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Smart Wearable Device for Child Safety by Using IOT

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ABSTRACT

Now-a-days we can see that human life is becoming very fast. Moreover, the city life is getting very busy day- by- day. So in the daily busy schedule it is becoming very difficult for the parents to monitor their children closely. This paper discusses about a smart wearable device like a wristband which tracks the child from time to time to ensure their safety. If any problem occurs it would alert parents through the cell phone so that they can take immediate action. This paper focus on the SMS text enabled communication. Parents can send SMS with some keywords and the device reply back. The device can detect the child's approximate location, it can detect the body temperature and the surrounding temperature, humidity and also the heartbeat of a child. For the emergency situation, the device would have some measures like an alarm buzzer, SOS light which will notify the bystanders to help the child. So this paper is all about the safety and security of a child to help them to recover from any type of difficulty.

Keywords: child safety, IoT, location, SMS, Wearable, GPS

INTRODUCTION

The "Smart Wearable Device for Child Safety" project aims to enhance the safety and security of children by leveraging the power of Internet of Things (IoT) and Global Positioning System (GPS) technology. The project focuses on developing a wearable device that parents and guardians can use to monitor their child's location in real-time, ensuring their safety and providing peace of mind. INTERNET OF THINGS (IOT) is the new technology that connect the entire world.

It establish the connectivity among various systems or devices or services in order to make automation development in all areas. Child safety is a very big and unsolved issue in our society.

Many of the crimes are left without reported. Each and every day young children are being assaulted, molested and violated. The sensor plays a pivotal role in monitoring the child's immediate environment, providing data on temperature and humidity levels.

The ESP32 microcontroller, renowned for its robust performance and versatility, serves as the brain of our smart wearable device. Combined with the precision and sensitivity of the DHT11 sensor, which measures temperature and humidity, this device offers a comprehensive safety net.

The integration of the DHT11 sensor allows for monitoring the child's environment, enabling parents to respond promptly to fluctuations in temperature or humidity, ensuring optimal conditions for their child's well-being The DHT11 sensor to measure temperature and humidity levels in the child's immediate surroundings.

The wearable device incorporates GPS technology to provide accurate real-time location tracking of the child. Parents can monitor the child's location through a mobile application or a web interface.

RELATED WORKS

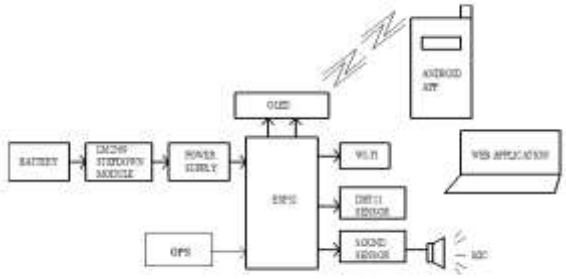
Many wearable devices are available today. Some existing works like Design and implementation of Microcontroller Based short Message Control System which exposes some applications of SMS technology other than call and sending and receiving SMS. This system gives some solution of some problems of daily life like home appliances television, light, controlling, water pumping, ON/OFF of a switch etc. remotely when the user is not in house. These solutions are cost effective. The messages which are allowed by Short Message System(SMS) on a GSM platform has a length maximum of 160 characters. The main target of this paper is to designing a embedded device.

PROPOSED DESIGN AND ARCHITECHTURE

The proposed system, a Smart Wearable Device for Child Safety using IoT and GPS, aims to enhance the safety and security of children in various environments. This wearable device will incorporate advanced IoT and GPS technologies to provide real-time tracking geofencing, emergency response, and secure communication features.
The GPS module in the wearable device accurately tracks the child's location in real-time. Parents can monitor the child's movements on a map through a dedicated mobile application or a web interface.

The ideal design of the proposed device will work in different ways –

1. When the value of Pulse sensor and DHT11 exceeds the threshold value then the device will send an SMS to the parent to alert them.
2. If a parent request for a specific data at a specific time then the device will send a reply SMS with the requested data. Like if a parent request the child's location at a specific time then the device will reply back with the location of the child at that particular time.



Block diagram

The proposed Smart Wearable Device for Child Safety aims to bridge the existing gaps in child monitoring solutions by leveraging the advanced capabilities of the ESP32 Microcontroller and the precision of the DHT11 sensor. This innovative system integrates various technologies to create a comprehensive, reliable, and user-friendly child safety wearable device. The child safety wearable device is capable of acting as a smart loT device.

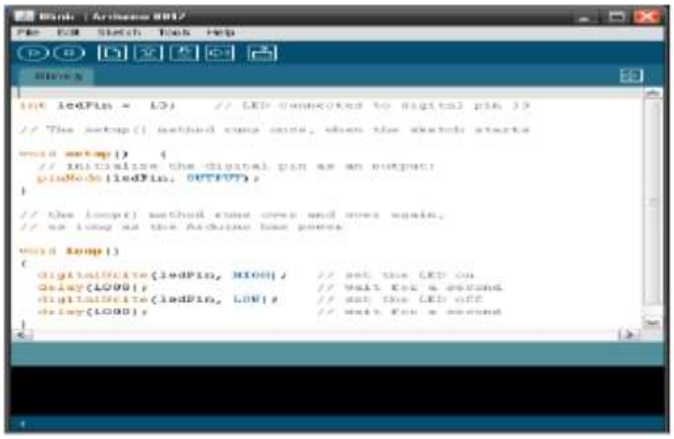
It provides parents with the real-time location, surrounding temperature, Sound sensor for their child's surroundings and the ability to locate their child or alert passers-by in acting to saving or comfort the child. The smart child safety wearable can be enhanced much more in the future by using highly compact Arduino modules such as the Lily Pad, Arduino which can be sewed into fabrics. Also a more power efficient model will have to be created which will be capable of holding the battery for a longer time.

SYSTEM REQUIREMENT

1. **Arduino IDE**:

It gathers the statistics and information from the various modules connected to it, such as the Global positioning system module .This system is activated by the Arduino Uno by receiving short message service from GSM module. This module is used as a link to send the data received by the Arduino Uno through short message service to a mobile.The GSM module

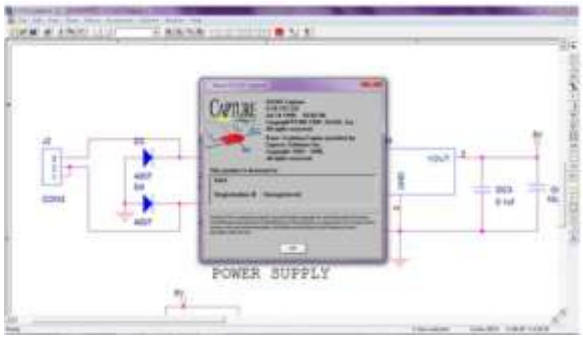
functions as a trigger for the Arduino Uno to request data from its various modules connected to it. A text with special keyword is sent to get the present latitude or longitude (GPS coordinates) to the GSM module via the user's phone.



Arduino IDE

2. **OrCAD** :

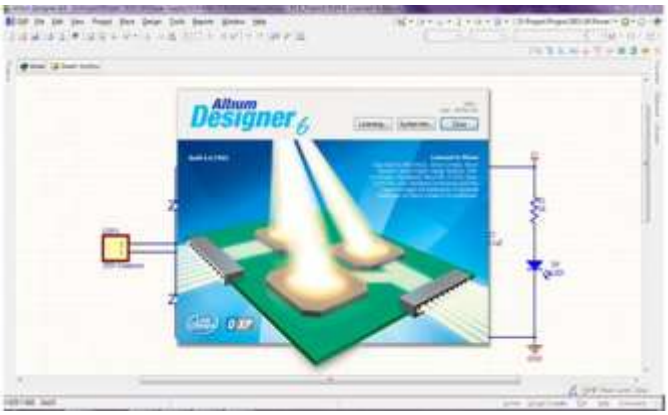
OrCAD is a proprietary software tool suite used primarily for electronic design automation (EDA). The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards. The name OrCAD is a portmanteau, reflecting the company and its software's origins: Oregon + CAD. OrCAD PCB Designer is a printed circuit board designer application, and part of the OrCAD circuit design suite. PCB Designer includes various automation features for PCB design, board-level analysis and design rule checks (DRC). The PCB design may be accomplished by manually tracing PCB tracks, or using the Auto-Router provided. Such designs may include curved PCB tracks, geometric shapes, and ground planes. PCB Designer integrates with OrCAD Capture, using the component information system (CIS) to store information about a certain circuit symbol and its matching PCB footprint.



OrCAD

3. **Altium**:

Altium Limited is an Australian owned public software company that provides PC-based electronics design software for engineers. Founded in Tasmania, Australia 1985, Altium now has regional headquarters in Australia, China, United States, Europe, and Japan, with resellers in all other major markets. The company was known as "Protel" until 2001.



Altium

HARDWARE REQUIREMENT

1. Esp32 microcontroller :

ESP32 Development board is based on the ESP WROOM32 WIFI+BLE Module. This is the latest generation of ESP32 IoT development module. This development board breaks out all ESP32 modules pins into 0.1" header and also provides a 3.3 Volt power regulator, Reset and programming button and an on-board CP2102 USB to TTL converter for programming directly via USB port.

At the core of this module is the ESP32 chip, which is designed to be scalable and adaptive. ESP32 integrates a rich set of peripherals, ranging from capacitive touch sensors, Hall sensors, low-noise sense amplifiers, SD card interface, Ethernet, high-speed SDIO/SPI, UART, and I²C.

Using Bluetooth, users can connect to their phone or broadcast low energy beacons for its detection. The use of Wi-Fi enables a large physical range, as well as a direct connection to the internet via a Wi-Fi router. Perfect for wearable electronic or battery powered applications, the ESP32 chip uses less than 5µA.

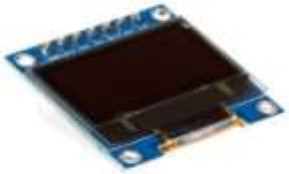
Esp32 microcontroller

2. OLED Display:

The display module can be interfaced with any microcontroller using SPI/IIC protocols. It is having a resolution of 128x64. The package includes display board, display, and 4 pin male header pre-soldered to board.

OLED (Organic Light-Emitting Diode) is a self-light-emitting technology composed of a thin, multi-layered organic film placed between an anode and cathode. In contrast to LCD technology, OLED does not require a backlight. OLED possesses high application potential for virtually all types of displays and is regarded as the ultimate technology for the next generation of flat-panel displays.

OLEDs basic structure consists of organic materials positioned between the cathode and the anode, which is composed of electric conductive transparent Indium Tin Oxide (ITO). The organic materials compose a multi-layered thin film, which includes the Hole Transporting Layer (HTL), Emission Layer (EML) and the Electron Transporting Layer (ETL). By applying the appropriate electric voltage, holes and electrons are injected into the EML from the anode and the cathode, respectively



OLED Display

3. Step-down Module

This is a LM2596 based Adjustable DC to DC Buck converter module. This is a non isolated step down module with adjustable output of 1.5 volt to 35 volt and rated current of 2 Ampere. The maximum current can go up-to 3 ampere if heat sink and proper cooling technique is used.

Step-down Module

4. DHT11 Sensor :

It uses thermistor to measure the surrounding air **temperature and a capacitive humidity sensor** to measure the moisture content. It sends digital readings on data pin so there is no need to use an Analog to Digital Converter (ADC) chip. It is very easy to use but the only problem with this sensor is that it sends data every 2 seconds. There are lot of resources online on hot to interface DHT11 Sensor to Arduino which will make this sensor easy to interface to any Arduino Board.

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.

DHT11 Sensor

5. Battery:

Power up your devices and projects with the high-performance 12V Lithium-ion Batteryavailable exclusively at RoboMart. This rechargeable battery offers reliable energy storage and is designed to meet the demands of a wide range of applications, from robotics and electronics to portable gad

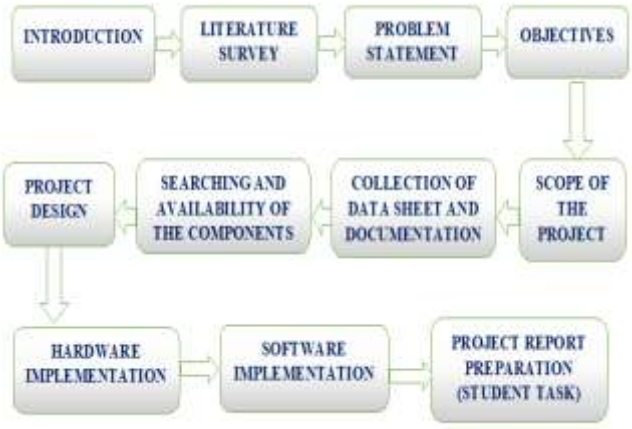
Battery

6. **Push Button:**

Push Button Switch is widely used as a standard input "buttons" on electronic projects. These work best when you mount it on PCB but can also be used on a solder less breadboard for temporary connections in prototypes. The pins are normally open (disconnected) and when the button is pressed they are momentarily closed and complete the circuit

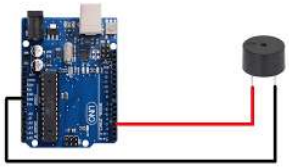
Push Button

PROJECT IMPLEMENTATION



Alarm Buzzer

Buzzers are used for making beeps alarms and tones. They can be used in alarm systems, for keypad feedback, or some games. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc. Here, alarm buzzer is used to alert the bystanders whenever the sensor value exceeds the threshold to indicate that the child is in a trouble. tone(buzzer, 1000) sends a 1KHz sound signal to pin 9, delay(1000) pause the program for one second and no Tone (buzzer) stops the signal sound. The loop() routine will make this run again and again making a short beeping sound as an output.



Alarm Buzzer

GPS (Global Positioning System) Module:

Global positioning system is a navigation system based on satellite which consists of at least 24 satellites.GPS works 24hours in every condition without any subscription fees. The satellites transmits at least 2 low power radio signals. First Establish the connection. Then Create a new instance of the Tiny GPS Plus object and Connect to the Serial with a baud rate of 9600. While gps Serial is available Get the data from the GPS. If gps encode data Get the location, lattitude and longitude and print them. So the GPS module gives the child's approximate location as output by measuring the latitude and longitude through which the parent can know their child's whereabouts.

GPS (Global Positioning System)Module

RESULT

This paper using the GSM technologies is beneficial as the cellular range is vast and since all the communication between the wearable and the user is taking place via SMS and therefore no internet connectivity is required. But, still, the GSM module possesses the added advantage of using GPRS which enables the board to use the internet if required.

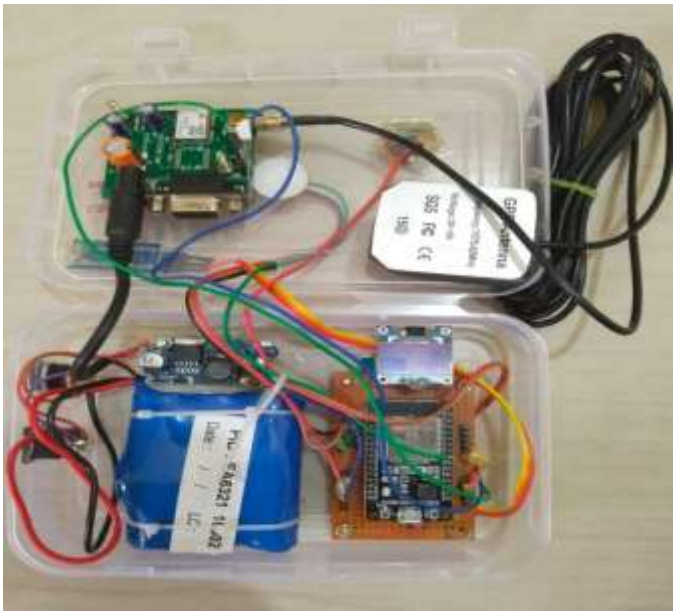
In all the situations, testing of the GPS module will be done. This would respond back to the user's smart phone very quickly. The current location of the wearable system can be seen from the GPS module with exact accuracy and also shows exactly where it is present. Sometimes it can be seen that the wearable is marginally off from the exact location.

This mismatch in the exact location of the wearable can tum out to be serious in a real life situation, where the parent may be misled to the incorrect location of the child. Therefore, it is found that NEO6MV2 GPS module is effective in providing the accurate location with worthy response time and in great accuracy.

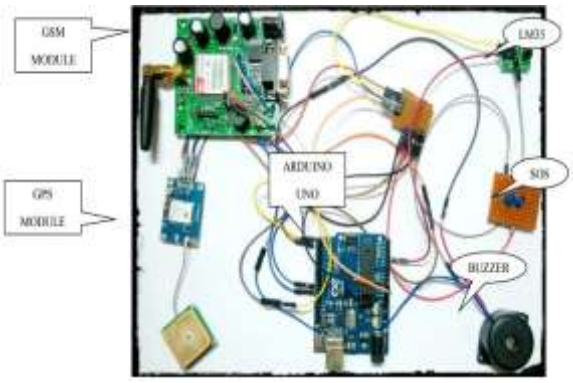
The single disadvantage is that the GSM module could not interpret numerous valid keywords directed as a single message. For example, SMS string sent: 'Location', 'Temperature', 'Buzz' and 'SOS' .SOS Light and Distress Alarm Buzzer will send an SMS either "SOS" or "BUZZ," .This would trigger the light or buzzer to perform an output function instead of providing measurements back to the user's mobile such as in the scenario of the other sensors.

Upon receiving the proper keywords, the SOS light and Alarm Buzzer would first perform the particular task of flashing the SOS light and sounding an alarm which can take a little longer than their sensor counter parts.

After completion of their respective functions, the response is sent back to the user cell phone stating: "SOS Signal Sent" and "Playing Buzzer".



Setup of child safety device



Connection of wire

Notification alert

Output of sound detected

Output of the temperature and humidity

Notification

Latitude and longitude detected

FUTURE SCOPE

- The system includes a compact, lightweight wearable device equipped with GPS module, accelerometer, heart rate sensor, and GSM/Wi-Fi communication capabilities. The device is designed to be comfortable for children to wear, ensuring they are willing to keep it on.

- The GPS module in the wearable device accurately tracks the child's location in real- time. Parents can monitor the child's movements on a map through a dedicated mobile application or a web interface.

- Parents can define safe zones and danger zones using defencing technology within the application. Whenever the child enters or exits these predefined areas, the system sends instant alerts to the parent's smartphone, ensuring parents are informed of the child's location status.

- The child safety wearable system acts as a smart device. Child's surroundings can be located with the help of accurate and precise real-time location. Surrounding environment temperature, SOS light along with Distress buzzers are provided in this system .This helps in locating their child .This also aids the bystanders to rescue the child

- The smart child safety wearable can be boosted considerably in the future by using extremely squeezed Arduino modules like Lily Pad Arduino which can be embroidered into fabrics. Also as a future scope, more power efficient model can be created that holds the battery for a longer time.

CONCLUSION

The child safety wearable device can act as a smart device. It provides parents with surrounding temperature, Distress alarm buzzer for their child's surroundings and the ability to locate their child or alert bystanders in acting to rescue or comfort the child. This paper surveys various papers related to an IOT based safety wearable device that helps the parents or guardians to monitor the safety of their ward or children.

The main aim is to provide an effective and convenient solution to the parents or guardians to keep track of their child's safety and in turn to reduce the increased occurrence of crime against missing children.

This safety device for children that can be used in online transportation is perfect for children today.

In addition to the low cost of manufacture, the speed of sending locations accompanied by images of the perpetrator via the telegram application is also relatively fast, 0.91 seconds and 11.57 seconds respectively using the same network between the device and the receiving cellphone

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