2026 Volume: 02 Issue: 01 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-08

DEVELOPMENT OF WEARABLE CHILD TRACKER WITH GPS AND MESSAGING INTEGRATION

Norfadhilah Hasan*, Nur Nadhirah Binti Abdul Rashid, Adnin Muhadi Bin Ahmad Badri

Department of Electrical Engineering, Politeknik Sultan Mizan Zainal Abidin
Jalan Paka, 23000 Dungun, Terengganu, Malaysia.

Article Received: 18 December 2025
Article Revised: 06 January 2026
Published on: 26 January 2026

***Corresponding Author: Norfadhilah Hasan**
Department of Electrical Engineering, Politeknik Sultan Mizan Zainal Abidin Jalan Paka, 23000 Dungun, Terengganu, Malaysia.

DOI: https://doi-doi.org/101555/ijrpa.9551

ABSTRACT

In the modern era of rapid technological advancement, child safety has become a growing concern, particularly in public spaces such as shopping malls, parks, schools, and recreational areas, where numerous cases of children getting lost or temporarily separated from their parents or guardians have been reported. These incidents highlight the limitations of conventional supervision methods and expose children to potential safety risks if immediate action is not taken. This paper presents the development of a Wearable Child Tracker with GPS and Messaging Integration, an Internet of Things (IoT)-based safety device designed to enhance child security and parental awareness. The proposed system integrates a Global Positioning System (GPS) module with an ESP32 microcontroller to acquire accurate real-time location data, which is transmitted wirelessly to parents or guardians through the Telegram messaging application using a bot-based communication approach. This architecture eliminates the need for a dedicated backend server, thereby reducing system complexity, operational cost, and maintenance requirements. The wearable device is compact, lightweight, and energy-efficient, making it suitable for continuous daily use by children. Functional testing indicates that the system is capable of providing real-time location updates with acceptable accuracy and response time under normal network conditions. Overall, the proposed solution demonstrates the feasibility of integrating wearable technology, GPS tracking, and instant messaging platforms to improve child safety and provide peace of mind to parents and guardians.

KEYWORDS: *Wearable device, Child safety, Internet of Things (IoT).*

INTRODUCTION

The advancement of digital and communication technologies has significantly transformed modern lifestyles, particularly in the areas of safety, monitoring, and automation. One of the most critical societal concerns that has emerged alongside rapid urbanization is the safety of children in public and semi-public environments. In locations such as shopping malls, theme parks, playgrounds, and transportation hubs, children are vulnerable to becoming separated from their parents or guardians due to overcrowding, distractions, or momentary lapses in supervision.

Statistics and media reports frequently highlight cases of missing or lost children, emphasizing the urgent need for preventive and responsive safety mechanisms. Traditional child supervision methods rely heavily on direct physical monitoring, verbal communication, and visual contact. While these methods are effective under controlled conditions, they are often insufficient in crowded or unfamiliar environments. As a result, there is a growing demand for technological solutions that can support parents by providing real-time monitoring and early alerts during emergency situations.

Wearable technology has emerged as a promising solution due to its portability, convenience, and ability to operate continuously without interrupting the user's daily activities. Wearable devices equipped with sensors and wireless communication modules can collect and transmit data in real time, making them suitable for safety and tracking applications. In parallel, the Internet of Things (IoT) paradigm enables seamless connectivity between devices, networks, and users, allowing data to be accessed anytime and anywhere.

This project focuses on the development of a Wearable Child Tracker with GPS and Messaging Integration that leverages IoT technology to address child safety issues. By integrating GPS functionality with an ESP32 microcontroller and utilizing a messaging platform as the user interface, the system provides a practical, low-cost, and user-friendly solution for real-time child location monitoring. The main objective of this study is to design, implement, and evaluate a wearable tracking system that can enhance child safety while remaining simple and accessible for everyday use.

LITERATURE REVIEW

The application of location tracking technology for personal safety has been widely studied in recent years, particularly with the advancement of wireless communication and embedded systems (Al-Fuqaha et al., 2015). Early research on tracking systems primarily focused on vehicle monitoring and fleet management using GPS and GSM technologies (Noor Azlyn et al., 2024). As electronic components became smaller and more energy-efficient, researchers began extending these technologies to wearable devices for individual monitoring, including children, elderly individuals, and patients with medical conditions (Chen J, 2023).

Several studies have proposed child tracking systems based on GPS and GSM modules (Nasaruddin et al. 2023). These systems typically transmit location information via Short Message Service (SMS) to a parent's mobile phone. While GSM-based systems offer wide coverage, they require the use of SIM cards and incur recurring communication costs, which may not be economical for all users. Additionally, SMS-based communication provides limited interactivity and slower response times compared to internet-based messaging platforms (Mr.B.Sobhan et al. 2025) .

More recent research has explored the use of Wi-Fi-enabled microcontrollers such as Arduino ESP8266 and ESP32 for IoT-based tracking applications. The ESP32, in particular, is favored due to its dual-core processor, integrated Wi-Fi and Bluetooth capabilities, and low power consumption. Studies have demonstrated that ESP32-based systems are capable of handling real-time data processing and wireless communication efficiently, making them suitable for wearable tracking devices.

The integration of messaging platforms into IoT systems has gained attention as an alternative to traditional mobile applications. Messaging applications such as Telegram provide open APIs that allow developers to create bots for automated communication. Research indicates that using messaging platforms reduces development complexity, eliminates the need for custom application interfaces, and enhances user accessibility. Telegram is often preferred due to its cross-platform compatibility, cloud-based architecture, and support for secure message transmission. These studies support the feasibility and effectiveness of integrating GPS-based wearable devices with messaging applications for real-time child monitoring (Ferdin et al. 2025).

METHODOLOGY

Figure 1 illustrates the three primary components of this wearable child tracker with GPS and messaging integration. According to Norfadhilah et al. (2020), these are input, process, and output. The input component is made up of a push button and 3.7 volts straight from the DC power source. The ESP32 will thereafter be the primary component of the procedure. The Arduino IDE software's programming language has been used to program the Esp32. The output and time have been set in this software. After then, it will make contact with the relay that is connected to the output.

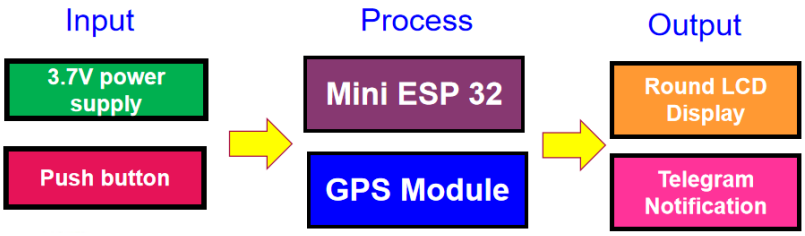

Figure 1: Block diagram of Wearable Child Tracker with GPS and Messaging Integration.

The system consists of the ESP32, a GPS module for location tracking, the SOS button for emergencies, and a display for status updates. The device sends location data and alerts to a parent's mobile app, ensuring real-time updates. The compact and wearable design ensures the device is comfortable and practical for everyday use. Figure 2 shows how the Wearable Child Tracker with GPS and Messaging Integration will operate.

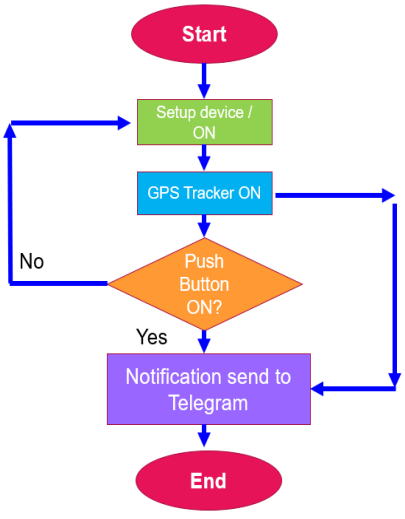

Figure 2: Flowchart of Wearable Child Tracker with GPS and Messaging Integration.

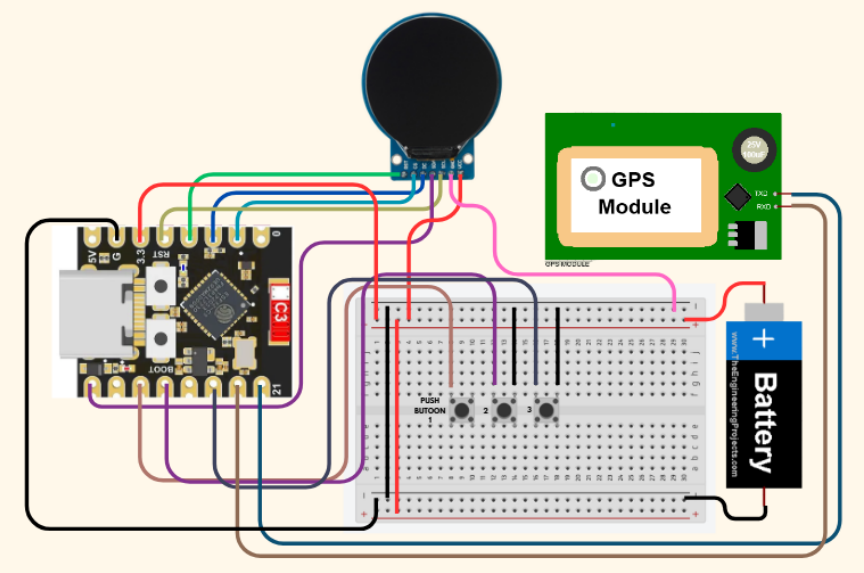

Figure 3: Circuit of Wearable Child Tracker with GPS and Messaging Integration.

Based on the figure 3, the system is built around the ESP32 microcontroller, which functions as the central control unit for all connected components. The ESP32 is connected to a round TFT display (GC9A01A) via SPI communication pins to ensure stable and efficient data transmission. This display serves as the main user interface, showing system status and location-related information. All components are arranged on a breadboard to provide organized wiring and clear circuit layout, while a 3.7 V lithium-ion battery supplies reliable power to support continuous system operation.

The system operates as a wearable tracking device that combines GPS positioning and wireless communication. Power from the battery is distributed to the ESP32, which manages data processing and system control. The GPS module is linked to the ESP32 through serial TX and RX pins, allowing it to receive satellite signals and determine the device's real-time location in terms of latitude and longitude. These coordinates are processed by the ESP32 and can be displayed directly on the TFT screen, enabling users to monitor the current position clearly and accurately.

To support remote monitoring and emergency response, the ESP32 utilizes its built-in Wi-Fi capability to transmit location data to parents or guardians via the Telegram messaging application. Push buttons connected to the ESP32 act as user input controls, such as initiating an SOS alert or requesting an immediate location update. When a button is pressed, the system promptly sends the latest GPS coordinates through a Telegram bot, allowing fast and direct communication without requiring a dedicated server.

RESULT AND DISCUSSION

By referring to the end of product in figure 4, the Wearable Child Tracker demonstrates a successful integration of electronic components within a child-friendly and practical design. The device is embedded inside a small backpack, with the SOS push button and round TFT display positioned for clear visibility and easy access. The display provides real-time system feedback, including operational status and location information, while the SOS button enables quick activation during emergency situations. When worn by a child, the device remains compact, lightweight, and comfortable, indicating its suitability for continuous daily use. Functional evaluation confirms that the GPS module can obtain location data effectively and that the system responds accurately to user inputs.

From a performance and usability perspective, the developed wearable safety product highlights the effective application of IoT technology for child monitoring and protection. The combination of GPS tracking and Telegram-based messaging allows real-time location information to be transmitted directly to parents or guardians without the need for a dedicated server, thereby reducing system complexity, cost, and maintenance requirements. This approach enhances practicality and ease of deployment in real-world environments. However, certain limitations were observed, such as reduced GPS accuracy in indoor areas and dependence on stable internet connectivity for message delivery. Despite these constraints, the system performs reliably in outdoor and semi-outdoor conditions and successfully meets its intended objectives of enhancing child safety and parental awareness.

Figure 4: End product of Wearable Child Tracker with GPS and Messaging Integration.

CONCLUSION

In conclusion, this project successfully developed a wearable child tracking system that combines GPS technology and messaging integration to enhance child safety. The system allows parents or guardians to monitor a child's location in real time through a simple and widely used messaging application. By using the ESP32 microcontroller and Telegram integration, the proposed solution offers a practical, low-cost, and easy-to-use approach suitable for everyday safety monitoring.

The results show that the device can provide reliable location information and timely alerts under normal conditions, while the wearable design ensures comfort and usability for children. Although the system depends on GPS signal quality and internet connectivity, its overall performance is satisfactory for daily use. With future improvements such as geofencing, enhanced security, and better power management, this wearable IoT solution has strong potential to further improve child safety and provide greater peace of mind to parents and caregivers.

ACKNOWLEDGMENTS

We thanks to Director of Politeknik Sultan Mizan Zainal Abidin Terengganu, Malaysia for support us in doing this research and also to all UPIK and JKE staff.

REFERENCES

1. Al-Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of Things: A survey on enabling technologies, protocols, and applications. *IEEE Communications Surveys & Tutorials*, 17(4), 2347–2376.
2. Chen J, Wang T, Fang Z, Wang H. (2023). Research on elderly users' intentions to accept wearable devices based on the improved UTAUT model. Front Public Health. 2023 Jan 9;10:1035398. doi: 10.3389/fpubh.2022.1035398
3. Noor Azlyn Ab Ghafar, Norfadhilah Bt Hasan, Nor Hasnati Bt Abdull Patas (2024); Effectiveness of A Child Safety Device In Preventing Forgotten Children Incidents in Vehicles; International Journal Of Progressive Research In Engineering Management and Science (IJPREMS); Vol. 04, Issue 11, November 2024, pp : 1099-1103; e-ISSN : 2583-1062
4. Mr.B.Sobhan Babu, P. Srinivasarao, M. Prasanth Reddy, K. Diendra Kumar, N. Naga Rithvik (2025); IOT Based Child Tracking System ; International Journal of

Multidisciplinary Research (IJMR) - Peer Reviewed Journal Volume: 11 Issue: 3 March 2025; DOI: 10.36713/epra2013; eISSN 2455-3662

5. Nasaruddin, N., & Mohd Zin, R. (2023). Child Tracking System using Blynk and GPS Technology . *Evolution in Electrical and Electronic Engineering*, *4*(2), 92-99.
6. Ferdin Permana Putra, Sahril Sabirin (2025) ; Prototype of Internet of Things-Based Control System Using Telegram with Bot API Method; Volume 6, No. 2 February, 2025; ISSN 2721-3854; e-ISSN 2721-2769
7. Norfadhilah Hasan, Salmiza Said, Nurul Ashikin Ismail (2020); Development of smart bed prototype; Southeast Asian Journal of Technology and Science; Vol. 1, No. 1, 2020, pp. 12-16; ISSN: 2723-1151