevention are commonly used for the four wheelers and not they do not concentrate more on the two wheelers. Previously, GPS is used to get the current position of the two wheelers and that data will be sent to the user mobile phone through the GSM. In this paper, implementation of theft prevention in two-wheeler is done using GSM, GPS and Android technology. The position of the two-wheeler is obtained through the GPS module, which sends the position to the microcontroller, which then sends the message to the user smart phone through the GSM module. Android application helps the user to stop the vehicle under theft. Use of android application helps in preventing the theft more efficiently. Use of GPS module helps in efficient tracking of the system through the microcontroller. Vehicle tracking is done quickly using GSM and GPS modules. If the theft has happened, then the owner is immediately indicated through SMS consisting of current GPS location of the vehicle. In this paper the problem of duplicate key usage is not addressed as the system concentrates mainly on tracking of the stolen vehicle rather than duplicate key usage. Secondly, the problem of lifting the vehicle without driving is also not addressed in this paper. More technology would require to solve these issues. [2]

This paper introduces a vehicle tracking system and an anti-theft system that works mainly using GSM-GPS and other open-source technologies which makes it cheapest system for Fleet Management, safety and security. When the vehicle is not being used by the owner,the system checks for change in GPS coordinates of the vehicle. Once the location of vehicle changes, owner is immediately notified via text SMS Message. The text SMS message consists of current GPS Location of vehicle and a warning

message. The owner then sends a SMS, which instructs the microcontroller to turn OFF the vehicle by switching the relay supply of the battery of the vehicle.Vehicle tracking is done quickly using GSM and GPS modules. If the theft has happened, then the owner is immediately indicated through SMS consisting of current GPS location of the vehicle. In this paper the problem of duplicate key usage is not addressed as the system concentrates mainly on tracking of the stolen vehicle rather than duplicate key usage. The problem of lifting the vehicle without driving and the problem of fuel theft are also not addressed in this paper. More technologies and advanced use of IOT would require to solve these issues. [3]

In this proposed security system various features are included along with the engine immobilizer and alarm. Few of the important features supported by this system are alerting owner by SMS about the theft attempt, allowing user to control the system remotely by SMS, tracking the location of vehicle using GPS technology, Remote Keyless System, servo motor operated locking system (handle lock, fuel lock and rear wheel lock) and side stand indicator. The owner is immediately alerted through SMS about the theft attempt as the location of the vehicle is tracked through GPS. The system is designed in such a way that it is compatible by all the brands of vehicle. Servo moto locking system is an important feature that protects the vehicle by locking the fuel area, handle and rear wheel which maintains extra security. In this paper, the user will be informed only after the theft and there is no proper user interface to monitor the vehicle. The problem of lifting the vehicle instead of driving it is also not been addressed properly. [4]

In this paper, a new security device is proposed for the protection of a two-wheeler from theft. This device works on the Wi-Fi module, which can be accessible through a web page or Android app. There are lots of security systems available in the market which are easily detectable & hack able by the thieves, these systems work on the remote control or GPS or GSM. Through this device, we are providing efficient security to two-wheeler; this device also has an additional feature of finding the two-wheeler in the dense parking area. For sensing the position of the vehicle, tilt sensor is being used which shows that two-wheeler has been moving from their still or bending position. Vehicle is tracked quickly using GSM and GPS modules. This paper covers all security functions like tilt sensor, when somebody tries to move the vehicle or if the WIFI is not connected to the authentic device. The system

also produces a buzzer sound when somebody tries to ON the ignition. But the problem of fuel theft and duplicate key usage to access the vehicle are not addressed in the system. [5]

Smart bike monitoring system[6] provides three features that saves the life of people who met with an accident by detecting accidents and send SMS alert to their well wisher, giving exact location of vehicleusing location tracking, and side stand automation mechanism to secure and balance user.

Paper[7] used RISC based ARM processor to authenticate the user through face recognition. On unauthorized access it use MMS to intimate the owner along with location information through GSM.

Authors[8] used Blockchain technology to secure the inbuilt RFID tag of the electric vehicle at charging station. At charging station the authenticity is verified from block before charging is initiated else information to the owner is sent.

III. PROPOSED SYSTEM

The main objective of this paper is to implement an Anti-theft system for two wheelers which has to be easily handled by the owner and protects the vehicle by alerting the owner immediately in cases of chances of theft. It is also essential that the system has to be compact and easily maintained. Therefore, the proposed system consists of mobile app that controls the whole system. The system goes live using the command received from the applications and all the sensors are activated. The ignition coil goes offline using relay to prevent the wire tampering and duplicate key usage. The sensors continuously monitor the vehicle and any change in the reading gives alert to the user application through GSM. The ultrasonic sensor detects the uplift of the vehicle by stranger. The float sensor monitors the level of fuel in the tank. All these sensors are connected to Arduino which is in-turn connected to GSM that sends alert message and a buzzer fixed within the vehicle produce high noise to indicate vehicle theft. There is an external casing provided to protect the entire system. There is an emergency button in mobile which sends the information regarding the vehicle that is been stolen to the police database. The project is built using various tools and software. The project is divided into three major modules:

1. The android application
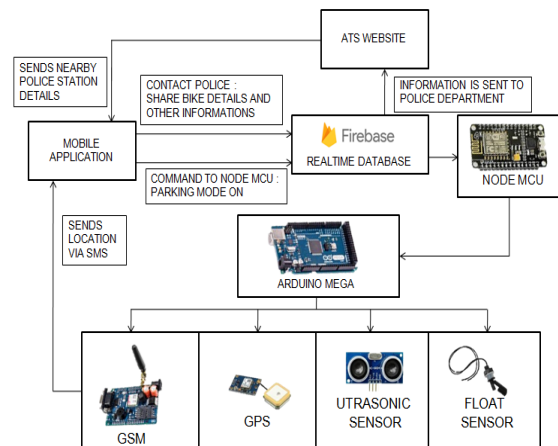2. The hardware system
3. The ATS web application

Fig.1 System Design

IV. HARDWARE MODULES

The hardware system is built using components like NODE MCU, Arduino mega, GPS, GSM, Float sensor and Ultra sonic sensor. They are programmed using Arduino IDE with embedded C to perform the tasks assigned to them. It is connected to the firebase to communicate with the mobile application.

A. Node MCU 8266

Node MCU (Node MicroController Unit) is an open-source firmware and development board specially for IOT based applications. It is built around on an inexpensive System-on-a-Chip (SoC) called the ESP8266 which is designed and manufactured by Expressif systems containing the major elements of a computer like CPU, RAM networking andeven a modern operating system and SDK. This module helps in connecting this Anti-theft system with the firebase real-time database.

B. Arduino Mega 2560

The Arduino Mega 2560 is a microcontroller board which is based on the ATmega2560 which has 54 digital I/O pins, 4 hardware serial ports, 16 analog inputs, 16 MHz crystal oscillator, a power jack, an In-circuit Serial Programming (ISCP) header and a reset button. All sensors of the ATS system are connected to this module and specific instructions are given to different sensors using this module.

C. GPS Neo6m

This is a complete GPS module that is based on the Ublox NEO-6M. This unit uses the latest technology to give the best possible information and has got a built-in 25 x 25mm active GPS antenna with a UART TTL socket. This module is used to find the exact location of the vehicle.

D. GSM module

A GSM module is a hardware device that uses GSM mobile telephone technology for providing a data link to a remote network. Here It sends the coordinates of the vehicle to the mobile application.

E. Ultra-sonic sensor HR-SR04

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4-pin module, whose pin names are Vcc, Echo, Trigger and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. In this Anti-theft system, it is used to detect the uplift of the vehicle.

F. Float sensor

A float sensor is a device used for detecting the level of liquid within a tank. This sensor may be used in a pump, an indicator, an alarm, or other devices. Here in this system, it detects the decrease in level of fuel.

G. Casing

It is where all the sensors are present and it is locked using electro-magnetic lock. It provides an extra protection to the system from theft.
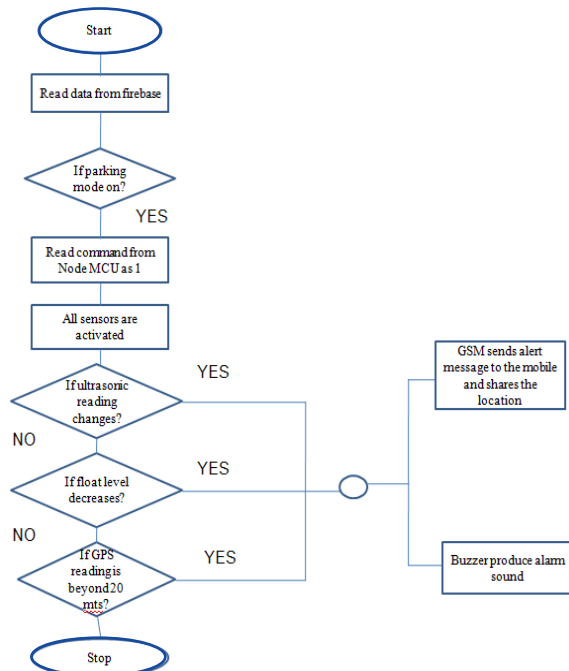

Fig.2 Hardware module algorithm

The hardware system is built using components like NODE MCU, Arduino mega, GPS, GSM, Float sensor and Ultra sonic sensor. They are programmed using Arduino IDE with embedded C to perform the tasks assigned to them. It is connected to the firebase to communicate with the mobile application.

V. SOFTWARE MODULES

A. The ATS Website

The website is used by the Police department where they receive the details of the two-wheeler that is been stolen. The site shows all the required details of the vehicle and also its current location. Once the user presses the emergency feature in the mobile application the web application receives all the vehicle related information. The admin will then contact or direct the user to the nearby Police Station and also inform the station officials about the theft. It will always be monitored by an admin. It is built using Microsoft visual Studio with HTML, CSS and Java Script. The website is also connected to the firebase database to receive data.

B. The ATS Application

The application helps in interaction between the user and system. This android application consists of a sign-up page for new users and a login page for the registered users. There is also a reset password option for changing the password which is done through email verification. The application is built using Android studio 3.6.0 and is used to interact with the hardware system using Firebase Real-time Database(Baas). Google maps and Google API are used in locating the exact location of the vehicle.

Various features involved in this system are:

1. Parkingmode: This module brings all whole system live. All the sensors begin to react with the environment and give data to the Arduino. Also, the ignition coil of the vehicle goes offline.
2. Track my vehicle: This module helps in locating the exact location of the vehicle using Google maps.
3. Casing: This module is used to unlock the casing.
4. Emergency mode: This module sends all the vehicle related information to the ATS web application.
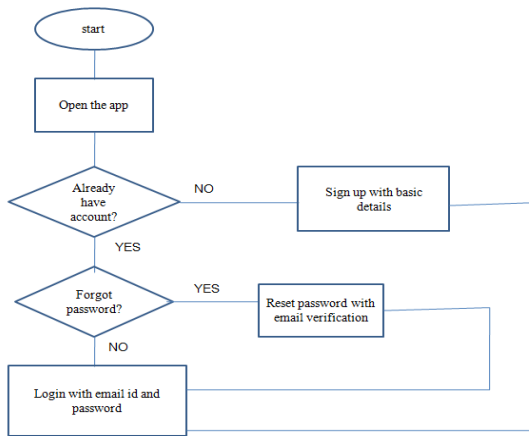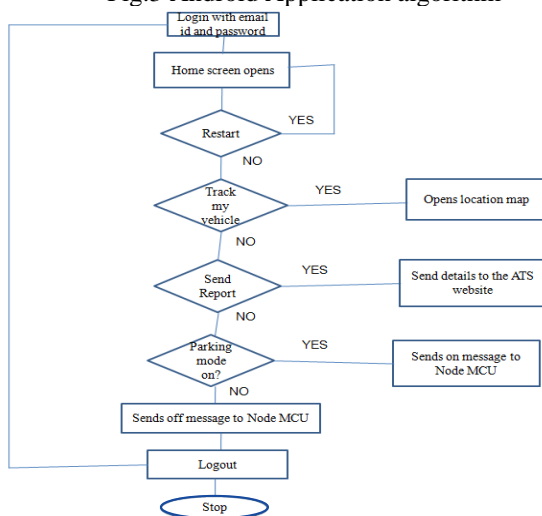
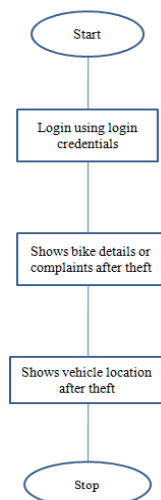Fig.3 Android Application algorithm

Fig.4 System features working

Fig.5 Web page algorithm

VI. RESULT

The system is developed successfully with an Android application and web page for more easy interaction between the owner and the police station in case of theft. In the mobile application, the sign-up page consists of all basic details of the user for registration. Once the sign up is done, the user will have an account of their own and can login using their email id and password. The system features like parking mode, restart, track my vehicle option helps in easy access. The intermediate results of the mobile application and the real time database of the firebase are shown below through Fig.6 to Fig.10.
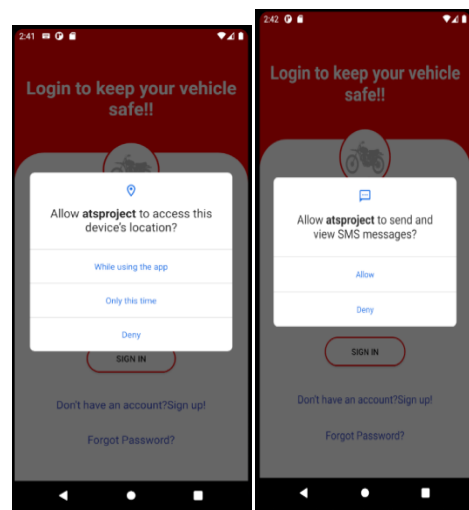

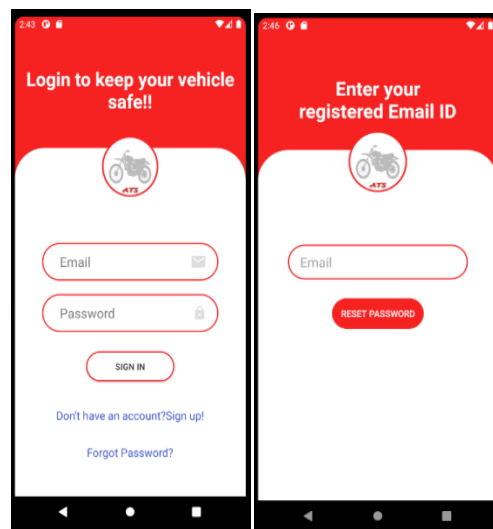Fig. 6 Location access and SMS access permission
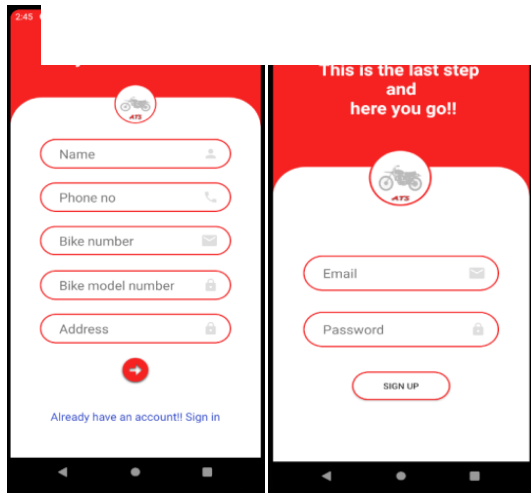
Fig. 7 Login Page and Reset Password Page

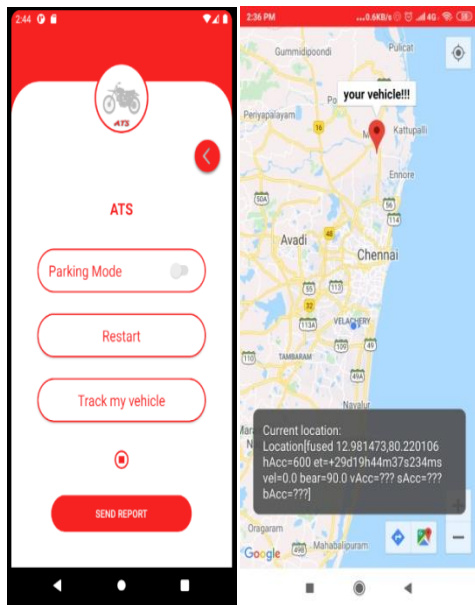Fig. 8 Registration Pages

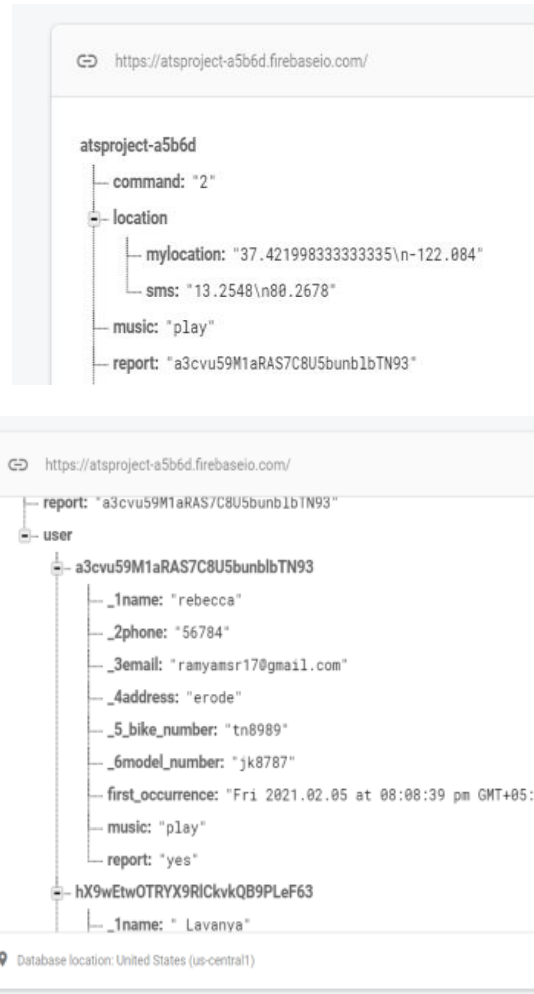Fig. 9 Home Page and Google Map

Fig.10 Real time Firebase database

VII.   CONCLUSION

In this paper, a theft prevention system for two wheelers has been implemented. A dedicated android application has been developed to keep the user in touch with the vehicle even after the theft. But on top of it, the system mainly aims in protecting the vehicle from theft by the ultrasonic sensor and the casing. The problem of duplicate key usage has been addressed wisely by switching of the ignition coil by sending messages to the user. Apart from the whole vehicle theft, there are many scenarios where fuels are also been stolen. Therefore, this system also has a

solution for it where the float sensor keeps track on the change in the fuel quantity. The entire system can be easily controlled by the owner of the vehicle and the database of the stolen vehicle is also sent to the police database where the station officials can view the complaint along with the current location of the vehicle in the website. This system is very useful as it uses the latest technologies in IOT and also addresses one of the major problems of vehicle theft in a simple and economic way.

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