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Vehicle Anti-Theft and Cloud Based Tracking System

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ABSTRACT: Vehicle thefts result in a huge loss for automobile owners especially those who depend on them for their source of income. Most vehicles today have only theft alarms which can be easily disabled by thieves. An embedded car anti-theft system can provide automobiles with higher security thereby decreasing the probability of robbery. Methods like image processing are for authentication and can be very time consuming. The existing vehicle theft alert systems have a user mode and a theft mode. Vehicle theft can only be detected in theft mode. If the owner forgets to switch on the theft mode they will not be notified of the theft. The authentication methods used do not enable the system to work in different possible situations. Also in the existing system, we can prevent the vehicle from getting stolen but we cannot catch the person responsible for the crime. The aim of this project is to design an anti-theft system that uses GSM (Global System for Mobile Communication) to alert the user of possible vehicle theft and receive the user's commands to initiate the required actions. Once a theft is detected, the vehicle's GPS (Global Positioning System) location will be tracked and sent to the user. The location will be visualized on ThingSpeak. In ThingSpeak the latitude and longitude measurements are used to determine the vehicle location and visualization can be observed in the form of a map. Thingspeak can be accessed on mobile. The user does not have to explicitly set the vehicle in theft mode.

KEYWORDS: GSM, GPRS, GPS , Radio frequency transmitter and receiver , Central locking , ThingSpeak.

I. INTRODUCTION

In India in keeping with car robbery, housebreaking census from 2013, the car thefts are growing almost 8.47 %. The rate at which vehicle thefts occur every year is quite high. Since vehicles are a heavy investment, a huge loss occurs to the owners when their automobiles are stolen. On an average, for this case the generation to keep away from the robbery of the car needs to additionally be increased. Microcontrollers primarily based totally actual time car robbery detection and prevention gadgets offer answers for this problem. The Global system for mobile communication (GSM) is a globally well known for mobile communication. The car proprietor uses Subscriber Identity Module (SIM) inserted within his cellular telecel smartphone to send messages to GSM modem and GPS (Global Positioning System) gadget that's part of the car robbery prevention (gadget embedded into car). The foremost scope of this venture is to ship an alert message to the owner of the car whilst the car is stolen. This project consists of a GSM modem, GPS module, microcontroller and is an application of Internet of Things (IoT) . When a person attempts to steal the automobile, the microcontroller receives interruption and orders GSM Modem to send the SMS (Short Message Service). The owner gets an SMS that his vehicle is being stolen and also the precise location of the car through the GPS system. The user and theft mode concept in the existing system requires the user to explicitly set the vehicle in theft mode. This project aims to design a system that does not require the user to switch to theft mode in order for it to operate.

II. STUDY ON EXISTING SYSTEMS

The motivation for doing this project and finding a new implementation for vehicle theft detection in a vehicle anti-theft system comes from the study on existing systems and the limitations that have been found. The new proposed

system is also proved to be more efficient , low cost and faster development time thereby satisfying some of the major requirements needed for a commercial embedded product.

A. Image processing

In image processing for theft detection an image of the driver is captured and processed in the microcontroller unit. If it is not the vehicle owner , an alert is sent through SMS. This prototype requires good image processing hardware which can be costly. And it is also time consuming to perform image processing. With the present technology it is difficult to obtain an image of high resolution. The image may be found useless in most cases.

B. Radio frequency identification (RFID)

This method involves using an RFID reader to read the RFID tag on the car key. If the tag is incorrect an alert is sent to the user. However this method works only when the thief attempts to steal the vehicle using a duplicate key. If the thief steals the original key, the theft will not be detected. Most of the practical vehicle theft cases involve the theft of the original key. Hence this method proves inefficient in maximum cases.

C. Use of vibration sensor to detect vehicle movement

In this method a vibration sensor is employed to detect the movement of the vehicle. If the vehicle moves by a threshold that is more than what is specified then an alert is sent to the user. This method is still less efficient because it detects vehicle theft once the vehicle starts moving. Also vibration sensors can be inaccurate and not properly detect and exceeding threshold thereby it is not efficient in sending theft alert.

The proposed system models the working of a car central locking system by employing a 433mHz hybrid radio frequency transmitter receiver module. Based on the state of the receiver output , the central microcontroller unit (Arduino mega) will process the theft alert and GPS tracking. It provides a faster theft detection and alert mechanism and is also quite cost efficient. Theft can be detected in almost all possible scenarios. The development time is also quite fast which is an important factor in producing commercial embedded products.

III.SYSTEM ARCHITECTURE

A.Hardware Architecture

a) *Arduino mega 2560*: The Arduino Mega 2560 is much like Arduino UNO however comes with greater GPIO (General Purpose Input Output) pins, greater memory space, and is larger in size. The unit additionally helps the ICSP (In-Circuit Serial Programming) header that's used to software the board with out disconnecting it from the principle circuitry. Two voltage regulators are included on the board through which you can adjust the voltage as you require. Arduino Mega 2560 is programmed the usage of Arduino IDE (Integrated Development Environment) software program this is the reputable software program delivered through Arduino. The ATmega2560 controller at the board comes with 256 KB of flash memory used for storing code (out of which eight KB is used for the Bootloader), at the same time as the SRAM (Static Random Access Memory) is eight KB and EEPROM (Electrically Erasable Programmable Read Only Memory) is four KB.

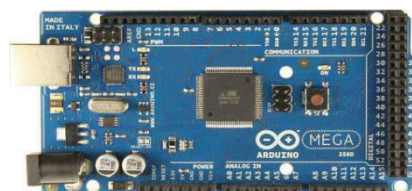


Fig 1 - Arduino Mega

b) *433mHz Hybrid RF Transmitter, Receiver Module*: This module has been used since it is the same principle used to control a cars central locking system using a remote key. It has a range of upto 100 meters. The transmitter uses amplitude shift keying(ASK) modulation. The receiver is made of a RF (Radio Frequency) tuned circuit and operational amplifiers for signal conditioning (Amplification) . The module requires an RF encoder board at transmitter and decoder circuitry at receiver. The signals are encoded before transmission and decoded to gain the original information at the receiver. This ensures transmission security.

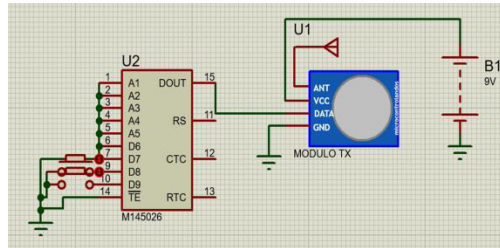


Fig 2 - Transmitter Schematic

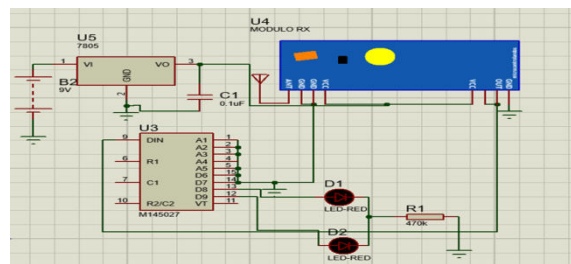


Fig 3 - Receiver Schematic

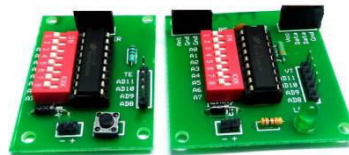


Fig 4 - RF Encoder Decoder Module

c) *GSM/GPRS Module*: We are using GSM SIM900A in this project. SIM900A Modem is constructed with Dual Band GSM/GPRS based from SIMCOM. It is entitled to work on frequencies of 900/1800 hz. The configurable baud rate is from 1200-115200 via AT command. Through the GPRS (General Packet Radio Service), the inner TCP/IP (Transmission control Protocol / Internet Protocol) stack of the GSM can access the internet. SIM900A is an extremely compact and dependable wireless module. It is pretty suitable for SMS, voice and Data transfer applications in M2M interface. The complete GSM/GPRS module is an SMT (Surface mount technology) kind and is designed with a completely effective single-chip processor integrating AMR926EJ-S core. The advantages can be from small dimensions and also cost-effective solutions will allow the benefits. In this project both GSM and GPRS functionality of the SIM900A module are used. GSM is used for sending the SMS alerts to the user. GPRS is used to connect to the ThingSpeak server and send data collected by the GPS module to the ThingSpeak channel. Using both at the same time is possible since the traffic of both the functionalities are independent of each other. However since a low cost module is being used it may not be very efficient. We cannot exploit both functionalities at the same time to full extent since it may overload and damage the component.



Fig 5–SIM900A GSM/GPRS Module Fig 6 - NEO 6M GPS Module

d) *GPS Module:* Global Positioning System (GPS) uses alerts dispatched via way of means of satellites in area and floor stations on Earth to accurately decide its function. In this project Neo 6M GPS module has been used GPS receiver module makes use of USART (Universal Synchronous/Asynchronous Receiver Transmitter) conversation to talk with microcontroller or PC terminal from the satellites withinside the shape of NMEA (National Marine Electronics Association) string. The accuracy of the Arduino GPS is 2.5m GPS Horizontal Position Accuracy.

A. *Software Description*

Arduino IDE: For the communication among the microcontroller and the modules and for sending and receiving automobile region information among the microcontroller and the server, the microcontroller and the modules are programmed through the Arduino IDE software. The Arduino incorporated improvement surroundings is a cross-platform utility for Windows, Mac OS, and Linux that is written in the programming language Java. Programming in done using Arduino C. Arduino C is a simplified language with a few important commands. The IDE (Integrated development environment) also contains a number of libraries. In this project the libraries used are SoftwareSerial for GSM and GPRS coding and TinyGPS for GPS programming.

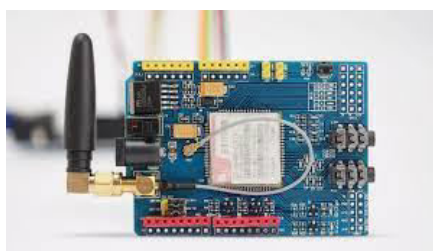


Fig 7 - Arduino IDE

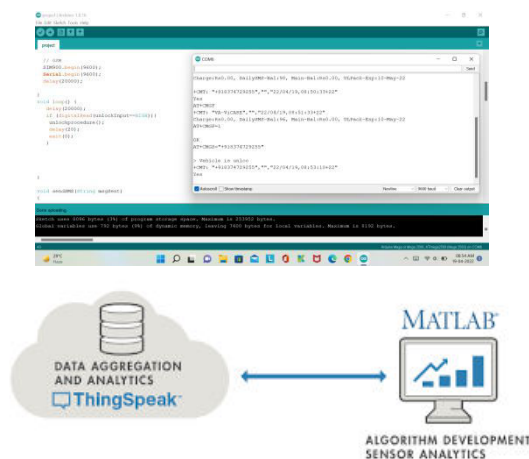


Fig 8 - ThingSpeak

b) *ThingSpeak:* ThingSpeak is an IoT analytics platform that allows you to analyze live data on the cloud. ThingSpeak has an unfastened Web Service (REST API) that helps you to accumulate and monitor sensor information withinside the cloud and expand Internet of Things applications. ThingSpeak is an open source platform. It is faster and easier to create a channel on ThingSpeak to monitor data over the web rather than building a web application which requires more time to develop and also the purchase of a domain name. Hence ThingSpeak has been used in this project to demonstrate a low cost and fast development system. Custom channels in ThingSpeak can be coded using MATLAB.



In this project a custom channel for live location tracking of the stolen automobile has been created by developing a simple MATLAB program. The code is accurate up to an extent.

IV. SYSTEM IMPLEMENTATION

A flowchart of the proposed system implementation is given below

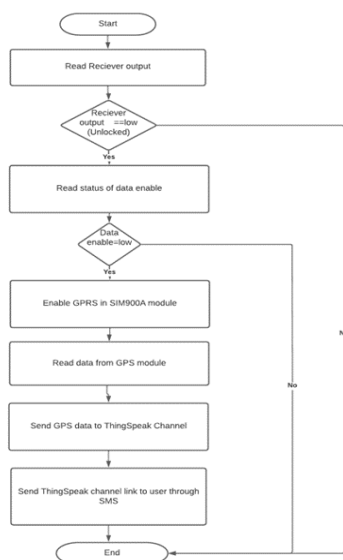


Fig 9 - Working Flowchart

A. Vehicle theft and SMS alert

The aim of this project was to show how a vehicle’s central locking mechanism can be controlled to detect vehicle theft. For this we have modelled a vehicle central locking system using a radio frequency transmitter and receiver module. The input is given from the transmitter switches. Switch 2 of the transmitter is for lock input , switch 3 data enable and switch 4 is for unlock input. Initially all the switches are in the state HIGH. They are enabled when made LOW. When switch 2 is made LOW the system operates normally. When switch 4 is made LOW the theft alert and tracking begin. In order to send SMS data the data enable switch must also be made LOW else the user will not receive SMS alerts. Once the inputs are given by the transmitter, the receiver output is read by Arduino and the corresponding action takes place. The alert is sent to the user 's mobile through SMS with the help of GSM SIM900A module.

B. GPS tracking and ThingSpeak visualisation

Once the theft is detected GPS tracking starts. The data collected from the GPS module is sent to ThingSpeak. The connection is established using GPRS functionality of the SIM900A module. The coordinates are instantly updated on the ThingSpeak server. The coordinates are viewed graphically and also on a map visualization. The coding for the map visualization in MATLAB has been done manually. The longitude and latitude of the vehicle at every point in time are graphically updated on the server. The location is thus tracked with high accuracy on the map as well. The channel can also be clearly viewed on mobile browsers.

V. RESULTS

The switches on the transmitter are used to give the input. If the receiver reads unlock input then the theft alert is sent to the user mobile through SMS. At the same time the GPS tracking begins. The data collected by the NEO 6M GPS module is sent to the ThingSpeak server. This is done by using GPRS. The user receives the link to the ThingSpeak channel through SMS. The tracking of the vehicle is visualized in ThingSpeak. The coordinates of the



vehicle are mapped graphically. The location is also viewed on a map visualization in ThingSpeak. The ThingSpeak channel is easily accessed on mobile. The alert is obtained almost immediately after the input is given. It takes about 15 to 20 seconds to connect to the ThingSpeak server and start collecting GPS data. The link to the ThingSpeak channel is sent to the user and It can be viewed on mobile. This eliminates the need for developing a separate Android or IOS application.

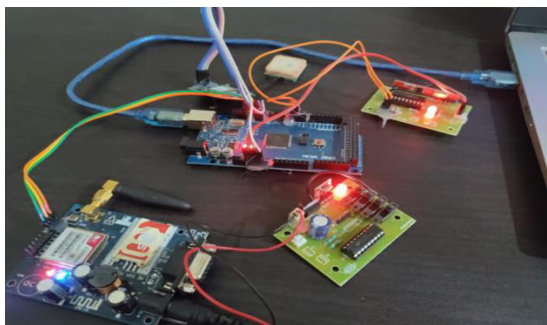


Fig 10 - Hardware

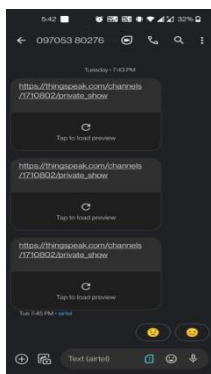


Fig 11 -SMS Alert results

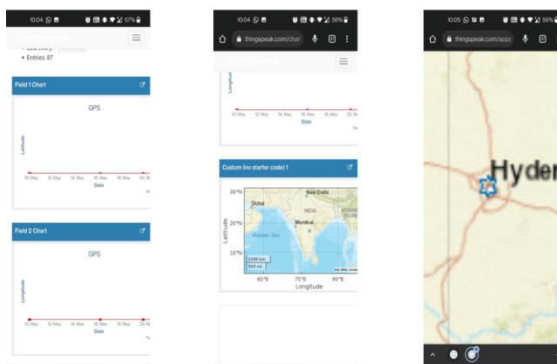


Fig 12-ThingSpeak channel in mobile

VI.CONCLUSION

The main objective of our project is securing an automobile. The aim is to offer the security of vehicles. We are relying on protection structures and security in our day to day lives. It is an unavoidable necessity, our proposed gadget affords protection and detects robbery accurately at low values. This project primarily aims at the prevention of vehicle robbery using GSM and GPS tracking. The location of the vehicle will be visualized on Thingspeak. The proposed system especially pursuists to offer a low-value robbery detection gadget, additionally pursuists to guard their automobiles from robbery.

We can aim at improving the scope of this project by involving additional features like adding biometric authorisation, image capturing inside the vehicle, etc. These features may require storage of huge data. With the ongoing technological modernisation, we can meet these requirements. Vehicle theft is an open problem but with advancement in the solutions, we can expect a decline in the thefts in the near future.

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