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Design and Implementation of Children Tracking System using ARM7 on Android Mobile Terminals

P. SANTHA RAJ[1], V. ANURADHA[2]

Abstract: Recently, all over the world, crime against children is increasing at higher rates and it is high time to offer safety support system for the children going to schools. This paper focuses on implementing children tracking system for every child attending school. However the existing systems are not powerful enough to prevent the crime against children since these systems give information about the children group and not about each child resulting in low assurance about their child safety to parents and also does not concentrate on sensing the cry of the child and intimating the same to its parents. The proposed system includes a child module and two receiver modules for getting the information about the missed child on periodical basis. The child module includes ARM7 microcontroller (lpc 2378), Global positioning system (GPS), Global system for mobile communication (GSM), Voice playback circuit and the receiver module includes Android mobile device in parent's hand and the other as monitoring database in control room of the school. Finally, implementation results for the proposed system are provided in this paper.

Keywords: Android, ARM7, GPS, GSM, lpc2378.

I. INTRODUCTION

Children Tracking system is widely used all over the world to assure parents that their wards are safe from suspicious actions and their kid is happy in school atmosphere without crying. The proposed system includes tracking the child's movement to and from school. The information pertaining to missed child is sent to control room of the school as well as to their respective parents, if they move beyond the coverage area. Not only the information about the child's whereabouts but also whether the child is crying is sent to parents through text message to their Android mobile device. System developed by Yuichiro MORI, et.al, uses "Autonomous Clustering technique" for managing groups of Android terminals attached to children in school. Android terminals have wireless LAN and Bluetooth device. It adopts Bluetooth communication among Android mobile terminals in every cluster to collect information and cluster head delivers the same through tags to server at school using wireless LAN. It results in lack of individual attention towards the children since the cluster head sends the information about the children group and not about each individual & also does not concentrate on child crying inside the school.

It offers less security [2]. Children tracking system is also developed based on mobile ad-hoc networks. System developed in [3] says that in GPS system and tag based system, each parent cannot obtain group information on the vicinity of the child. Through field experiments, it is confirmed that, as long as children walked at normal speed on the predetermined way to and back from school, the system could provide location and group information of children to their parents. From experimental analysis, it is found that system independent factors such as power shortage in phone and performing wrong registrations in Bluetooth tags dominate in lowering average tag recognition rates for school routes. Tracking system in hospital environment is performed using integrated Ultra wideband and GPS technologies for performing efficient indoor/outdoor tracking. Experiments show that system may provide extra protection for patients but system rely on Wi-Fi network to transmit data and updation rate is quite low due to network jam. It includes complicated calibration procedure as well as high set up cost for the UWB sensor network [4]. Multi-hop Clustering scheme can be incorporated for ad-hoc network and it includes dynamic change in topology of ad-hoc networks, overhead for the management of the network is small and uniformly distributed. It does not include design of generic function to evaluate adaptability of clustering schemes [6]. The above mentioned system [2] inspired me to make an attempt to reconfigure it by adding few features and thus making it more secure compared to the existing one.

II. DIFFERENT TECHNOLOGIES OF CHILD TRACKING SYSTEM

Cell phones make life more convenient. With one device, you can make calls, send text messages and take pictures and video. You can even check your email, surf the web and use GPS on many cell phones. This is why many children have cell phones. While cell phones are invaluable resources, they can sometimes be problematic and children can become the

victims. It's time for you to step up and monitor your child's virtual life and his or her cell phone and internet use. Child Tracking System is an android application that helps parents to monitor their child's cell phone activities. This software runs in a stealth mode so that your kids may not know it's there. Cell phone monitoring can not only help them avoid dangerous situations, but also can help you keep track of your children in other situations. You can use GPS tracking to make sure your kids are in safe places and make sure they are going to bed instead of texting or calling unwanted persons or surfing unwanted sites.

A. Cell phone tracking

Child Tracking System is an application that helps parents to retrieve the details of incoming or outgoing calls and messages of their children at the same time when they send or receive it. Even though child can delete the call log and SMS details manually, this application stores all the deleted data in the server. Content of the message and log can be viewed by their parents even if their child changes the number. The application also provides GPS location of the child so that the parents can monitor the history of where their child have been and can set up alerts if their children are going outside of approved geographical zones. The system also provides facility to track browser activities and to block calls or messages from specified numbers.

B. Android

Child Tracking System is an android based phone tracking application. Android is an operating system based on the Linux kernel, and designed primarily for touch screen mobile devices such as smart phones and tablet computers. The user interface of Android is based off direct manipulation, using touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching and reverse pinching to manipulate on screen objects. Internal hardware such as gyroscopes, accelerometers and proximity sensors are used by some applications to respond to additional user actions, for example adjusting the screen from portrait to landscape depending on how the device is oriented. Android allows users to customize their home screens with shortcuts to applications and widgets, which allow users to display live content, such as emails and weather information, directly on the home screen. Applications can further send notifications to the user to inform them of relevant information, such as new emails and text messages. Android is open source and Google releases the code under the Apache License. This open-source code and permissive licensing allows the software to be freely modified and distributed by device manufacturers. Additionally, Android has a large community of developers writing application written primarily in a customized version of the Java programming language.

C. GPS

The Global Positioning System (GPS) is a space based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver. A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include

- The time the message was transmitted
- Satellite position at time of message transmission

The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite using the speed of light. Each of these distances and satellites' locations defines a sphere. The receiver is on the surface of each of these spheres when the distances and the satellites' locations are correct. These distances and satellites' locations are used to compute the location of the receiver using the navigation equations. This location is then displayed, perhaps with a moving map display or latitude and longitude; elevation or altitude information may be included, based on height above the geo id. GPS measurements yield only a position. However, most GPS units can automatically derive velocity and direction of movement from two or more position measurements. The disadvantage of this principle is that changes in speed or direction can only be computed with a delay.

III. LBS COMPONENTS

In order to make Location based service (LBS) services possible, some infrastructure elements are necessary, including mobile devices, applications, communication network, positioning component, and service servers. Mobile devices are tools used by users to access LBS services, to send requests and retrieve results. Such devices can be portable navigation devices (PNDs), Personal Data Assistants (PDAs), laptops, mobile phones, and so on. Application is the interface for users to access the LBS service. It is usually software developed by an application provider, downloaded and installed on user's mobile device. A specific application is usually developed for a specific LBS service. Due to the restrictions of mobile devices (small screen size, limited processor power and memory, battery capacity), LBS applications need to be lightweight and battery saving. Communication network refers to the mobile network which transfers service request from user to service provider, and requested information back to the user. Global System for Mobile communications (GSM) is currently the most common standard for mobile network and is used by majority of mobile phones globally. Mobile networks are usually controlled and maintained by operators who provide connectivity for mobile users and charge them for data and voice transmission.

A positioning component is usually needed in a LBS application to determine the location of user's mobile device. Most of the current LBS services do not require users to input location manually, like giving zip code or street name. Instead user's location can be obtained by using some positioning technologies, such as satellite positioning,

cellular network positioning, WLAN stations or radio beacons. Service providers maintain service servers which offer different kinds of LBS services to users and are responsible for processing service requests and sending back request results. Servers calculate positions, search for a route, or search specific information based on user's position. Service providers usually do not store and maintain all the information requested by users. Instead, content providers are responsible for collecting and storing geographic data, location-based information, and other related data. These data will be requested and processed by service servers and then returned to users. Fig.1 shows the interactions among these components, and the process of a LBS service. First, user sends a service request using the application running on mobile device. The service request, with user's current location information obtained from the positioning component (in this example, GPS data), is sent to service server via the mobile communication network. The service server requests geographic database and other related database to get required information. At last, the requested information is sent back to user's mobile phone via mobile communication network.

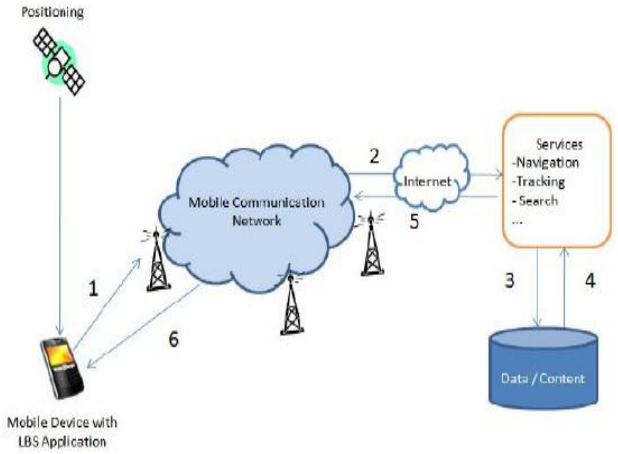

Fig.1. LBS components and Service Process.

IV. RESULTS AND DISCUSSION

Fig.2. ARM7 Board (lpc 2378).

(Fig.2) illustrates lpc 2378 microcontroller .This controller filters the incoming GPS data which holds repeated six packets and forwards only the latitude and longitude values (i.e.) current position of the child to GSM.

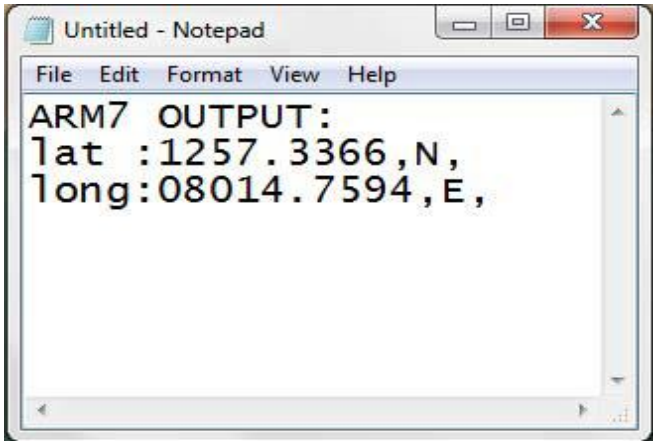

Fig.3. ARM7 output.

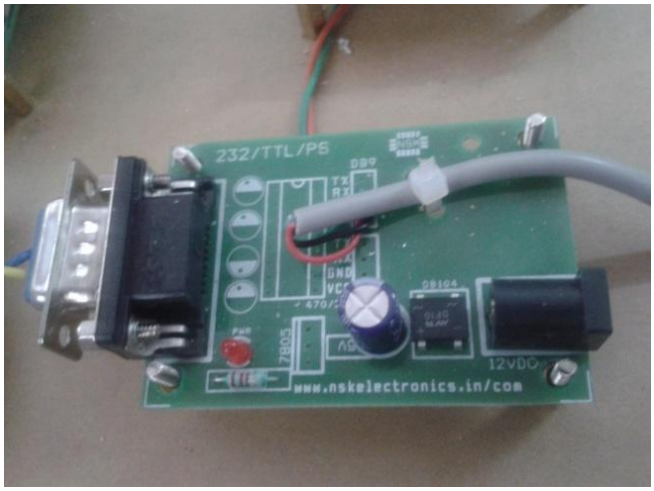

Fig.4. GPS board.

When supply is provided to GPS board (Fig.4), it automatically senses the current position of the child and sends its data to microcontroller.

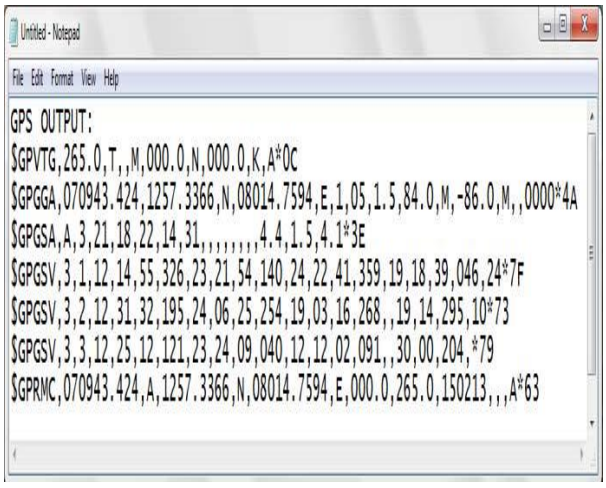

Fig.5. GPS output.

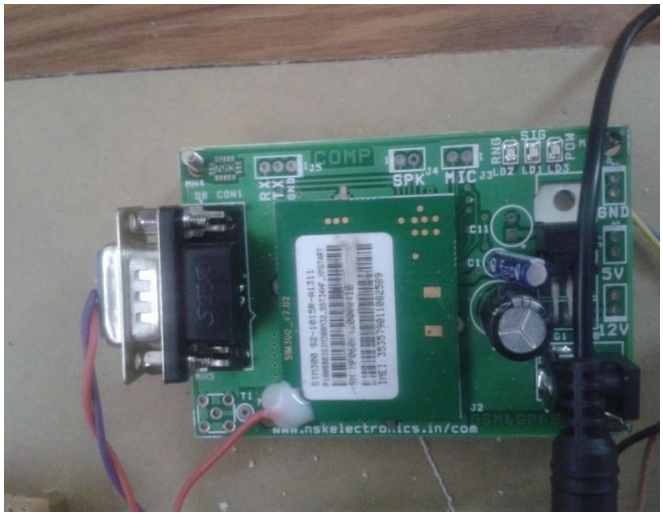

Fig.6. GSM board.

GSM module (Fig.6) receives the latitude and longitude value of the child's current position and sends it to two receivers.

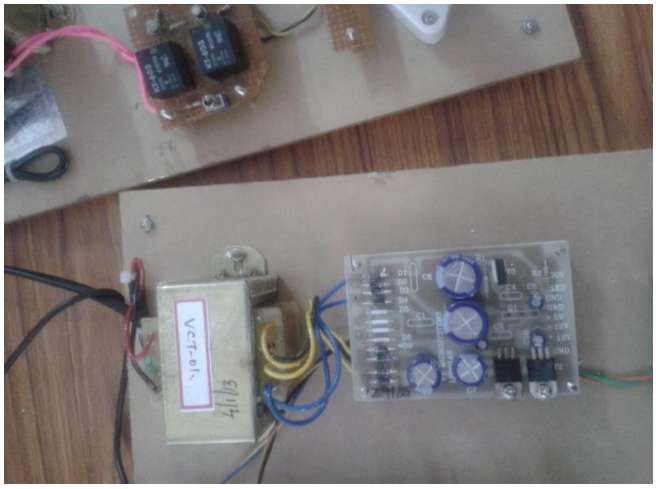

Fig.7. Power Supply.

(Fig.7) illustrates power supply unit which provides VCC and GROUND for all the hardware modules.

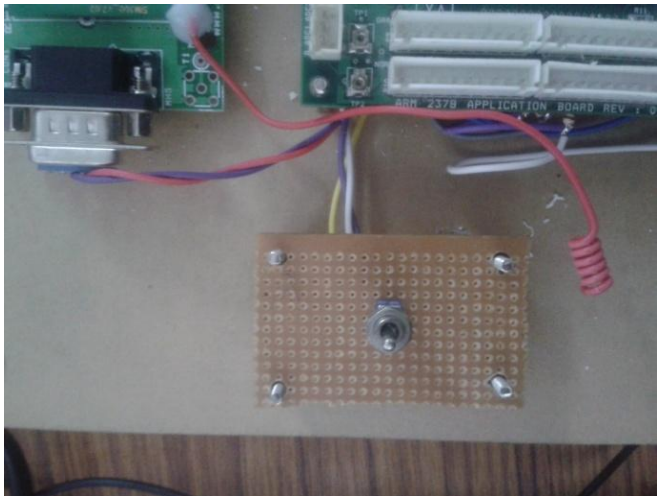

Fig.8. Relay Switch.

(Fig.8). represents a relay switch which will be closed whenever the child cries inside the school campus. The control over closing and opening of switch comes from ARM7 controller. This switch in turn alerts the speaker in voice playback circuit. The GSM responds to this event by sending text message to parent android mobile device.

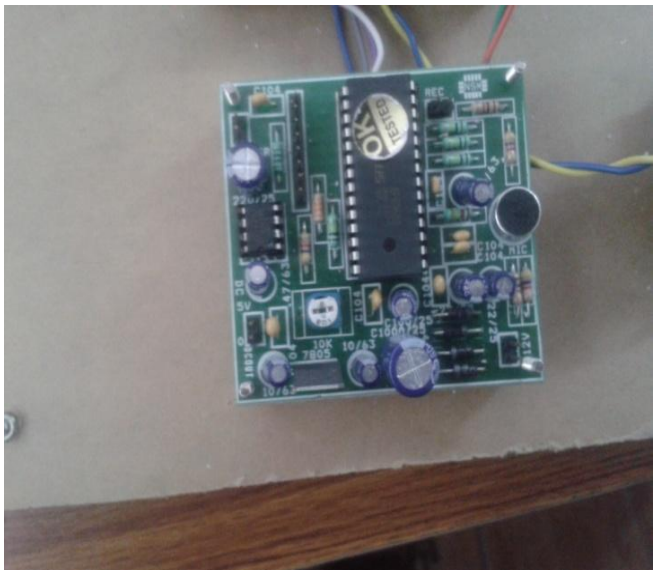

Fig.9. Voice Playback Circuit.

This circuit primarily focuses on matching the child crying in school with the recorded child's crying, upon which a high signal is supplied to this circuit from microcontroller leading to an alarm sound.

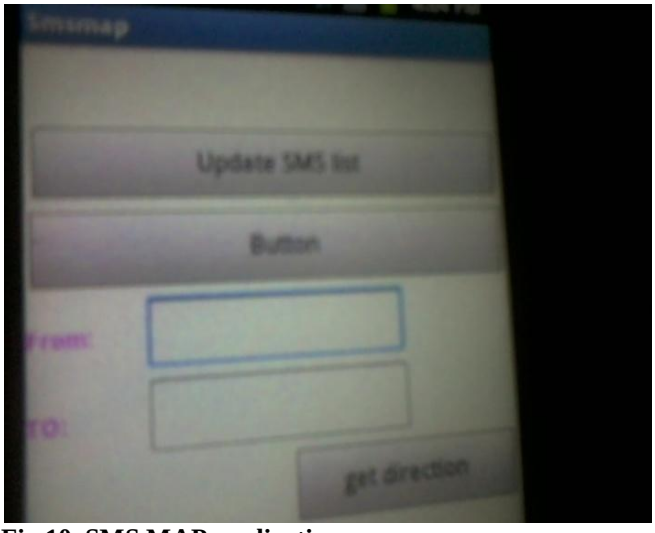

Fig.10. SMS MAP application.

The above figure shows the "SMSMAP" application created in the parent's android mobile. Upon double clicking this application the above image is displayed in the phone. When an update SMS List tab is pressed by the parent it results in retrieving the latest Lat, Long values sent by GSM Module and updating it in android mobile devices. When button tab is pressed it leads to GMAP indicating the place.

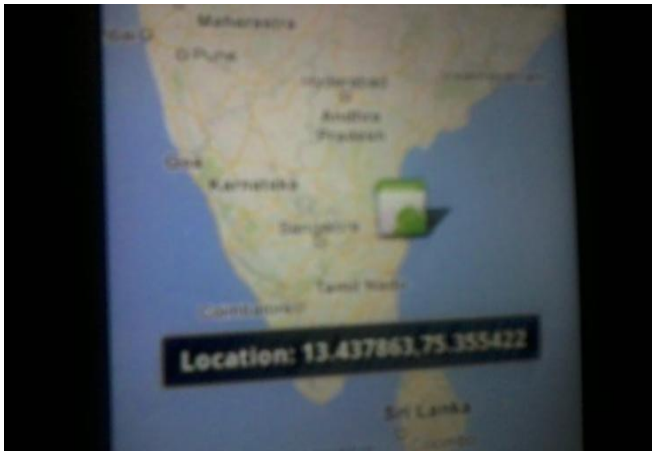

Fig.11. Pointer in GMAP.

The above figure illustrates the GMAP output obtained at the receiving end (parent android mobile device). It shows the pointer indicating the current location (place) of the missed child.

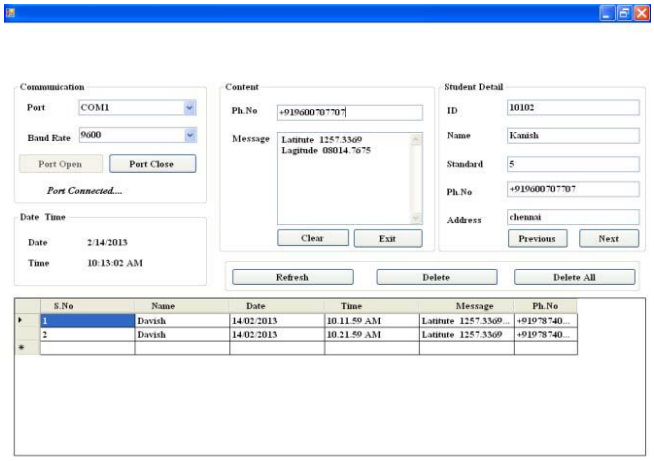

Fig.12. Monitoring Database.

The above figure represents monitoring database created at the control room of the school (receiver) it shows the information of the missed child on periodical basis.

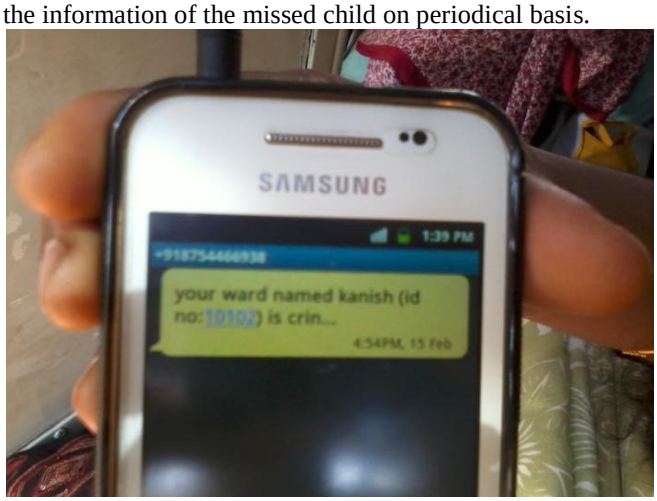

Fig.13. Output from Voice Playback Circuit.

The above figure represents the text message being forwarded to parent's android mobile when the crying of the child matches with the recorded voice in the voice play back circuit.

Fig.14. Overall view of transmitter module.

The fig.14 above indicates the full view of the transmitter module.

V. CONCLUSION

This project implementation primarily focuses on tracking a child's position and its location is sent to its parent and control room. It can be extended to perform the same for all children in the school by reducing the size of the child module, thus fixing it to ID card of every child. This project also focuses on recording a child's cry and when it matches with crying of the child in school the text message is sent to its parents. It can be extended by placing voice recognizing sensors which senses the cry of all the children inside the school and send the information to their parents appropriately by using the school database.

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Author's Profile:

P.Santha Raj, B.Tech:(2008-2012) National Institute of Technology, Warangal, Pursuing M.Tech: JNTUA, Shri Sai Institute Of Engineering And Technology, Anantapur, AP, India.
Email: santha.padagala@gmail.com.

V.Anuradha, B.Tech: (SLN college of engineering,gulburga university, raichur), M.Tech: (Pulla Reddy engineering college, kurnool) Working: Associate professor in Shirdi Sai Enginnering college ,Anantapur, AP, India.
Email: anuradhav.sln@gmail.com.