

# Design and implementation of ARM Based Children Tracking System

M.Geetha, B.Arunkumar

**Abstract**— Recently, all over the world, the number of crime over children is increasing day by day. This paper presents design and implementation of ARM Based Children Tracking System to avoid crime, health monitoring of students and reduce worries among parents. However the existing system are not powerful enough to give information about the children accidents such as unintentional injuries at school environment and also does not provide concentration on sensing the body temperature of the child and intimating the same to its parents and school control room. The information about student such as in time and out time from Bus and campus, body temperature will be recorded, and the GPS/GSM system automatically sends information (SMS / Phone Call) to their parents.

**Index Terms**— ARM7, GPS, GSM, Temperature sensor, Phone call.

## 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 and measure the body temperature of the children ,voice play back circuit is used to indicate whether the children is crying or not, accident detection switch is used to activate the auto dialer when there is a great vibration occurs to the children .

System developed by Yun young Nam and Jung Wook Park, uses" Cooperative Fusion Model of a Tri axial Accelerometer and a Barometric Pressure Sensor for preventing child accidents such as unintentional injuries at home. Falls are a frequent cause of injury in children. Accident and emergency departments and outpatient surveillance systems show that falls are one of the most common mechanisms of injuries that require medical care, and the most common nonfatal injury that at times needs hospitalization. In children younger than four years of age, most fall-related injuries occur at home [1].

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System developed by Yuichiro MORI, et.al, uses "Autonomous Clustering technique" for managing groups of Android terminals attached to children in school [2]. The new generation children tracking system consists of tags which collect information of children group, Android mobile terminals which each child holds, and the server which stores children tracking information. 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]. The system, using low-cost passive RFID tags, can be applied to AGV, automated robot position tracking devices, mobile devices, and location tracking devices. An RFID reader is equipped on the moving object, and RFID passive tags are fixed to the floor or ceiling to track the location. The tags detected by the reader have certain patterns to recognize the current position,. Several possible position tracking algorithms can be developed through data analysis. The simple way to track the position is by averaging the center position [4].

## II. SYSTEM ARCHITECTURE

This section describes the conceptual design of Intelligent ARM based children tracking system is shown in (Fig.1). The children information is transmitted and received using GSM/GPS technology. Child module is fixed to each and every child. The position of the moving child is tracked by GPS and is sent to ARM7 microcontroller.

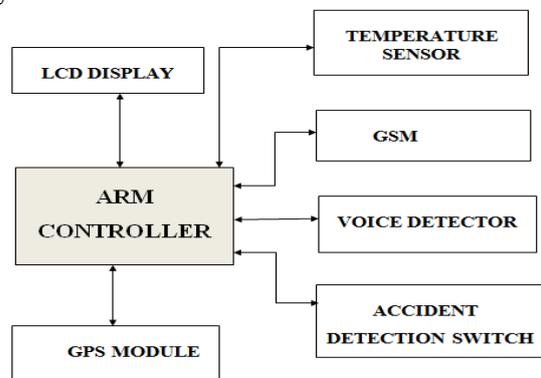


Fig.1a Transmitting Module

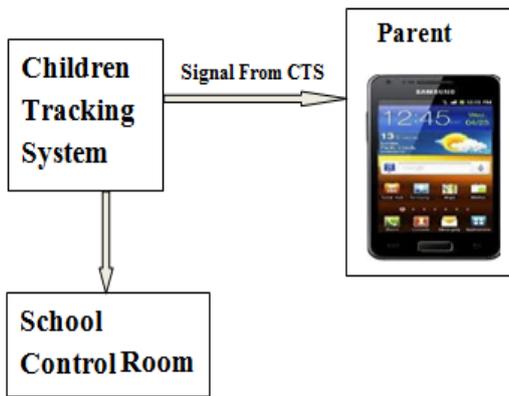


Fig.1b Receiver Module

The body temperature, accidental conditions also measured by using the child module and to provide a alert message when any injuries occurs to the child. The data from GPS receiver in NMEA format is received on ARM processor using UART1 protocol which contains Information about child position (longitude, latitude) and speed. This information can be check on the android mobile terminal using USB to serial convertor.

Design of hardware for children tracking system are used to track the location of the child and provide a safety to them in several ways like measuring the temperature of the child and send a alert message to the android mobile phone of parents. This design uses SIM300 GSM module that provide 900/1800/ 1900 MHz Tri-band for VOICE, SMS, DATA, and FAX.

## HARDWARE SYSTEM DESIGN

### A. ARM7 (LPC 2148)

ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

The LPC2141/2/4/6/8 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

### B. Voice Recorder

Grove - Sound Sensor can detect the sound strength of the environment. The main component of the module is a simple microphone, which is based on the LM358 amplifier and an electret microphone. This module's output is analog and can be easily sampled and tested by anyone.

### Features

- Easy to use sound sensor module
- Provides analog output signal
- Easily integrates with Logic modules on the input side of Grove circuits
- Uses Standard 4-pin Grove Cables to connect to other Grove modules such as Grove Power Modules, Logic Gates and Grove - Base Shield

### C. Accident Detection Switch

The accident detection switch is used to make an automatic call to the parents and ambulance as soon as the accident has occurred. The auto dialer and the LPC2148 Microcontroller play a vital role in this detection. The main working is that the circuit is connected to the CTS (children tracking system) and as soon as the accident has occurred there is a great vibration in the children body because the CTS system is attached with the children. The vibration makes the auto dialer to activate. The auto dialer then makes a call to the number saved in its memory. The number saved may be the contact number of the nearest hospital. Then the ambulance can be able to arrive to the desired location as soon as possible. The microcontroller helps the auto dialer in transmitting and receiving the signals.

### D. Global System for Mobile Communication

The most basic tele service supported by GSM is telephony. The transmitted data from ARM processor using UART1 module contains information about Children location that may be checked and displayed on the android mobile Terminal As with all other communications, speech is digitally encoded and transmitted through the GSM network as a digital stream. There is also an emergency service, where the nearest emergency-service provider is notified by dialing three digits (similar to 911).

A variety of data services is offered. GSM users can send and receive data, at rates up to 9600 bps, to users on POTS (Plain Old Telephone Service), ISDN, Packet Switched Public Data Networks, and Circuit Switched Public Data Networks using a variety of access methods and protocols, such as X.25 or X.32.

The advantage of GSM is, its Good subjective speech quality, Low terminal and service cost Support for international roaming , Ability to support handheld terminals, Support for range of new services and facilities , Spectral efficiency , ISDN compatibility.

#### *E. Global Positioning System*

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.

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 and, 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, so the receiver is located at the point where the spheres intersect. These distances and satellites' locations are used to compute the location of the receiver using the navigation equations. With the advent of cellular communication and GPS positioning, objects may be tracked from just about anywhere.

#### *F. Temperature Sensor*

The temperature sensing is performed by using a LM35 IC. Human body needs special type of sensors for reliable Readings which led to the choice of using the LM35 Temperature Sensors in our prototype. It operates at 3 to 5 V and can measure temperature in the range of -40 C to +125 C which is sufficient for the targeted body temperature range. The sensor's output is an analog DC voltage signal which is read by the microcontroller using an analog pin linked to an ADC. The ADC used has a resolution of 10-bits, 1024 levels, with a sample rate of 9 600 Hz input voltage range depending on the ground and Vcc.

The temperature monitoring system main objective is to continuously measure body temperature. The system shall always check for three hazardous conditions which are maximum temperature, minimum temperature, and maximum temperature change over a specific period of time.

### III. SOFTWARE SYSTEM DESIGN

#### *A. Keil uVision4 MDK ARM*

Keil uVision4 IDE (Integrated Development Environment) is a Windows based front end for the

CCompiler and assembler. Keil uVision4 is used for writing embedded C programs. Embedded C is a high level language, which includes many aspects of the ANSI (American National Standard Institute) C programming language. This software is mainly used to activate ARM7 (lpc 2148) microcontroller according to the input received by it. "Embedded C" code is written using this work bench. In this project, coding is written for GPS, GSM and Voice playback circuit ,measuring body temperature , fall detection of children of which is interfaced with ARM7 board at the transmitter end. As per the code embedded in the controller, the interfaced modules generate appropriate output at the receiving end.

#### *B. Proteus*

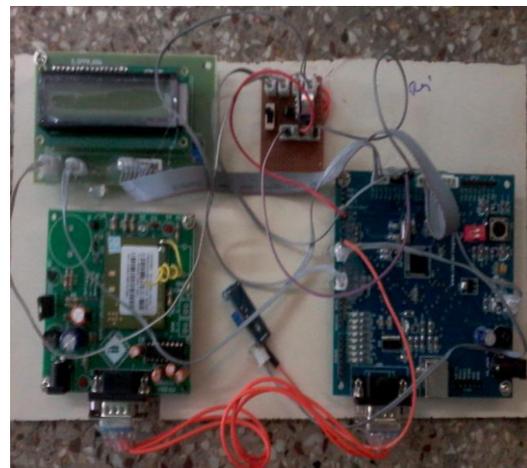
Proteus 8 is a best simulation software for various designs with microcontroller. It is mainly popular because of availability of almost all microcontrollers in it. So it is a handy tool to test programs and embedded designs for electronics hobbyist. You can simulate your programming of microcontroller in Proteus 8 Simulation Software.

After simulating your circuit in Proteus 8 Software you can directly make PCB design with it so it could be a all in one package for students and hobbyists. So I think now you have a little bit idea about what is proteus software.

### IV. RESULTS AND DISCUSSION

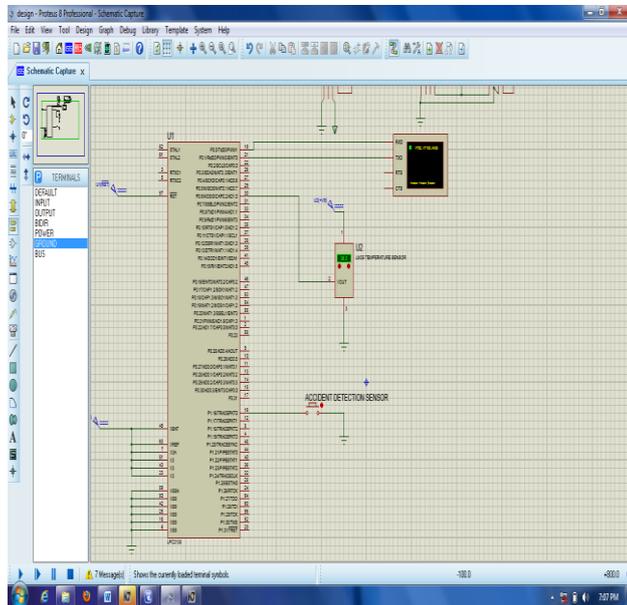
This prototype consists of ARM controller, temperature sensor, voice play back device, accident detector, and GSM module. The temperature sensor senses the temperature value in Celsius and sends SMS in case of high temperature (60 degree).

The accident detection sensor will detect the three levels that is low, middle and high level and when the low level is detected the alert message will be send to an ambulance as well as parents number. The experimental setup is shown in the figure 2.



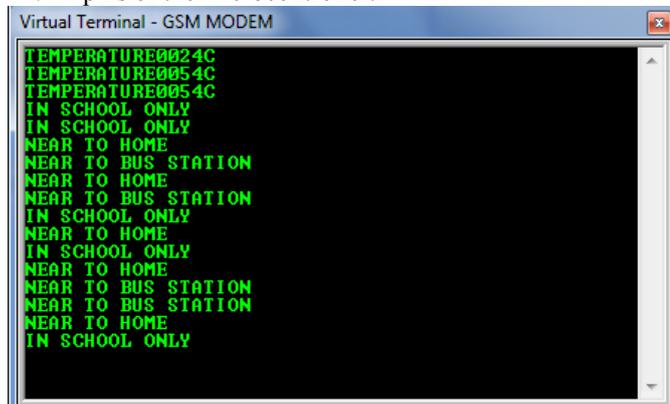
**Fig.2 Transmitter Kit**

The ARM 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 Simulation Diagram**

The simulation results of children tracking system as shown in Figure 3. The GSM Modem is connected to the Tx/Rx pins of the microcontroller.



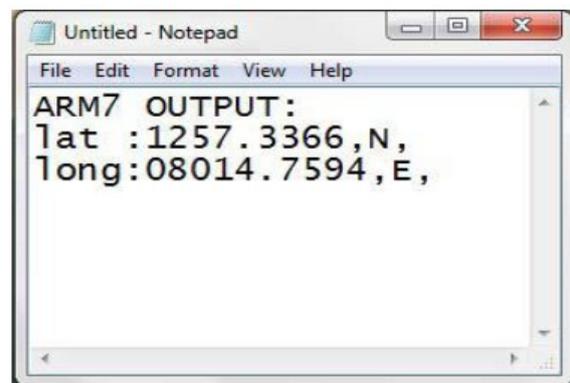
**Fig.3 Simulation Output**

The above figure illustrates a simulation result of the proposed system.



**Fig.4 GSM Board**

GSM module (Fig.4) receives the latitude and longitude value of the child's current position and sends it to two receivers.



**Fig.5 ARM7 Output**

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

Figure 5 illustrates microcontroller Output. 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.

## VI. CONCLUSION

There are three prototype sections, one is transmitter section and other two is receiver section. The transmitter consists of Temperature sensor, Accident detection sensor, Voice Detector, GSM and GPS. It sense the body temperature of the children. If exists, it communicates the receiver and find out the range of temperature of the children. The receiver consist of GSM module for sending the condition of the transmitter section. If the condition exceeds the defined value of the normal threshold value, it sends the information through GSM to the predefined person and alarm produces at

the transmitter section. This project presents design and implementation of ARM based children tracking system. It primarily focuses on tracking a child's position and its location and monitoring health condition of the child 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 body of every child. This project also focuses on tracking the accident zone of the school bus. In future it is possible to implement in mobile ad hoc network.

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