Mobile Phone Theft Detection Using Supercapacitors

Nayana G H[1] and Neethu Johny[2]

[1,2](Assistant Professor, Department of E &C, New Horizon College of Engineering, Bengaluru, India)

Abstract: *In our paper we focus on how the mobile phone theft detection can be made. It tries to overcome some of the flaws of traditional theft detection technique.It finds out a method that can be used to keep mobile in the ON state even when the battery is removed or even when the SIM card is changed. ON state here means the SIM module will be powered up, and powering up the SIM module is sufficient in order to meet objective; but that must be possible even when battery is removed. Later we improvise the technique in such a way that the accuracy of finding the lost mobile phone will be increased and also many different methods that can be followed to increase the accuracy of the search. We also mention how this approach can be implemented on any electronic gadgets like laptops, tablets etc and also on the vehicles.*

Keywords: *SIM, electronic gadget,module*

I. INTRODUCTION

The use of the mobile phones is increasing at a faster rate these days. No matter what is the age, each and every individual wants to own a mobile phone. The mobile phones price starts from Rs.1000-Rs.50000 or more. It is also necessary to provide security features to the mobile phone so that in the situations when it is stolen, it can be easily traced back quickly and in an efficient manner

There are many methods that are being implemented in the current times after the introduction of smart phones. Before getting into the latest methods that are being implemented, let us discuss with regard to the old technique that is followed even now for tracing the mobile location by the Police Investigation Department and it gives the result quite accurately.

Method1: The mobile phone can be easily traced by knowing the IMEI number of the mobile phone. IMEI number is the International Mobile Equipment Identification Number which identifies each mobile phone uniquely. With the help of the IMEI number it is possible to track the mobile phone location even if the SIM card is being changed.

Method2: Now a days as we all know the smart-phone craze has increased and the special feature of the smart-phone is the use of different operating system in it, depending upon the manufacturer. Some of the popular OS that are used in smart-phones are Android, IOS, Windows and few others. Taking the OS into advantage, security software's are being developed which are being installed by the smart-phone user. These applications send the message to the user's alternate number or the mail ID registered with the smart-phone and as soon as the HOST SIM card is removed and the new SIM card is inserted, the alert message the alert message indicating the change in SIM card as well as the location where the mobile phone is present will be sent to the person's registered mail ID. This approach is very latest after the introduction of smart-phones. Anti-theft software's, to name a few like Avast, AVG etc are being developed for smart-phones.

Shortcomings of Current Methods

The methods that are mentioned in the previous section has some drawbacks which reduces the accuracy in finding the mobile phone location and the worst case is that its not possible to track itself.

Method1 drawback: It was mentioned that the mobile phone can be easily traced with the help of IMEI number, but the main drawback of this method is that the mobile-phone should be switched ON and if in any case the mobile phone is switched OFF this method will automatically become useless. Using this IMEI number we can block the mobile phone so that the mobile phone can no longer be used, but this doesn't meet our objective of tracing the lost mobile phone effectively and accurately.

Method2 drawback: As it was mentioned in the previous section that the security software is being developed and installed in the smart-phone and this software helps in effectively finding out the location of the mobile phone. But this technique becomes useless when the person having this mobile phone uninstalls the software and then reboots its kernel. Even this technique fails to meet the objective of tracing the lost mobile phone.

In order to meet the shortcomings of these mentioned two methods, a new model is proposed which traces the mobile phone even when the SIM is removed as well as when the battery is removed

Proposed model

Review Stage

The main objectives that must be satisfied for efficient tracing of the lost mobile phone.

Objective

- The Mobile phone should be detected even when the battery is removed.
- The Mobile phone should be detected even when the SIM is removed/ in the absence of the SIM card

In order to satisfy the above objectives, we build an alternative hardware for the mobile phone which is used to power up the mobile phone even when the battery is removed. This satisfies the first objective. In order to satisfy the second objective we make use of separate SIM module which will be embedded inside the mobile phone itself and is not visible for the mobile user. We will also have the regular SIM module where we insert our SIM card. Let us discuss in detail with regard to the principle which is followed in satisfying the above mentioned objectives and also the working of the hardware in the next section.

Final Stage

For the purpose of the mobile phone detection we need to keep the SIM module in the ON state. Only the SIM module is sufficient to be in ON state but not the entire mobile phone, so the amount of power consumed by the SIM module only will be less. So when the SIM module is in ON state, it is easy to detect the mobile location as the SIM module will be transmitting signal since it will be in ON state. This signal helps in detection of the location where the mobile phone is currently present. The signal is transmitted from SIM module only because the SIM card will be inserted in it; and this signal will be detected and processed by the nearest BTS[Base Transceiver Station] along with the RBS[Radio Base Station]. Each RBS services many BTS's and an RBS cover an area. As each RBS services many BTS's, that particular area covered by the RBS will be subdivided into still small areas and each of these small areas will be serviced by a BTS. So when a mobile phone subscriber moves into a particular area, that area's BTS will update the location of the mobile phone and provide the necessary services. This information of the BTS servicing the mobile phone and also the RBS linked to BTS will be stored in the database linked to the number used in the mobile phone. So it is easy to retrieve the information of the location of the mobile phone with the help of SIM card inserted into it using the above mentioned principle.

Block Diagram

The Figure 1 shows the basic block diagram of the alternate hardware used in detection and the components used are:

- SIM 300 Module
- Supercapacitor
- Battery
- n-FET
- NOT Gate IC 7404
- OP-AMP IC741

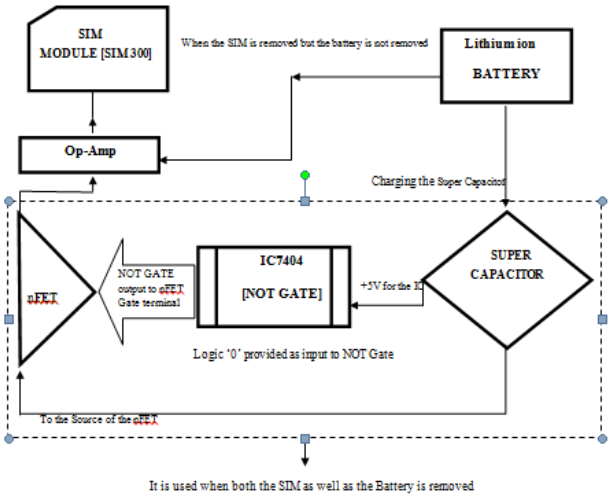


Fig1: Block diagram

SIM 300 Module

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

The modem can either be connected to PC serial port directly or to any microcontroller. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging. This GSM modem is a highly flexible plug and play quad band GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP

Supercapacitor [SC] comprises of a family of electrochemical capacitors. Supercapacitors, sometimes called as Ultra-capacitors or Electric Double Layer Capacitors [EDLC], don't have a solid dielectric. The capacitance value of an electrochemical capacitor is determined by the combination of storage effects:Double layer capacitance – Electrostatic storage of the electrical energy achieved by separation of charge in a Helmholtz double layer at the interface between the surface of a conductive electrode and an electrolyte. The separation of charge distance in an SC is of the order of a few Angstroms (0.3–0.8 nm) and is static.

Pseudocapacitance – Electrochemical storage of the electrical energy, achieved by redox reactions with specifically adsorbed ions from the electrolyte, intercalation of atoms in the layer lattice or electrosorption, under-potential deposition of hydrogen or metal adatoms in surface lattice sites which result in a reversible faradic charge transfer.

The ratio of the storage resulting from each principle can vary greatly, depending on electrode design and electrolyte composition. Pseudocapacitance can increase the capacitance value by as much as an order of magnitude over that of the double-layer by itself.

Supercapacitors are divided into three families, based on the design of the electrodes:

- Double-layer capacitors – with carbon electrodes or derivates with much higher static double-layer capacitance than the faradaic pseudocapacitance.
- Pseudocapacitors – with electrodes out of metal oxides or conducting polymers with a high amount of faradaic pseudocapacitance.
- Hybrid capacitors – capacitors with special electrodes that exhibit significantcapacitance from both principles.

II. IMPLEMENTATION

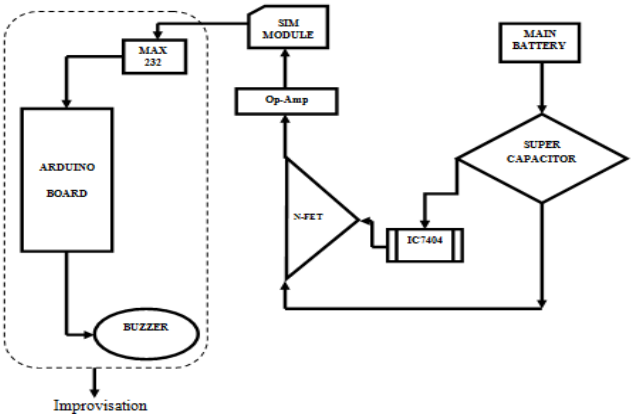


Figure 2: Implementation of mobile theft detection system

As seen from the block diagram *2*, at the purchase of the mobile phone, the mobile phone owner first registers the SIM to a particular network provider. The SIM which is used here will be used for the purpose of

mobile theft detection. Thus the mobile phone will be having two SIM's, one for the purpose of calling, messaging and to enjoy the regular mobile services, whereas the other SIM for the security purpose/theft detection purpose which will be having its own 10 digit number. The mobile phone owner registers with a particular phone number from which the message has to be sent in order to detect the lost mobile phone accurately. During normal operation of mobile phone, it will be powered by main battery. This battery also charges the Supercapacitor. When the main battery drains out or when the battery is removed, the Supercapacitor powers the SIM module (through NOT gate and nFET) as shown in *Figure 4.1*. When the SIM is in the ON state, it will be transmitting the signal. This transmitted signal will be received by the nearest BTS which helps in locating the mobile phone.

With the above method we can detect the location of the mobile phone using GSM technology, but the drawback is that we can get the information regarding the area in which the mobile phone is present but not the exact location. So we will be improvising it by using the hardware mentioned inside the block indicated by dotted lines as shown in *2*.

The working of the hardware used for improvising the accuracy of mobile location is as mentioned below:

Improvisation Part working

The improvisation part includes the detection of mobile phone to some accurate level. The code is burnt into the Microcontroller's flash memory. AT commands are used for communication with GSM modem. Commands are sent serially using serial transmission mode. Microcontroller is initialized with serial communication mode with 9600 baud rate.

Following AT commands are used in the code:

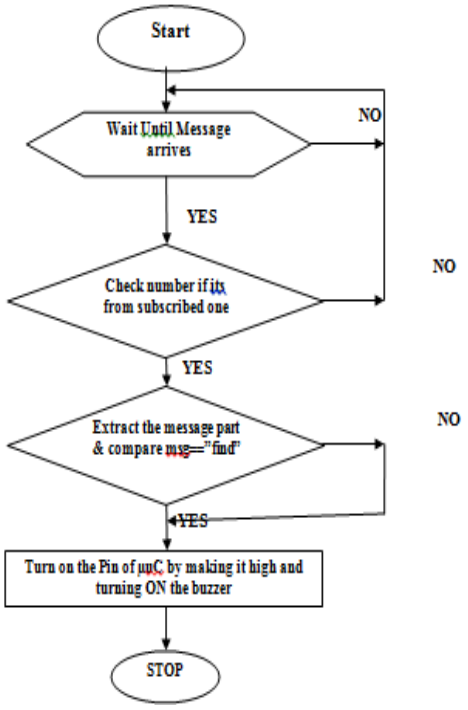
- AT+CMGF=1 will set the GSM modem to text mode.
- AT+CMGS="number" will send message to mentioned number.
- AT+CMGR=1 will read the first message from SIM memory.

When the mobile phone owner wants to track the lost mobile phone, the person sends a message from another number to which the mobile phone owner would have registered or subscribed earlier, that message will be in the "first message" slot. So when this message is retrieved, and further comparison is done (in the code) and if a match is found then the buzzer is turned on which makes a buzzing sound. The mobile phone can be traced on hearing this buzzing sound. This is one of the methods which can be followed to detect the lost mobile phone.

Code Part

The code just initializes the GSM modem in text mode and retrieves first message from the SIM memory and then compares the number (from which the message has been sent) with that in the code and if a match is found, then one of the pins of the Arduino board is made high (to which the buzzer is connected) and thus the buzzer makes a buzzing sound.

Flowchart for the Improvisation Part Code



Future Scope

Accuracy in locating the lost mobile phone can be further increased by switching ON the Bluetooth of the mobile phone and detecting it with the help of Bluetooth extenders. By interfacing the Bluetooth extenders to PC or laptop, the movements of the mobile phone can be tracked. Bluetooth extender has a feature of long range detection of Bluetooth devices typically in terms of hundreds of meters. Range can be further increased by making use of parabolic antennas in Bluetooth extenders.This can be extended to laptop theft dection,vehicles and jewelery detection.

With the help of Supercapacitor, battery life of any device can be increased. Thus it can be used as a battery life extender or substitute for battery in future aspects.

III. CONCLUSION

We have successfully designed a Mobile theft detection hardware that helps in detecting the mobile even when it's battery is removed as well as it's SIM card is removed. This was the only criteria that the now a days mobile theft detection systems were lacking and our designed hardware satisfies this criteria. Regarding the space occupied by this hardware, it can be easily embedded into the mobile phone hardware and the hardware cannot be tampered by any means as it will be unrecognizable.

We can further improvise this hardware by switching ON the GPS of the mobile phone by making use of the suitable Supercapacitor that provides the adequate high power to drive the GPS in ON state for a long time or by making use of suitable GPS module in the mobile phone such that the power consumed by the GPS module will be less.

The main highlight or the main component is the Supercapacitor that has a very slow discharging property but most importantly very fast charging property. The research is being made in this Supercapacitor field such that it replaces all the existing mobile phone batteries as it consumes very less space compared to the regular mobile phone batteries. The recent innovation in the field of Supercapacitor has lead to a miniature sized Supercapacitor and as to now it drives an LED for long period. Further research is being carried to implement this on the mobile phone.

Using the same approach, this hardware can be implemented on any electronic devices like laptops, tablets etc. and also on any automotive vehicles. Thus our project doesn't only serve for mobile theft detection but also in theft detection of many other devices and vehicles.

IV. REFERENCES

[1] In Safe Hands: A Review of Mobile Phone Anti-theft Designs by Shaun Whitehead, Jen Mailley, Ian Storer, John McCardle, George Torrens & Graham Farrell.

[2] Single-IC Supercapacitor-Based Power Supply Backup Solution by Ashish Kirtania.

[3] http://www.arduino.cc/

[4] http://www.atmel.in/devices/ATMEGA328.aspx