SMART LOCK –A MILESTONE FOR ROBEERS

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Abstract: **Currently most of the public having own vehicle, theft is happening on parking. The safety of a vehicle is extremely essential for public vehicles. The development of technology in the field of electronics has brought a drastic change in everyday life. The proposed systems consist of a digital keypad to provide password authorization to lock vehicles.It alerts the owner about the theft and allows the user to control the system removed by SMS. It also provides tracking of vehicle using GPS and servo motor operating locking system (fuel lock, handle lock and rear lock).This system is compatible with all branded vehicles.**

Keywords: GSM Technology, Vehicle tracking, Microcontroller, Short message services, Locking system.

I. INTRODUCTION

This is based on "GSM control system" to construct a control system that implements the complete control of interfacing. The project based objectives are given below:

a.To effectively receive and transmit data through Message.

b.To identify the location through GPS.

c.To avoid any physical changes in bike.

It is necessary due to the many of applications of both GSM and GPS systems and the wide usage of them by millions of people throughout the world.

This system aims to develop an advanced vehicle security system in the real time applications .The user will send a status message from his mobile phone and it will check for the user's authentication when the global system for mobile communication module gets the SMS and if found to be valid, it will immediately forward the details of the locations like the longitude and the latitude using GPS device so the user will find the exact location .At the same time SMS will be sent to a PC where user can get the particular location of the vehicle through google maps. The price of the security system should be reasonably low or else the automobile manufacturers cannot implement such a system, as it will increase the overall cost of the vehicle by a big margin.

II. RELATED WORK

In [2], the hardware and software of the GPS and GSM network were developed. The proposed GPS/GSM based System has the two parts, first is a mobile unit and another is controlling station. The system processes, interfaces, connections, data transmission and reception of data among the mobile unit and control stations are working successfully. These results are compatible with GPS technologies.

The traditional security systems as priced low, but they merely act as an alarm system and are no match to the well equipped thief. Many security systems have been proposed over the years, e.g. [4], [5], [7], [9], but almost all the recent advanced security systems are designed especially for cars. Several researchers have even used image processing technology to capture the face of driver and compare it with the picture of authorized drivers to detect the intrusion [14], [15].

In [8] this paper, the proposed tracking system based on cloud computing infrastructure. The sensors are used to monitor the fuel level, driver conditions, and speed of the vehicle. All the data transferred to cloud server-using GSM enabled device. All the vehicles equipped with GPS antenna to locate the place. To avoid the drunk and drive, the alcohol sensor installed to monitor the driver status. The proposed technology significantly avoids the accident in highways.

III. EXISTING SYSTEM

A security system is essential for motorist now a day as the number of motorcycle theft increases every year. Various security systems are available in the market with variety of functions, operating modes and features. Most of the systems are expensive which make motorcyclists could not afford to have a security system that is efficient.

The affordable security system has limitations. It provides basic function and makes loud noise that will disturb people around it. The basic security system is very simple and not user friendly.

The limitation of their system was the GSM was only used for tracking the motorcycle. It did not inform the user and deactivate the engine. In anti-theft alarm system the number of sensors are used and because of that the system became complicated and costly [3].

This paper describe the development of a motorcycle security system that uses a microcontroller to detect theft and inform the owner through GSM module when theft occurs. This system protects motorcycle from theft and provides a reliable security system to motorcyclist with affordable price. The system uses a microcontroller to control all operation including sending the message to user . Normally, digital speedometers are found only luxury car and high end motor bikes when it gets damaged we need to replace the mechanical worm gear and then the cable hence we design a digital speedometer-cum-odometer for motorbike in affordable cost.

IV. PROPOSED SYSTEM

An overview of the complete system is described in this section before detailing the specifications and the necessity for each module in the system. The conventional handle locking system is replaced by a handle lock operated by DC motor and controlled by the matrix keypad. Fuel lock replaces the knob at the nozzle of fuel tank. Rear wheel lock is used to jam the sprocket of the wheel.

The vehicle owner's cell phone with the registered Subscriber Identity Module (SIM) number acts as the master key of the security system.

A Short Message Service (SMS) is sent to the registered SIM via the Global System for Mobile communication (GSM) module whenever the vehicle is unlocked using the matrix keypad. Owner can in turn send a SMS to initiate the locking sequence, if he/she feels an unauthorized person has unlocked the vehicle . Global Positioning System (GPS) module is used to track the location and monitor the speed of the vehicle. Piezoelectric sensors are used as vibration sensors to detect any tampering with the vehicle. The owner is alerted by an SMS and loud alarm is activated, if there is any physical tampering with the vehicle or if the vehicle has been moved from the place where it was parked (>15m). The owner can, anytime, request the security system of the vehicle for its status by sending an SMS. The status message sent in response to request includes the lock status, location coordinates and the speed of the vehicle. Infra Red (IR) sensors are used as side stand indicators, until and unless the side stand is not pulled up engine cannot be started.

A. HARDWARE MODULE

(i) Matrix keypad

A keypad is a set of buttons arranged in a block or "pad" which bear digits, symbols or alphabetical letters. Pads mostly containing numbers are called a numeric keypad. The 4*4 matrix keypad usually is used as input in a project. It has 16 keys in total, which means the same input values.The 4*4 Matrix Keypad Module is a matrix non- encoded keypad consisting of 16 keys in parallel. The keys of each row and column are connected through the pins outside – pin Y1-Y4 as labeled beside control the rows, when X1-X4, the columns. First test whether any key is pressed down. Connect power to rows, so they are High level. Then set all the rows Y1-Y4 as Low and then detect the status of the columns. Any column of Low indicates there is key pressing and that the key is among the 4 keys of the column. If all columns are High, it means no key is pressed down.

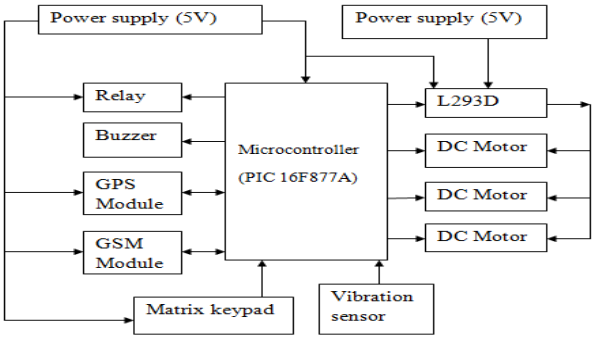

FIGURE 1: Block diagram of Smart Lock hardware module

(ii) Locking system

The handle, fuel and rear wheel locking systems are operated by DC motors. DC motor is chosen because the output shaft can be rotated to a specific angular position by sending it a pulse width modulation (PWM) signal through the control wire. PIC is used as interfacing unit.Operational voltage of 5V and current of 1A is supplied from the driver IC (L293D) as shown in fig. 1. While parking the vehicle, the rider should align the handle to the extreme left and press the lock button on the keypad. This initiates the locking sequence of the handle, fuel and rear wheel lock. To avoid the fuel theft, a lock is placed at the nozzle of the fuel tank. This lock acts as a valve. Once the vehicle is locked, fuel lock blocks the nozzle, disrupting the fuel flow in the tube. As there is no fuel flowing into the engine, it cannot be started, thus serving two purposes. Another lock is placed at the rear side of the vehicle, to jam the sprocket of wheel. Once the sprocket is jammed, the wheel cannot rotate. This ensures redundancy in the proposed security system.

(iii) GPS Module

Gms-u1LP GPS module is used for tracking of the vehicle. It utilizes MediaTek GPS MT3329 that supports up to 66 channels of satellite searching with -165dBm sensitivity and 10Hz maximum update rate for precise GPS signal processing under low receptive and high velocity conditions. It has a power saving switching mode power supply (SMPS) that helps reduce the overall GPS power consumption. We used the National Marine Electronic Association (NMEA) 0183 protocol , which is a worldwide accepted standard. The Recommended Minimum Navigation Information GPRMC sentence is decoded to get the coordinates, speed, UTC time, date month, year and other necessary information. (A sample of GPRMC sentence: $GPRMC, 064951.000, A,2307.1256,N,12016.4438,E,0.03,165.48,260406, 3.05,W,A*55).

(iv) GSM Module

The GSM module is required to establish a communication link between the owner of the vehicle and the security system [8], [17]. We used SIM300 GSM module in our system. AT commands were used to control this module. SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 also provides General Packet Radio Service (GPRS). The current consumption is as low as 2.5mA in SLEEP mode. SIM memory is used to store messages. The SIM300 module communicates with the MCU using asynchronous serial communication with a baud rate of 9600. The owner of the vehicle can send SMS to lock down the bike. Owner can also disable the remote keyless system if the remote is stolen. These features becomes very useful if incase duplicate or stolen remote is used to unlock the vehicle. Thus the cell phone of the owner with the registered SIM acts as the master key, which can override the instructions from the remote.

(v) Engine Immobilizer

This module is used to control the ignition system of the vehicle, there by controlling the engine. The capacitive discharge ignition (CDI) module [12] uses capacitor discharge current output to fire the spark plugs. The capacitive discharge ignition (CDI) module has 6 pins in common. Of these 6 pins, one pin is for ignition trigger pulse, one pin is to be connected to 12V ignition coil, one pin is for supply of ignition power to spark plugs, one pin is to be connected to kill switch and the remaining two pins are to be grounded. If the kill pin is grounded then the ignition power pin does not supply 20,000V to the spark plug, which is essential to produce a spark in the power stroke. A relay is

used to accomplish this function. Relay is used in "normally open mode", one terminal is connected to kill pin and another is grounded. Whenever the engine has to be immobilized the microcontroller unit (MCU) activates the relay coil which shorts the kill pin to the ground.

(vi) Vibration sensor

Piezoelectric sensor is used for this application, as the cost of this sensor is very less and it has reasonably good sensitivity. The chassis runs throughout the vehicle and it is made of metal, so the vibration in any part resonates all over it. Piezoelectric sensors are placed on the chassis [15], one at front end and another at rear end. As and when there is a vibration (because of the intruder tampering with the vehicle), it is transferred to the piezoelectric film and there is a proportional voltage developed at the terminals of the piezoelectric sensor. The analog voltages are converted to digital values by the inbuilt 10 bit Analog to Digital Converter (ADC) of Atmega328p-pu MCU. The voltage produced is directly proportional to the intensity of vibration. A threshold value is set to distinguish between the high and low intensities.

(vii) Side stand indicator

IR sensor is chosen for this application, as it consumes very less power, less area and has low cost. This sensor is placed below the chain guard, aligned with side stand (pulled up). If the side stand is pulled up IR radiations emitted from led are reflected back which falls on the phototransistor, else IR radiations are not reflected back. The resistance across the phototransistor is in the range of mega ohms when no IR radiations fall on it. Its resistance greatly reduces when IR radiations fall on it. Voltage drop across phototransistor is directly proportional to its resistance. The voltage drop across the phototransistor is fed to the comparator circuit. If the voltage drop is greater than the threshold then the output is logic high else it is logic low. If the side stand is not pulled up warning indication (Buzzer) is given and the engine is turned OFF. This feature ensures the security of the rider.

B. SOFTWARE MODULE

The Software used is proteus. The Embedded C programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.The proteus software which is mainly used in Embedded system , easy-to-use hardware and software .In this section the flowchart for individual module is described. These are basically the subroutines which are called from the main program whenever the particular task is to be performed. Once the subroutine is executed, the control returns to the main program.

(i) *Side stand indicator subroutine*

The side stand indicator subroutine is called only when the engine is in ON state. As shown in fig. 5, the IR sensor is activated (transmits IR rays) and MCU checks for the output signal If the side stand is not pulled up, the IR sensor output is a logic high signal, so a warning indication is given and the engine is turned off for the safety of the rider and control returns to the main program. If the side stand is pulled up completely then the IR sensor output is a logic low signal, so the engine is turned ON and control returns to the main program.

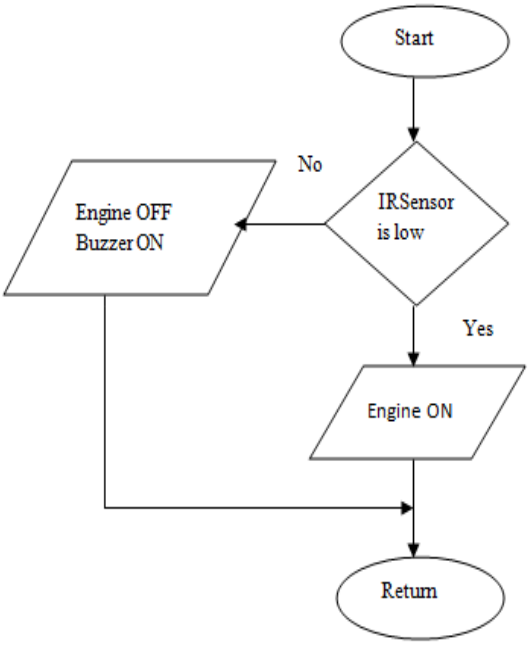

FIGURE 2: Flow chart of Side Stand Indicator Subroutine

(ii) GPS subroutine

The GPS subroutine is called from the main program if either of the following case arises:

- At the request of the owner for the status of the vehicle.
- At regular intervals of time, if the vehicle is in locked state (routine check).

As shown in fig. 3, the location coordinates are fetched from the satellites. If there is a status request from the owner then the location coordinates [6], [9], are sent. If it is a routine check then the latest location coordinates are compared with the reference coordinates (stored when the vehicle was locked). If the difference between the coordinates is greater than 15 meter then owner is alerted and buzzer is activated. Before fetching the next coordinates the microcontroller unit waits for a small interval of time.

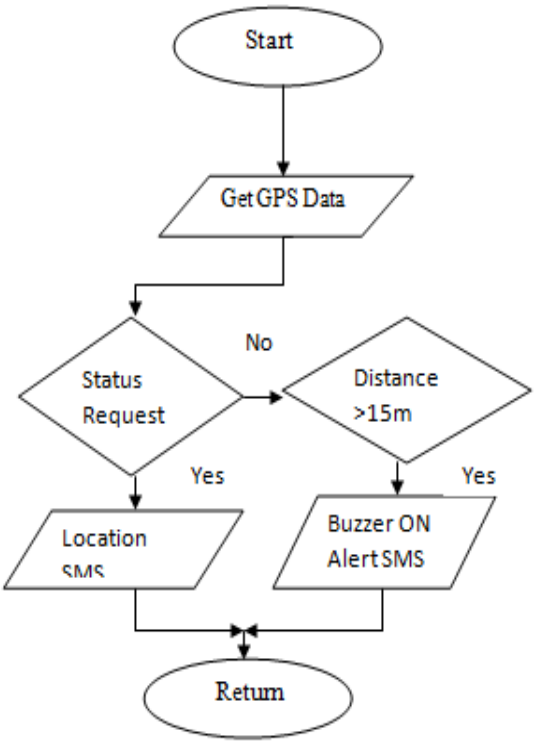

FIGURE 3: Flow chart of GPS Subroutine

(iii) DC motor subroutine

DC motors controls the locking system of the vehicle, hence the servo motor subroutine is called only when the vehicle is to be locked or unlocked. Whenever the locking sequence is initiated by the MCU, the DC motors rotate for a particular angle and locks the handle, fuel and rear wheel. Similarly if the unlocking sequence is initiated then the servo motors rotate for a particular angle, unlocking all the three locks.

(iv) GSM subroutine

GSM subroutine is called only when the GSM hardware receives a SMS from the registered SIM number [17], [18]. As shown in fig. 9, every SMS is associated with a particular set of operation. If the status request is made by owner then status of locking system, location and speed is sent in response.

If Lock SMS is sent by owner then the lock sequence is initiated and RKS remote is disabled. If Unlock SMS is sent by owner then the unlock sequence is initiated. If the Enable SMS is sent then the remote is reactivated. If the Buzzer SMS is sent then the buzzer is deactivated. Thus the GSM module enables the owner to control the security system of the vehicle remotely.

V. RESULTS

The hardware module was tested on Hero Honda CBZ 159cc (2001 model), TVS Victor GL 110cc (2003 model), Bajaj Discover 125cc (2006 model) and Yamaha FZ 153cc (2013 model). Purposefully vehicles of different company and segments (100cc, 125cc and 150cc) were chosen to demonstrate the compatibility of the hardware module. The module was placed under the seat in all the above test vehicles. All the three, servo motor operated, locks were fixed in their respective positions. The 12V battery of the respective vehicle was the power source to the module. The RKS remote could transmit signals to the receiver module, as far as 100m (maximum) from the vehicle. The Atmega328p-pu MCU was interfaced with the computer via the Arduino Uno R3. Arduino Uno R3 converts a USB connection into Serial TX and RX which is in turn connected to MCU serial pins. The MCU communicates with the computer at a baud rate of 38,400. The Arduino IDE serial window was used to observe the states

displayed by the MCU. Two screen shots of Arduino IDE serial window are shown below as examples to illustrate values of different parameters in different states. Fig. 10 shows that initially vehicle was in locked state, unlock button on RKS remote is pressed, the unlocking sequence is performed (Lock OFF), SMS is sent about unlock activity and MCU checks for any new SMS from owner. Fig. 11 shows that initially vehicle was in unlocked state (Lock = 0), lock button on RKS remote is pressed, the locking sequence is performed (Lock = 1), GPS coordinates are fetched (reference value), MCU keeps checking for new SMS and for vibrations (0 indicates no vibrations sensed).

```
Checking New SMS ...
Lock : 0      Eng : 0      HSrv : 0      FSrv : 0      WSrv : 0
Lock On
getting gps
Fuel Resv Off
getting gps
0
Checking New SMS ...
Lock : 1      Eng : 0      HSrv : 180      FSrv : 91      WSrv : 180
0
0
0
^
```

FIGURE 4: Screenshot of Proteus 8 Full (Unlocked state)

```
Checking New SMS ...
Lock : 1      Eng : 0      HSrv : 180      FSrv : 91      WSrv : 180
Lock Off
Send SMS Unlock
Checking New SMS ...
Lock : 0      Eng : 0      HSrv : 0      FSrv : 0      WSrv : 0
Checking New SMS ...
Lock : 0      Eng : 0      HSrv : 0      FSrv : 0      WSrv : 0
Checking New SMS ...
Lock : 0      Eng : 0      HSrv : 0      FSrv : 0      WSrv : 0
Checking New SMS ...
```

FIGURE 5: Screenshot of Proteus 8 Full VC(Locked state)

VI. FUTURE SCOPE AND CONCLUSION

In this proposed Smart lock system is reliable and vigorous version of security system for two wheelers. The proposed system has both hardware and software modules. This security system can be installed on two wheelers of any company ,this will create a huge market for the product. The module is small in size and placed under the seat of vehicle so there is no need of physical changes .By this proposed system ,everyone believe that vehicle theft will be reduced.

Hopping code algorithm could be used in Remote Keyless System (RKS) for added security. Presently only SMS feature is available, we can include the Call feature for ease of operation. Like for example giving miscall would lockdown the vehicle. SIM 300 even supports GPRS coding schemes hence data network could be used to send alerts and receive control messages. Microphone could be interfaced to the GSM module so that during theft activity voice call could be established with the owner enabling him/her to be able to listen and record the conversation of people around the vehicle. Hall Effect sensor could be used to find the position of gear, which could be displayed with a single seven segment display.

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