Designing and Development of IOT Integrated Theft Monitoring& Live Tracking System

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ABSTRACT

With the emergence of new technology and innovations, people are searching smarter ways to protect/monitor their properties remotely. In accordance to that, at present GPS based tracking system is frequently used in vehicle tracking, children/pet tracking, aircraft tracking, any personal belongings tracking, fleet management and so on. This paper introduces a Smart Anti-Theft Vehicle System based on Internet of Things (IoT) for monitoring the movement of any equipped vehicle from anywhere in real time. At the implementation of this system, Global Positioning System (GPS), Global System for Mobile Communication (GSM)/General Packet Radio Service (GPRS) and Microcontrollers are used to enable users for monitoring their vehicles in a convenient manner. This system provides the access to check the movement and control (emergency stop by closing the fuel line) vehicles remotely by using mobile application. The hardware prototype of the proposed system and the user application for monitoring and controlling vehicles are presented in this paper.

Keywords: Vehicle tracker, Embedded Systems, GSM/GPRS, GPS, IoT, Sensors, Mobile Apps, Amazon web-service, IoT-cloud, LinkItOne, Location tracking

I. INTRODUCTION

Vehicle tracking systems are generally used in urban areas as these areas are heavily populated and developed. Now-a-days, the security of a vehicle is important as they are used to prevent from stealing. In this project we designed the vehicle tracing circuit. Number of vehicle tracing technologies is already implemented. We here are using the GSM and GPS modules to locate the vehicle location. Present location of the vehicle can be traced/received by getting coordinates from the satellite using GPS technology and transmitted through GSM in form of a message to parental mobile/sim
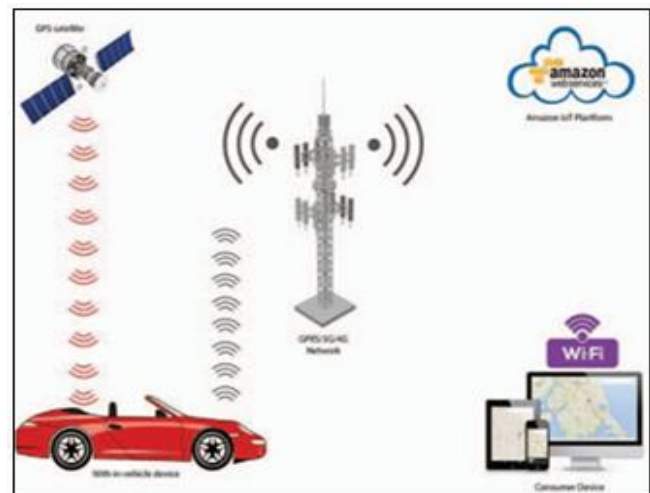

Fig.1 Block Diagram of vehicle theft module

II. SYSTEM DESCRIPTION

Arduino is one type of open source microcontroller on the ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins and 6 Analog pins. It is programmable with the ArduinoIDE.
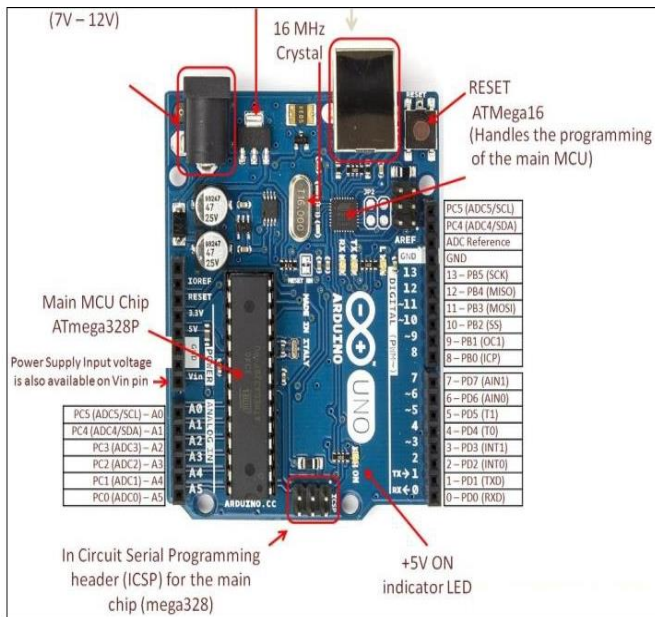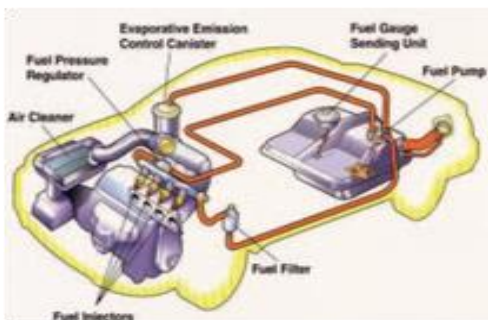

Fig.2 pin diagram of arduino.

A. VEHICLE FUEL SYSTEM:

The function of the vehicle fuel system (see Fig. 3) is to store and supply fuel to the engine. The engine intake system (details in [8–9]) is where the fuel is mixed with air, atomized, and vaporized. Then it can be compressed in the engine cylinder and ignited to produce energy or power.

Fig.3: Typical Vehicle Fuel System & Fuel Pump

The fuel is stored in the fuel tank and the fuel pump is responsible for flowing the fuel from the tank. The fuel then travels through the fuel lines and is delivered to the fuel injectors. When the fuel is delivered, the final conditions for providing complete combustion are atomization and the spray pattern of the fuel. More details about vehicle fuel system is illustrated on [11–13]. Fuel generates the power and the power moves the car. The engine unable to generate any power if fuel pump refuses to draw the fuel.

B.ANTI-THEFT TRACKING SYSTEM BASED ON GPS:

Unauthorized access of any valuable devices/properties can be prevented by using Anti-Theft Tracking System. Ramadan and Al-Kheder in [15] presented a prototype design of a vehicle tracking and anti-theft system for protecting a vehicle from any intruder by using GPRS/GSM technology. The system used Kalman filter [16] for minimizing the positional (GPS coordinates) errors, due to week GPS signal. An abstract idea for controlling the vehicle's ignition also proposed there without proper implementation details. A notebook with Google Earth is used for monitoring the vehicle's location and its status. Google maps based Smart phone application would be another alternative to replace the task that the notebook performs.Fig.4showsthearchitecturalviewofthatsystem.

Fig. 4: Architectural view of Vehicle Tracking and Anti-Theft System

C.FINDER VEHICLE TRACKING SYSTEM:

It is one of the popular Global Positioning System (GPS) based tracking system commercially available in Bangladesh. The device consists of GPS sensors, GSM/GPRS module together embedded on a microcontroller. According to their news portal some stolen vehicle has been recovered by using the tracking system. They use On-Board Diagnostics (OBD) technique for monitoring the condition of the vehicle. The benchmark of the system and more technical details are not currently available due to their business policy. A geographical map based mobile application has been developed (recently) for monitoring the vehicles location. A typical type of OBD-based vehicle tracking system is illustrated in Fig.5.

D. LINKIT ONE DEVELOPMENT BOARD:

The LinkIt ONE development board (Fig.5) is used as the main control board of our proposed system. It's an open source, high-performance board for prototyping Wearable and IoT devices. The board is based on MediaTek MT2502A SoC microcontroller. Some other sensors and module such as GSM/GPRS module, GPS sensor, SD cards, Bluetooth 2.1 and 4.0 as well as Wi-Fi and GNSS are also embedded with this development board. In summary, it's an all-in-

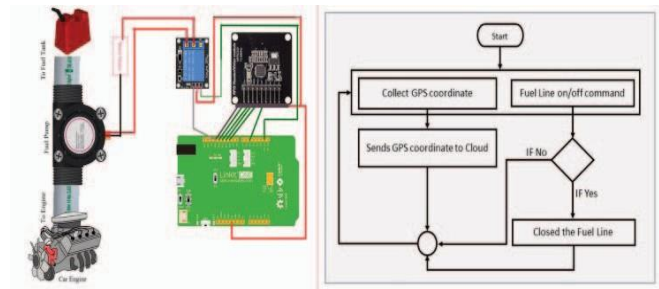one compact high performance embedded board for prototyping various devices.

Fig. 5: The circuit diagram (left) and dataflow diagram (right) of in-vehicle device.

E. IN-VEHICLEDEVICE:

Our In-vehicle device consists of a microcontroller along with other sensors such as GPS (for collecting location data), GPRS shield (establish connection with IoT-cloud), a relay switch (for controlling the fuel pump) and RFID reader for driver authentication. A Radio frequency based proximity card is used here for turning on the fuel pump (works as a fuel supply switch) before start the vehicle. Without this proximity card, no one can open the fuel line. This provides an extra layer of security. Drivers must use this proximity card before start the vehicle. All the required hardware used in this system shows the block diagram of our system. A Mobile SIM module with data connection is mandatory for Internet connection. The data flow diagram of in- vehicle device is shown in A source code to control and coordinate them(all sensors data and other activities)is written using high level Arduino programming language, successfully compiled and then uploaded into the microcontroller memory.

F. MOBILEAPPLICATION:

We have developed a geographical or Google maps based mobile application that collects the location data from IoT- cloud and visualize them in real time. As a result, the user scan track the location of their vehicle in real time through the Mobile application.

A virtual control switch for fuel pump is also added with our application which is responsible for turning on/off the fuel pump. The virtual control switch allows users to control the fuel line of the vehicle, that forces the vehicle to stop within a minute (due to the absence of fuel supply). The data flow diagram and the screenshot of the application are illustratedin Fig.5. based real time push notification system is also included with the application; that notifies the users while the vehicle crosses the geo-fence defined by users.
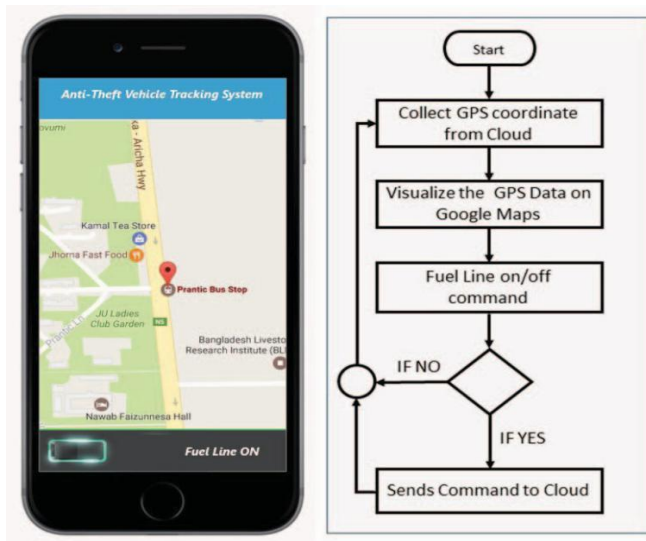

Fig. 6: The Mobile application and dataflow diagram of the user application.

III. ROPOSED METHOD

This paper presents an IOT based vehicle theft detection system. As there are many systems used till date to detect the robbed vehicle, proposed system overcomes most of the limitations of existing systems and methods. In this mechanism as soon as the dc motor starts i.e., vehicle theft occurs, Arduino activates GPS, GSM and sends an alert message to the owner and the longitude and latitude readings of vehicle are posted using internet of things with the help of Wi-Fi module. The entire mechanism can be operated with a switch for user convenience.

A. WI-FI MODULE - ESP 8266:

The ESP8266 Wi-Fi Module is a self-contained SOC that can give any microcontroller access to your Wi-Fi network. Each ESP8266 module comes pre-programmed with an AT command set firmware, that is, it can simply have hooked up to Arduino device and get Wi-Fi ability. The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

B. DC MOTOR:

Most common type of motor. DC motors normally have just two leads, one positive and one negative. If you connect these two leads directly to a battery, the motor will rotate. If you switch the leads, the motor will rotate in the opposite direction.

C. SWITCH:

This is used to activate the entire theft detection system. As long as switch is in ON position SMS alert and location will be sent to owner as soon as vehicle starts. If the switch is OFF, no alert will be sent and location details are also not shared. In this way, using switch we can control system activation and deactivation. GPS (Global Positioning System) Global Positioning System (GPS) is a satellite-based navigation system. We use NEO-6M GPS module as it is compatible with a variety of GPS receivers. It has a built-in ceramic antenna. Integrates with a 3V button battery. Normally GPS works in any weather conditions at anywhere in the world.
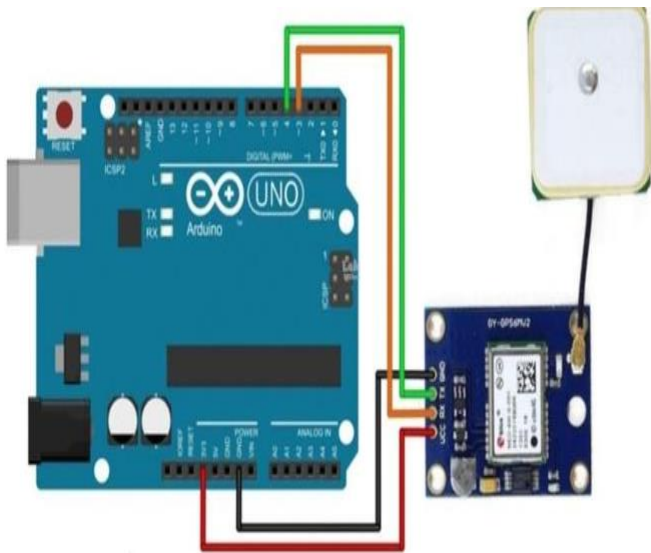
Fig.7 Arduino connected GPS

	Our System	Finder and Others
Tracking/ Monitoring	YES	YES
Fuel Line Control	YES	NO
Driver Authorization	YES	NO
Location logging	YES	YES
Cost Effective	YES	NO

Table.1 comparison with existing system (with others)

IV. RESULTS

The below figures show the circuit (figure 2) and alert message received as soon as the motor starts and location of the vehicle can also be sent in message (figure 3) and the vehicle longitude and latitude readings are also posted using internet of things (IoT) as shown in figure 4.

Fig. 8 Proposed circuit

V. CONCLUSIONS

Vehicle theft is one of the major problem of our country and technology is always helping us for solving problems. With the growth of ICT in Digital Bangladesh, it is obvious for us to introduce more and more smart solution for our everyday life. A smart anti-theft vehicle tracking system is presented in this work. The hardware design and development of our tracking system has been described in this paper. Some sensors such as (GPS, GPRS/GSM module, NFC etc.) along with microcontroller are used for developing in-vehicle device. A Smartphone application has been developed for visualizing the location of the vehicle on geographical maps. The system perfectly tracks the location of vehicles and perfectly controls the fuel lines anytime from anywhere. We hope that, Our Internet of Things based proposed system will help owner to protect their vehicles against theft in a smart way.

VI. ACKNOWLEDGMENT

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