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Mobile Phone Automobile Security System (MASS)

A Thesis

By

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Declaration:

This is to certify that the work presented in the thesis is an outcome of the experiment and research carried out by the author under the supervision of Dr. Professor Nurul Absar Chowdhury.

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I seek excuse for any errors that might be in this report despite my best effort.

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Abstract

A car security system has become an essential part for all car users as it ensure safety to the properties car. The purpose of this project is to develop a car security system that is cheap and can be controlled by mobile phone .The system will enable the understanding whether the right owner is driving the car or is it being taken away and also sending an Short Message Service (SMS) to owners according to the event happens. The SMS is used as the control medium to transmit instruction to the mobile phone from the security system. There are some issues that lead to this project development. The first issue is the current conventional security systems are costly and are controlled by the system organizations. Other issue is the owner did not know the status of the car when parked whether something had happen to the car. An additional function can be added to this system which is auto ignition triggered by remote or SMS. According to those issues, the solution must be made by this system. Basically, the system has three sections which is the owners hand phone, Global System for Mobile Communication (GSM) modem and also the controller which act as the brain of the system. The owner hand phone communicates to the GSM modem and the GSM modem connected in two way communication to the controller. Finally, from the project, a car security system is developed totally controlled by the owner.

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Chapter 1

INTRODUCTION

1.1 Overview

Importance of Car Security System

A car security system is vital not only to safeguard your car from thieving hands but also to keep you insured and your assets protected at the same time. A good car security system will definitely get you a low cost car insurance plan and will help you recover your car easier than having no car security at all.

A lot of car security systems are easily maneuvered and manipulated by professional car thieves so you need to ensure that you've got the most advanced security system for your car. As reported by the U.S. National Insurance Crime Bureau, about 1.1 million cars are stolen each year which means that car security systems should be upgraded and highly maintained to reduce the probability of being a car napping victim.
If you think that parking in well-lit locations, crowded areas or high traffic places is enough to keep your vehicle safe from auto thievery, then you are very wrong. Simple locking of your windows and doors will never keep your car safe as well because most professional car thieves can easily manipulate such situations and you will be amazed that your car has simply disappeared from its parking location.
For the reasons stated above, it is best to get a car security system.

1.2 Objective

The main objective of this project is to design, construct and test a GSM-based vehicle anti-theft system that can be used to improve the performance of car security system. When the alarm is activated, the proposed system will activate and send a signal to the user's cellular phone, informing the user the current status of the car.

In order to achieve the objectives of the project, the following works were carried out.

1. Design and develop the hardware of the proposed system.
2. Develop a control program of the proposed system.
3. Design and develop car security system.
4. Conduct appropriate tests for the proposed system.

1.3 Problem Statement

There are different types of car security system that are available in the market nowadays. All of this security system was design to fulfil the car owner's needs according to their usage. Not all car owners have the same reason to equip their car with the security system. Differ to other car security systems, MASS was design to improve and new functionality was added to make this system special.

There are some issues that lead to the development of MASS.

Some of the issue that happen is the owner did not know the status of the car when it parked whether something had happen to the car such as collision or attempted break in. Some security systems available in the market already have their monitoring system itself like display at the remote control screen and so on. But, the monitoring system itself also has a limitation due to the ways trigger the owners and the range of it functionality. By developing Car Security System via SMS, the owner can be triggered at any time using their own mobile phone as long as the signal from the provider appears at that place.

There are security systems for car available in the market for starting the car engine from a range. It depends on the range and the ways it trigger the starting engine section in the car. The MASS was designed to improve and ensure that only one single individual can have the capability to do so and the system is free from hacking.

1.4 Scope of Project

MASS is going to be developed for car applications. So the target user for this system will be targeted to the people who have their own car. This system will be attached to the car circuitry for the detection process.

MASS will be contain of The Arduino Mega 2560 microcontroller as a main brain to control whole system. The GSM modem is required to transmit SMS to the receiver.

The current flow and the voltage for each section will be considered during the circuit design. The controller need to be program before can be used. The Arduino Mega2560 can be programmed with the Arduino software. The software also needed to develop the hardware.

1.5 Methodology

The project developments consist of two sections, which is hardware development and software development. The hardware development will be performed first before the software development section. The software will be developed according to the circuit that has been design.

Hardware development can also be called as circuit development in MASS project. It involves all the circuitry needed to interface between the microcontroller pin and car circuitry. The selection of the component is critical since it must be suitable to the load, so the component such as transistor will be compared from each to another by searching the datasheet of each component. The circuit system must be able to interface with the GSM modem. The hardware development starts by searching the information from books and components datasheet.

After the first phase has been completed, the second section which is software development is started. The software development using the software called Arduino software

1.6 Report Structure

This report contains five chapters.

The first chapter is the introduction of the project. This chapter covers about the project introduction, overview of this project, objective, problem statement and scope.

The literature review of this project will be covered in the second chapter. Literature reviews includes the study of the component in the project such as The Arduino Mega 2560 microcontroller and GSM Modem. This chapter will also explain the theory of each aspect of the project.

The next chapter is covered the project methodology. The explanation of the step of the project will be clarified. The block diagram will be shown and explain in detail. The process of the project is drawn in the flowchart of the project. All the process is elaborate completely in this chapter.

Result of the project will be covered in chapter four. The result from the circuit simulation is added for proofing the theory and show that the circuit can actually run. The result is fully elaborate helped by figures and table. The system circuit stability and controllability are also being analyzed. The objective of the project compared from the result that has been produced.

The final chapter is conclusion and suggestion. This chapter will conclude the result of this project, and the suggestion for further project is stated to improve the system that has been developed.

Chapter 2

LITERATURE REVIEW

2.1 Overview

The technologies for security system nowadays are evolving very fast each year. These security systems almost cover for controlling and managing appliances where the safety issue is the top priority. The developments for security system evolve harmony to the advancement of technology. In today's economic context, the design of these control and alert is of a great impact in term of productivity and production costs. Because of these cost, the complexity of a system and the multiple hardware/software combination, the designer has to take the safety of the system into account.

The usage of the component in the design hardware is the critical part. The suitable controllers need to be carried out to manage the performance of the system. In MASS, the controller need to be considered is The Arduino Mega 2560 microcontroller. This controller act as the main brain to the system and the goodness of this controller will be explained.

This chapter will cover the study of previous project; the theory used in developing the Car Security System via SMS and also explains each part in details for component used. This chapter will also include the research findings from reading, observing and information seeking to further the knowledge about the tools being used.

During this project, the study had focusing on to criteria that need consideration in order to design Car Security System via SMS. This is to give a clear view on the project.

2.2 Study from previous project

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.
- **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 its 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.

2.3 Microcontroller

There are several methods that are used to control the system. One of them is by using the microcontroller. However, for this project, the focus will be revolving only on The Arduino Mega 2560 microcontroller.

The microcontroller acts as the brain that control all the functionality and interfaced circuit attach to the system. Microcontroller is also known as microprocessor that contains most of its peripherals and required memory inside a single integrated circuit along with the CPU. Embedded microcontroller has been in used for more than three decades. Arduino also used to conducts the logical data to process the input signal and produce the output signal. It can be used for many applications, where control is required. Arduinos are popular among user due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
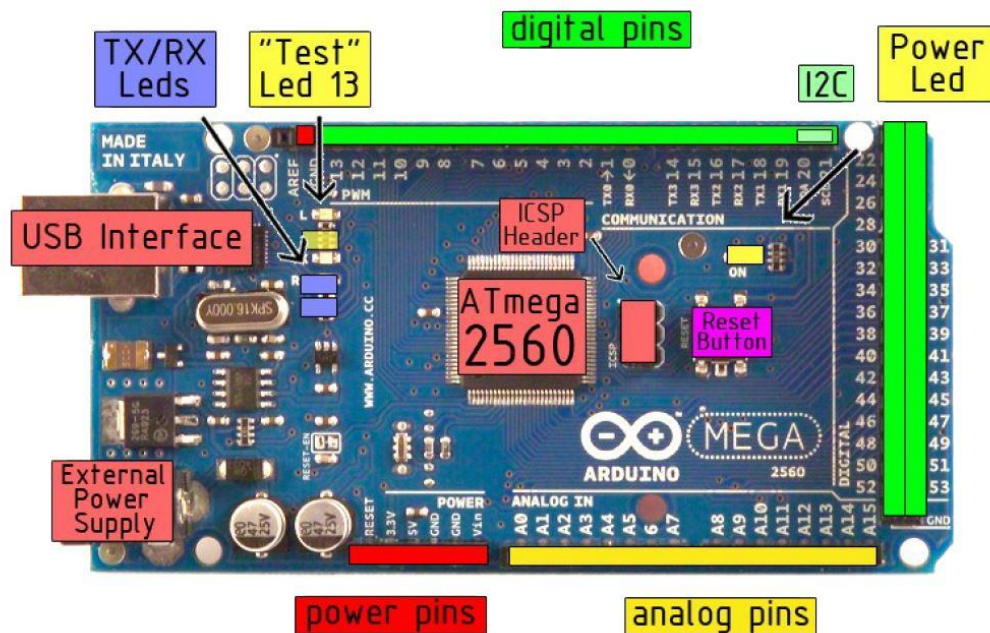

Figure 2.1- Arduino Mega 2560 microcontroller

2.3.1 Program the microcontroller

There is some method that is widely used to develop program for the microcontroller. Most of the programmers prefer to use either C, C++, Pascal, Basic or Assembly language as their programming method for the microcontroller. The developed coding was then will be compiled with program compiler such as MPlab, PICC, Keil and Source Boost compiler before it can be implemented to the microprocessor.

In software development of MASS, the programming is done by Aurdino software. As a sample, we can see high levels and low levels in the workings of a car. In a car, the nuts, bolts, and pistons of the low level can be grouped together conceptually to form the higher-level engine. Without knowing anything about the nuts and bolts, we can treat the engine as a black box: a simple unit that behaves in predictable ways. At an even higher level (the one most people use when driving), we can see a car as a group of these black boxes, including the engine, the steering, the brakes, and so on. At a high level, a computer also becomes a group of black boxes.

Rather than requiring a physical press of the reset button before an upload, the Arduino Mega2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.
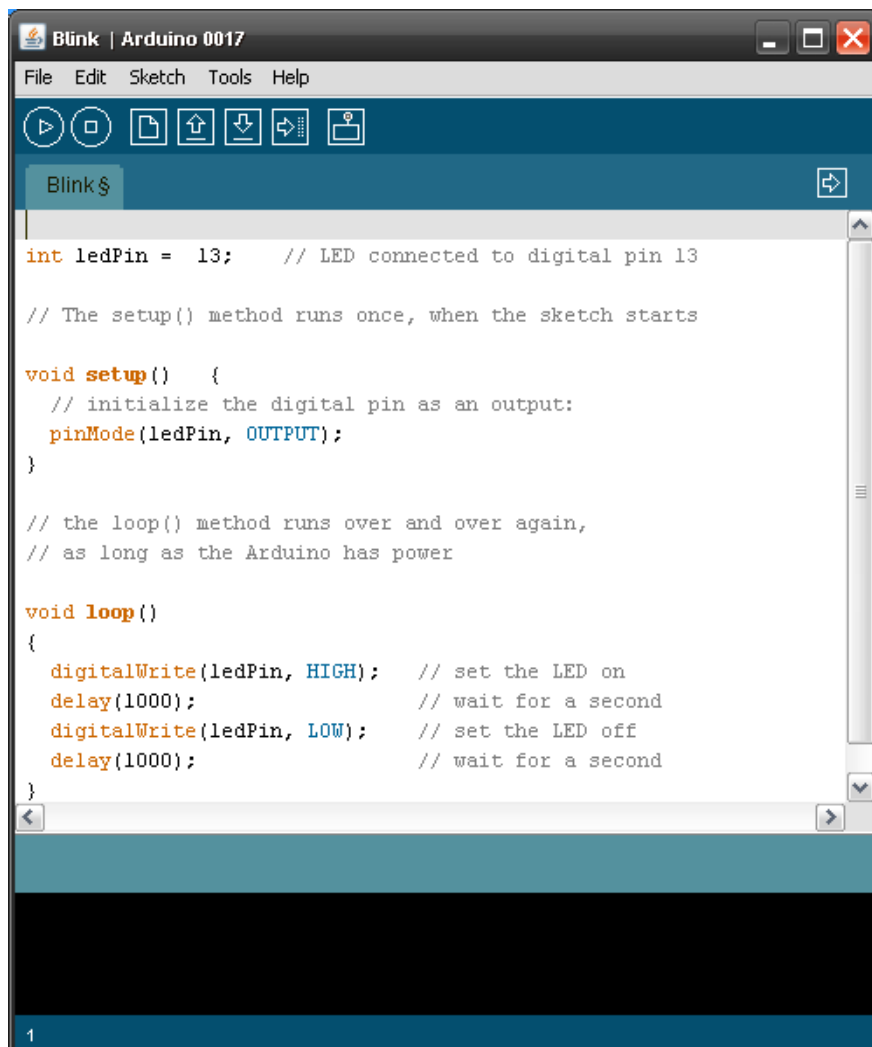
This setup has other implications. When the Mega2560 is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Mega2560.

While it is programmed to ignore malformed data (i.e.anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Aurdino offer efficient and compact code and provide elements of structured programming. It is a popular and widely used programming language for creating computer programs. Programmers around the world embrace it because it gives maximum control and efficiency to the programmer. One of the most notable features of Aurdino is that it is up to the programmer to manually manage the usage of computer memory.

The Atmega2560 on the Arduino Mega comes preburned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.

You can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header.

Figure 22- Programming Arduino Mega 2560 microcontroller

2.4 Global system for Mobile Communication

MASS requires a medium to transmit SMS.

The medium transfers for SMS are GSM. GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges.

We have used Sim 900 GSM Module.

Fig.2.3- Sim 900 GSM Module

2.5 Simulation

Before the development circuit being tested in real situation, the circuit must be tested in the simulation model. This is to make sure the circuit can operate accordingly to the input and output given by micro-controller pin. Simulation also being done to avoid accident to wrong connection and may save cost for the project hardware development.
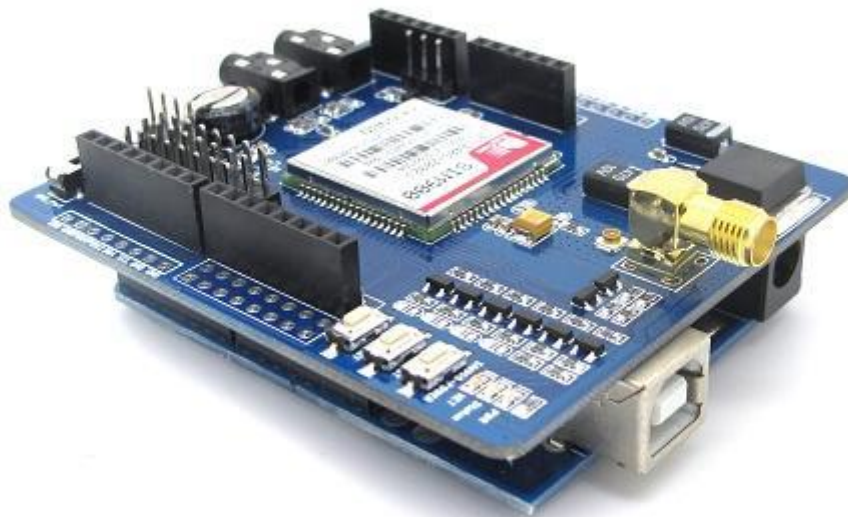

Fig-Simulation

Chapter 3

METHODOLOGY

3.1 Overview

There are certain steps needed during the development of Car Security System via SMS. The entire step that has been developed to ensure the project can be completed according to the schedule. The explanation of the step of the project will be clarified. The block diagram will be shown and explain in detail. The process of the project is drawn in the flowchart of the project. All the process is elaborate completely in this chapter.

3.2 Block Diagram

This project contains 3 sections which is the hand phone, the GSM modem and the microcontroller with the NUMPAD. The hand phone will communicate to the GSM modem using mobile phone platform. This includes receiving information from the GSM modem.

The GSM modem not only communicates to the mobile phone but also communicate to the microcontroller. The microcontroller will provide information to be send to the owner through the GSM modem.

The microcontroller will control the whole operation to the system. It used to gain control to the numpad circuit, car auto start system and also receive detection from the sensor such as vibration sensor. The operation in the microcontroller is more to comparison data because the microcontrollers only do the job when there are inputs given to it and compare to the program that burned to it. Figure 3.1 show the connection to each section of the system.
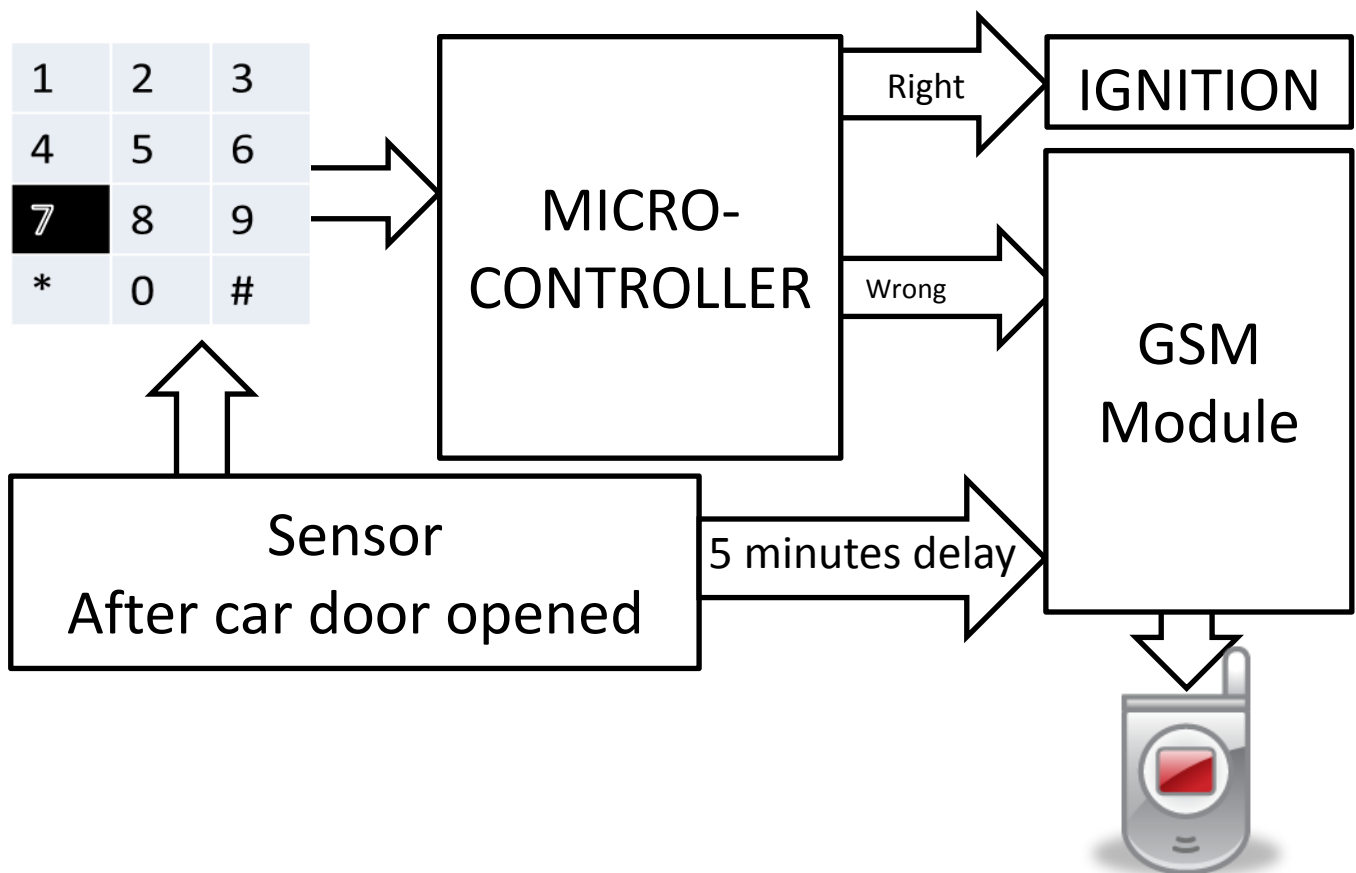

Fig 3.1- MASS Block System

3.3 Flow Chart

```
┌─────────────────────────────────────┐
│           Park the car              │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│         Security System on          │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│           Car Triggered             │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│      Security System Activated      │
└─────────────────────────────────────┘
                  ↓
┌─────────────────────────────────────┐
│          Sends Message              │
└─────────────────────────────────────┘
```
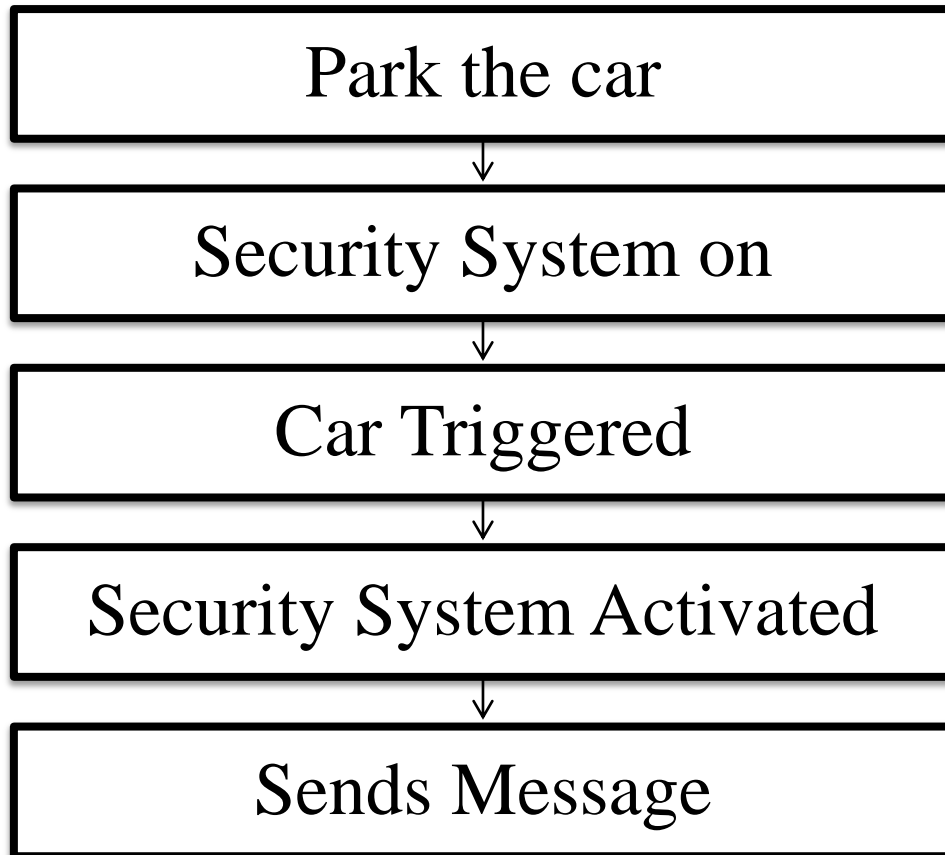
Fig 3.2- MASS Flow Chart

The system will work as follows:

- Detect an intrusion mainly through the alarm system
- Once an intrusion is detected, owner notified via SMS
- A sensor will be situated inside the car and will be switched on as soon as the driver leaves the car. It will detect motion when any human enters the car.
- Numeric touch pad is interfaced with port of the microcontroller.
- User has to enter the security code using numeric touch pad.
- Unable to punch a pin-code/ fingerprints within few minutes after entering will cause a SMS to be sent to the owner's mobile phone.
- Owner knows about the situation and alerts police about it.

Chapter 4

RESULT

4.1 Overview

The result from the circuit simulation is added for proofing the theory and show that the circuit can actually run.

The result is fully elaborate helped by figures. The system circuit stability and controllability are also being analyzed. The objective of the project compared from the result that has been produced.
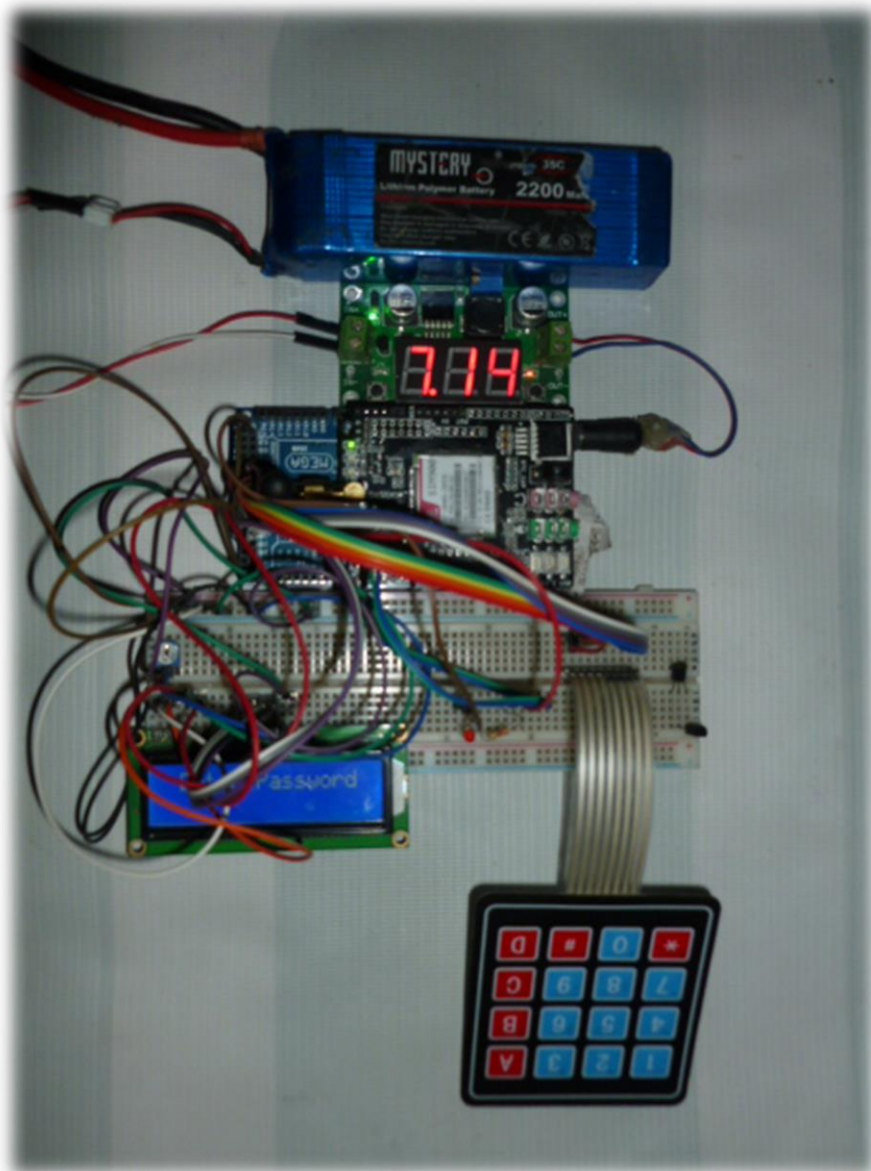

Fig 4.1- MASS System
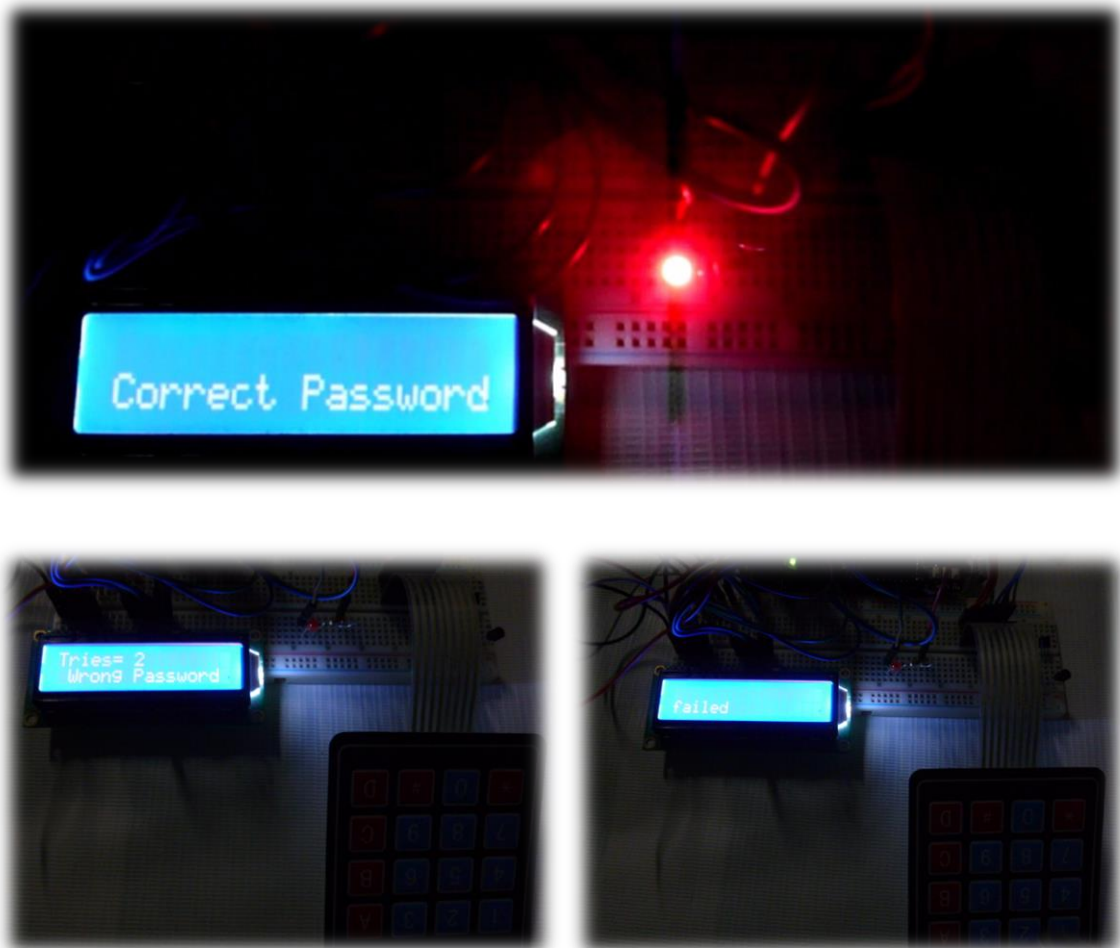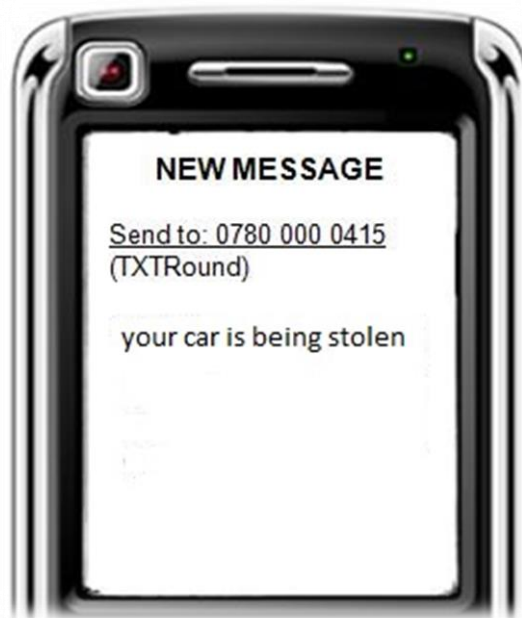
4.2 The microcontroller simulation

Fig 4.1: Microcontroller Simulation

Entry of correct password will allow the car to be started as shown in the figure.

As we can see that the simulation will allow the entry of wrong passwords for three entries after which SMS will be sent directly to the user's phone.

4.3 GSM Simulation

Finally, the message to be sent over to the owner's phone will be sent in two conditions.

- If the pin-code is not provided within five minutes of the entry in the car.
- If the passcode is wrong for three consecutive time.

Chapter 5

CONCLUSION

5.1 Overview

During the design implementation process each system has been verified individually to ensure there was negligible error. After the integration of the total system the integrated unit has been tested and verified to make sure the implemented design is accurate and the system has been developed as such that it has met all the requirements defined for it.

5.2 Advantages, Disadvantages and Future Development

Mass will have the following benefits over other systems:

- Distance is not a problem, can send a SMS to any SMS enabled phone
- Can be easily integrated with existing car alarm systems
- Will lower Insurance Costs
- Self-Diagnostics to check functionality
- Taper proof and cannot be deactivated illegally – 100% secure
- Less than 10sec delay in sending a message
- Cost effective.
- Fast and efficient

However, it will also have backlashes:

- In this process door of the car is not lock. To lock the door we need to use another system
- The car cannot be tracked.
- We can't save our car if our mobile is not in working condition anyhow.
- If car's owner's mobile is out of coverage area on that time also we can't save the car.

Thus, it can be fixed:

- GPS tracking system can be added to track the exact location of the car.
- Car dial system can be used to automatically stop the motor of the car with the mobile phone.

5.3 Applications

Further uses of the system can be as follows:

- Car security system finds many applications in this modern world.
- It is useful in all type of security system e.g. in any vehicles tracking system – scooter, truck, bike, etc.
- It is also useful in Bank security.
- Simple security system is used to save important items. In place of simple security system we can implement this **GSM** based security. So that we get SMS immediate whenever systems disturb and alarm will also generate. So it is use full in every type of security system and we can make more secure our things.
- We also plan to integrate a small digital camera inside the vehicle and interface it to the security system. The camera would be enabled and powered up, starting to obtain a video signal from the environment hopefully with the thief present in the frustum. A 10-20sec movie can be sent to the third generation mobile phone, like 3G, over the M2M link providing the rightful owner with audio and video of the scene.

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