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WRIST BORNE SAFETY DEVICE

USING GLOBAL POSITIONING SYSTEM AND GLOBAL SYSTEM

FOR MOBILE COMMUNICATION TECHNOLOGIES

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ABSTRACT

There have been many measures tried in the past to prevent crimes against children such as, kidnapping, sexual harassment, manhandling and bullying but there is no fool proof method in place to prevent them. This project can improve the situation by allowing children to raise the alarm or call the parents apart from giving real time access of the location of the children to the parents. This paper proposes to implement location tracking, location data logging, alarm triggering, SMS transmission and two-way voice call facility using microcontroller, GPS module and GSM/GPRS module, HTTP Server and SQL Database.

KEYWORDS: GPS, GSM/GPRS, Child Tracking, Geofenced, HTTP Server, Authentication, Voice Call, Distress

INTRODUCTION

Crimes against children are on continuous rise in the modern world. Crimes against children tend to be local crimes with the vast majority taking place within the home and school premises. Every year thousands of children become victims of crime—whether it's through violent attacks, kidnappings or sexual abuse. Every parent of a child knows that it's hard enough to keep their child at home safely, but a whole new set of challenges may arise when the child goes off to school. Parents are concerned with the general well-being of their child during school hours, for example whether the school provides appropriate levels of safety measures or whether there is a solid school discipline policy in practice. A report on a study on the scenario of crimes in India published by National Crime Records Bureau points out that crimes against children are increasing every year and the nature of some of the crimes are very heinous in nature.

There have been some systems in use and some systems proposed to prevent the crimes against children. One of the proposed systems[1] consists of Android terminalsa which has Wireless LAN device and Bluetooth device with the ad hoc communication. A paper [2] proposes using a combination of latest Technology using image processing, web based development using VB. net language apache web server, GPS/GSM, RFID, WSN, PHP and SQL.
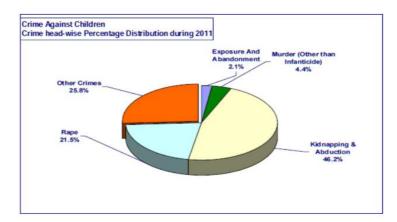
Figure 1: Distribution of Crime Against Children

CCTV cameras are widely used to keep an eye on the area where children study and play but cameras are not present everywhere and especially on the roads connecting the home to the school.

Children are our nation's most precious resource. As they lack the skills to protect themselves from any harm being perpetrated on them it is our responsibility to safeguard children and to teach them the skills to be safe. This project uses microcontroller, GPS, GSM, HTTP and SQL to implement a child tracking, location logging, geofencing and alarm triggering functionalities in a portable embedded system which can be manifested as a wearable such as a wrist band. The location of the child obtained from the GPS module is sent in an SMS to the parents and is updated on an SQL Database on a Server. The parent and the child can call each other using GSM. Hence a two way mechanism to track the child and raise an alarm when the child is in danger is developed.
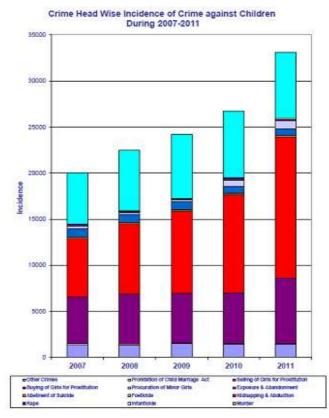

Figure 2: Incidence of Crime against Children

Wrist Borne Safety Device Using Global Positioning System and
Global System for Mobile Communication Technologies

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RELATED WORKS

Authorities around the world install CCTV cameras and recorders to monitor the activities going on at public places and other vulnerable areas. It can capture the face of the culprit and bring him/her to justice.

A project that has been developed for the purpose of tracking children is "ionKids"[3]. This system allows the monitoring of up to four children simultaneously. The main components of this system are the Radio Frequency (RF) transmitter and the RF receiver. The RF receiver is held by the parent and the RF transmitter is worn by the children on the wrists. The maximum range of the transmission is 300 meters. The point where the child went out of range can be also tracked by the system.

Another system mainly consists of Bluetooth tags which are installed on electrical poles or lamp posts, cellular phone terminals carried by children and safe volunteers, and the server which stores and manages the flow of information. According to the architecture of the system, cellular phone terminal with each child reads the tags installed on electrical poles, and it sends the location of the tag as the current location of the child carrying the phone to the management sever over the internet through the GPRS. Based on the collected information in the management server, the information on each child such as the current location and passage history is delivered to his/her parent and school through Web App[4].

This project [5] is a combination of the latest technologies such as GSM/GPRS, RFID, GPS, image processing, WSN and web app development using PHP and VB .NET language, Apache web server and SQL. Using RFID it is easy to track the student in a selected zone. The information about student's movement such as entry time and exit time to and from bus and campus is recorded on a web server and the GSM system automatically sends information to their parents.

FUNCTIONALITIES

The functionalities of this child safety system is described in this section. The block diagram in Figure 3 shows the working procedure. As and when the parents want to know their child's location they can check the HTTP server. Also during any emergency, the parents will be updated through message as well as HTTP server using the two major components, GPS and GSM modules.
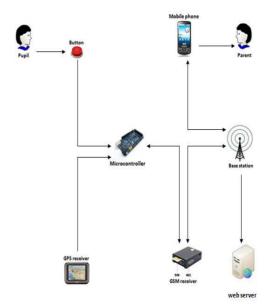

Figure 3: Block Diagram

- GPS coordinates with time sent through SMS to a phone number every 30 minutes.

- GPS coordinates with time updated in a HTTP Server every 5 minutes (preferably in a text file).

- If a button is pressed for 5 seconds the coordinates sent through SMS every 2 minutes with a text "The child is in danger!". Similarly the database on HTTP Server updated every 2 minutes and a text "Danger!" should be appended in the same row.

- **Geofencing -** A continuous range of latitude and longitude should be fixed. If the received GPS coordinates are outside that range the SMS should be sent every 2 minutes with coordinates and the text "Out of Region!". Similarly the HTTP Server should be updated with a text "Outside!" appended in the same row. If the coordinates come back into the range automatically then the SMS should be sent with coordinates and the text "Back to Region!" and the faster update of coordinates should be stopped.

- To reset the device one SMS needs to be sent from a predefined number only.

- The coordinates with time can be fetched by sending SMS from a predefined number only.

- Calling to a predefined number using push button. Same button to be used to receive the call if the call comes from the same predefined number.

- Call forwarding to another number handled by embedded system if the call to first number not answered.

HARDWARE COMPONENTS

- **MICROCONTROLLER – NXP LPC1768**

A microcontroller is required to store, process and control the flow of data acquired from and to be transmitted to and from various peripherals respectively. NXP LPC1768 mini board has been used for prototyping due to its small size and wide range of connectivity supported by it.

It has a high performance ARM® Cortex™-M3 Core which is clocked at 96MHz, and coupled with a 32KB RAM and 512KB FLASH memory. The miniboard supports Ethernet, USB Host/Device, 2xSPI, 2xI2C, 3xUART, CAN, 6xPWM, 6xADC, GPIO connections.
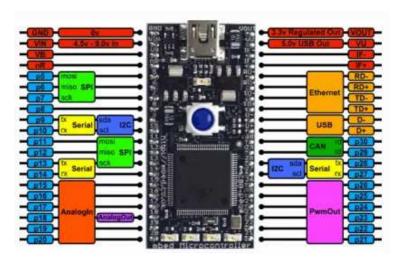

Figure 4: Pin Diagram of Mbed

- **GPS MODULE**

Global Positioning System (GPS) consists of a constellation of over 24 satellites which continuously transmit location and UTC time data. A GPS module consists of a GPS receiver and supporting circuitry like power regulator and serial communication port. The GPS module used has a Ublox Neo-6 receiver with a patch antenna. The module sends GPS data in various formats each format containing useful information, including coordinates and UTC time, calculated by the module on the basis of data received.
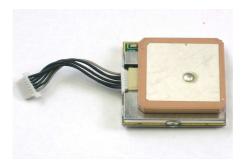

Figure 5: GPS Module

- **GSM MODULE**

Global System for Mobile Communication is the widely used standard for cellular mobile communication for sending/receiving SMS(Short Messaging Service), establishing voice calls and using GPRS(General Packet Radio Service) over mobile phones. GSM module has a GSM modem and supporting circuitry like power regulator and serial communication port. GSM module is used in this project for sending SMS, making voice calls and updating SQL database with the latest coordinates.

Figure 6: GSM Module

- **WEB SERVER WITH SQL DATABASE**

The web server with SQL database can be used for updating the details like coordinates under normal condition and coordinates with message during dangerous condition. The data is sent to the server through GPRS.

ADVANTAGES

- Anytime parents can know the location of the children.

- Parents can access the history of movement of their children through database.

- Children and parents can call each other whenever they feel the need to do so.

- If the child moves out of the permitted region the parents get to know instantly.

- If the alarm raised is false ort after the child has been rescued then the parents can reset the device by sending one SMS.

CONCLUSIONS

An effective system to protect the children from harm being caused to them has been developed. The system allows SMS sending/receiving, voice call feature, and database updating. Geofenced is also implemented. Authentication to reset the system is there to ensure no one else is able to switch off alarm state.

FUTURE ENHANCEMENT

- Coordinates can be plotted on an android application using Google Maps API: Help of an android app can be taken for the whole system to make it more user friendly and easy to handle as the parents can open the app and get to see the Plot of coordinates on the map, where his/her child has travelled, proving to be a better option than sending message alert after every half an hour to the designated numbers, like it has been used by "Zhigang Liu school of computer and communication engineering in China" to build an anti theft vehicle system.

- Camera unit can be installed on the wristband to capture the image of the aggressor: cases are seen in which the child could not express himself and provide the relevant information about the aggressor, so cameras can be very useful.

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