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ITRACK- Find My Pal

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ABSTRACT

Normally when a phone or any other device that we use very frequently is lost, we have to go to the police station and file a FIR (First Information Report). After we file the FIR, the police have to find the device by using their regular techniques which happens to take a very long time. For example if a phone is lost, the police will try to find the phone using its IMEI number. But the procedure of tracking the phone using IMEI number has many other drawbacks other than the amount of time it takes to find the phone. So in order to overcome some of the drawbacks of the existing techniques followed by the police, we would like to propose a system that would reduce the consumption time in finding the devices and also makes our method not fully dependent on the police while finding the device. Our proposed system is an inbuilt software application which comes pre-installed in the phone or any of the handheld devices. The main aim of our paper is to find the lost devices even before the SIM card is removed. We have also derived a method to track the devices exact location based upon its latitudinal and longitudinal position and also to track the path through which the device is travelling also. This paper tells about how the proposed inbuilt software application integrates with different hardware components and already existing applications. We can also locate the place where the device present or the path through which the device has travelled. In this paper we have also discussed about how the hardware components interact with the ITrack application. By implementing our proposed application we found that the tracking procedure of a lost device has become much more efficient when compared to the already existing application like find my friend, track phone etc. This application can give an accurate location of the device and in a very fast way.

INTRODUCTION

This is the era of wireless devices where developers are keep on evolving new technologies right from java script mobiles to the world of Android and Windows based mobiles, tablets, laptops and other wireless devices. The use of these devices is increasing drastically day by day. Starting from small kid to the old aged people we cannot stay without using these wireless devices. Due to this fast emerging technology, we are becoming more and more dependent on these devices. The advantages of these wireless devices are enormous they are being implemented in every action of life.

But have we ever thought what happens if we lose these devices? Yes parallel to the world of emerging technology, the problem of losing it also is increasing. So what do we do when these devices are lost? The procedure for finding the lost devices may vary. (Sasivimon Sukaphat, 2011)

Suppose when we lose our mobile phone, we usually file an FIR and hand over the IMEI number to the

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police. We might also have to bribe them for finding the phone.

They use the IMEI number to track the phone and they don't have any other alternative techniques to track the phone. By the time we go and complain to the police the thief might have done his or her work.

He or she may have dismantled the phone, sell the phone to other user or even can crack the IMEI number (Stutz, M., *et al*., 2014) and change it to the older version mobile phones. By using the existing system the chances are finding the phone is very weak (Robert Shimonski, *et al*., 2015).

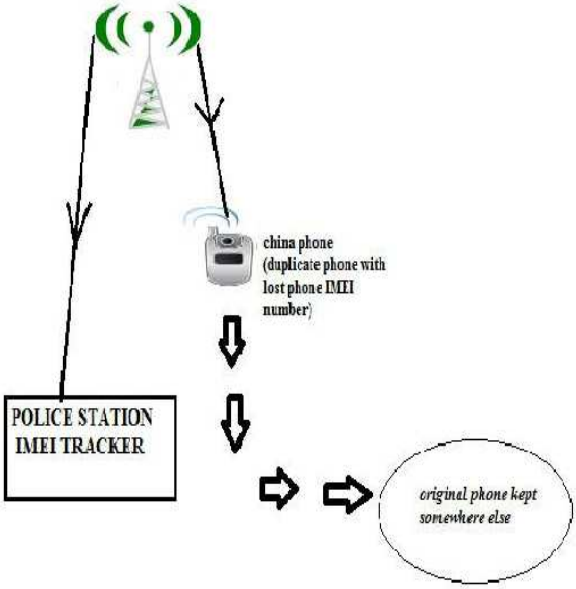


Fig. 1: Creating duplicate IMEI number

If the lost device is a laptop, then the police can find it using the serial number. This method of finding laptop is not efficient at all there is no assurance of finding it.

In all these mentioned above techniques the main drawback is that the time consumption is high and the assurance of getting back lost device is uncertain we need to be fully dependent on the police in case of lost device.

Sensors In Itrack:

Proximity sensor:

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target (Chia-Yu Lin, *et al*., 2012).

The maximum distance that this sensor can detect is defined "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. Proximity sensors (Goeger, D., *et al*., 2010) can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object.

Proximity sensors are commonly used on smart phones to detect (Osadcuks, V., *et al*., 2014) (and skip) accidental touch screen taps when held to the ear during a call.

They are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing. This is common in large steam turbines, compressors, and motors that use sleeve-type bearings. A proximity sensor adjusted to a very short range is often used as a touch switch. Proximity sensors are of many types and are used in various applications.

Some of the available proximity sensors are Capacitive, Capacitive displacement sensor, Doppler effect (sensor based on effect), Eddy-current, Inductive, Laser rangefinder, Magnetic, including Magnetic proximity fuse, Passive optical (such as charge-coupled devices), Passive thermal infrared, Photocell (reflective), Radar, Reflection of ionizing radiation, Sonar (typically active or passive), Ultrasonic sensor (sonar which runs in air), Fiber optics sensor and Hall effect sensor.

The following are some of the applications of proximity sensors in mobile devices: i) Touch screens that come in close proximity to the face ii) Attenuating radio power in close proximity to the body, in order to reduce radiation exposure

Tracking Sensor:

Tracking the location of a wireless device is pretty hard one. Normally the tracking is done using various tracking chips such as RFID (Radio Frequency identification) (Enyang Xu, *et al*., 2011) These RFID chips are very small in size and are used for bar code identification. Nowadays the tracking chips are implanted in humans, pets, wallets and many other things that can be tracked. Using these tracking devices one can find the location of the particular person or device or thing .For tracking a device we would need certain Location Base-Services (LBS) which is a combination of hardware and software integrated into one application. The term LBS has derived from the world of telecom and telematics. This LBS has been deployed in many of the handheld devices and PDA'S. From fixing a proper location of the device it is not necessary that the line of sight is required. This is a major advantage of this system and hence can be used very effectively. Though this system is effectively deployed there are many drawbacks in this system of tracking the devices.

Itrack And Its Components:

The tracking chip is placed inside the device along with the motherboard of the device. Due to which it cannot be easily removed from the phone or laptop. We have written an algorithm by which integrate this chip work with our software.

The working of this chip is totally based upon the triggers it receives from the owner. The trigger may in the form of a message or a email where this trigger is received by the tracker alone not by the device. This is very useful in tracking the devices even when the device is dismantled. This tracking that we use gives the exact location of the device or the path through which it had traveled. We have devised the following formula(1) to calculate the distance of the device (Jun Yan, *et al*., 2014).

$$d=acos\ (sin\ (lat1)*sin\ (lat2)\ +cos\ (lat1)*cos\ (lat2)*cos\ (long2-long1))*R \quad (1)$$

Where,

Lat1 is latitude of source,

Lat2 is latitude of destination,

The GPS (Global Positioning System) will not work effectively if the device is kept in-doors as the signals would be weak.

To overcome this difficulty they have introduced a system call A-GPS which is highly dependent on the Location Based Services. But in this system, if the device has been turned off the tracker is also turned off.

To overcome this very defect we are providing the GPS with a battery back-up. Now in our system we are connecting the tracking device UBX-G5010 for effective signaling.

We have also implemented the magnetic proximity fuse. Two sensors can be placed in the phone, one behind the device i.e., between the motherboard and the back panel. And the other in the front i.e., between the motherboard and the display panel of the phone. By placing two sensors one in the front and one in the back we can locate the device if it is being dismantled.

The main aim of implementing these sensors is to know the device's location even before it is dismantle

Fig. 2: Components of ITRACK

GPS Tracking:

The proposed tracking algorithm belongs to one of the distance based algorithms.The threshold value for the distance is calculated after the passing of that distance and a new point entered is obtained adaptively,taking

into account: the current accuracy of user's position and the speed of the user. An additional reduction of the number of points is realized by means of analysis of the position of the last 3 points generated.

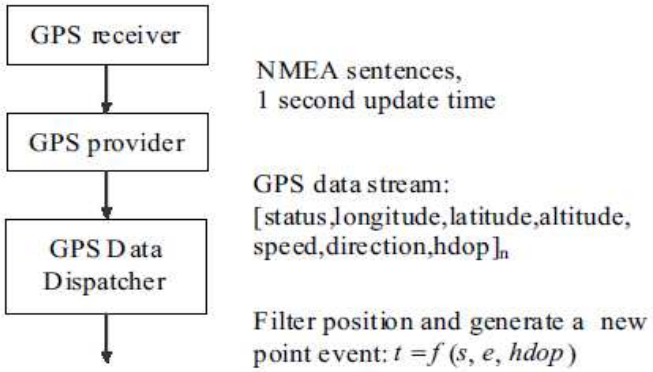
```
1.  i=0,numberOfPoints=0,xpath[3],ypath[3]
2.  while
3.      GetNewPoint(filtLn_n, filtLat_n, hdop_n)
4.      OptimizeTrack(filtLn_n, filtLat_n)
5.  endwhile
```

Addnewpoint:

The method AddnewPoint realizes the speed filtering, position filtering, travel mode weather its by car or on foot, and generates a new point, if there are necessary conditions – HDDP, the speed and path passed within the needed ranges.

The program module which realizes the tracking algorithm must listen to its mailbox from the trigger sent by the owner for „newpoint" message. After the receipt of the message the GPS data are read by the GetnewPoint method and the reduction of the points is realized with the OptimizeTrack method.

```
1.  Algorithm AddNewPoint (GPS data)
2.  v_n =speed_n, v̂_n = FilterSpeed(v̂_{n-1}, v_n)
3.  if(v̂_n > v_Th)
4.     HDOP_max=4.5
5.  else
6.     HDOP_max=3.5
7.  endif
8.  if(hdop_n < HDOP_max)
9.     e_n = E.hdop_n
10.    if(v_n >100)
11.       distTh = S_max
12.    else
13.       distTh = e_n + [(S_max − e_n)/100]v̂_n
14.    endif
15.    [filtLon_n, filtLat_n] = filterPosition(lon_n,lat_n)
16.    dist = GPSDist(filtLon,filtLat,lastLon,lastLat)
17.    if(dist ≥ distTh)
18.       lastLon = lon_n
19.       lastLat = lat_n
20.       POBox.add("newpoint")
21.    endif
22. endif
```



Sequence to obtain the moment to enter a new track point

The data received from the GPS receiver are processed by the program module. GPS Provider parses the National Marine Electronics Association (HMEA) 0183 that sentences to the necessary 9PS data. The module GPS Data Dispatcher is intended to adaptively define the moment of generation of a new track point. The time interval (t), after which a new point is entered, depends on: traveled distance (s), and the current horizontal accuracy of GPS receiver (hdop).

Australian Journal of Basic and Applied Sciences, 10(12) July 2016, Pages: 7-16

Optimize Track:

The optimization procedure requires two buffers of the typedouble (xpath, ypath) for buffering the coordinates of the last three points. The pseudo-code of the OptimizeTrack method is as follows

```
1.  Algorithm OptimizeTrack(lon_n, lat_n)
2.  xpath[i] = lon_n , ypath[i] = lat_n
3.  i = i + 1
4.  if (i = 1)
5.     AddPoint(xpath[0], ypath[0])
6.     numberOfPoints++
7.     return
8.  endif
9.  if (i = 3)
10.    if (CheckPoints(xpath,ypath,hdop_n) = true)
11.       xpath[0] = xpath[1], ypath[0] = ypath[1]
12.       AddPoint(xpath[0], ypath[0])
13.       numberOfPoints ++
14.       return
15.    endif
16.    xpath[1] = xpath[2], ypath[1] = ypath[2]
17.    i = 2
18. endif
```

CheckPoints Algorithm:

```
1.  Algorithm CheckPoints(xpath, ypath, hdop_n)
2.   α1 = Bearing(xpath[0],ypath[0],
            xpath[1],ypath[1])
3.   α2 = Bearing(xpath[1],ypath[1],
            xpath[2],ypath[2])
4.   γ = abs(|α1 − α2|)
5.  if ( γ ≥ γ_Th )
6.      return true
7.  else
8.      dist = GetNearestDistToTrack(xpath,ypath)
9.      if (dist > d_Th )
10.         return true
11.     endif
12. endif
13. return false
```

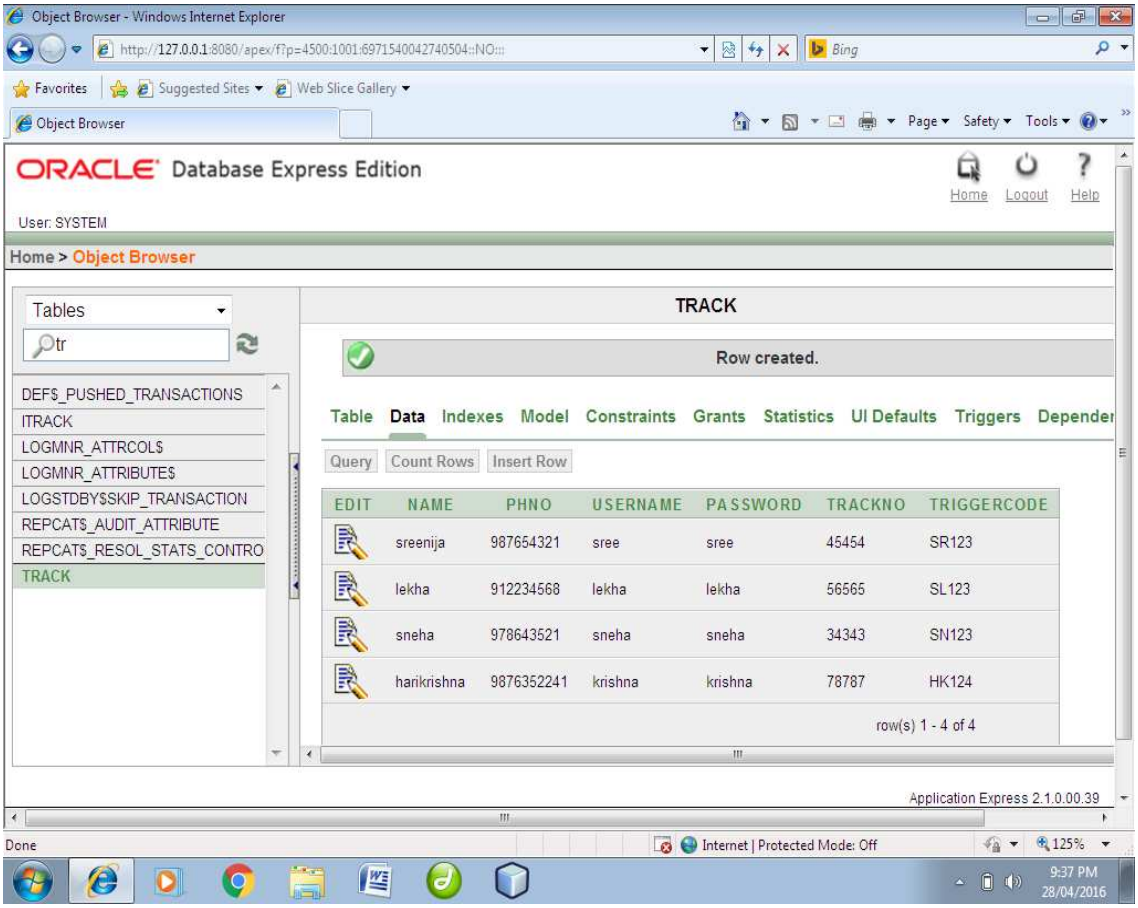
Through the ADDPOINT algorithm, a new point in the path of tracking is being inserted. This method is called only when the check point algorithm realizes the optimization of the number of checkpoints returns true.

The table 1 shows the parameter values that have been observed after doing off-line experiments

Table 1: parameter values

Parameter	Description
$\alpha = 0.65$	This value guarantees a delay of 8 sec. in case of route curves. The aim is to prevent over-smoothing due to high values of the parameter *r*.
$r_{min} = 1.0$ $r_{max} = 4.0$	The so selected interval for the parameter *r* guarantees the filtering of the GPS position without occurrence of invalid data.
$\gamma_{min} = 10°$ $\gamma_{max} = 25°$	The minimum and maximum value for the threshold for angle γ over which it is assumed that the point belongs to the route.
E= 10 m, d_{Th} = 4.25*hdop, S_{max} = 65 m, v_{Th} = 8km/h	

Database:



In the database the registered person's username, password, tracknumber and trigger code are stored.The track number and the triggercode are unique five character code. These information will be asked once only .since this is an inbuilt application and the information mentioned cannot be changed thereafter, but, if the owner wants to change the phone number to or from which the trigger is being sent and the location is being received it can be done only by going to admin settings and giving the specified password of the registered owner alone.

After the requisition of the required change to the database, the administrator will send a unique code to the mail id of the owner through which he has or she has to confirm the changes to be made.

The phone number that is given for the database is the phone number of any trusted friend/relative of the device's owner. Only the number that is registered in the database can be used to send the trigger if in case of owner trigger.

And if it is a self-trigger it is the number to which the location of the device's presence is sent. .

If an intruder is trying to use the device the trigger will get on and since we have given the number already in the database the trigger message will be given to the authentic user of the device.

For Each user the specification of the phone number is mandatory.

And since itrack can be implemented on other devices too instead of phone number the device's serial number can be given if it is a laptop and the device's IP address can be mentioned if it is other device's like pagers, tablets and palmtops.

Itrack On Handheld Devices:

ITRACK Application for Mobile phones:

The way that our system works i) how it receives a trigger, how it recognizes and ii) the way our system replies to the received trigger is explained below this system gets a email address or a phone number from which the trigger can be sent (Michal Ficek, *et al*., 2013).

This system also comes with the separate battery back-up to avoid the possibility of tracker working even if the device is turned off. So, this system gets the 10% charge from the phone's total charge .this keeps the system running in the device always. As said above our system gets activated only after receiving a trigger.

We have now split this triggers into two mechanism the first one is owner triggers is given as e-mail or as short message from the registered email address and phone number respectively which are registered in our system.

These details such as the email address, phone numbers and other details related to the owner of the device can never be altered. These details can just be provided once into system.

These details cannot be altered (since, we are proposing for a system that comes built in within the system and hence there are no possibilities for deleting this system in any way) hence it can be said that the trigger will be definitely received from the owner itself.

This trigger when received by the system, it informs the system that the device is being held by some other person or it has been misplaced when the system being know ledged that is in a wrong place, it activates the tracking sensors.

The tracking sensors UBX-G5010 is used and is integrated into the system. These tracking sensors calculate the location of the device which is found out by using the latitude calculation.

It also calculates the distance between trigger sender and the device. The location of the device is shown in a map where we use software applications like localise to show the path towards the device. Suppose if device is travelling somewhere the path through which it is travelling is also depicted in the map.

If in case it is a person who has taken the phone and if that person opens and checks the data in the phone, the data which has been seen by that particular person is also recorded. We have also synchronized the front and the rear camera of phone which takes multiple pictures while the device is being used when the ITRACK is in activated by the trigger. Now these pictures are sent to the owner via E-MAIL.

In self trigger, the system gets automatically trigger when the phone is being dismantled that is the proximity sensor which is used is magnetic proximity fuse. This sensor cuts the circuit and the system gets automatically triggered. Now since the system is triggered it activates all its integrated component and works same as a owner triggered system. This is very useful in avoiding the person from dismantling the phone and selling its parts easily (Sadaphal, V.P., B.N. Jain, 2008). Our system totally concentrates in finding the lost device in all possible cases. it is less time consuming and makes us independent of police and a very safe and accurate way in finding the lost devices

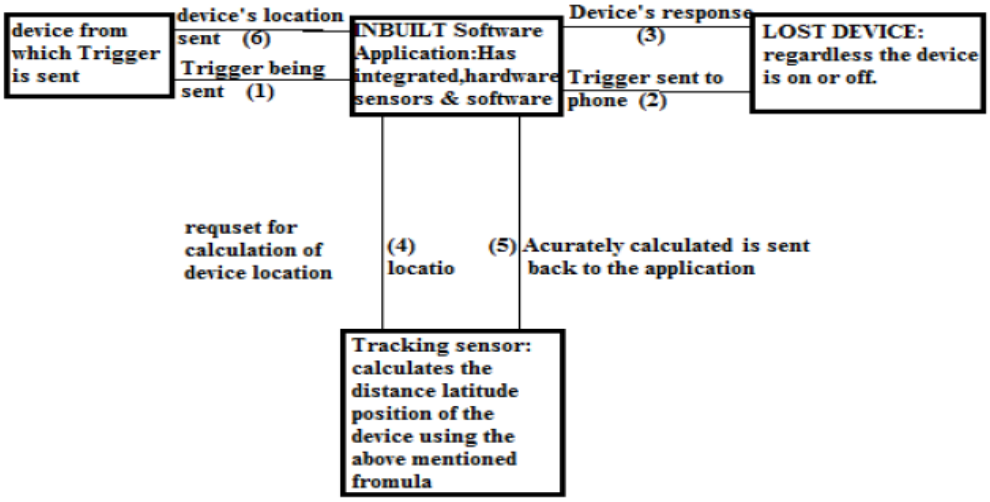


Fig. 3: Architecture of ITRACK

ITRACK Application for laptops:

A laptop or notebook is a portable personal computer which is suitable for mobile use. A laptop does run on power supply or batteries such as Li-on, Nicad, NiMH. A laptop has a LCD screen, keyboard (with or without num pad) and a touchpad (act as a mouse). By using USB port we can connect to other external devices.

Laptops which are thinner are also know as ultra books. Some companies that develop laptops are HP, Dell, Apple, Sony and HCL.

For tracking our lost laptop we have developed an in-built application that comes pre-installed with the operating system. The application will have access to the web cam so that we can identify the thief who had stolen the laptop.

Once the photo of the thief is taken the laptop will send the photo to the email that is given by the user which registering for the software. And also a copy of the same photo is send to the mobile number (if the user's phone has the capability to receive MMS). We have added an additional battery for the purpose of sensors to work even if the main battery is removed.

Then we embed two proximity sensors into the laptop. A proximity sensor is one of the many available sensors in the market today. The main purpose of proximity sensor is that it can detect presence of any nearby object which are not in physical contact. A proximity sensor will be emitting a beam of electromagnetic radiation like infrared and it looks for changes in the field or return signal By using proximity sensor we can come to know if the thief has dismantled the laptop or not. For our project we are using two proximity sensors.

The first sensor is placed at the front side of the laptop in between the LCD Screen and the keyboard. The second proximity sensor is placed at the back side of the laptop in between motherboard and the battery. By using this two proximity sensor we can detect if the thief tries to dismantle the laptop. We have added a tracking sensor to the laptop. The main purpose of this tracking sensor is to track the location of the laptop.

The proximity sensors and tracking sensor will be activated only if the user sends the trigger to the laptop. After the trigger activates the sensors, the user gets the location of the laptop. The laptop sends its coordinates using application like GPS. And by using localize map application the laptop will send the path in which the laptop has travelled and also mentions the distance between the user and the lost laptop.

ITRACK Application for other mobile devices:

We are providing a similar inbuilt application for other mobile devices which does not have an inbuilt SIM card slot. Since there is no SIM card available we are not able to connect to internet. So we are providing a data card so that it can connect to internet and send the location and photo of the thief. After receiving the location further action can be taken.

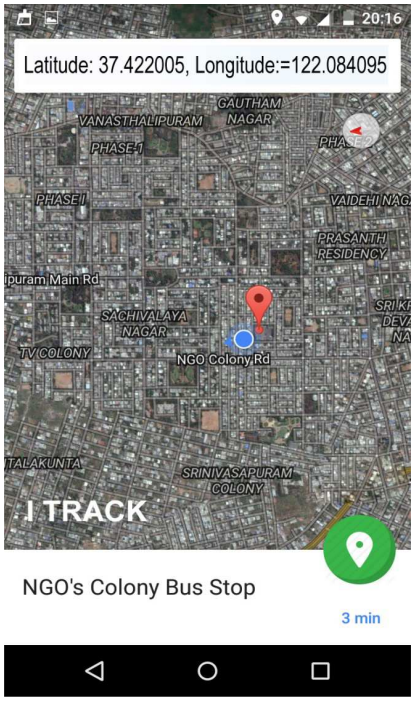


Fig. 4: Exact location of lost device

Result:

Hence, by implementing the proposed ITRACK application it is found that the efficiency, speed, and accuracy of this application in phone or any other handheld devices such as laptop and tablets is higher than that of compared other tracking application like localize, find my friend , lost android etc.. This application when installed in laptop is also found more efficient than the normal procedure that is used in finding the device such as lo-jack software.

Discussion:

The proposed ITRACK application is an in-built software application rather than the application that are to be installed to find the devices. This application requires mandatory registration unlike other applications. It also requires that a phone number of a trusted person to be provided for the tracking method activation purpose. Since it is an in-built application it doesn't need any external interfaces such as a tracker or a connector to be added to it. And since it also has mechanism called as the self-triggering system there is a possibility of the unauthenticated person from dismantling the device. Two proximity sensors is placed inside the device one between front panel and the another between back panel and the mother board .the sensors are embedded in such

a way that the application is self triggered as in when there is a change in the charge of the proximity fuse. Unlike other application that requires a internet connection to be around them this application is being provided with a internet card that helps the application to send the location to the owner.it also has the e-mail connected to it, all the details are secured with a password protection. The alteration of these details cannot be altered without the owner's permission.it is the owner's duty to remember the trigger code given by the application. If the device is to be tracked then owner has to specify the unique trigger code that is allocated to him, only when the tracking of the device will be activated. The tracking algorithm derived above gives the path through which the device has travelled. It also frequently updates the path through is travelling by adding new checkpoints .using the formula, the application calculates the exact location of the device's position. Since we have merged the cameras the photo of the intruder will be taken while using the phone and sent to the owner through MMS and E-mail. The application also records the details which the intruder has sniffed in the device.

Conclusion:

There by we conclude that our application named ITRACK is found to be effective procedure to track the accurate distance, location, path of the lost device instantly. When compared to the existing system such as the IMEI number tracking, lojack software and so on. Unlike the IMEI number which can be cracked or duplicated,the trigger code of our application cannot be even accessed by any unauthenticated user since it is password protected

We have created a new In-built application named ITRACK. This application with help of sensors will be able to track our lost devices. And also when compared with already existing applications our ITRACK is more efficient, reliable, time saving and also reduces the dependency upon the police to find our lost devices.

In future we would also like to propose implement this ITRACK application to bikes and car thus making our country theft free country. It will be better when compared to existing systems already present. We are also currently in the process of implementing Remote Lock down option which will help to avoid unauthorized access.

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