SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

2ND GENERATION CAR SECURITY SYSTEM

A Thesis Presented To

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Md. Khalilur Rhaman 12/4/2012

Signature of Supervisor

ABSTRACT

The requirement of a car has been so vital nowadays that normal people has now been considering it more as a necessity than a luxury. Having a car automatically brings in a proper security for it. The world has so far experienced many security solutions for a car, yet car thefts did not show any sign of reduction. As such, we would like to implement a car security system that will have a lot more functions and will be more reliable than the present ones. Throughout the thesis we wish to implement the following functions:

- Passive Immobilizer: This will enable locking and unlocking within a short, specified distance from the remote. The locking will automatically occur if the remote is beyond the range. Wireless communication system will be followed here.
- Car Tracking System: This will basically be a GPS unit that will provide information on the car's geographic location by using Satellite communication.
- Warning alarm: After all the security functions to access the car, still if someone illegally gets access to start the car, this warning alarm will let the people around know about the car being stolen.
- Weight Sensor: The weight sensor senses the weight that sits on the car. For ay abnormally high value in the car, the sensor senses that and will light on the alarm accordingly.
- Robust Jumper Alert: Where the car experiences heavy jumps or shakes this alarm will be on. The car's present state will be compared with a reference stability level for this purpose.

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INTRODUCTION

To some, car is a necessity, to a few more, a car shows the level of aristocracy, and to many a car is an asset earned by years of hard work and earnings. Whatever the case is, a car is an apple's eye to almost all families and its safety is thus of utmost importance from every aspect.

Unfortunately, car theft has been so frequent, and in some cases dangerous too, that the requirement of advanced car security system has been fundamental. With the advancement of technology in car securities, ways of car stealing has been developed too. So a package of different types of security will ensure higher safety and protection against thefts. This has been the key motivation for us to undergo such a project that will enhance our cars with strict guarding.

EXISTING SYSTEMS

A few of the leading manufacturing countries of car security system includes China, USA, Italy and India. Some of the highly demanded car security systems are listed below:

- **Alarm Systems** – Practically, noise influences on thieves quickly and effectively. It also acts as a messenger to let the people nearby know about the illegal entry in a car. That is why there is wide range of alarm system sensors: impact, motion, door-open, etc. Most alarm systems ensure that their alarm noise is loud enough to grab people's attention.
- **Remote Keyless Entry System** – This is a system which locks and unlocks cars remotely. This is achieved by sending pulses on a particular frequency. Advanced mechanism uses encrypted pulse transmissions that ensure higher safety.
- **Steering Wheel Locks** – For amateur and unprofessional thieves, this system is very effective. This is achieved since the steering gets firmly fitted that allows theft to be practically impossible.
- **Immobilizers** – This special type of security cuts off the fuel or the ignition to stop the car from being started. However, even with this method enabled, a thief can break into a car, but stealing gets quite impossible as long as the immobilizer is hidden from the thief; in other words, as long as the immobilizer is not disabled by the thief.

- **VIN Etching** – Vehicle Identification Number (VIN) is etched onto many parts of a car. This specifically serves the security purpose of prevention of stealing cars with an intention to sell its parts. This means, even if a vehicle is stolen, the presence of VIN on various important parts of the car will makes its identification easy.
- **Central Locking system** – The main idea of this security is pretty simple. Through this, locking or unlocking of only the driver's door will act as a similar action to the other doors of the car.
- **GPS Vehicle Tracking system** - With the GPS tracking device installed in the car, the owner is certain that his car won't ride away too far a distance without it's knowledge. The minute it is suspected that the car has been stolen, the owner can inform the authority and they will immediately tap into the GPS system so that they can instantly check where the car is at that very instant. Skilled car thieves can override the car's alarm system and get away with the car, but with the GPS tracking system active in the car, hiding is never an option.

Unfortunately, even with so many advanced technologies to guard our cars for safety, car theft has not been stopped. Rather in some countries, car theft has increased than the past years. A possible answer to this mystery might be, with the advancement of car security, car theft has upgraded itself as well with the use of higher advanced technology and tactics.

STATISTICAL ANALYSIS

Given below are some simple statistical analysis of car thefts for Malaysia and UK:

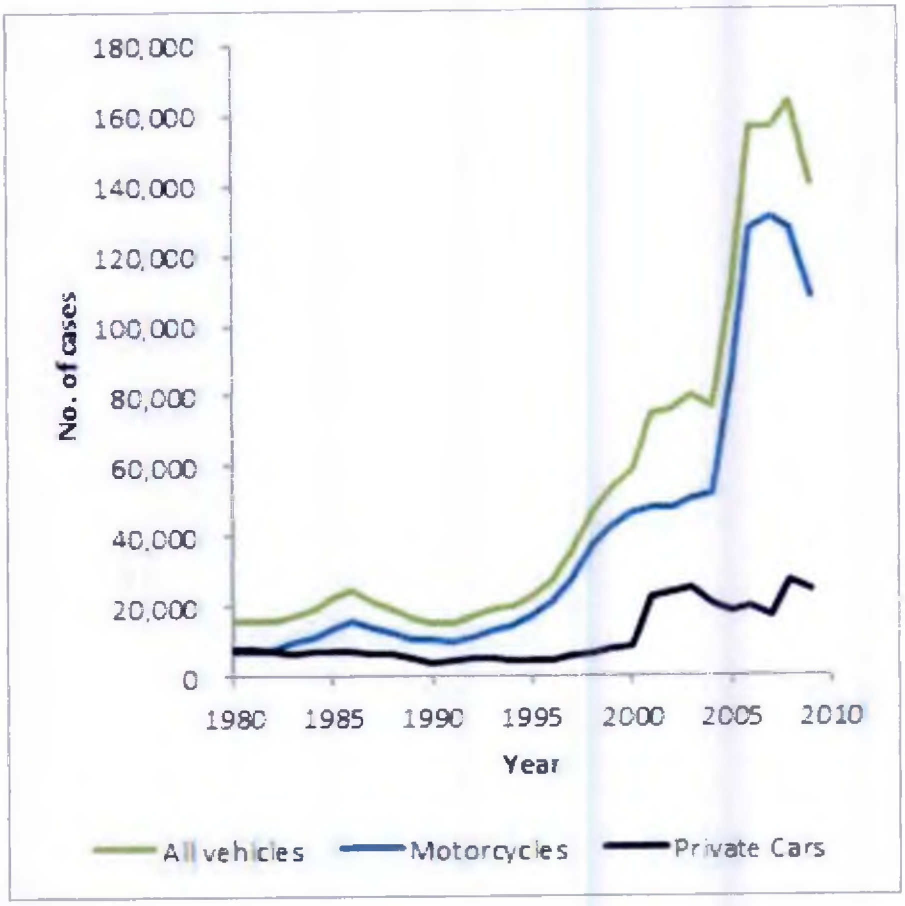


Fig: 3.1 Car theft statistics in Malaysia from 1980 to 2010

As per this graph, in 1980, around 9000 cars were stolen. From 1990 to 1997, car theft even though decreased slightly but drastically increased in between 2000 and 2005. Still not at 2010 car theft has increased significantly compared to that in 1980. The graph says around 21000 cars have been stolen in 2010. This gives a percentage increase of around 133% compared to 1980.

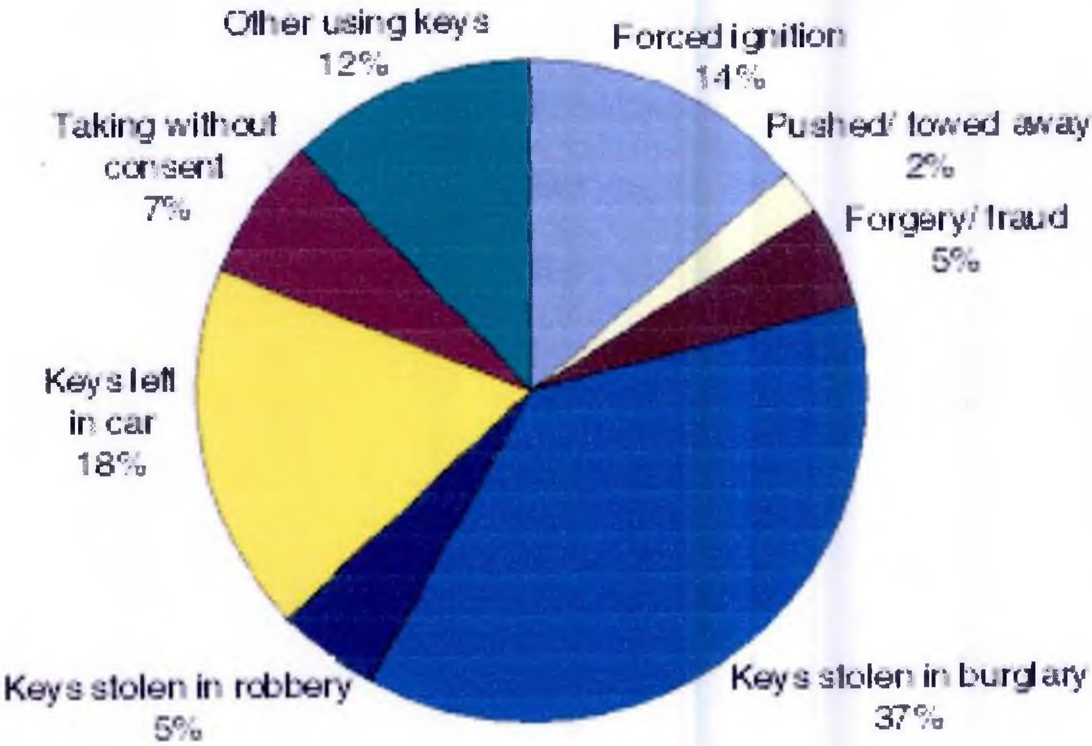


Fig: 3.2 Recent Car theft methods at UK in 2009

This analysis shows that still now the car's key has been one of the key factors for car thefts. Just stealing the key through burglary has aided the thieves to steal a car. A few other ways were the Forded Ignition and Pushed/Towed away. Most of these solutions will be solved once our targeted implementation of this project is accomplished.

ACCOMPLISHED FEATURES

Through this project we wish to implement the following security systems:

- Passive Immobilizer
- Weight Sensor
- Warning Alarm
- GPS Vehicle Tracker
- Robust Jumper Alert

PASSIVE IMMOBILIZER

The basic idea of passive immobilizer is to make sure that at any cost, one's car cannot be left unlocked and unsafe. Locking and unlocking should be done only when it is required and it will be ensured by this system. A small remote will be kept with the key by means of a key ring. Thus technically, with this system the doors of the car will get auto locked whenever the key (or to be practical the driver) is away from the car at a specified distance. In the same logic, auto unlocking will be done when the key is within a certain distance from the car.

WEIGHT SENSOR

As the name suggests the weight sensor senses the weight that sits on the car. For any abnormally high value in the car, the sensor senses that and will light on the alarm accordingly. The limit of weight has to be given by the manufacturer during the construction of the product. The idea of using a weight sensor is more appropriate for commercial vehicle owners or for private car owners who have an appointed driver for their car. However, that would only be possible if the car has a log-in memory system, because then the total weight sat in the car at various instant of time will be saved and shown at the end of the day and owners will be aware if their driver is misusing their car for rent purposes or not. However, due to lack of resources the log in memory was not setup for this thesis project.

WARNING ALARM

Even after all the security measures, if the car experiences any illegal entry in it, the warning alarm system will act. This will not only warn the people nearby about it being stolen with noise; it will also notify the driver through the sensor in the key ring. This notification will be wither a visual light, or audible sound, or may be a combination of both, or even something more advanced. The warning alarm is expected not only to notify but its sound will also help to distract the thief and make him more nervous with the noise.

GPS VEHICLE TRACKER

GPS stands for Global Positioning System. A GPS locater device will be installed in the vehicle and through this the vehicle can be monitored. The GPS will get its signals from the satellites to pinpoint the car's location. It combines mobile technology (GSM) with the satellite (GPS) to operate and control vehicles easily with any mobile phone by SMS anywhere at any time. Its functions of locating, tracking, control and anti-robbery will be applied to all kinds of vehicles.

ROBUST JUMPER ALERT

This jumping alert will help drivers drive on the safest way possible ensuring the passengers complete comfort. The system will alert the driver whenever the car experiences any heavy jumping or shaking. As long as that state of discomfort continues, the alarm will be on.

We had plans to accomplish a few different features at the end of our project. However, as we proceeded on, there have been some changes due to resource unavailability, cost ineffectiveness and conditions for which implementing the other features wasn't necessary. For now, we have prioritized the features and have chosen the ones which have been considered as the most important ones. If resources are available then those features, if later proved to be effective enough for security purposes, may be implemented.

SYSTEM ARCHITECTURE

BLOCK DIAGRAM

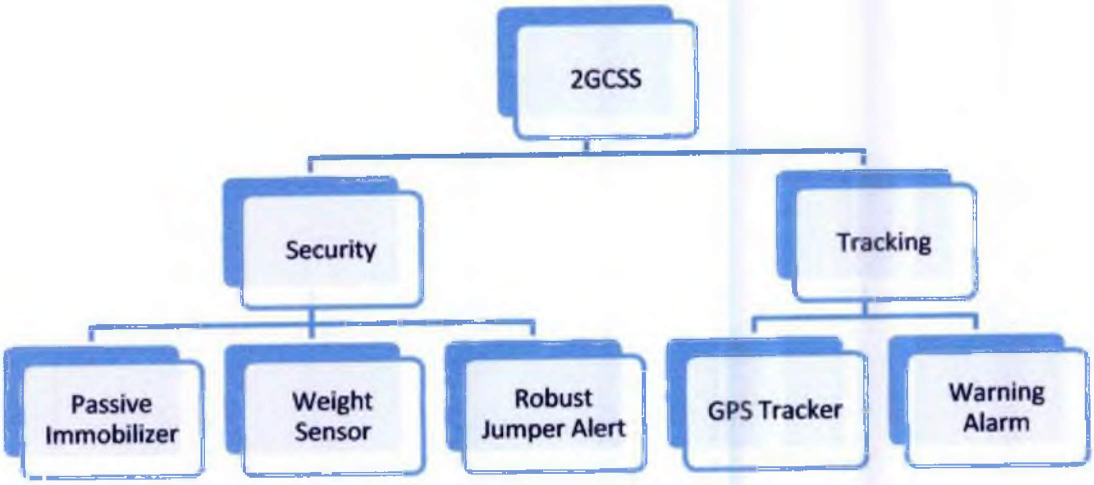


Fig: 5.1 Block Diagram of the Main system of the Project

PREVIOUS PLAN

In the last semester, we were mainly focused to implement the Passive Immobilizer using microcontrollers, and the GPS Tracker. For the passive immobilizer, there are basic two components, the transmitter, KST TX01, which will be placed in the remote, and the receiver, KST RX806E, which will be installed in the car. PIC16F72 microcontroller with 28 pins and PIC18F4550 with 40 pins were used in the transmitter and receiver circuit respectively. The transmitter and the receiver were paired such that they had a synchronization which will not match with other pairs. In the transmitter, a signal was generated which would be encoded, and thus an encrypted signal was transmitted. If received by the receiver, the receiver was coded to decode the encrypted signal. The system was designed such that only when the correct signal was received, the receiver would light the LED, which when implemented in the main car, meant the unlocking of the car. The only major problem in that system was the signal transmitted was so strong that we couldn't limit it within 2m. Since this wasn't accomplished, it wasn't possible to ensure that the car would lock when its paired remote was not nearby.

Due to this limitation, we then implemented the entire passive immobilizer system using Encoder and Decoder.

PROJECT PROGRESS

PASSIVE IMMOBILIZER

The basic idea of passive immobilizer is, with this system the doors of the car will get auto locked whenever the key (or to be practical the driver) is 2m away from the car. In the same logic, auto unlocking will be done when the key is within 2m distance from the car.

The passive immobilizer consists of a transmitter and a receiver which is synchronized with a frequency of 433MHz. The figure given here shows the schematic circuit diagram of

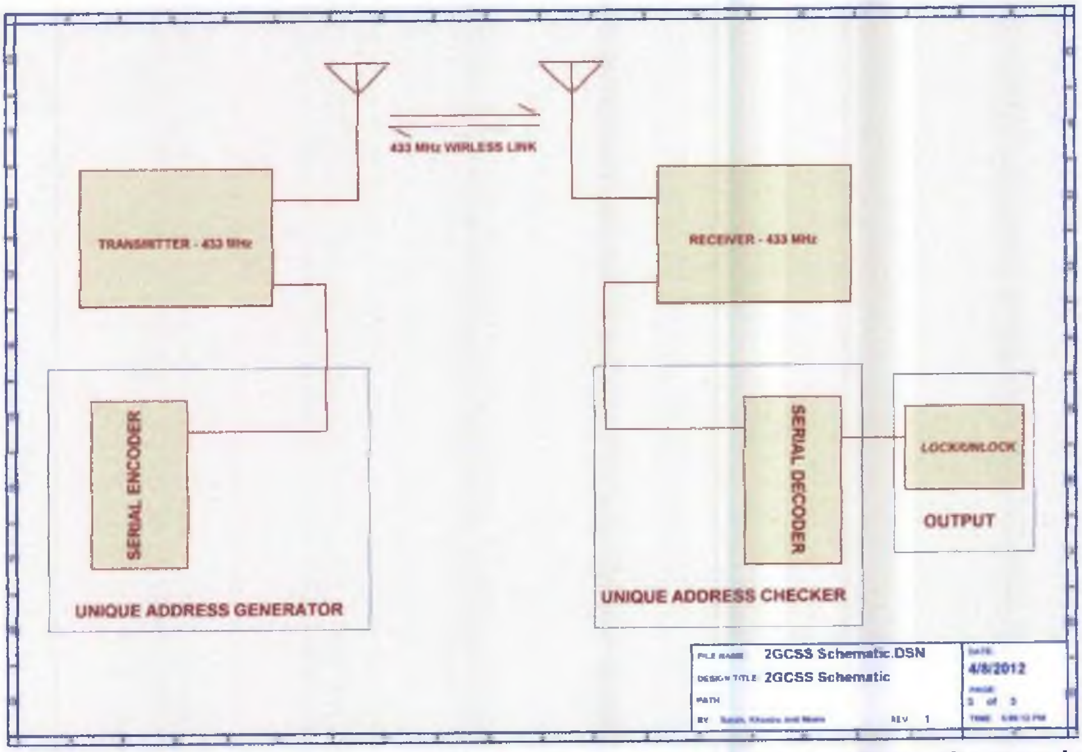


Fig: 7.1.1 Schematic Circuit Diagram of the basic passive immobilizer system

the basic configuration setup of this wireless communication system. The encoder in the transmitter circuit sends a serial input as a signal. This encoded signal with the specific frequency is then decoded. The LED will glow if the decoder has decoded the desired signal which ensures that the transmission has been valid.

The transmitter and receiver in the passive immobilizer have a very strong signal strength which can transmit signal throughout a city. Hence in order to reduce the range the signal strength has been weakened.

Inside the transmitter is a module which has an oscillator that generates a frequency of 433MHz. This frequency goes to the mixer where it is combined with the serial input. The output from the mixer is then amplified using an amplifier that gives an output signal very powerful. Inside the amplifier there is another module which contains a transistor, which can be used to vary the signal strength. An 8.2kΩ resistor is connected to the transistor that ensures less current flow through the transistor, and hence weakens the signal. This in turn, reduces our signal range and we finally get our desired distance which is roughly 2m.This resistance value has been obtained by trial and error method, where different resistance values have been set and its corresponding signal range has been measured. The graph with Fig: 7.1.3 shows our obtained findings regarding resistance and distance limits.

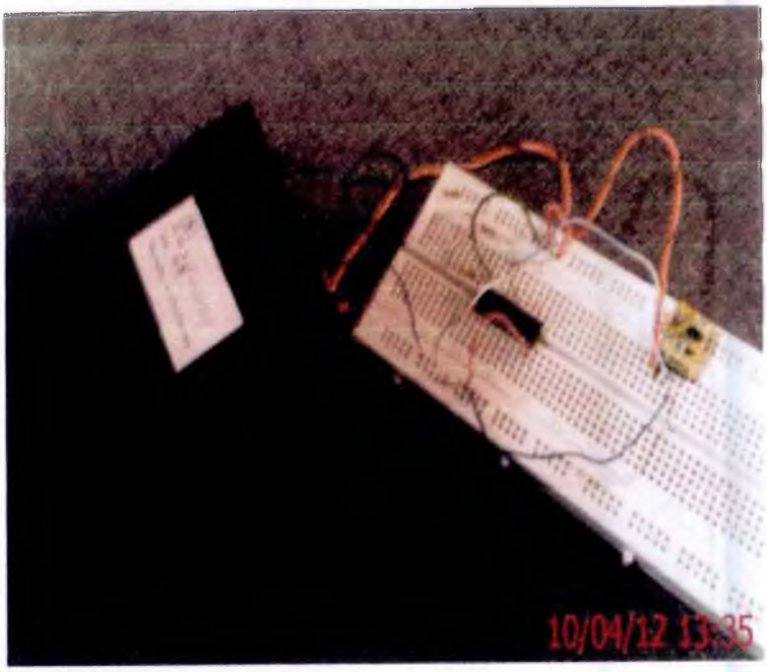


Fig: 7.1.2 Transmitter Circuit Diagram

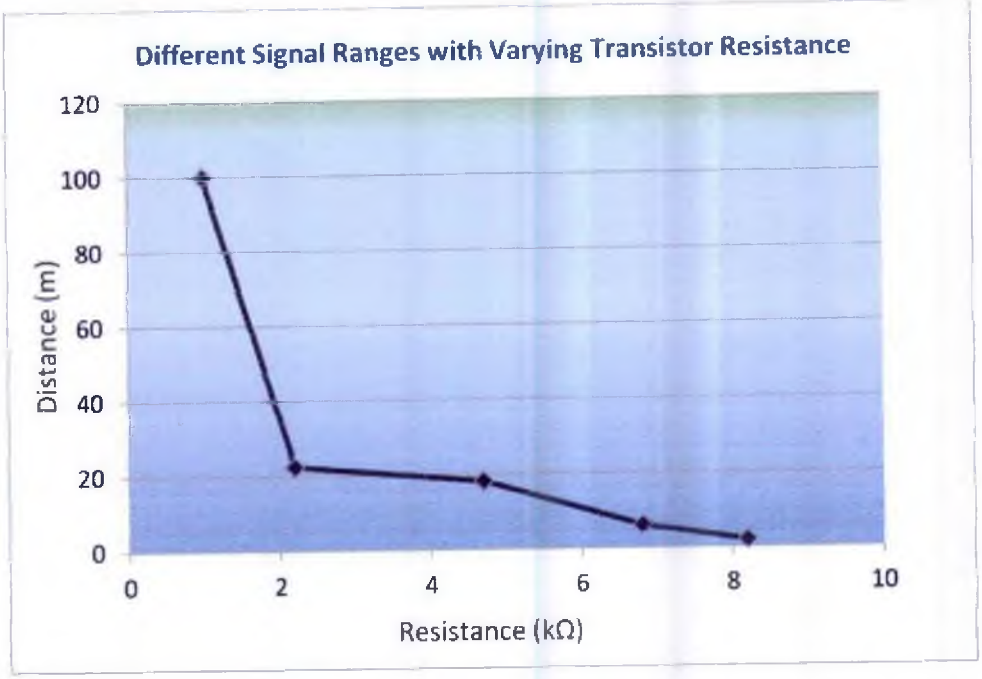


Fig: 7.1.3 Graph of Different Signal Ranges with Varying Resistance of the Transistor

Given on the next page is fig: 7.1.4 of another schematic diagram of passive immobilizer where the different internal procedures and the changes made to alter the signal strength are given:

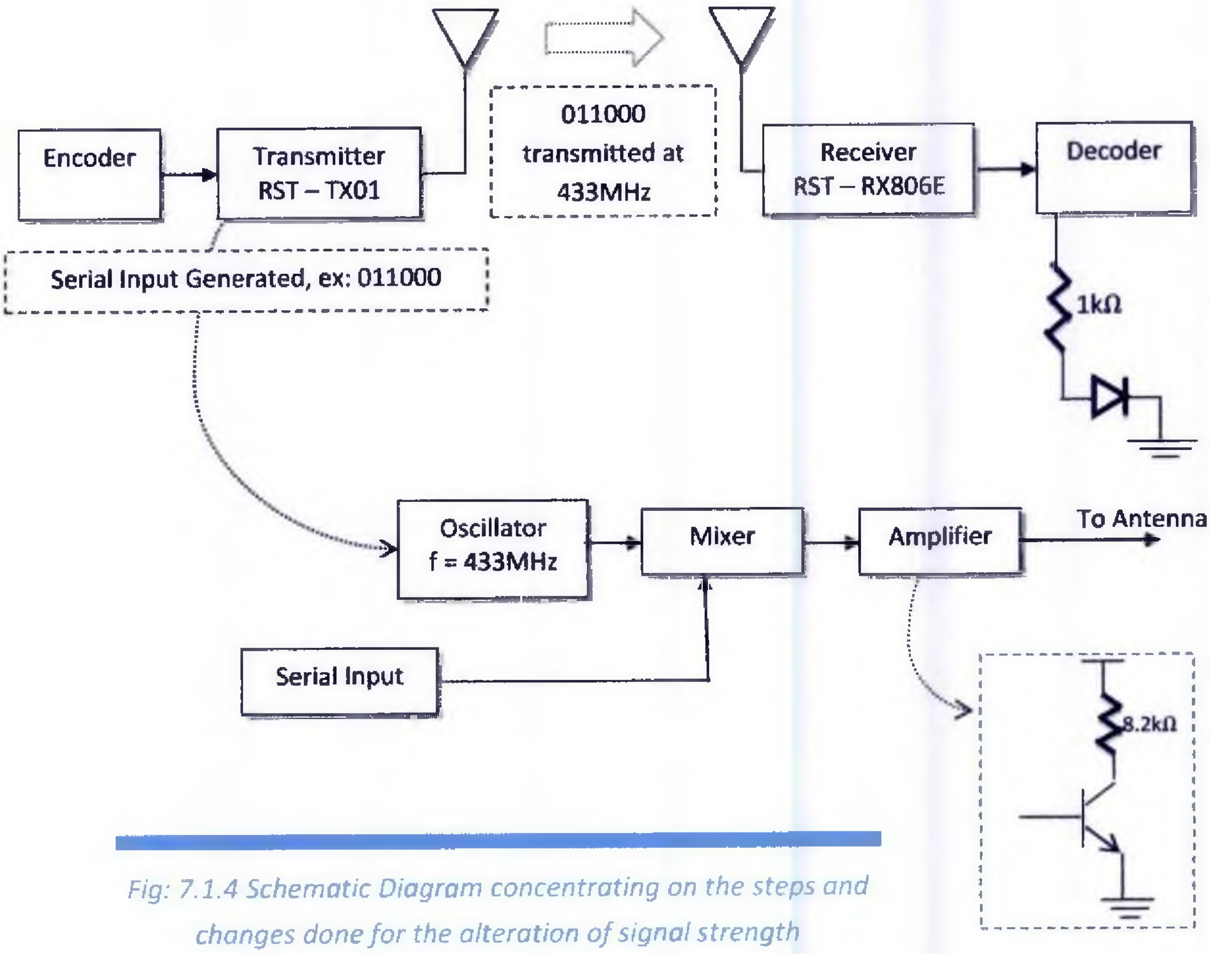


Fig: 7.1.4 Schematic Diagram concentrating on the steps and changes done for the alteration of signal strength

Fig: 7.1.5 Schematic Diagram of the Transmitter

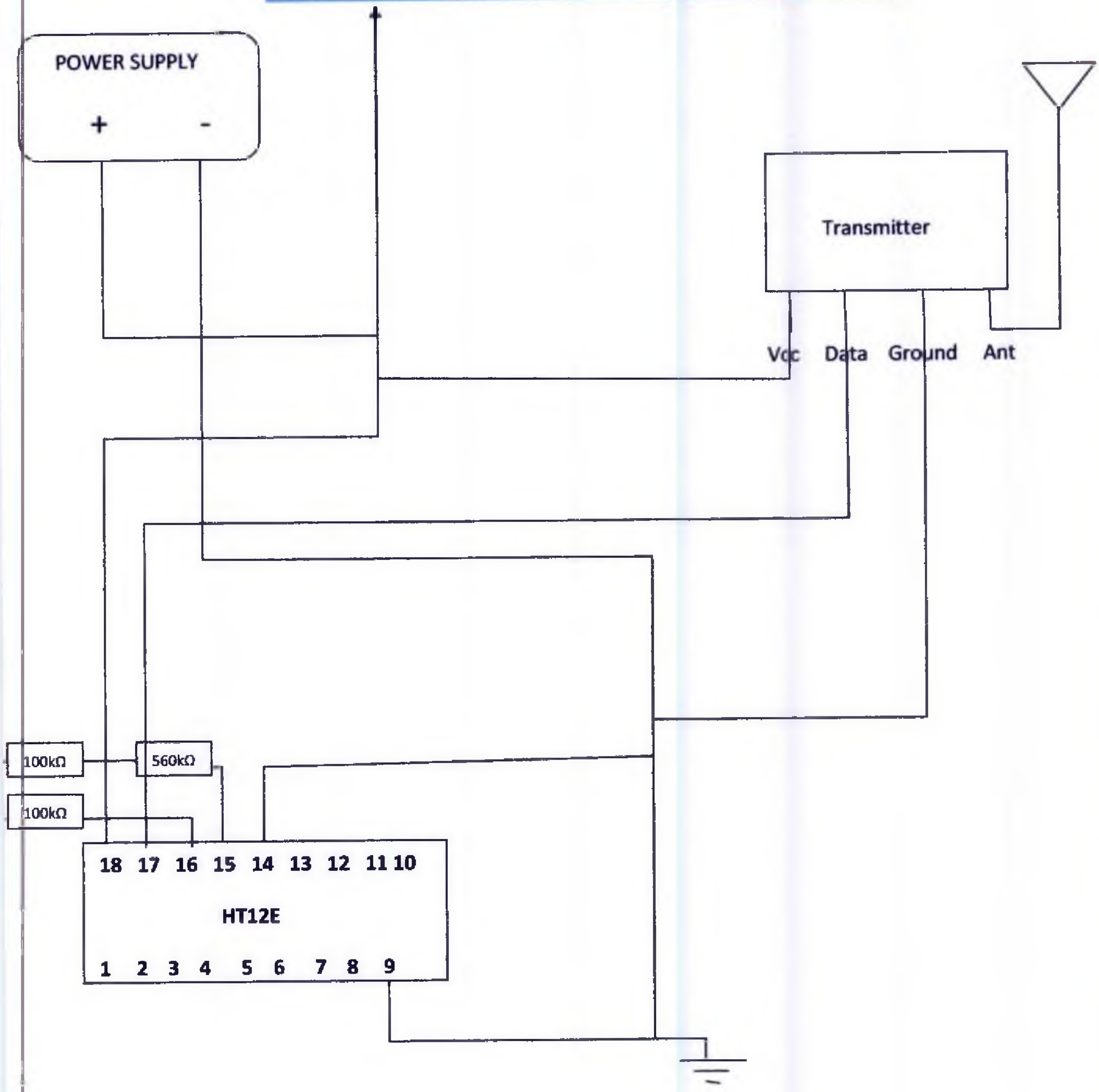
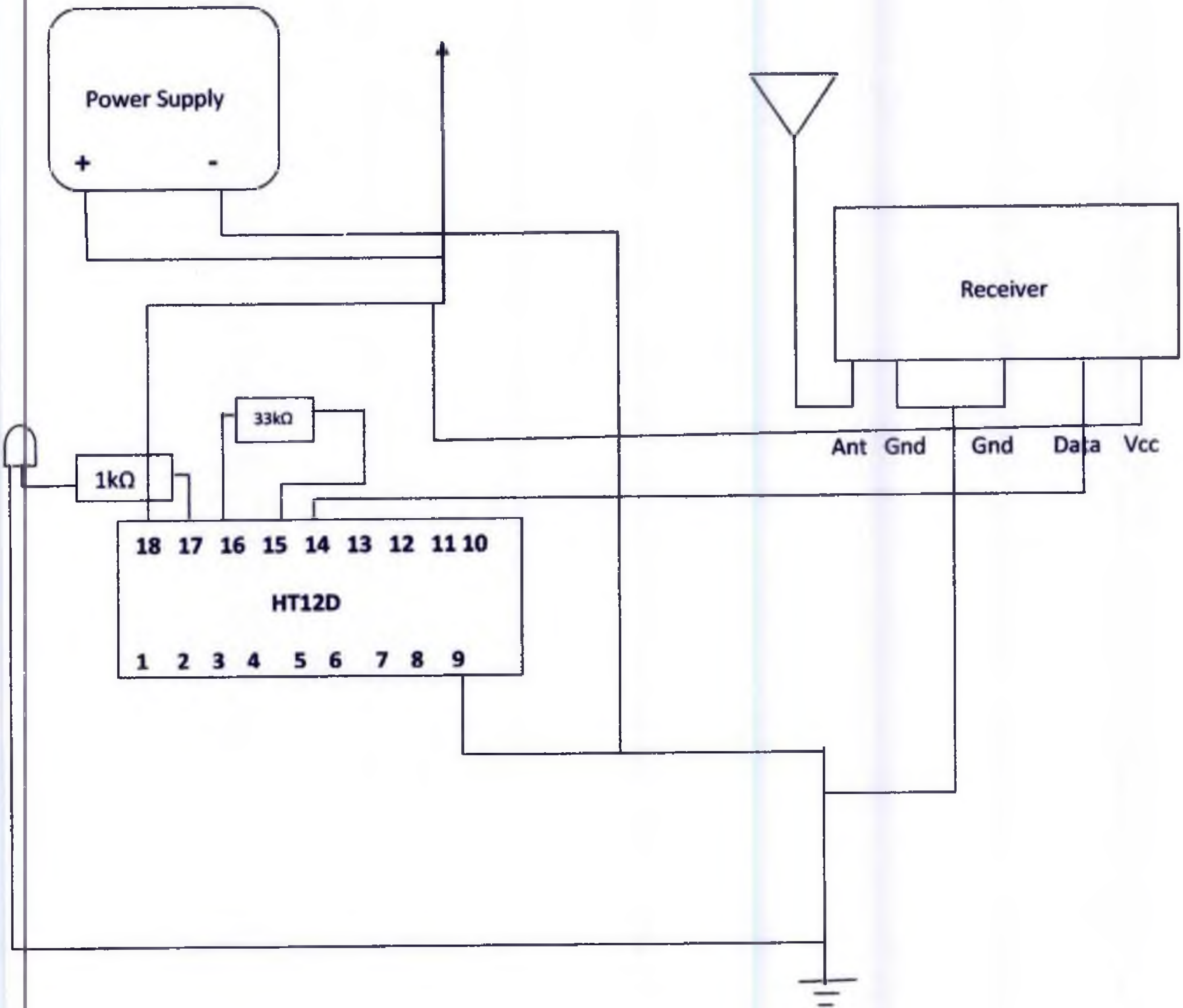


Fig: 7.1.6 Schematic Diagram of the Receiver



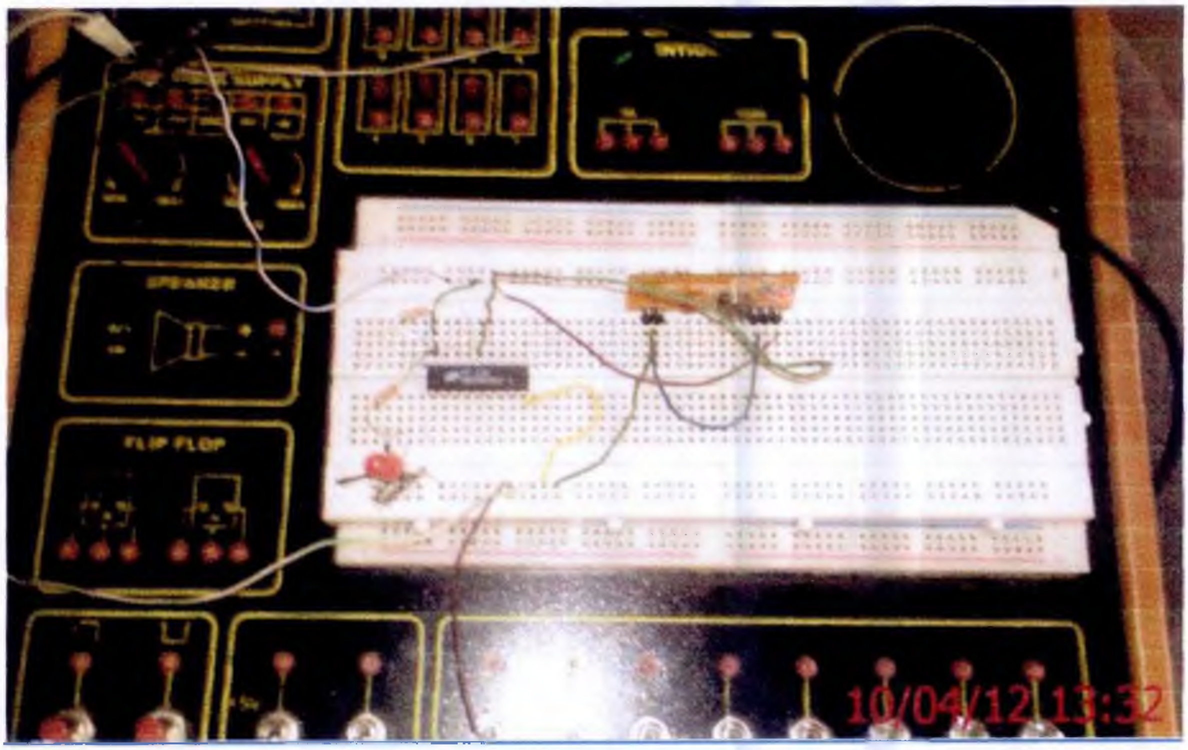


Fig: 7.1.7 Circuit Diagram of the Receiver

WEIGHT SENSOR

The weight sensor is a device that senses weight. We have set a tolerance limit which when exceeded the weight sensor will respond to it turning on the buzzer as a way of notification for the exceeded weight limit.

The weight sensor comprises of 4 wires two of which includes the positive and negative voltage respectively, whilst the other two wires are the positive and the negative outputs. When a certain weight or force is applied to the weight sensor, it generates a corresponding voltage which is the output. This output is the difference between the positive and the negative outputs. The output obtained here usually ranges from 20mv – 25mV. This value is so small to be readable that it needs to be amplified, for which an Op-amp, namely LM358, is used. We know, the gain from an Op-amp is given by:

Gain = $1 + R_f / R_i$

The R_f has been set to 1MΩ and R_i to 1kΩ. Thus we have got a gain of 1001. As such, we amplified our output voltage to roughly 1000 times. This readable voltage reading is then passed through another Op-amp. This time, the op-amp is used as a comparator. A variable resistor is connected to the inverting input of this comparator, LM358. The voltage from this variable resistor is varied such that the buzzer, which is the final output, coming from the comparator, will be within a mass range of 18-20 kg. Due to scarcity of resources, the weight sensor used here is limited to 20kg. If commercially used, more powerful weight sensor with a higher range may be used. The entire circuit plan and working mechanism will be same as the one we have done. The amplified gain may be varied by varying the resistors, R_f and R_i, as per requirement.

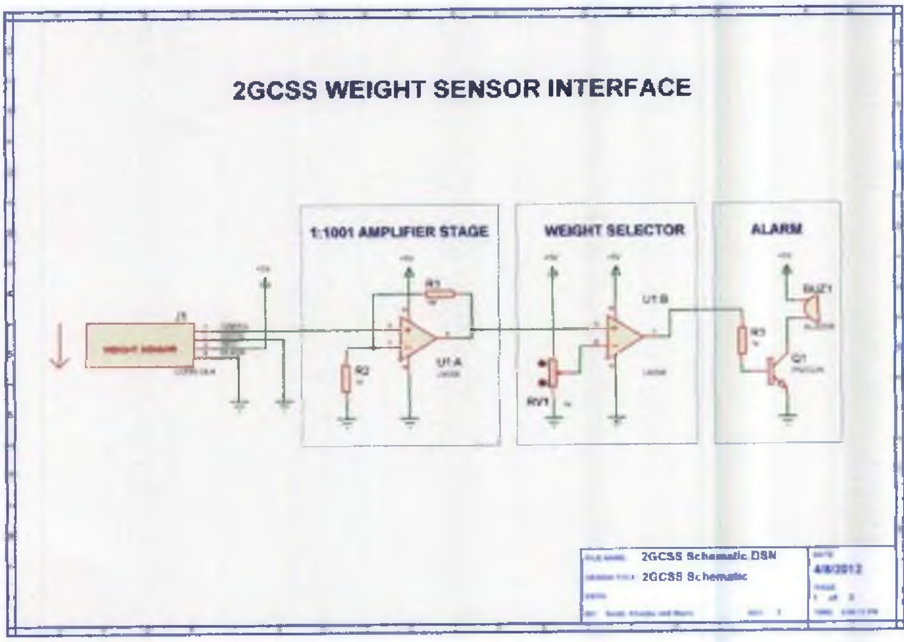


Fig: 7.2.1 Schematic Diagram of Weight Sensor

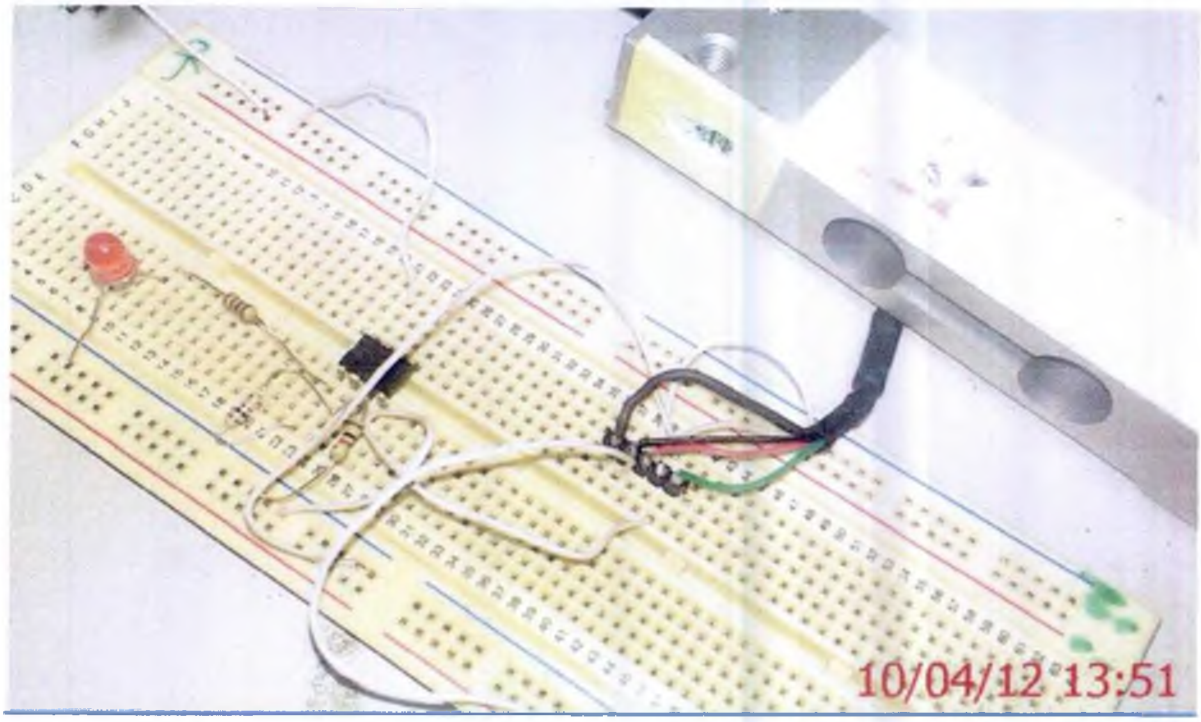


Fig: 7.2.2 Circuit Diagram of Weight Sensor

GPS VEHICLE TRACKER

GPS stands for Global Positioning system that can track vehicles at any region of the world. It has a total of 60 pins, which act as connectors. We have implemented the hardware as shown in the figure below.

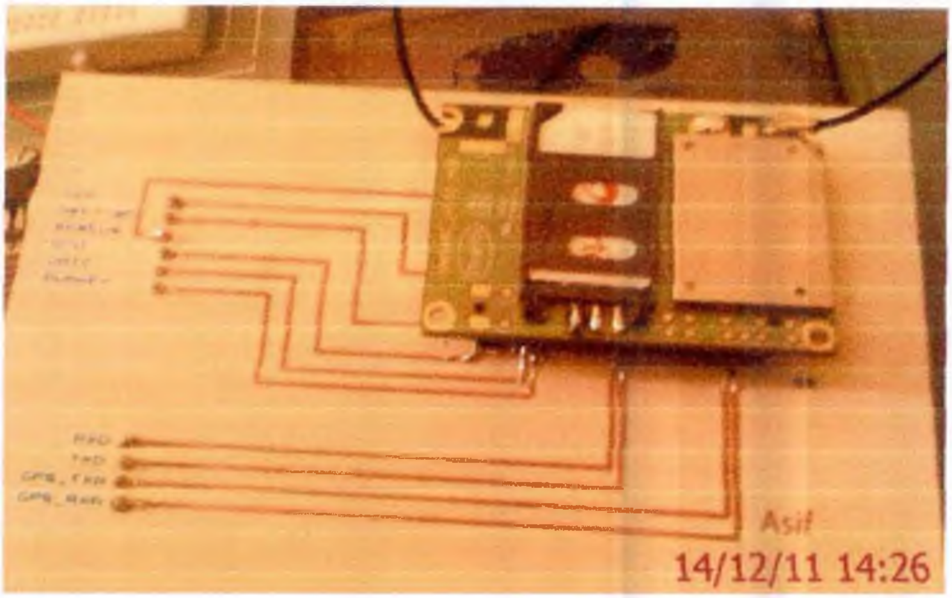


Fig: 7.3.1 Main Hardware of the GPS Tracker

The main pins of the hardware that we have used include the Power key, Status Key, Vcc, GPS_TXA and Ground. The power key when connected to the ground, the receiver's entire system is by default set on it. The status key shows the current condition of the communication. The GPS_TXA receives the data from the satellite, which is then passed on to the module.

GPS, GPRS and GSM only use ATcommands. ATcommand is used to convert the 8 bit data sent through a microcontroller into a string value which is readable by normal people on the display. The display shows the longitudinal and latitude position of the vehicle being tracked.

We have roughly 24 artificial satellites allocated for communication purposes. Their positions are set in a way that every position has three satellites are above it forming a triangular communication system. There are different protocols through which the GSM module can communicate synchronously with the satellites. We have used NEMA protocol and SIM548C module for our project purpose. NEMA protocol sends 8 bit data, and 1 stop bit and a final no parity bit. The advantage of using NEMA protocol is it automatically synchronizes with the satellite with a baud rate when in open air. The higher the baud rate is, the greater is the time for synchronization. So, NEMA protocol usually uses a 4800 baud/s for synchronizing with the three satellites.

There are 3 ways to start the GSM module: Cold start, Warm start and Hot start. Cold start occurs when the device is initialized for the first time. It takes approximately 10-12 hours, or in some case, even 2 days to fix itself with the satellite position. Warm start takes relatively lesser time (57s ~ 2min) and occurs when the device has been initialized but restarted after quite some time. Hot start is the fastest among all and takes only 5 ~ 10 seconds to connect itself. It has to be previously mentioned as to which type of start the device will execute. However, if not mentioned the GSM module will set that depending on the environmental factors of communication. However, it is usually preferred to go for warm start as it takes satisfactorily less time and is also risk free.

The SIM can be used for further implementation of this tracker, such as controlling the vehicle's engine by sending SMS.

Fig: 7.3.2 Circuit Diagram of the GPS Tracking System

WARNING ALARM

The warning alarm is set for false key entry to start the car. If any illegal entry with a false key is tried the buzzer will be turned on. The ignition switch has four positions, LOCK, Accessories (ACC), ON, and START. When the key is inserted in the first position (LOCK) the timer starts from that instant. If it takes the key more than 5 seconds to go to the second position (ACC), the buzzer will be turned on indicating that an illegal entry is tried. If the key goes to the second position within 5 seconds the buzzer will remain off ensuring that the entry is legal. This setup has been given with the assumption that false keys or illegal entry in the ignition switch practically takes some time; unlike the original key which can be turned smoothly within the different positions of the ignition switch.

The ignition switch has various wires for its connection, each having connectivity at different positions of the key within it. When the key is out of it, none of the wires have any conductivity. When the key is first inserted, and it is in the LOCK position, only two wires get conductivity, one is the positive end, the other negative or Ground. These wires have connectivity as long as the key is inside the ignition switch. The positive end wire is connected to pin: 16 of the microcontroller PIC16f877A, with a 10kΩ resistance and 5V power supply, as shown in the diagram. This means pin no: 16 is only active when the car's key is inserted in the ignition switch. With pin no: 17, another wire is connected which only gets conductivity when the key shifts in the ACC position from the LOCK point in the ignition switch. The code in the microcontroller has been set such that as soon as pin no: 16 is shorted, a timer, set by default in the microcontroller will start, and will count up to 5 seconds. Within this 5s, if pin no: 17 is not shorted, the LED which is the alarm, coming out of pin no: 21will light. A buzzer alarm can also be used in place of LED. If, however, pin no: 17 gets shorted within the counted 5s interval, no alarm will be given ensuring the right key has been inserted. The timer will be reset to zero then.

Apart from these pins, a 20MHZ crystal has been used connected to pin no: 13 and 14. Pin: 12 and 13 goes to Vcc and Ground respectively. Similarly, pins: 32 and 31 goes to Vcc and Ground respectively. Pin: 1 has a 10kΩ resistor connected before being connected to 5V power supply, Vcc. The entire circuit setup of Warning Alarm is same as that of Robust Jumper, except an additional connection in Pin: 2 in the Robust Jumper. So, a combined circuit setup of Warning Alarm and Robust Jumper is given in Figure no: 7.4.1

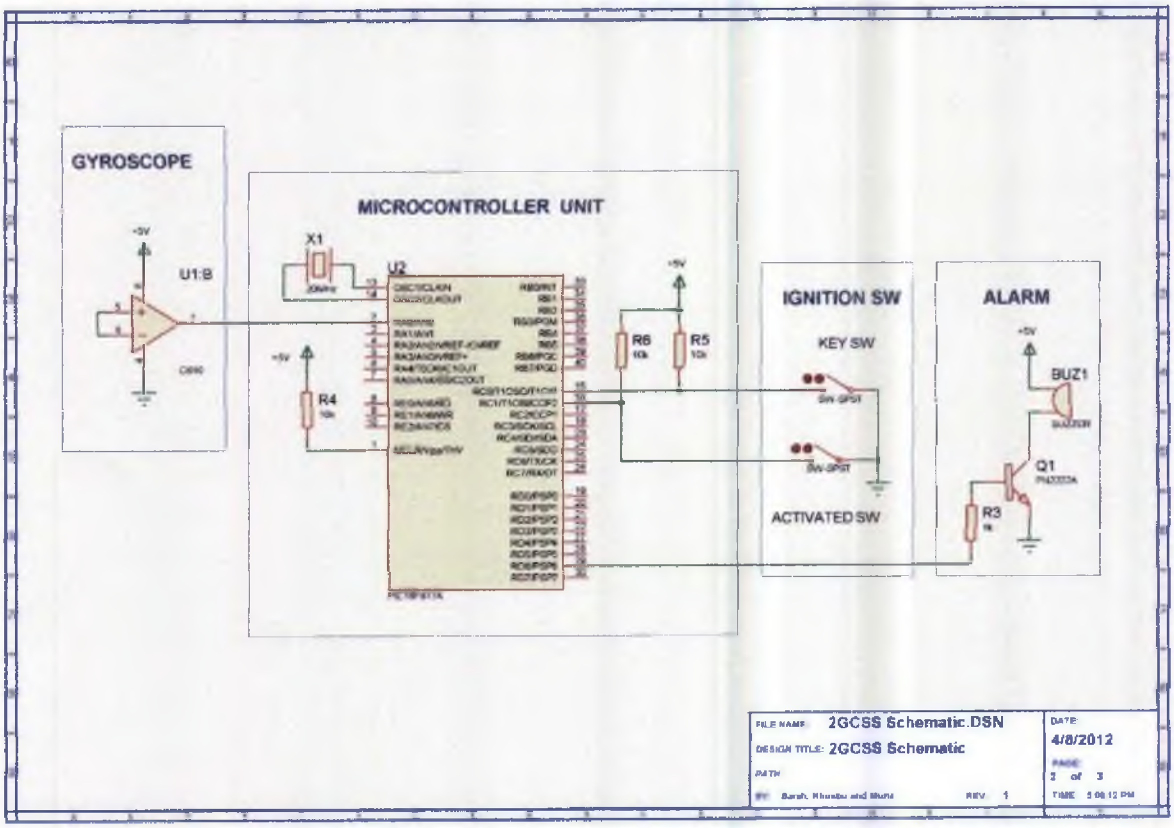


Fig: 7.4.1 Schematic Diagram of the Warning Alarm and Robust Jumper Alert Together

The warning alarm is expected not only to notify but its sound will also help to distract the thief and make him more nervous with the noise.

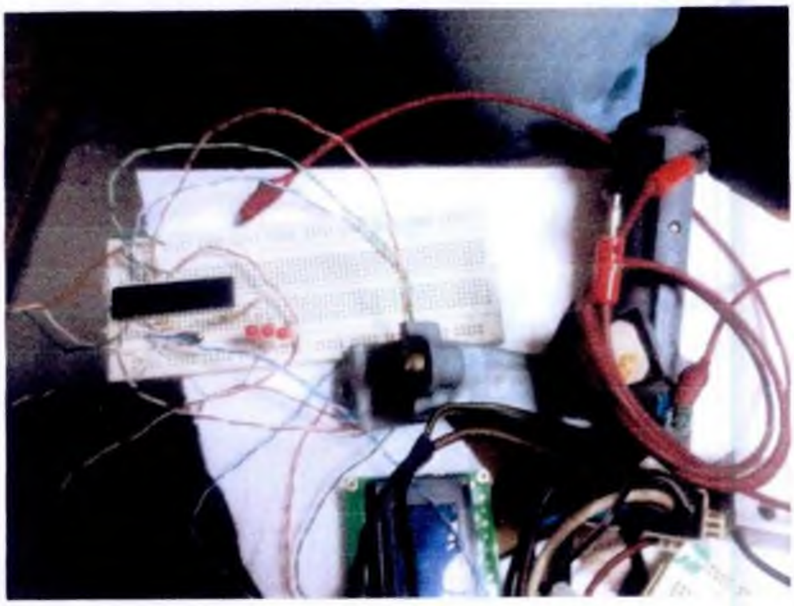


Fig: 7.4.2 Circuit Diagram of the Warning Alarm

ROBUST JUMPER ALERT

The circuit setup for Robust Jumper Alert is very much similar to that of the Warning Alarm mentioned earlier, except for an additional connection in Pin: 2. However, the mechanism and purpose of this alert is totally different than the previous one. This jumping, or in some way, shaking alert will help car owners know when someone is trying to mess with his car. The system will alert the owner whenever the car experiences any heavy jumping or shaking from its position at rest. As long as that state of discomfort continues, the alarm will be on.

A potentiometer has been used, that serves the purpose of Gyroscope. Gyroscope is a very small electronic device sensitive to the change in gravitational acceleration 'g'. From standard physics this may be understood that, at various angular positions with respect to the ground, the 'g' at the centre of the object, varies. Now, when a car shakes, very slight changes in 'g' occur; but the gyroscope is sensitive even to those changes. With the initial position, the gyroscope calculates the 'g' and generates a voltage corresponding to that. That voltage is the reference value. So the gyroscope will be on right when pin: 16 is open, which connects to the first wire of the ignition switch that gets conductivity. At that very instant, it will calculate the 'g' and will generate a voltage which will be set as the reference voltage. During any shaking or unwanted bumps of the car when it's at rest position, the gyroscope generates various voltage readings corresponding with the changes in 'g'. When the POT has been used, we set the voltage range that the gyroscope has done automatically. Now, within the microcontroller, PIC16F877A, the code has been set such that if the generated voltage is not within ±0.5V of the reference voltage, the alarm, which is pin: 21 will ring or light, that is, will be on. This ±0.5V has been considered as the maximum tolerance level of movement of the car. This mechanism stops working as soon as pin:16 is shorted, and restarts as soon as pin: 16 gets deactivated.

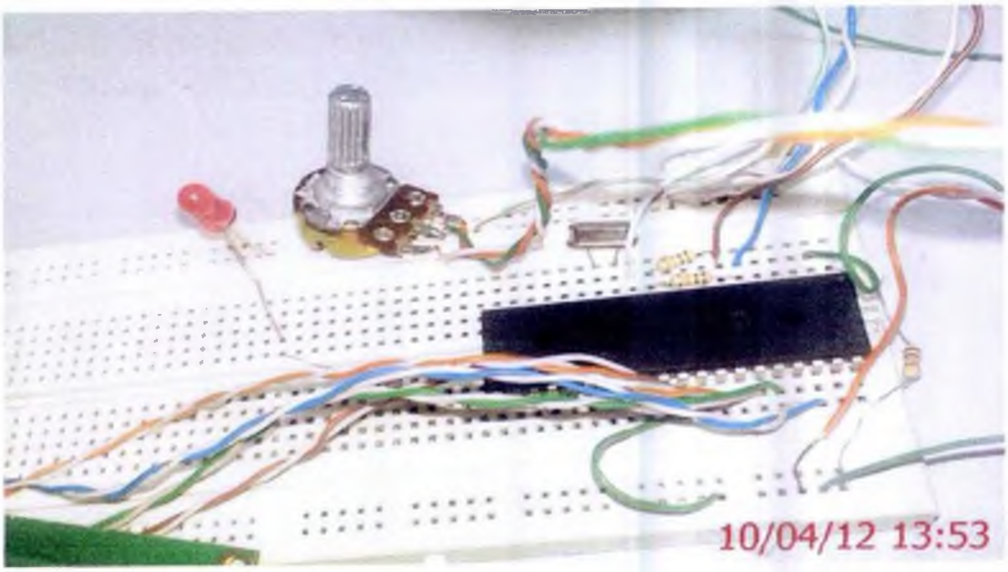


Fig: 7.5.1 Robust Jumper Alert Circuit Diagram

FUTURE WORK

PASSENGER ON BOARD COUNTER

The passenger on board counter basically counts the number of passengers. This system will either work by calculating the external weight on board to the car or by counting the number of passengers with the help of infrared sensors. The sensor in that case will be set in the car's doors. In either the case, the total number of passengers that the car had over a day will be notified with the help of this counter.

FINGER PRINT DETECTOR

This system will utilize Biometrics Fingerprint identification technology. This will encode the car security system and starting functions of the vehicle. Only authorized drivers with enrolled fingerprints can start the car engine, or enable and disable the setting of the alarm. The Fingerprint Car Starter is expected to store around 9 to 10 user's fingerprints, in which the master driver will hold 1 password that can easily enroll or delete records to adjust users. This enables usage of friends and family to manage the vehicle.

GPS VEHICLE TRACKER FURTHER IMPLEMENTATION

A lot more functions can be done with the GPS Vehicle Tracker. In the future, SMS system can be enabled to detect the location when a car has been stolen. At the same time, through SMS, the car's engine can be stopped with the software.

PROBLEMS FACED

- For the ROBUST Jumper Alert, the original plan was to use a gyroscope as the sensor. It was even implemented perfectly using a gyroscope. However, the gyroscopes available here are so sensitive that all of them used to work properly for 23 days, and then got damaged. As a result, to avoid such unpredictable behavior of the gyroscope, we replaced it with a POT, which is basically a variable resistor. The purpose was fulfilled then as well.

DISCUSSION

This project is not just a thesis project, but if implemented properly, this project may be responsible for a significant development in the industry of Cars and Car Thefts. This is what we, the Project Implementers believe. This project is first of its kind in BRAC University, and we wish to give a positive turn to it. Since it's the first time here, resources are all not easily available, which is an obstacle for us. However, we wish to accomplish it and get the maximum out of what we are expecting it to be if not more. Continuous support from the Lab Instructors and our Project Supervisor has helped us a lot to overcome a lot many difficulties we have faced in the midway while working.

CITATIONS

- http://autotips.plentycar.com/the-best-car-protection/
- http://autotips.plentycar.com/car-anti-theft-devices/
- http://www.autonavigationgps.com/how-does-a-gps-tracking-system-work/
- http://www.wenturegroup.com/fingerprint-car-lock
- http://www.car-theft.org/theft-methods/
- http://christopherteh.com/blog/2010/09/30/private-car-theft-statistics-in-malaysia-one-stolen-every-24-minutes/

APPENDIX

Main Window of GPS software Code (Longitude and latitude)

```
Imports System
Imports System.Collections.Generic
Imports System.ComponentModel
Imports System.Data
Imports System.Drawing
Imports System.Text
Imports System.Windows.Forms
Imports System.IO.Ports


Public Class frmPP


#Region "Member Variables"

    ' Local variables used to hold the present
    ' position as latitude and longitude
    Public Latitude As String
    Public Longitude As String

#End Region



#Region "Constructor"


    Public Sub New()

        ' This call is required by the Windows Form Designer.
        InitializeComponent()

        ' Try to open the serial port
        Try
            SerialPort1.Open()
        Catch ex As Exception
            MessageBox.Show(ex.Message)
            timer1.Enabled = False
            btnUpdate.Text = "Update"
            Return
        End Try

    End Sub


#End Region

    Private Sub timer1_Tick(ByVal sender As System.Object, ByVal e As System.EventArgs) _
```

```
Handles timer1.Tick

    If SerialPort1.IsOpen Then

        Dim data As String = SerialPort1.ReadExisting()
        Dim strArr() As String = data.Split("$")
        Dim i As Integer = 0

        If strArr.Length > 1 Then

            Try

                For i = 0 To strArr.Length

                    Dim strTemp As String = strArr(i)
                    Dim lineArr() As String = strTemp.Split(",")

                    If (lineArr(0) = "GPGGA") Then

                        Try
                            ' Latitude
                            Dim dLat As Double = Convert.ToDouble(lineArr(2))
                            Dim pt As Int32 = dLat.ToString().IndexOf(".")

                            Dim degrees As Double = _
                            Convert.ToDouble(dLat.ToString().Substring(0, pt - 2))

                            Dim minutes As Double = _
                            Convert.ToDouble(dLat.ToString().Substring(pt - 2))

                            Dim DecDegs As Double = degrees + (minutes / 60.0)

                            Latitude = lineArr(3).ToString() + DecDegs.ToString()

                            ' Longitude
                            Dim dLon As Double = Convert.ToDouble(lineArr(4))
                            pt = dLon.ToString().IndexOf(".")

                            degrees = _
                            Convert.ToDouble(dLon.ToString().Substring(0, pt - 2))

                            minutes = _
                            Convert.ToDouble(dLon.ToString().Substring(pt - 2))

                            DecDegs = degrees + (minutes / 60.0)
                            Longitude = lineArr(5).ToString() + DecDegs.ToString()

                            ' Display
                            txtLat.Text = Latitude
                            txtLong.Text = Longitude

                            btnMapIt.Enabled = True

                        Catch

                            ' Can't Read GPS values
                            txtLat.Text = "GPS Unavailable please check"
                            txtLong.Text = "GPS Unavailable please check"
```

```
                        btnMapIt.Enabled = False

                    End Try

                End If

            Next

        Catch
            'do nothing
        End Try

    End If

Else

    txtLat.Text = "COM Port Closed check the COM Port"
    txtLong.Text = "COM Port Closed check the COM Port"
    btnMapIt.Enabled = False

End If

End Sub


Private Sub btnUpdate_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnUpdate.Click

        ' cycle timer
        If timer1.Enabled = True Then
            timer1.Enabled = False
        Else
            timer1.Enabled = True
        End If

        ' update button label
        If btnUpdate.Text = "Update" Then
            btnUpdate.Text = "Stop Updates"
        Else
            btnUpdate.Text = "Update"
        End If

    End Sub


    Private Sub exitToolStripMenuItem_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles exitToolStripMenuItem.Click

        Application.Exit()

    End Sub


    Private Sub toolStripMenuItem2_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles toolStripMenuItem2.Click

        Try
```

```
            SerialPort1.Close()
            SerialPort1.PortName = "COM1"
            SerialPort1.Open()
        Catch ex As Exception
            MessageBox.Show(ex.Message, "COM1")
        End Try

    End Sub


    Private Sub toolStripMenuItem3_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles toolStripMenuItem3.Click

        Try
            SerialPort1.Close()
            SerialPort1.PortName = "COM2"
            SerialPort1.Open()
        Catch ex As Exception
            MessageBox.Show(ex.Message, "COM2")
        End Try

    End Sub


    Private Sub toolStripMenuItem4_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles toolStripMenuItem4.Click

        Try
            SerialPort1.Close()
            SerialPort1.PortName = "COM3"
            SerialPort1.Open()
        Catch ex As Exception
            MessageBox.Show(ex.Message, "COM3")
        End Try

    End Sub


    Private Sub toolStripMenuItem5_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles toolStripMenuItem5.Click

        Try
            SerialPort1.Close()
            SerialPort1.PortName = "COM4"
            SerialPort1.Open()
        Catch ex As Exception
            MessageBox.Show(ex.Message, "COM4")
        End Try

    End Sub


    Private Sub toolStripMenuItem6_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles toolStripMenuItem6.Click
```

```
        Try
            SerialPort1.Close()
            SerialPort1.PortName = "COM5"
            SerialPort1.Open()
        Catch ex As Exception
            MessageBox.Show(ex.Message, "COM5")
        End Try

    End Sub


    Private Sub btnMapIt_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnMapIt.Click

        If Latitude <> String.Empty And Longitude <> String.Empty Then

            Dim f As New frmMap(Latitude, Longitude)
            f.Show()

        End If

    End Sub

    Private Sub AboutToolStripMenuItem_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles AboutToolStripMenuItem.Click
        AboutBox1.Show()
    End Sub


    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As System.EventArgs)
Handles Button1.Click
        Application.Exit()
    End Sub

End Class
```

From Google map we can find the position of our vehicle

```
Imports System.Text


Public Class frmMap

    Public Sub New(ByVal lat As String, ByVal lon As String)

        InitializeComponent()

        If (lat = String.Empty Or lon = String.Empty) Then
            Me.Dispose()
        End If
```

```
        Try

            Dim queryAddress As New StringBuilder()
            queryAddress.Append("http://maps.google.com/maps?q=")

            If lat <> String.Empty Then
                queryAddress.Append(lat + "%2C")
            End If

            If lon <> String.Empty Then
                queryAddress.Append(lon)
            End If

            webBrowser1.Navigate(queryAddress.ToString())

        Catch ex As Exception

            MessageBox.Show(ex.Message.ToString(), "Error")

        End Try

    End Sub


End Class
```

CODE FOR ROBUST JUMPER ALERT AND WARNING ALARM WRITTEN IN PIC16F877A

```
#define Blue &PORTA,4
#define Red &PORTA,5

// LCD module connections
sbit LCD_RS at RB4_bit;
sbit LCD_EN at RB5_bit;
sbit LCD_D4 at RB0_bit;
sbit LCD_D5 at RB1_bit;
sbit LCD_D6 at RB2_bit;
sbit LCD_D7 at RB3_bit;

sbit LCD_RS_Direction at TRISB4_bit;
sbit LCD_EN_Direction at TRISB5_bit;
sbit LCD_D4_Direction at TRISB0_bit;
sbit LCD_D5_Direction at TRISB1_bit;
sbit LCD_D6_Direction at TRISB2_bit;
sbit LCD_D7_Direction at TRISB3_bit;
// End LCD module connections

char txt1[] = "2G-CSS";
char txt2[6];
char txt3[6];
char txt4[4];
unsigned int KeyIdleCounter;
unsigned int adc_value;
unsigned int adc_before;
unsigned int adc_after;
unsigned int difference;


void main()
{
  ADCON1 = 0x06;
  CMCON = 0;
  TRISA = 0xFF;
  TRISC = 0x00;
  //TRISD = 0xF0;
```

```
Lcd_Init();                    // Initialize LCD
Lcd_Cmd(_LCD_CLEAR);           // Clear display
Lcd_Cmd(_LCD_CURSOR_OFF);      // Cursor off
//Lcd_Out(1,6,txt1);

// reset
adc_before = 0;
adc_after = 0;
difference = 0;
KeyIdleCounter = 0;

while(1)
{
 // when only key is inserted
 if(!Button(Blue, 10, 0) && Button(Red, 10, 0))
 {
  adc_before = ADC_Read(0);
  WordToStr(adc_before, txt4);
  Lcd_Out(1,8,txt4);

  // increament the counter
  KeyIdleCounter++;
 }

 // both sw is active
 if(Button(Blue, 10, 0) && Button(Red, 10, 0))
 {
  adc_before = ADC_Read(0);
  WordToStr(adc_before, txt4);
  Lcd_Out(1,8,txt4);

  // no need of counting
  KeyIdleCounter = 0;
 }

 // the car is idle
 if(!Button(Blue, 10, 0) && !Button(Red, 10, 0))
 {
  adc_after = ADC_Read(0);
  difference = abs(adc_after - adc_before);
```

```
 // threshold value exceed!
 if((adc_after > (adc_before + 100)) || (adc_after < (adc_before - 100)))
 {
  RC5_bit = 1;
  Lcd_Out(4,8-4,"Shaked!   ");
 }
 else
 {
  Lcd_Out(4,8-4,"Normal    ");
  RC5_bit = 0;
 }

 WordToStr(adc_after, txt4);
 Lcd_Out(2,8,txt4);
 WordToStr(difference, txt4);
 Lcd_Out(3,8-4,txt4);

 // no need of counting
 KeyIdleCounter = 0;
}

if(KeyIdleCounter > 100)
{
 // show mwssage
 Lcd_Out(4,8-4,"Wrong Key  ");
 RC5_bit = 1;

 while(1)
 {
  // key is unlocked
  if(Button(Blue, 10, 0)){break;}
 }

 // unlock
 KeyIdleCounter = 0;
 Lcd_Out(4,8-4,"Normal   ");
 RC5_bit = 0;
}

 Delay_ms(10);
}}
```

YOUR REMARKS PLEASE: