Child Safety Wearable Device Using ESP32 Cam

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Abstract

IoT, a new technology, connects every single place on Earth. For automation to advance in all domains, it creates connectivity between diverse systems, gadgets, and services. In contemporary society, child safety is a major problem that still has to be tackled. A large number of crimes go unreported. The project's goal is to protect the child from threats. The number of child safety precautions has significantly decreased in modern times. As a result, there is an ongoing rise in violence toward children. Along with children, women are also physically and psychologically assaulted. An SMS text-enabled wearable device will help parents locate their children using GPS and Bluetooth technology. Any cell phone can be used for it; a high-end smartphone isn't always necessary. The fact that this wearable can be controlled wirelessly using a mobile phone gives it a significant edge over other wearables. The wearable gadget includes an alarm buzzer. When the young child presses the panic button, an alert will ring. It also contains a camera that helps the parents to get images of the child's surroundings using ESP32 Cam. By employing GPS, if a child enters a critical state, the Blynk application will send the latitude and longitude of that specific position to the parents. An SD card module with an SD card that will record the location is present in this system.

***Keywords**:* Node MCU, wearable device, IOT, GSM, GPS, ESP32 Cam

1. Introduction

The Internet of Things, or IoT as it is more often known, is a network of linked objects and the underlying technology that makes connections possible. The capabilities of IoT have significantly improved in a world full of sophisticated industrial tools where billions of connected devices are transforming the way we conduct business. The IoT's potential for growth is pretty intriguing. In reality, approximately 24 billion IoT devices will be in operation by 2030. Advancements in 5G, AI, and advanced analytics are expected to raise the standard. IoT is redefining our world, altering how we interact, altering how we conduct business and more. It is facilitating improved customer experiences and streamlines company processes. Today's world has seen unprecedented growth in violent crimes against children, and the victims are frequently discovered in perilous situations where they are unable to use a cell phone to call their families or the police.

Nowadays, kids aren't allowed to play outside unsupervised because of mistreatment and fear of violence. Even though new technology has provided a plethora of safety measures, it nevertheless occurs frequently. Parents frequently purchase mobile phones for their kids in order to stay in touch with them due to the immediate threat. Giving a youngster a mobile phone can cause certain well-known socio-psychological problems like cyberbullying, inappropriate use of social networking sites, access to objectionable content online, and even phone theft. As they develop, children and young teenagers often seek some degree of independence from their parents and, in some cases, travel on a daily basis without the company of a parent or other adult supervision.

The ability of parents or other adult guardians to travel with their children on a regular basis may be constrained by the modern workplace culture. These have given rise to worries about children's safety, paving the way for technologies and tools that enable tracking and locating kids. Concerns about ethics should also be taken into account while tracking and locating people. It is essential to increase protection and support measures for kids travelling to and from school as child abuse has recently increased at higher rates throughout society. By allowing them to quickly and covertly contact registered contacts in an emergency, the planned technique tries to provide child safety.

When youngsters are away from home and their parents, WHDs (Wearable Health Devices) offer continuous ambulatory monitoring of human vital signs. Location tracking with WHDs may prove to be a useful addition to the overall monitoring of the children's whereabouts for the purpose of ensuring their safety. Parents now have the peace of mind to let their kids go outside and enjoy the world without worrying about where they are or if they are safe thanks to location and vitals monitoring. With the advent of wearable sensors and numerous communication technologies like Wi-Fi, ZigBee, Bluetooth, GSM, etc., IoT has made this possible.

2. Related Work

Design and development of a wearable, Internet of Things based gadget for women's and girls' security [1] examines galvanic skin resistance and body temperature to assess physiological signals in relation to body location. The demand for an always-on internet connection is the system's primary weakness. Wirelessly transferring sensor data to an open-source cloud infrastructure enables real-time data monitoring.

The smart device that contributes to ensuring the safety of women and children has been discussed in ReachOut Smart Safety Device [2]. A study suggests creating a wearable prototype that can communicate with a distress button and send its location to the cloud. The device will include a GPS module for retrieving the coordinates after pressing the panic button. Parents' Android app will retrieve the geolocation data from the cloud when it receives an emergency notification.

A safety tracking device called the Child Safety Wearable Device[3] uses the GSM platform to send and receive SMS text messages. The fact that it may be used without a smartphone is advantageous. It also uses a number of sensors, such as temperature, humidity, and location, to

determine the child's status and subsequently sends an SMS to the parent. These sensors can be programmed with an Arduino UNO.

Child Safety Wearables with Multiple Sensors[4] This device has security features like an SOS light and an alarm buzzer to inform bystanders in an emergency. With a few phrases, parents can SMS the device and get a response. It is incorrect to utilise a threshold to determine an abnormal scenario because it could result in numerous false alarms. The use of an intelligent system removesthese limitations.

Intelligent Child Safety System for IoT Devices[5] Self tracking bracelets are designed to make it easier for parents to monitor and track their children in real time. Sensors track temperature, BVP (Blood Volume Pulse), and GSR (Galvanic Skin Response). Any distressed scenario is recognised using the Decision Tree Classifier method.

Smart Child Safety Wearable Device[6] has talked about a wearable that concentrates on the SMS content protected in communication between the parent and GSM-enabled wearable for kids. Wearable gadgets will respond appropriately to messages from parents containing particular watchwords like position, temperature, UV, SOS, and buzz. The child security system is configured to work as a successful IOT device and offers parents constant range, encircling temperature, UV radiation list, SOS light nearby inconvenience caution chime, and the ability to find their child or alert by sanders in acting to ensure or comfort the child.

Device to Remotely Track and Locate the Position of a Child for Safety[7] Parents can track their children using a kid-friendly mobile device. This gadget is used to improve the safety of a child travelling alone along a well-known route. It can be modified to trace a typical travel path, and if it notices a deviation from the expected path, it will alert the parents. Design of Wearable Device for Child Safety[8] smart wearable device which provides safety to the child. The GSM module of the device continuously monitors the children. This device makes use of sensors and a processing interface to continuously track vital signs like heart rate, temperature, etc. in case potentially hazardous situations develop. Wearable gadgets will reply to the request if the parent sends messages with particular terms, such as location, temperature, UV, SOS, or buzz. This technology immediately informs the parent if a youngster unintentionally enters a restricted area.

Raspberry Pi Based Smart Wearable gadget for Women Safety Using GPS and GSM Technology[9] has discussed the wearable gadget with the panic button to ensure the safety of women. Each time they encounter a problem, the person wearing the device hits the button. After pushing the panic button, the system's embedded GPS module quickly locates the user and uses the GSM module to broadcast the user's location to the emergency contact and police. The USB camera snaps a photo of the user's surroundings and sends it together with an alarm message in an email to a predetermined email address.

An answer to women's safety Making women's movement safer by utilising a smart band and the CWS App[10], an Android app and an IoT device. Women can obtain exceptional and rapid safety support by using the device’s emergency switch. When a problem arises, the device can send the volunteer's and the nearby police station's location in real-time. The user

of this device can also determine where the closest safe zone is located. This device additionally functions both online and offline. In the absence of an internet connection, the user can still use the device to contact the nearest police station and offer their help. In addition to an Arduino Nano and other parts, the device also includes GPS, GSM, and Bluetooth.

3. Methods

The electrical system that is suggested in this research aims to accomplish the following: i)Using GPS, the data enables to track the child's location. ii)When a child is abducted or lost, they can use the panic button on the gadget to warn their parents or other concerned parties. iii) The device assists by automatically renewing the location and providing live updates on location h. iv) The device has a heart rate sensor that sends alerts to the persons who need to know. v) A temperature sensor is also there, and it provides information on the temperature of the area as well as any fires,etc. Figure 1 provides a schematic depiction of the suggested idea.

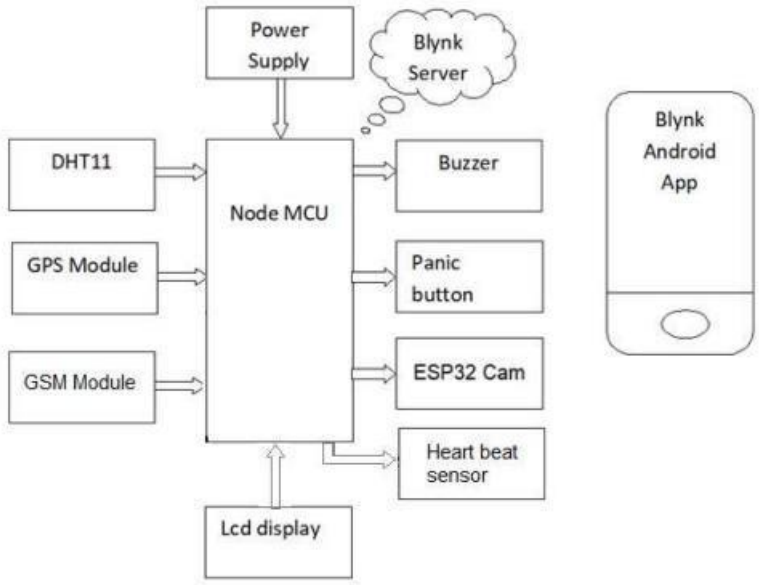

Fig 1.Block Diagram of the proposed method

A. Node MCU (ESP8266):

Node MCU-ESP8266 is a microcontroller with Wi-Fi capabilities. It is an open source IoT platform. This little gadget enables microcontrollers to connect to a Wi-Fi network and establish simple TCP/IP connections using Hayes-style commands. Node MCU defaults to using the firmware. Lua is the scripting language used by this firmware. Its operating system is XTOS, and its CPU is the ESP8266. It has 128KB of RAM and 4MB of storage. Power for the controller is provided by USB.

B. DTH11:

The DHT11 is a straightforward, incredibly cost-effective digital temperature and humidity sensor. It generates a digital signal on the data pin by employing a capacitive humidity sensor and a thermistor to measure the air’s to humidity. Although relatively simple to use, data collection calls for exact timing. USB is used to supply the controller withpower.

C. GPS Module:

The Global Positioning System (GPS) is a satellite-based system that uses ground stations and satellites to calculate and estimate its position on Earth. GPS is also known as the Navigation System with Time and Ranging (NAVSTAR) system. A GPS receiver needs data from at least four satellites in order to be accurate.

D. GSM Module:

Mobile phone users in Europe and other regions of the world frequently utilise the GSM (Global System for Mobile communication) digital mobile network. The most popular of the three digital wireless telephony technologies—TDMA, GSM, and code-division multiple access (CDMA)—GSM employs a variant of TDMA. (CDMA). Data is first converted to digital form and compressed by GSM before being sent along with two other streams of user data, each in its own time slot, down a channel.

E. Buzzer:

A mechanical, electromechanical, or piezoelectric audio signalling device is a buzzer or beeper. (piezo for short). Buzzers and beepers are widely utilised as timers, alarm clocks, and to confirm human input such mouse or keyboard clicks.

F. ESP32 Cam:

The ESP32-CAM is a small, low-power camera module constructed on the ESP32 architecture. It contains an inbuilt TF card slot and an OV2640 camera. The ESP32-CAM can be used for a wide range of intelligent IoT applications, such as WiFi image upload, QR identification, wireless video monitoring, etc.

G. Arduino IDE:

A cross-platform programme (for Windows, macOS, and Linux), the Arduino Integrated Development Environment (IDE) is created using C and C++ functions. With the aid of third-party cores, it may also be used to build and upload programs to other vendor development boards that are compatible with Arduino. The Node MCU ESP8266 is a microcontroller that supports Wi-Fi. It is an open-source Internet of Things platform. This little gadget allows microcontrollers to connect to a Wi-Fi network and establish simple TCP/IP connections using Hayes-style commands. The firmware is what Node MCU usually refers to. This firmware uses Lua as its scripting language. It runs on XTOS and is powered by an ESP8266 CPU. 4MB of storage and 128KB of RAM are available. USB is used to supply the controller with power.

The proposed device is linked to the Blynk server, enabling real-time child tracking. The desired solution offers the benefit of pinpointing a child's precise location using GPS, and updates the information to the end user, such as the child's parent or other family members, via a mobile application and SMS. It is a dependable and safe way for child protection. The numerous sensors, including the heartbeat, temperature, and humidity sensors, sense the corresponding values when the children are wearing the gadget and provide them to the

microcontroller. The controller compares actual heart rate, air temperature, and humidity readings to the threshold values. And using IOT, the information will be updated and returned to the mobile application via the Blynk server. Information will be distributed by SMS over GSM in the absence of internet services. This strategy also includes the introduction of a GPS module, which will follow the user's location and record all sensor readings in the Internet of Things.

Schematic Diagram and the Flow Chart

The smart wearable device system's schematic diagram is displayed in Fig. 2. The interface between the Node MCU and several components, including GPS, GSM, ESP32 camera, buzzer, DHT11, panic button, LCD display, and heart rate sensor, is demonstrated.

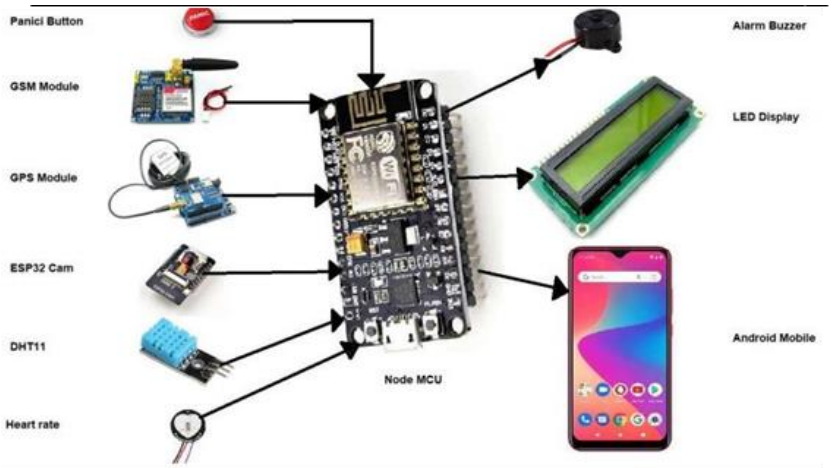

Fig 2. Schematic diagram

The smart wearable device system's flowchart outlines the sequence of events that occur there. The modules for GPS and GSM are initialized when the system is turned on. Push buttons will bepressed by the child when they encounter difficulties.

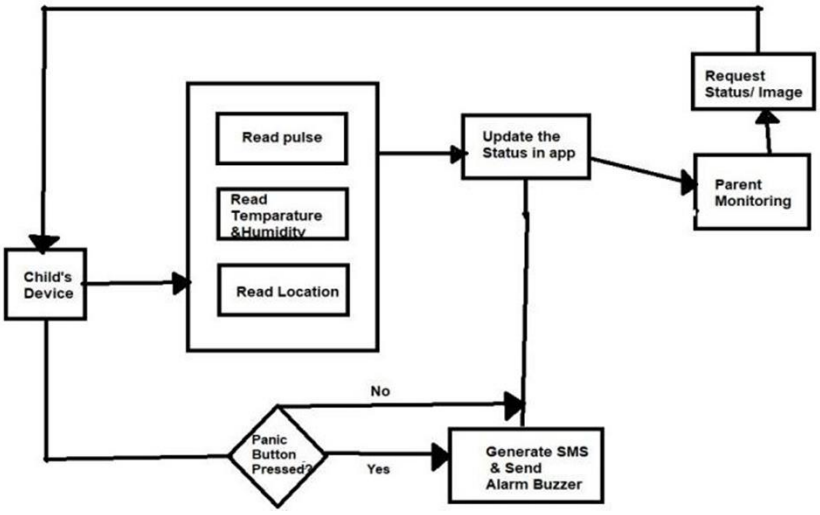

Fig 3. Flowchart showing sequence of operations that take place in the Smart Wearable Devicesystem

When the panic button is depressed, the child's location is linked to the pre-defined contact using the GSM module, and the GPS location is read by the GPS module. In addition, the ESP32 camera records a picture of the surroundings and sends it to the Telegram bot. As a result, the youngster could be saved thanks to this alarm and security system. Additionally, the buzzer activates, notifying everyone in the vicinity. Fig 3 depicts the system's flowchart.

4. Results

In this part, the outcomes that were achieved are discussed. In the majority of the literature, the suggested module has an LCD Display and uses SMS to communicate information. The end user terminal in the suggested prototype is fitted with a mobile application that the parent or guardian can use. The android app displays the environment's temperature and humidity as well as the child's heart rate and can determine whether the child consistently presses the panic button or not. When the panic button is pressed, an SMS containing the child's location and a message explaining that the child is in trouble will be sent to the predefined number.

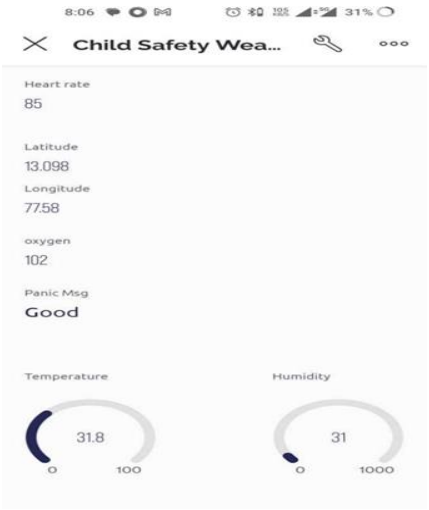

Fig 4. Information page

The information page, shown in Fig. 4, provides information on the child's location, including thechild's location's latitude, longitude, temperature, and humidity.

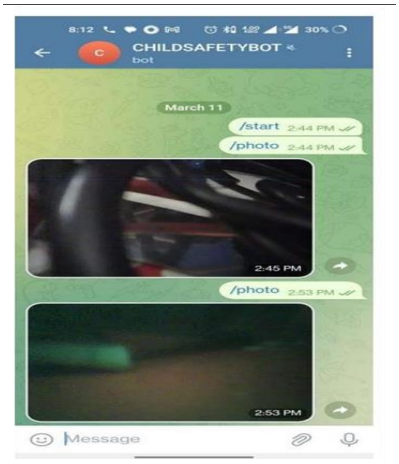

Fig 5. Telegram bot receiving the photo from the device.

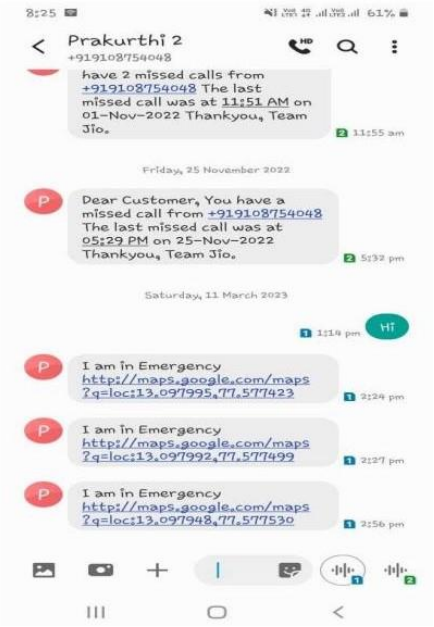

Fig 6. Alert message from the device when the panic button is pressed.

Fig 5 shows the telegram bot receiving the photo from the device as a response to the parent's request. Fig 6 shows the alert message received from the device by the pre-defined contact stating the child is in trouble along with the child's live location.

5. Discussion

The envisioned technique provides a better approach to monitor and track the children's whereabouts utilizing Google Maps and their latitude and longitude. Today's primary objective, reducing child abuse, can be achieved through maintaining safety and security. The main goal of this project is to design and build a small, portable device that may provide youngsters, especially, with the advantages of its own safety method. The majority of risky disagreements that kids encounter can be resolved using this method, which will also help to protect them. It is used to alert the parent and to find a misplaced child at any time utilizing real-time location. Additionally, the parent could request and get a picture of the neighborhood.

The system can be improved by turning it into a wristband and integrating it with a Raspberry Pi so that it can use the built-in wi-fi utility, take clearer images than the ESP32 Camera, and analyze where the child is located, such as in a classroom, playground, or on a bus, among other activities.

References

[1] Anand Madhavi Kannan Alisha RM, Vijayalakshmi P, Shrestha Sinha, "Design and Development of an IOT based wearable device for the Safety and Security of women and girl children", in IEEE Xplore, May 2016.

[2] Akash Moodbidri, Hamid Shahnasser, "Child safety wearable device", in IEEE Xplore, June 2017.

[3] Utsav Rai, Kashish Miglani, Aman Saha, Bismita Sahoo, Vergin Raja Sarobin M,"ReachOut Smart Safety Device", in IEEE Xplore,2018.

[4] Ushashi Chowdhury, Pranjal Chowdhury, Sourav Paulmart, "Child Safety Wearable Device", in IEEE Xplore October 2019.

[5] Aparajith Srinivasan, Abirami S, Divya N, Akshya R, "Intelligent Child Safety System Using Machine Learning in IoT Devices", in IEEE Xplore, December 2020.

[6] Bannuru Ranjeeth , B. Srinivasa Reddy , Y. Manoj Kumar Reddy, "Smart Child Safety Wearable Device, in IEEE Xplore, August 2020.

[7] S.M.K.C.S.B. Egodawela, H.M.D.M.B.Herath, R.D.Ranaweera and J.V. Wijayakulasooriya, "Device to Remotely Track and Locate the Position of a Child for Safety, in IEEE Xplore, April 2021.

[8] M. Benisha,R Thandaiah Prabu, M Gowri, "Design of Wearable Device for Child Safety" in IEEE Xplore, March 2021.

[9] Dhiraj Sunehra, SMIEEE, V. Sai Sreshta, V. Shashank, B. Uday Kumar Goud, "Raspberry Pi Based Smart Wearable Device for Women Safety using GPS and GSM Technology", in IEEE Xplore, November 2020.

[10] A. Z. M. Tahmidul Kabir, Al Mamun Mizan, Tasnuva Tasneem, "Safety Solution for Women Using Smart Band andCWS App", in IEEE Xplore, August 2020.

[11] Divya Chipkara, Nipun Sachdeva , Yash Dev Vashisht, "Design of a Women Safety Device", in IEEE Xplore, April 2017.