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CSNT 2017

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All Time Tracking System For recovering stolen devices even in power-off state

Mohd Aijaj Khan
Department of Electronics Engg
Madhav Institute of Tech. and Science
Gwalior, India
AijajKhan@ieee.org

Anubhav Tripathi
Department of Electronics Engg
Madhav Institute of Tech. and Science
Gwalior, India
anubhava@ieee.org

Manish Dixit
Department of CSE and IT
Madhav Institute of Tech. and
Science, Gwalior, India
manishdixit@ieee.org

***Abstract*— This concept is about tracking a smartphone using a GPS independent of state whether the smartphone is switched on or off. When the user makes a request to track, the receiver receives the request and then triggers the GPS to locate the device. Further, the GPS obtains location data in the form of geographical co-ordinates which is then processed by the chip and transmit the latest co-ordinates to the user. Since independent power supply is used, under any circumstances our smartphone can be easily tracked by the user.**

***Keywords*—Global Positioning System (GPS), Assisted Global positioning System (A-GPS), Complementary Metal-Oxide Semiconductor (CMOS) battery, Communication chip, Google Maps, Latitude and Longitude coordinates, Mobile tracking.**

I. INTRODUCTION

Smartphones are the present and future of this world. One cannot imagine his life living without this humble device. Today's smartphones can do anything, from processing very large payments to storing our every other private information and doing our daily office activities from even remote places [1]. Smartphones are becoming powerful day by day due to integration of many sophisticated technologies mainly high-end processors, Random Access Memory (RAM) [2] etc.

Obviously, smartphones are not smart without internet. We have already discussed many methods of tracking our lost mobile phones if they are switched on [3]. But what if the thief who has stolen your mobile switched-off your smartphone and thrown all the Subscriber Identity Module (SIM) cards.

Coming to solution for this problem, we hereby introduce you our new idea, which is the concept of Special Embedded SIM on an Integrated Circuit (IC) with Global Positioning System (GPS) receiver and a Complementary Metal-Oxide Semiconductor (CMOS) battery to power the GPS module even when there is no battery in mobile. This system is independent of the external battery or any other device in the phone.

II. PROBLEM

Smartphones are now a very important part of life. But it is inevitable for the smartphone to be lost. There are several good and efficient methods for finding a lost smartphone such as Device Manager by Google [4], antivirus applications or anti-theft application that employs GPS to track a device or captures a photograph of the thief and mail it to the e-mail id provided by the user [5]. But these methods have certain restrictions such as the device must be powered on and it should have active internet connection or a SIM card inserted to the smartphone. The problem is that if the smartphone device is switched off or the thief has removed the battery, how are we going to track the lost device. Therefore, we are going to introduce our All-Time Tracking System (ATTS) which will find solution to this problem.

III. CONCEPT

This research is about the problem faced by the user or the manufacturer locating a lost smartphone device or similar devices under the circumstances such as our device may be switched off (or the battery has been removed) or in offline so that it is discontinued from all network services or if the device has been reset, it becomes harder to track it. To overcome this problem, we propose a system that has separate and independent power supply from the main supply to power the tracking system. Therefore, even if the device has been disconnected or powered off, we can still track the device using certain unique id such that the IMEI [6] or the unique id feed inside tracking system as a reference number to it.

Our concept is to build a separate tracking unit in our smartphone which consists of a separate GPS module, a separate independent power supply (in this case we proposed the use of CMOS battery as it will give a long term uninterrupted power supply with duration around 3 to 4 years) [7] and a separate IC to store and process the location data. Our location data will be form of location co-ordinates which consists of latitude and longitude composition of the place which represent the exact location of our device [8].

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The co-ordinates thus obtained can be used in Maps Service Provider such as Google Maps in this format "Latitude, Longitude" to obtain the location of the smartphone. For example, if we obtained latitude of 26.234379 and longitude of 78.207142, we can go to google maps and just search "26.234379, 78.207142" and it will show the desired location [9].

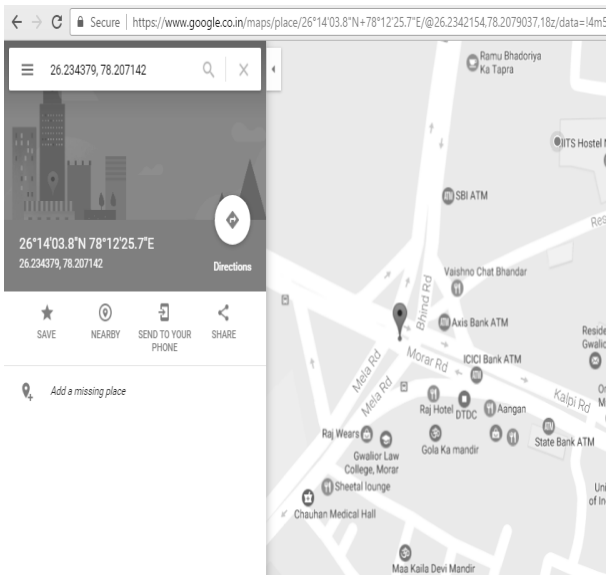

Fig. 1. Location of a geographical co-ordinate using Google Maps

IV. COMPONENTS USED

A. GPS Module- GPS module is basically a GPS navigation device or simply GPS receiver that is capable of accurately calculating geographical location through the information received from GPS satellites. GPS stands for Global Positioning System and it is global navigation satellite system (GNSS) [10] originally developed for use by US Military but later it was allowed to be used for civilian purposes [11].

B. CMOS battery- It is Complementary Metal Oxide Semiconductor transistor based battery with terminal voltage of around 3V and it can last for a duration period of around 3 to 4 years. The CMOS battery does not store data. In computers, the CMOS battery ensures that the CMOS chip, which stores data, has power. CMOS memory requires power to retain data, so the battery is necessary when no external power is supplied to the computer [12].

C. Communication chip- It is a chip used for communication with the user. It is mainly a SIM like chip that will work basically as a transmitter and a receiver and it requires signal strength from nearest tower [13]. Together with the GPS module, it will form the Assisted-GPS system which is faster and more reliable than mere GPS.

D. Pre-programmed IC- It is a pre-programmed chip that includes a storage and is capable of processing co-ordinate data by utilising the GPS or A-GPS, storing the same in the storage and then transferring it to the transmitter. In case the device is not getting GPS location, it can send the stored data as it will be the most recent co-ordinate because the storage chip is allowed to only store the recent geographical co-ordinate [12].

V. RESEARCH CONTRIBUTIONS

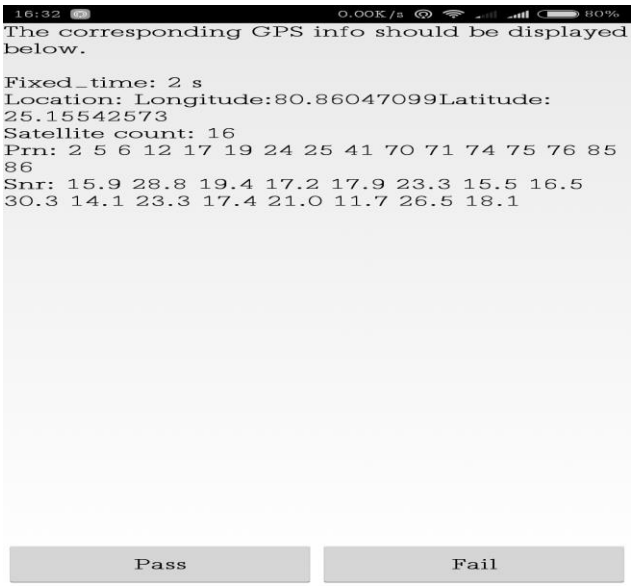

Fig.2 Testing of the Geographic Co-ordinates using GPS through Engineering mode of Android System

GPS stands for Global Positioning System and it is a network of satellites positioned at an altitude of 20000 km from Earth's surface. They are originally owned by United States Government and initially used for military purposes but later on it was made available for civilian purpose too. There are also GPS system by Europeans called Galileo

Positioning System, China's BeiDou Navigation Satellite System and India's NAVIC. GPS location tracking is technique by which we determine a location of the GPS receiver and the process used for tracking the GPS receiver is known as Trilateration.

A. TRILATERATION

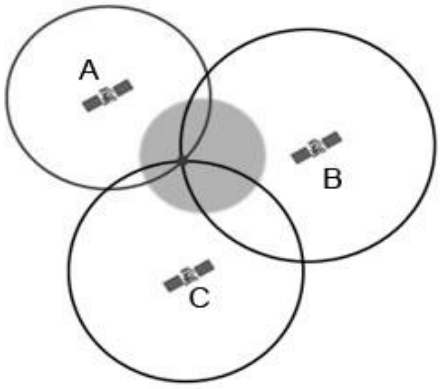

Fig.3 Trilateration of Satellites to determine the precise geographical co-ordinates.

Let's take an example of a location where 3 or more satellites are above in the sky. It is based on overlapping spheres if you know your distance from each satellite A, B and C then the satellite must form individual spheres with radius the distance of receiver from the satellites and the receiver must lie in it. Therefore, the point of intersection of all the spheres is the position of the GPS receiver.

B. ASSISTED GPS

Assisted GPS is the technology that uses network services in the cell phone to assist determining the the location. Its advantages are that it helps tracking device, turn by turn navigation is possible with this technology and location based tracking etc.

C. OUR CONTRIBUTIONS

We identified a worst-case scenario of a stolen device being switched off and so to challenge even that condition, we came up with an idea of separate tracking system integrated with any component of the device (most secured component is preferred like the screen). We went through the existing research papers about tracking a vehicle using mobile phone, tracking a device using software etc. We used Component Testing Tool in the Engineering mode of an Android device to determine coordinates with the satellite data. We used the coordinates of locations and used in maps providers like Google Maps and got the exact location.

VI. PROPOSED SYSTEM

This All-Time Tracking System is designed such that its working components are embedded into the device that must be tracked [14]. It consists of some basic parts such that GPS receiver, 3V CMOS battery as independent power supply and a pre-programmed chip by the manufacturer that can enable receiving request to track the device and sending the desired latitude and longitude co-ordinates to the manufacturer or to the user. These components are fabricated inside the most important and secure places of the target device. For example, the ATTS can be fabricated securely inside phone screen just like the fingerprint sensor FS9100 developed by Synaptics™ [15]. The subsequent paragraph will focus on how ATTS tracks smartphones for now.

We will be using CMOS battery for ATTS for the reason that even if the smartphone has been switched off or the battery is removed, our tracking system can still work. The CMOS battery will be fabricated along with the IC and GPS receiver to power it and use our tracking system. Since

A

a communication chip is integrated, it may facilitate Assisted-GPS (A-GPS) which is faster and more efficient [16].

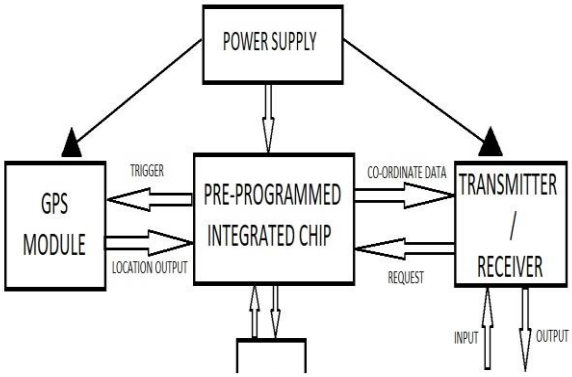

Fig. 4. Block diagram of the proposed ATTS system

The IC that we will be using for tracking system consists of a pre-programmed chip and communication chip integrated by the service provider [17] that would enable the device to receive request and accordingly transmit the co-ordinate data through SMS or GPRS whatever suites to the manufacturer. The service provider integrates a Embedded-SIM communication chip that will be used for communication through the aforementioned methods. GPS module will also be integrated in the chip which will form the geolocation tracker.

VII. WORKING

If a smartphone is lost or stolen, the user may make a request to manufacturer or can do this manually depends upon the manufacturer's service. The manufacturer's customer care will send a request information to the lost smartphone equipped with ATTS using a unique reference number which could be the IMEI or another unique number for the IC of ATTS.

The receiver of ATTS will receive the request from the customer for tracking which will trigger the GPS location service [18]. After obtaining the co-ordinates, it will send to the IC where it will be processed and stored. Most recent co-ordinates will be stored in the storage element [19].

Now IC will transmit the co-ordinates to the manufacturer through the transmitter and hence the manufacturer will get the co-ordinates of the smartphone.

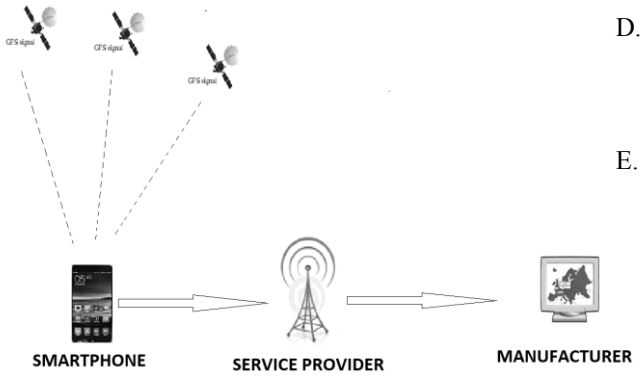

Fig. 5. Working of proposed ATTS system

VIII. ADVANTAGES

A. The smartphone can be easily tracked, even if it is switched-off or it's battery is removed.
B. Since the ATTS can be fabricated inside the screen, it cannot be physically tampered and shut down without causing loss to display.
C. Since, Assisted-GPS can be used, therefore, the location tracing is faster, more efficient and reliable.
D. Even the user can track his smartphone on his own, if the manufacturer permits it and provides a tracking website for its users.

IX. DISADVANTAGES

A. If the phone is in indoors, there may be a delay in tracing the smartphone [20].
B. The error in accuracy of GPS location can vary from 10m-100m depending the states of the motion of the smartphone [21].
C. The phone will gain a considerable width and weight due to integration of new IC.

X. FUTURE SCOPE

A. Since ATTS can be fabricated inside smartphone's screen, it will gain some width. In order to reduce width or to make smartphone slimmer, we can remove the extra GPS (other than ATTS) and make more use of the Fabricated GPS.
B. We can also integrate an alarm in ATTS to identify and locate the smartphone in crowd.
C. We can also integrate front camera with ATTS so that whenever thief switches the smartphone on, it will capture and send to the user or manufacturer [5].
D. We can also introduce a lock option that lock our device and encrypt all the data inside with a lock code provided by the manufacturer or the user just like Device Manager from Google does [4].
E. We can also use this system to find and locate another range of stolen devices like laptops, vehicles etc.

XI. CONCLUSION

Through this paper, we have analyzed the concept of how stolen smartphones can be easily tracked and recovered using the proposed ATTS system. This system would be widely useful and through some modifications, it can also be integrated in Automobiles and various electronic systems. Research is still going on this concept and we may see further compact versions of ATTS that could be installed in even small items so that nothing of our equipment gets lost.

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