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ADVANCE AUTOMOBILE SECURITY AND LOCKING SYSTEM USING LEB AND DTMF TECHNOLOGY

[1]CHINMAYA KUMAR MISHRA, [2]DEVENDRA KUMAR MISHRA, [3]B.K. MISHRA

[1,2]TRECO Technologies Pvt. Ltd., New Delhi
[3]BARC, Mumbai
E-mail: [1]chinmaya_ckm@rediffmail.com

Abstract - This paper describes a method for advance automobile security and locking system particularly for bikes, which could be controlled through smart phone as well as ordinary non android phones. The whole circuit of the system could be installed inside the bike in such a manner that it would be very difficult for a miscreant to alter it directly. Low Energy Bluetooth technology and Dual Tone Multi Frequency system backed with a separate power supply constitutes a simple, economical and congestion free security system with high reliability. The initial lab level test for proposed circuit has been conducted and results are very satisfactory. Arduino board and IDE have been used for all simulation and practical test purpose.

Keywords - Bluetooth, DTMF, Arduino Pro-Mini, Arduino IDE, power supply, automobile security, Vehicle theft.

I. INTRODUCTION

Rapid Globalisation, sustained development and economic empowerment of Indian society has flooded Indian market with different luxury and transportation vehicles. These vehicles (CAR, Bike etc) have today become inseparable part of our life not only for luxury but also for business. But at the same time vehicle theft has become a major problem for society in general and low enforcement agencies in particular. According to an article of TOI dated Dec- 27-2014 almost 1.65 lakh vehicles stolen in a year in India. Within a year another article of TOI dated Nov- 11-2015 claimed that in 2015, a vehicle is stolen every 13 minutes in Delhi compare to every 24 minutes in 2014. Off course scenario presented in articles poses a serious concern about vehicle theft.

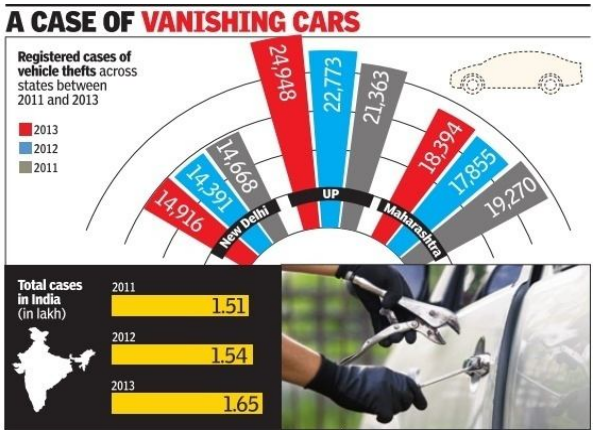

Fig1, Graphical Representation of vehicle theft (TIO)

While concern of vehicle protection raising year by year, many Anti-theft devices to enhance vehicle protection has been developed and suggested by Researchers/engineers. For examples, a key operated manual switch that interrupts power supply from the battery to the ignition, fuel cut-off that is integrated into the fuel line and prevents the flow of fuel to the engine, GSM-GPS based engine power interrupt system and forced entry alert system etc. However, theft problem is still rampant which shows that we need some more advancement in solution to tackle this problem. If we see problems with exiting system closely, we can identify that first two solutions are directly outside exposed and hence miscreants can either modify or snatch it easily to start the vehicle. The last one with GSM-GPS technology is advanced but dependency on vehicle power supply which can drain the source if switched on for long time, must use of smart phone, and continuous need of network availability to get alert for force entry or sending command/SMS to shut the vehicle, making this system less effective to address the actual problem.

In our proposed model we have focused on following main things;

- System must have its own source of power hence longer use would not be a burden on vehicle power source (battery).
- System must be economical and simple. Also could be operated by android phone as well as simple non android phone.
- An outside exposed switching mechanism which provides user facility to ON proposed system as needed but the same time becomes affectless once system is ON and eventually system could only be controlled through user's mobile, hence better security from miscreants .
- Better integration possibilities with advanced future technologies.

In this paper **section-I** is used to explain function of different parts and its main components integrated with proposed system. **Section-II** describes circuit and related calculations for its passive elements present in proposed system. In **Section-III** glimpse of basic Arduino programming to integrate LEB and DTMF with proposed system has been shown.

SECTION-I

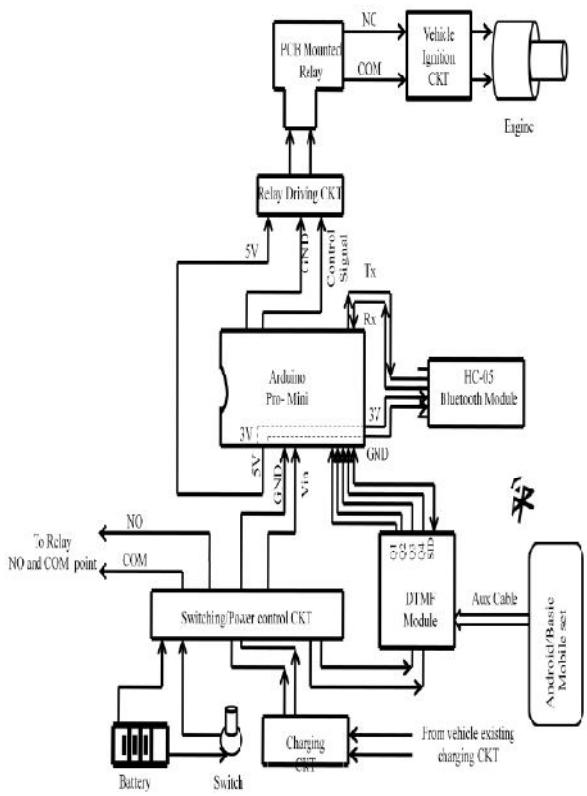

Fig2, Proposed security system layout

A Brief description of different parts of above proposed system with specification of different component used in this are listed as below,

1) Aurduino Pro-Mini :

Introduction:

The Arduino Pro Mini is a microcontroller board based on the ATmega328.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable or Sparkfun breakout board to provide USB power and communication to the board. The Arduino Pro Mini is intended for semi-permanent installation in objects or exhibitions.

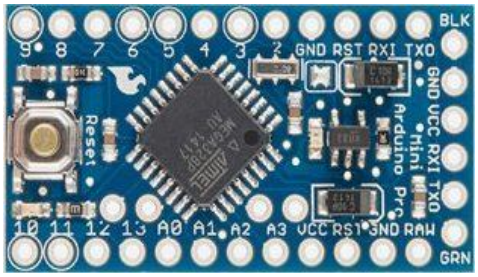

Fig3, Arduino Pro-Mini board

The board comes without pre-mounted headers, allowing the use of various types of connectors or direct soldering of wires. The pin layout is compatible with the Arduino Mini. There are two version of the Pro Mini. One runs at 3.3V and 8 MHz, the other at 5V and 16 MHz. The Arduino Pro Mini was designed and is manufactured by Spark Fun Electronics.

Use in proposed system:

- It's the brain of whole system, stores all programs and logics to connect and communicate with peripherals like LEB and DTMF module.
- Providing operational Control signal for relay module.
- Source of power for LEB and relay module.
- Providing scope for system future up- gradation by connecting advance peripherals through its unused digital ports.

2) Bluetooth Module (HC-05):

Introduction:

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks (PANs). Range is approximately 10 Meters (30 feet).

Fig4, HC-05 Bluetooth Module

The HC-05 Bluetooth Module has 6pins named as Enable, Vcc, GND, Txd, Rxd and State. Its Supply Voltage is 3.3V to 5V. A BUTTON SWITCH is used to switch this module into AT command mode which enables user to change the parameters of this module but only when the module is not paired with any other BT device.

Use in Proposed system:

- To provide wireless connection between proposed system and user smart phone using Bluetooth technology.
- To Receive and send, control and status signal between proposed system and user.

3) DTMF Module (IC MT8870):

Introduction:

This board decodes DTMF signal either from an audio source or phone line to 4 bit binary TTL(5V) level output. It also indicates outputs with LED. Can use directly with microcontrollers to develop various DTMF related applications like remote monitoring, remote control, Caller ID, Auto Dialler. Its operating voltage and current is +5V (regulated) and 100ma respectively. It is Based on excellent MT8870 IC.

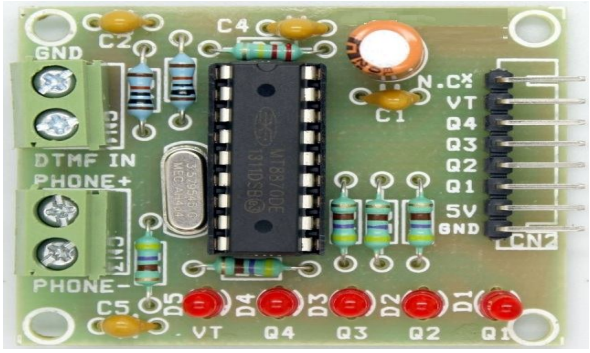

Fig5, DTMF Module (MT8870 IC)

Use in Proposed system:

- To provide wired connection between user's normal/smart phone and proposed system to receive control signal from user's mobile.
- To serve the advantage of proposed system to user's carrying normal mobile set without any advance feature say BLE, Wi-Fi, GPS etc.

4) Switching/Power Control Circuit:

Introduction:

This circuit has been introduced in proposed system for smooth power supply to different system peripherals and also to carry wired switching logic to make proposed system automatic and more secure from outside circuit alteration.

Use in Proposed System:

- To carry wired switching logic which makes proposed system autonomous while switched on and more secure from outside circuit alteration.
- To carry points for power distribution among different system peripherals say Arduino Pro-Mini, DTMF module and Relay.

5) Charging Circuit:

Introduction:

This circuit is in system to charge the dedicated power source of proposed system. This circuit is using existing vehicle charging system to charge the dedicated power source and the same time it ensures that when vehicle is not running dedicated power source must not be as a load on vehicle power supply.

Use in proposed system:

- To charge the dedicated power supply.
- To ensure that when vehicle is not running proposed system power source is not become a load on vehicle power source.

6) Relay Driving Circuit

Introduction:

This circuit is commonly used to operate low power relay coil which actuates relay contacts and in turn allows it to control a high power circuit. In other words, this circuit allows operating a high power required system through a small power source. The design and types of relay switching/Driving circuits is huge, but mostly transistors and MOSFETs are used as their main switching device. As transistor can provide fast DC switching (ON-OFF) control of the relay coil from a variety of input sources we have used it in our case.

Use in proposed system:

- To provide switching control (ON-OFF) to system relay.
- To avoid direct operation of relay coil through Arduino pin.

7) Relay

Introduction:

Fig6, Leone L90 CSDC ,6V-30A, T-Type Relay

Leone L90 CSDC ,6V-30A, T-Type high current carrying capacity PCB mounting relay .

Use in proposed system:

- To connect and cut off the electrical circuit of vehicle ignition system according to user specified signal.

8) Battery

Introduction:

Fig7, 6V,4.5AH Amptek Lead Acid battery

- 6V,4.5AH Amptek T6-4.5 STD Lead Acid battery.

Use in proposed system:

- To supply power to whole proposed system.

9) Switch

Introduction:

Fig8, 6V, On/Off Push Floor Switch

- ATO 80-1163 – On/Off Push Floor Switch .

Use in proposed system:

- Initial control of switching action of proposed system to optimise system power consumption.

SECTION-II

1. Switching/power control circuit: (explain working with diagram):

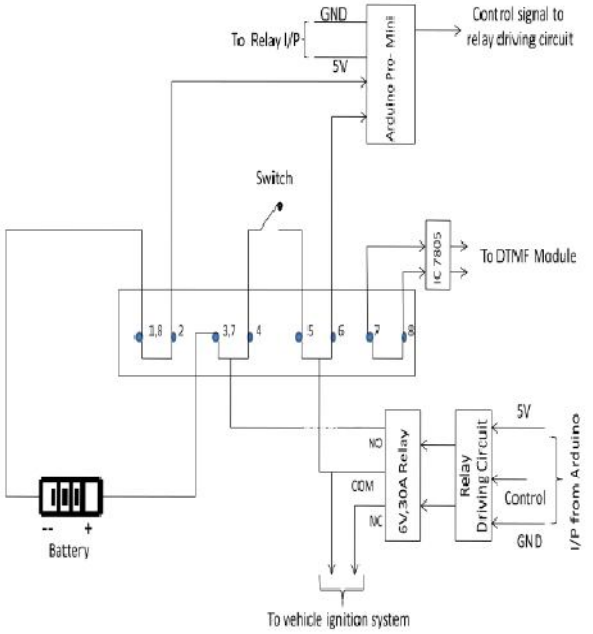

Fig 9, Switching/power control circuit

Important functions of circuit:

a). When switch is ON whole circuit start getting supply. No "NO-NC" change in relay.

b). Switch is ON and Relay driving circuit triggered through LBE or DTMF module. "NO-NC" change in relay and vehicle ignition system turned off.

c). Switch tuned off but system still getting power supply. Literally there is no effect of making switch ON or OFF at this stage and circuit continue to get supply until turned off through LBE or DTMF module.

2. Charging circuit (explain calculation with diagram):

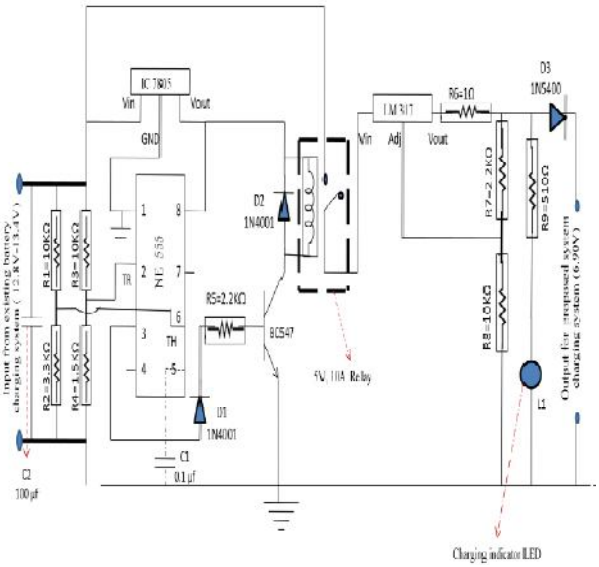

Fig10, Charging circuit

CALCULATIONS:

i) For NE555 based relay operation:

Relay ON if Vin > Vt (3.333V)

Relay OFF if Vin < Vtr (1.667V)

$$Vth = \frac{2}{3} Vcc = \frac{2}{3} \times 5\ V = 3.333V$$

$$Vtr = \frac{1}{3} Vcc = \frac{1}{3} \times 5\ V = 1.667V$$

If R1 = 10K Ω and Vin = 13.4V

Then,

$$R2 = \frac{R1 \times Vth}{Vin - Vth} = \frac{10 \times 3.333}{13.4 - 3.333} = 3.311 \sim 3.3K\Omega$$

Now again if R3 = 10K Ω and Vin = 12.8V

Then,

$$R4 = \frac{R3 \times Vtr}{Vin - Vtr} = \frac{10 \times 1.667}{12.8 - 1.667} = 1.497 \sim 1.5K\Omega$$

ii) For LM317 based charging circuit:

$$Vo = \left(1 + \frac{R8}{R7}\right) Vref$$

$$= \left(1 + \frac{10}{2.2}\right) \times 1.2 = 6.931V \sim 6.90V$$

SECTION-III

1. Basic Program to change Bluetooth name and password:

```
void setup()
{
  Serial.begin(9600);
  Serial.println("Enter AT commands:");
  BTSerial.begin(38400);  // HC-05 default speed in AT command more
}
void loop()
```

```
{
 // Keep reading from HC-05 and send to Arduino Serial Monitor
 if (BTSerial.available())
   Serial.write(BTSerial.read());
 // Keep reading from Arduino Serial Monitor and send to HC-05
 if (Serial.available())
   BTSerial.write(Serial.read());
}
```

2. Important at Commands to Change Name and Password:

- To return HC-05 to mfg. default settings: "AT+ORGL"
- To get version of your HC-05 enter: "AT+VERSION?"
- To change device name from the default HC-05 to let's say MYBLUE enter: "AT+NAME=MYBLUE"
- To change default security code from 1234 to 2987 enter: "AT+PSWD=2987"
- To check your existing password: “AT+PSWD”
- To change HC-05 baud rate from default 9600 to 115200, 1 stop bit, 0 parity enter: "AT+UART=115200,1,0"

3. Basic programme to integrate DTMF with system:

```
void setup()
{
pinMode(A1,INPUT);
pinMode(A2,INPUT);
pinMode(A3,INPUT);
 pinMode(A4,INPUT);
pinMode(A5,INPUT);
 pinMode(LED_BUILTIN, OUTPUT);
 }
char mobile_input;
char count=0;
char password_entered[5];
char password_set[5]="1234";
char status=0;
//mobile_input=PINC & 0xf0;
//mobile_input={A1 A2 A3 A4};
void loop()
{
mobile_input=PINC & 0xf0;
if(status==0)
{
/*4 digit password entry*/
if(count<4)
{
_delay_ms(10);
/*10 millisecond delay*/
mobile_input=mobile_input>>4;
/*Right shifting the DTMF value*/
}
/*Checking whether the DTMF output is less than 10 or not*/
if(mobile_input < 0x0a)
{
if(mobile_input==0x0a)
{
password_entered[count]=48;
/*Inserting the ASCII value of 0 in the password_entered array*/
}
else
{
password_entered[count]=48+mobile_input;
/*Inserting the ASCII value of pressed key in the password_entered array*/
}
/*Checking whether 4 digit password is entered or not*/
if(count==4)
{
count=0;
/*Reseting counter variable*/
password_entered[4];
/*Adding Null charcater at the password_entered array*/
/*Comparing entered password with set password*/
if(!(strcmp(password_entered,password_set)))
{
status=1;
/*Entered password is right*/
 digitalWrite (LED_BUILTIN,HIGH);
}
   else
   {
    digitalWrite (LED_BUILTIN,LOW);
   }
         delay(10000);// added 10 second delay to make sure the password is completely shown on screen before it gets cleared.
   //clearData();
  }
 return;
}
}
}
```

CONCLUSION

A cost effective, intelligent, and more secured system has been proposed. System could be operated through smart phones as well as with normal mobile phone hence more user friendly and economical. System is open for other advanced technology (GSM, NFC, GPS etc) integration hence better future feature enhancement possibility. Same system can be modified and used to protect different residential and commercial premises or could be integrated with IoT based security systems.

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