

Children Safety Monitoring using IoT

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Abstract— In this modern and fast moving world, human safety and security has become an important issue. In the past few years, crime against school going children has grown rapidly. In this paper, a prototype Children Safety Monitoring using IoT is implemented using Global Positioning System (GPS) and Global System for Mobile Communications (GSM) technologies. The system is built on nodeMCU ESP2866 microcontroller board and uses a commercial GPS receiver to compute the position of the child continuously. The child's position information is periodically sent through GSM to parent's smart phone (as a notification containing latitude and longitude value). At the school end a website is developed to monitor child's location. This system can help the parents and the school authorities to monitor the children when they leave the school or they go missing.

Keywords: Safety system; NodeMcu ESP8266 microcontroller; GPS receiver; Mobile Communications; Smart phone; Website

I. INTRODUCTION

Security of children or their wards have become an important issue for every parent. A Children Safety Monitoring using IoT provides state-of-the-art accessibility, comfort, energy efficiency and security to the children going to school. In this paper, a cost-effective and reliable Children Safety Monitoring using IoT is implemented. This system integrates GPS and GSM technologies with Google map application, so that the location can be obtained accurately and in real time.

GPS is a satellite navigation system, whose signals can be used to compute three dimensional position of a user located anywhere on or above the surface of the earth. It can be used to track location of objects and individuals equipped with a GPS receiver in an outdoor location. GPS is widely used for many applications such as defense, aviation, fleet management, surveying, vehicle location identification, and for route guidance. GSM is a worldwide standard used for cellular communication. It is often used for sending quick text messages. Use of GSM with GPS in the system helps to inform the parent and school monitoring system about the location of the child through Short Messaging Service (SMS).

Figure 1 shows the block diagram of the proposed children safety monitoring using IoT. It consists of transmitter section and two receivers. The transmitter section is the child module consisting of NodeMCU ESP8266 microcontroller board with an inbuilt Wi-Fi module, GPS receiver, GSM model, body temperature sensor, panic button and battery pack. The child module is present with each child going to the school. The receivers include an android smart phone in parents hand and desktop PC at the school monitoring system.

Several people around the world are using Android based smart phones due to their distinct features and numerous applications. The developed children safety monitoring using IoT sends the position information about the child's location periodically to the parent's smart phone

through a SMS message. This message contains location values, which will enable the parent to view the exact location of the child. A school monitoring database developed contains details of all the children and it can access updated location of a particular child. This system provides a modern, more reliable and cost effective way of providing safety to children when they are away from home.

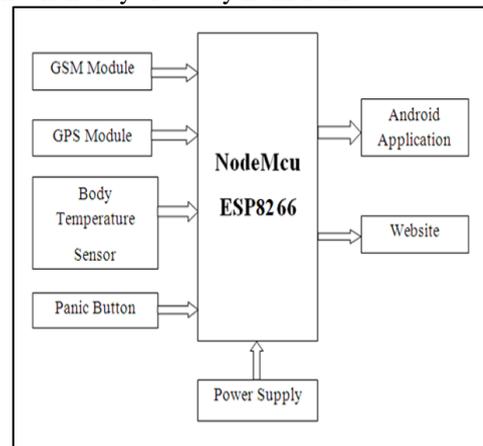


Fig. 1: Block diagram

II. LITERATURE REVIEW

This section describes the previous work done related to the children safety monitoring system. Poonam Patel, Saurabh Kr Rauniyar in their paper 'Arduino Based Child Tracking System using GPS and GSM'[1] said that lost child information can be tracked using Google map along with the position and location of child through GPS and GSM. It used GPS and GSM tracking system using smart phone but the child not necessarily have smart phone with him.

Deepali M Bhavale, Priyanka S Bhavale in their paper 'IoT based approach for women and children security using wireless and GPS' [2] said this system is proposed using the Haversine and Trilateration tracking algorithm. It is a speed monitoring system that provides security. The proposed system may not work if the driver of the bus or the vehicle is not trust worthy.

R A Jain, Aditya Patil, Prasenjeet Nikam, Shubham More, Saurabh Totewar in their paper 'Women's Safety Using IoT' [3] said this this proposed system is made up of sensors, the methodology used is IoT technology with location tracking. The advantages of the proposed system are it provides security and location information of the victim. There should be correct internet connectivity.

Akash Wadhawane, Amir Attar in their paper 'IoT Based Smart Safety System for Human Safety' [4] said that the methodology used is the body sensor network. This paper provides us system with compact size, low cost. The disadvantage of the proposed system is lack of integration sensor, and the network restriction between the body moments.

Khasim Shaik, Santoshi Bogaraju, Sagar Vadepu in their paper 'Implementation of Novel Application for women and children protection using IoT enabled Technique' [5] is said that the smart phone is connected to smart band through Bluetooth Low Energy Module. The methodology used is the GPS tracking mechanism. The proposed system is a high performance, low cost, eco-friendly. The problem with this is the connection to the Bluetooth.

Abhijit Paradkar in his paper 'All in one Intelligent safety system for women safety' [6] said that the methodology used in this paper is voice keyword recognising, GPS technology. Its advantage is mice unit with amplifier. The system does not support the voice recognition during the threshold shaking frequency.

III. SYSTEM DESIGN

Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. This section provides the information of various hardware modules used in the system design such as NodeMCU ESP2866, GSM, GPS, body sensor and panic button.

A. Node MCU ESP8266 microcontroller and its features

NodeMCU is an open source LUA based firmware development Kit/board consist of ESP8266 Wi-Fi enabled chip. NodeMCU Development board is featured with Wi-Fi capability, analog pin, digital pins and serial communication protocols. Since NodeMCU is open source platform, their hardware design is open for edit/modify/build. The ESP8266 is a low-cost Wi-Fi chip developed by Espressif Systems with full TCP/IP stack and microcontroller. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi. It is a programmable Wi-Fi module. NodeMCU ESP 8266 is developed by ESP8266 open source community, a single board microcontroller, with operating system XTOS. It is a microcontroller board with 128kBytes memory and 4Mbytes storage.

B. Data Acquisition using GPS Receiver

A GPS navigation device, GPS receiver, or simply GPS is a device that is capable of receiving information from GPS satellites and then to calculate the device's geographical position. Using suitable software, the device may display the position on a map, and it may offer directions. A GPS receiver can compute the user position with range measurement to three satellites, knowing the position of satellites computed from ephemeris data. The GPS receiver and satellite clocks are not perfectly synchronized; therefore a fourth satellite's range measurement is needed to estimate the receiver clock bias. A single frequency GPS receiver is used in the children safety monitoring system. The GPS receiver module provides raw data which can be converted to the desired format for post-processing. National Marine Electronics Association (NMEA) data obtained from the GPS receiver is used. Almost all GPS receivers generate NMEA data called sentences. These data have processed to calculate positions relative to the World Geodetic System 1984 (WGS-84) ellipsoid.

C. Interfacing of GSM modem

GSM uses Time Division Multiple Access (TDMA) technology as the air interface standard. The identification information of mobile terminal or handset is held on the SIM card. Though node Mcu is a Wi-Fi module but sometimes it is required to send an SMS with a Wi-Fi application. An IOT trigger or event may require us to send an sms. In this project i am going to show how to send an SMS with NodeMcu Wi-Fi module. To send a SMS we need a GSM module. We choose popular sim900 GSM module for this project. SIM900 GSM utilizes AT commands for it configuration and working. Sim900 module consumes 500mA of current while sending SMS.

D. Body Temperature Sensor

Temperature as we all know is one of the most commonly measured parameter in life. A temperature sensor basically describes how hot or cold a body is. Temperature sensors usually measure temperature by sensing some change in a physical characteristic of the measuring device or material.

E. Working

In our work a wearable band provided with a panic button, which is a part of the presented scenario, would help continuously monitor the location and body temperature of the child. This device can be tracked from both parents and school side via android application and website respectively. The users of the school website are principal, staff, admission department. This website maintains the information of all those students having this device. It includes the current location of the students, body temperature and personal information of the student. Whenever a child is in danger he/she can press the panic button which will alert the concerned users of this school website. They can track the real time location of child and can save them from danger. Whenever the body temperature goes above normal temperature, this will alert the users of school website. The android application is used by the parents, which helps them continuously monitor the location of their child. Whenever a child is in danger he/she can press the panic button the current location in terms of latitude and longitudinal position is sent as a message to the concerned mobile number through GSM module if Wi-Fi is not available and if Wi-Fi is available at that time then this will alert the parents on their android application with current location information.

Figure 2 shows the flow of principal module in school website. Principal will login to the website using his login credentials and manages the accounts of staff i.e., he can add and view the staff details. He can view the student information. Principal can exit his profile by logging out.

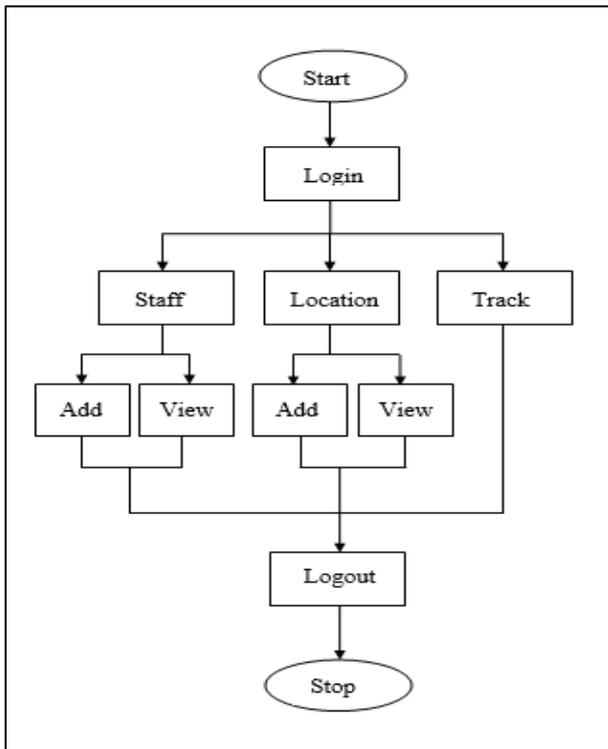


Fig. 2: Principal flowchart

Figure 3 shows the flow of staff module in school website. Staff will login to the website using his credentials and can track the information of the students i.e. the current location, body temperature and personal information of the student. Staff can exit the profile by logging out.

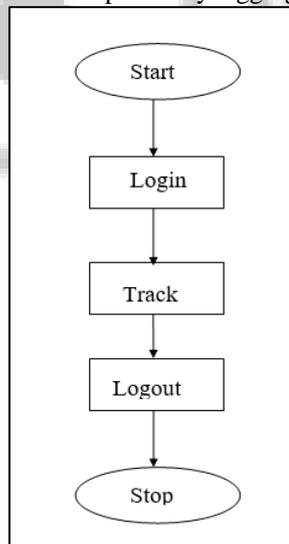


Fig. 3: Staff flowchart

Figure 4 shows the flow of admission department in school website. A staff from admission department will login to the website using his credentials. Once the staff has logged in, he can add parent's data of the student also can track and view the information about the student i.e. personal information, body temperature and location. Admission staff can exit the profile by logging out.

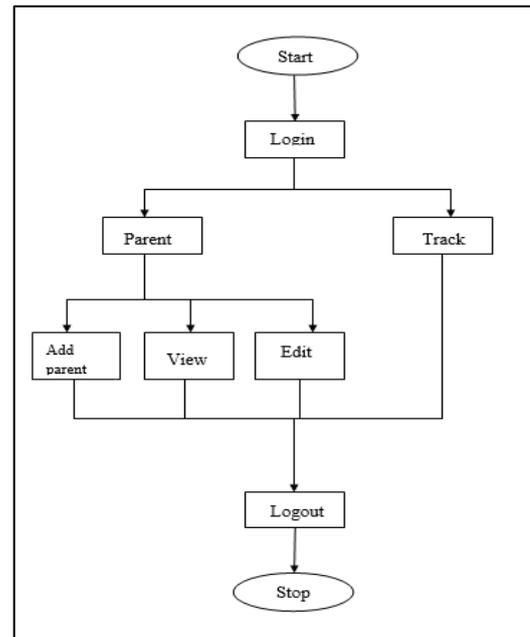


Fig. 4: Principal flowchart

IV. RESULTS AND DISCUSSION

The figure 5 indicates the full view of the device, which includes Node Mcu ESP8266 which controls the overall system, GSM module which is used to send messages, GPS module is used to track the location of child, body temperature sensor which senses the body temperature.

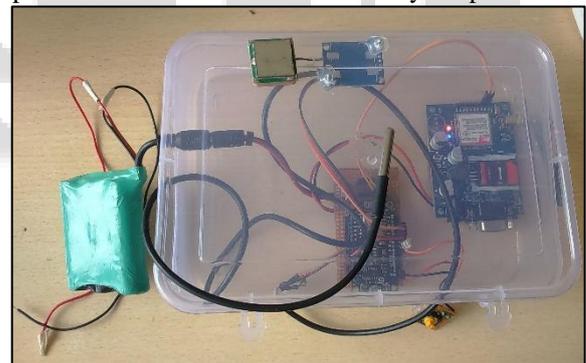


Fig. 5: Overall view of device

The figure 6 represents the text message being forwarded to parent's android mobile when the panic button is pressed by the child.

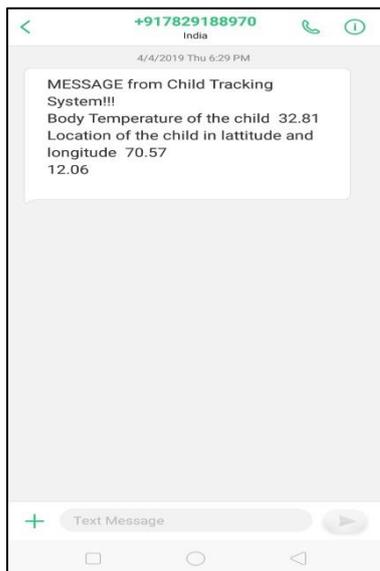


Fig. 6: Message sent to mobile

The figure 7 represents the child monitoring system through website in schools which will also alert them when there is a raise in body temperature of the child and also in some dangerous situation when child presses the panic button.

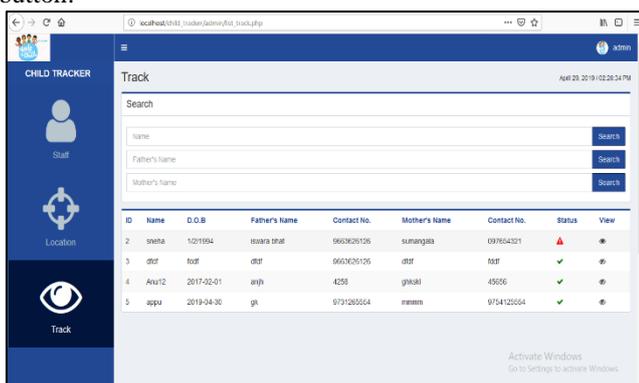


Fig. 7: View of website in the school end

V. CONCLUSION

The implementation of this system safeguards the children. This system mainly focuses on the wireless method which will alert and communicates with secure medium. This system would be highly sensitive and easy to handle. Its quick action response will provide better and comfortable safety and security to every individual user.

REFERENCES

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