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IoT Based Smart Vehicle and Accident Prevention System

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ABSTRACT—*The features of the application enhances the safety and security of the individual in either accident or vehicle theft prone scenarios. It provides the accessibility in providing necessary information and assistance regarding the consequences faced by the individual either in accident or vehicle theft situation. The features provided are accessed by photo, voice alert and message notifications respectively. The application is related to motor vehicle changing speed and action taken to trace the vehicle when it's stolen. In this application a smart phone should always be embedded in the vehicle. If the speed of the motor vehicle exceeds predefined speed limit, an SMS will be sent to the emergency phone number set in the application. The technology used in accomplishing the project is Embedded C, Keil Compiler, Flash Magic, Embedded Java, Eclipse and Android SDK in terms of software requirements. It also includes messaging where the message will be sent to the stored emergency number whenever speed is above the allowed limit along with GPS location and also when the vehicle meets with an accident. Hence, Vehicle Theft system and Accident prevention system is obtained.*

Keywords— Android Smart Phone, DC Motor, GSM, IOT, SST89E516RD2 microcontroller, Vibration sensor.

I. INTRODUCTION

It gives an idea about the accident prevention system and vehicle theft system. Nowadays accidents and vehicle theft cases of two- wheelers are increasing at an alarming rate. Every year approximately 1.2 million people are killed due to road accidents and 50 million are injured. Accidents are quite common on Indian roads and are at the peak due to increased number of vehicles. Speed is the cause of most number of traffic accidents. The number of two-wheelers on the road is more than four-wheelers and eight wheelers. It has been estimated by WHO (World Health Organization) that there is an increase in the number of deaths due to accidents by two-wheelers than four-wheelers. Vehicle theft has become frequent in parking lots. Bike-theft is a major problem. Traditional solution for accident detection uses the Global Positioning System (GPS) to get the location of the accident and a message is sent through a microcontroller or a mobile device.

The survey conducted by Government of India during the year 2010, says that there were close to 5 lakh accidents, which resulted in more than 1.3 lakh deaths and inflicted injuries on 5.2 lakh persons. These numbers translate into one road accident every minute, and one road accident death every 4 minutes. Unfortunately, more than half the victims are in the economically active group of 25-65 years. The loss of

main bread winner can be catastrophic. Speed is the main reason behind all these accidents happening every year. “Speed thrills but it also kills”!!! Over speeding is the main cause when it comes to road accidents in the city. Statistics available with the traffic police shows that nearly 27% of the total accidents are taking place due to over speeding. Exceeding the lawful speed limit is the single biggest reason for road accidents. This led to the creation of accident prevention system.

Every year nearly 36,000 vehicles worth Rs.115 crore are stolen in India. Only about 15,000 are traced. Once the vehicle is robbed, it’s difficult to trace or else it takes months together to find out the vehicle and there is no guarantee of getting back the vehicle in its original condition. This led to the creation of vehicle theft control system.

1. Internet of Things (IoT)

The Internet of Things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enable these objects to connect and exchange data. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

IoT can assist in the integration of communications, control, and information processing across various transportation systems. Dynamic interaction between these components of a transport system enables inter and intra vehicular communication, smart traffic control, smart parking, electronic toll collection systems, logistic and fleet management, vehicle control and safety.

2. Android

Android is a mobile operating system developed by Google, based on a modified version of Linux kernel and other open source software and designed primarily for touch screen mobile devices such as smart phones and tablets. In addition, Google has further developed Android TV for televisions, Android Auto for cars and Wear OS for wrist watches, each with a specialized user interface. Variants of Android are also used on game consoles, digital cameras, PCs and other electronics. Since Android devices are usually battery-powered, Android is designed to manage processes to keep power consumption at a minimum.

3. Microcontroller

Micro controllers are widely used in embedded system products. Micro controller is a general purpose device that is meant to read data, perform limited calculations on that data, and control its environment based on those calculations. The prime use of micro controller is to control the operation of a machine using a fixed program that is stored in ROM and that does not change over the lifetime of the system. The micro controller will receive the data from GSM modem and GPS receiver and displays on LCD.

4. The SST89E516RDx and SST89V516RDx

These are members of the Flash Flex family of 8bit microcontroller products designed and manufactured with SST’s patented and proprietary Super Flash CMOS semiconductor process technology.

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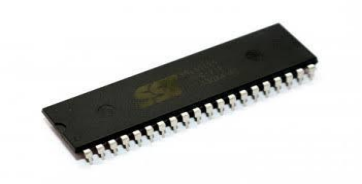

Figure 1: SST89E516RD2 Microcontroller

The Fig. 1 shows the micro controller used. The devices come with 72 Kbyte of on-chip flash EEPROM program memory which is partitioned into 2 independent program memory blocks. The primary Block 0 occupies 64 Kbyte of internal program memory space and the secondary Block 1 occupies 8 Kbyte of internal program memory space.

The 8-Kbyte secondary block can be mapped to the lowest location of the 64 Kbyte address space; it can also be hidden from the program counter and used as an independent EEPROM-like data memory. In addition to the 72 Kbyte of EEPROM program memory on-chip and 1024 x8 bits of on chip RAM, the devices can address up to 64 Kbyte of external program memory and up to 64 Kbyte of external RAM. During power-on reset, the devices can be configured as either a slave to an external host for source code storage or a master to an external host for an in-application programming (IAP) operation. The devices are designed to be programmed in system and in-application on the printed circuit board for maximum flexibility.

5. Vibration Sensors

The Fig. 2 shows the Vibration sensors. Sensors are used for measuring, displaying, and analyzing linear velocity, displacement and proximity, or acceleration. Vibration however subtle and unnoticed by human senses is a tell-tale sign of machine condition. Abnormal vibration indicative of problems with an industrial machine can be detected early and repaired before the event of machine failure; because such a failure is potentially costly in terms of time, cost, and productivity, vibration measurement allows industrial plants to increase efficiency and save money.

Figure 2: Vibration Sensor

6. L293D Driver

The Fig. 3 shows the L293D Motor driver which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It can control two DC motor with a single L293D IC.

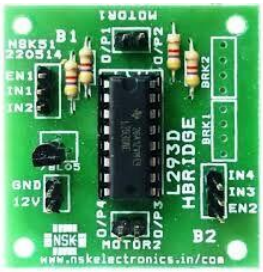

Figure 3: L293D H bridge motor driver

L293D IC works on the basic principle of H-bridge, this motor control circuit allows the voltage to be flowing in any direction. The voltage must be change the direction of being able to rotate the DC motor in both the directions. Hence, H-bridge circuit using L293D ICs are perfect for driving a motor. Single L293D IC consists of two H-bridge circuits inside which can rotate two DC motors separately.

7. Ignition Key

The key used in a motor vehicle to turn the switch that connects the battery to the ignition system and other electrical devices.

Figure 4: Ignition Key

The Fig. 4 shows the Ignition key or starter switch is a switch in the control system of an internal combustion engine motor vehicle that activates the main electrical systems for the vehicle. Besides providing power to the starter solenoid and the ignition system components it also usually switches on power to many "accessories". The ignition switch usually requires a key be inserted that works a lock built into the switch mechanism. It is frequently combined with the starter switch which activates the starter motor. The ignition locking system may be bypassed by disconnecting the wiring to the switch and manipulating it directly.

8. Global System for Mobile communication (GSM)

The Fig. 5 show the GSM module for transmitting and receiving messages. GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA).

Figure 5: GSM module

GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

9. Global Positioning System

Figure 6: Location Tracking

The Fig. 6 show the location tracking of GPS. The Global Positioning System (GPS), originally Navistar GPS, is a space-based radio navigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geo-location and time information to a GPS receiver anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

The GPS does not require the user to transmit any data, and it operates independently of any telephonic or internet reception, though these technologies can enhance the usefulness of the GPS positioning information. The GPS provides critical positioning capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and

makes it freely accessible to anyone with a GPS receiver.

10. Liquid-crystal display (LCD)

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly; a backlight or reflector is used to produce images in color or monochrome. As Fig. 7 shows, LCDs are available to display arbitrary images or fixed images with low information content, which can be displayed or hidden, such as pre-set words, digits, and 7-segment displays, as in a digital clock. The same basic technology is used except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including LCD televisions, computer monitors, instrument panels etc.

Figure 7: Liquid Crystal Display

Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smart phones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma display, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television sets.

11. DC motor

Figure 8: DC Motor

The Fig. 8 show the DC motor that is used to convert direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight motor used for portable power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills.

II. SYSTEM ARCHITECTURE

System architecture is a conceptual model that defines the structure, behaviour and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviours of the system. A system

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architecture can comprise system components that will work together to implement the overall system.

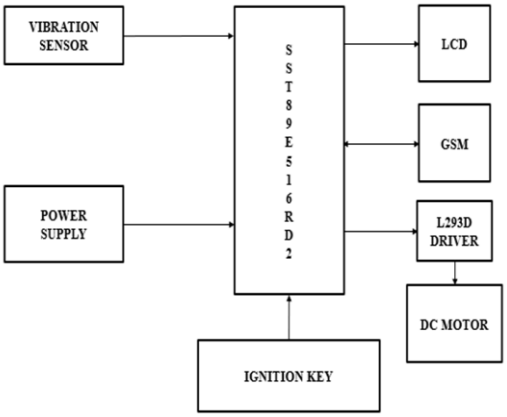

Figure 9: Block Diagram for System Architecture

12. Microcontroller

The microcontroller is used to control all the activities of the component modules sequentially. We have used 8051 series Microcontroller, AT89s51. 8051 communicates with sensor, ignition key, LCD display, GPS modem and GSM modem.

13. Vibration Sensor

The vibration sensor is used in detecting the jerks of the vehicle when it is under an accident or a vehicle theft scenario. It detects the amount of vibration, compares it with threshold level set by user and gives high pulse at its output. Here Digital output vibration sensor is used.

14. Power supply

Power supply is used to provide the necessary energy for the system to start with reference to the component modules.

15. LCD

LCD is used in displaying the notification message regarding the activities that are executed with respect to the interaction of the component modules sequentially. This is non-mandatory component of the circuit.

16. GSM

GSM is used in transmitting and receiving the message notification regarding the activities of the vehicle sequentially. Microcontroller sends AT commands to the GSM modem, then GSM modem sends SMS.

17. L293D driver

L293D driver is used to convert the binary oriented values to the respective machine language which is provided as input to the dc motor for its execution.

18. DC Motor

DC motor is rotated with respect to the input values converted into respective machinery language which is obtained from L293D driver.

19. Vehicle Theft System

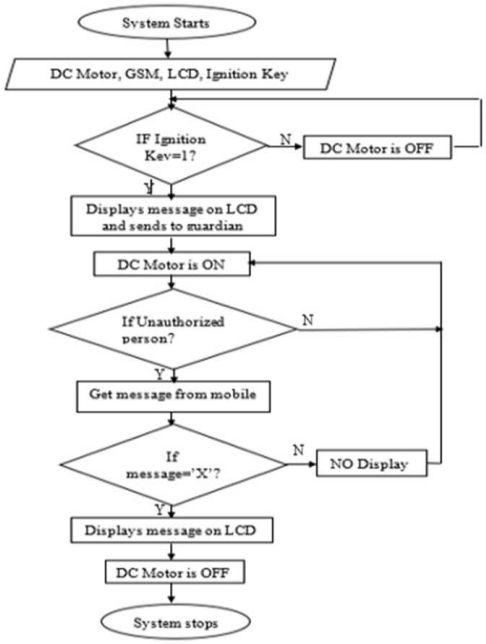

Figure 10: Flowchart for Vehicle Theft System

The above Flowchart shows the process for the vehicle theft system. It shows the description about the interaction of the components that is DC motor, LCD, GSM and ignition key for the execution of the system. Here the vehicle theft system execution is described where an unauthorized person access the

vehicle, there are certain message notifications received thereby making the owner of the vehicle be aware of the situation and help him stop the vehicle theft and has the accessibility of tracking the location of the vehicle for like, how far the unauthorized person travelled with the vehicle which prevents vehicle theft simultaneously.

The algorithm for the above flowchart is as follows:

Step1: Start

Step2: If Ignition Key is on,

Step3: Then DC Motor is on, Displays message on LCD and sends notification to guardian.

Step4: Else go to Step2

Step5: If unauthorized person accesses the bike, then vehicle is stopped through guardian application.

Step6: Else DC Motor is on.

Step7: Stop.

20. Accident Prevention System

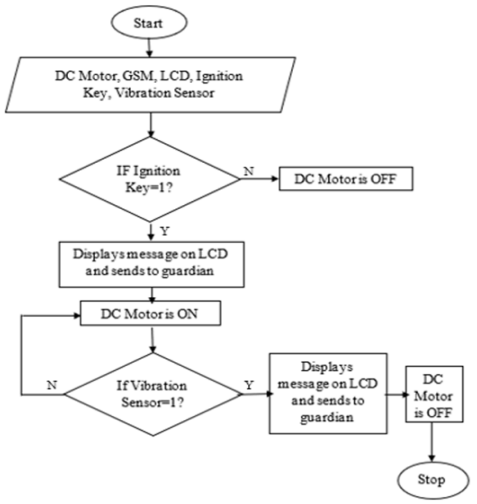

Figure 11: Flowchart for Accident Prevention System

The above Flowchart shows the process for the accident prevention system. It shows the description about the interaction of the components that is DC motor, GSM, LCD, ignition key and vibration sensor for the execution of the system. Here the accident prevention system is described, whenever the vibration sensor detects the jerks of the vehicle leading to the affirmation situation of occurrence of accidents, the situation is immediately notified to specific phone numbers related to the individual who drives the vehicle and then the related person say a guardian can a send him/her immediate medical assistance according to the location tracked in the GPS using the information of latitude and longitude.

The algorithm for the above flowchart is as follows:

Step1: Start

Step2: If Ignition Key is on,

Step3: Then DC Motor is on, sends notification to guardian and displays on LCD.

Step4: Else no action is performed.

Step5: If accident detection Sensor is activated, then displays message on LCD and sends alert to guardian. DC Motor is off.

Step6: Else no display on LCD.

Step7: Go to Step2

Step8: Stop.

III. CONCLUSION

The conclusion of the accident prevention system and vehicle theft prevention system may be derived as follows:

- A low-cost vehicle tracking and monitoring system is presented. The application includes a transmitting module which contains an embedded system to combine GPS and GSM devices to retrieve location information and send it to the other stationary module.
- The application built is useful in providing information regarding the accident or vehicle theft prone scenarios where the immediate assistance is provided with respect to the interaction of the guardian.

- It provides a secured procedure methodology by providing the information regarding the accident and vehicle theft situation in the form of voice, photo, GPS and email options.

Therefore, the accident prevention system and vehicle theft prevention system enhances the safety and security of an individual with respect to the above features.

IV. FUTURE SCOPE

- The hardware can be further more improvised using an alcohol sensor, where most of the accidents are occurring due to intoxication. This can be implemented by placing alcohol sensor to detect the alcohol by giving certain limit value of the alcohol.
- This can also have eye blink sensor which prevents the individual who meets with an accident due to drowsiness. It can be overcome by placing eye blink sensor as required for the individual. It can also do graphical software development in order to track the vehicle.

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