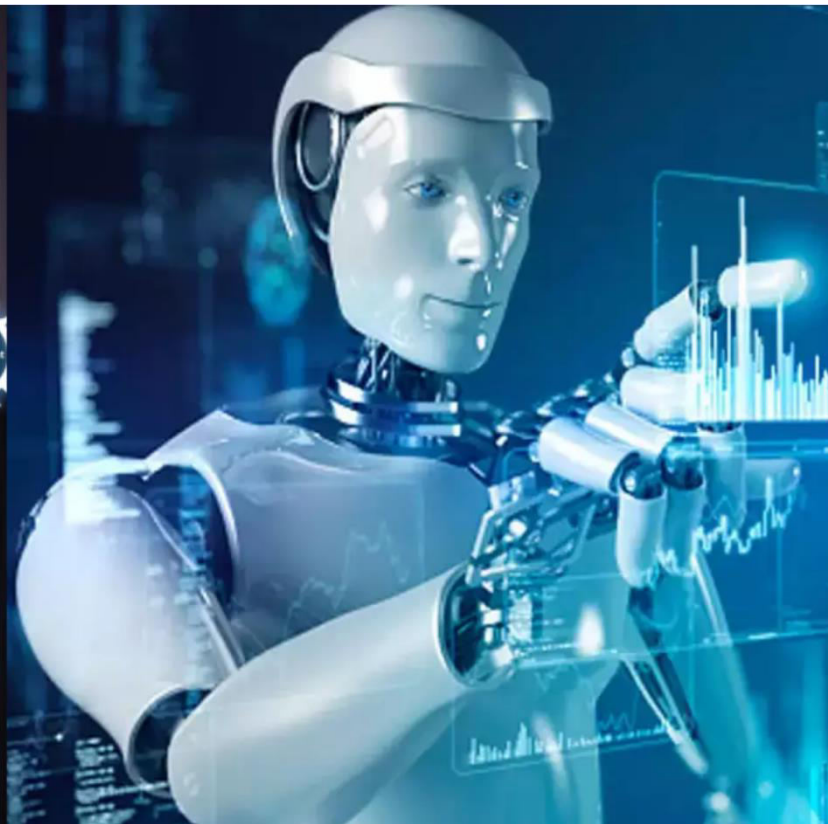




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Child Protection Device using GPS and Arduino

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ABSTRACT: The problem which is being investigated through this thesis is not having a device(s) or method(s) which are appropriate for monitoring a child's vital and tracking a child's location. This aspect is being explored by other researchers which are yet to find a viable solution. This work focuses on providing a solution that would consider using the Internet of Things for measuring and improving children's health. Additionally, the focus of this research is on the use of technology for health and the needs of parents who are concerned about their child's physical health and well-being. This work also provides an insight into how technology is used during the pandemic. This thesis will be based on a mixture of quantitative and qualitative research. This will allow a review of the problem in detail and how technology can help the health sector, especially for children. The deliverable of this study is to recommend a suitable smart band device that enables location tracking of the child, activity tracking as well as monitoring the health and wellbeing of the child. The research also includes an element of practical research in the form of (i) Surveys, the use of smart technology and a perspective on the solution from parents. (ii) Focus group, in the form of a survey allowing opinions and collection of information on the child and what the parents think of smart technology and how it could potentially help with their fears. (iii) Observation, which allows the collection of data from children who were given six activities to conduct while wearing the Fitbit Charge HR. The information gained from these elements will help provide guidelines for a proposed solution.

KEYWORDS: GPS TRACKER, ARDUINO, IOT DEVICE.

I. INTRODUCTION

The "Introduction" section of the proposal for the "Comprehensive Mobile Solution for Child Safety and Wellbeing" highlights the urgent need for innovative approaches to ensure the safety of children in an increasingly digital world. As technology becomes more integrated into daily life, children are exposed to various risks, including online threats and physical safety concerns. This reality necessitates the development of effective monitoring systems that empower parents and guardians to keep their children safe. The introduction begins by addressing the growing prevalence of child safety issues, emphasizing the importance of real-time tracking and communication. Traditional methods of child monitoring often fall short, lacking the immediacy and accessibility that modern technology can provide. The proposed mobile solution aims to fill this gap by leveraging GPS capabilities and mobile applications to offer continuous location tracking and emergency alerts. This system not only allows parents to monitor their children's whereabouts but also facilitates quick responses in emergency situations. Moreover, the introduction underscores the significance of user-centered design in developing the application. By engaging with stakeholders—parents, educators, and child safety experts—the project aims to gather insights into their specific needs and concerns. This collaborative approach ensures that the application is not only functional but also user-friendly and effective in addressing real-world challenges. Additionally, the introduction highlights the importance of educating both children and parents about online safety. The proposed solution will include features that promote digital literacy, helping families navigate the complexities of the online environment. By fostering awareness and providing tools for safe online interactions, the project aims to create a holistic approach to child safety. In summary, the introduction sets the foundation for a comprehensive exploration of the proposed system, outlining its objectives, features, and the anticipated positive impact on child safety and wellbeing in a technology-driven society.

II. OBJECTIVE

The overarching aim of the project is to enhance child safety and wellbeing through the integration of technology in monitoring and communication. By developing a mobile application that utilizes GPS tracking and emergency alert

features, the project seeks to provide parents with real-time information about their children's whereabouts, thereby fostering a safer environment. Additionally, the project aims to promote awareness and education regarding online safety, equipping both children and parents with the knowledge to navigate digital spaces securely. The specific objectives of the project include to design and develop a user-friendly mobile application that allows for real-time location tracking of children. To implement an emergency alert system that enables children to notify their parents or guardians instantly in case of danger. To conduct thorough market research to identify existing gaps in child safety solutions and understand user needs. To engage with stakeholders, including parents and child safety experts, to gather insights that inform the application's features and functionalities. To promote digital literacy among children and parents, ensuring they are equipped to handle online threats effectively.

III. LITERATURE SURVEY

1."Design and Development of Child Abuse Detecting System (CADS)" by Mariam Khan et al. (2023): This research introduces a wearable device that monitors children's emotional and physical states using sensors like galvanic skin response, heart rate, pulse oximeter, and force-sensitive resistor. The system sends real-time data to a cloud platform, alerting guardians via GSM when thresholds are exceeded, aiming to proactively address child abuse.

2."A Remote Baby Surveillance System with RFID and GPS Tracking" by Ruven A/L Sundara joo et al. (2022): This paper proposes a system integrating RFID and GPS technologies to monitor babies in daycare settings. It utilizes IoT-connected sensors to detect conditions like crying, waking, temperature, and mattress wetness, sending real-time data and alerts to guardians through a mobile application.

3."Minor Privacy Protection Through Real-time Video Processing at the Edge" by Meng Yuan et al. (2020): This study addresses privacy concerns related to CCTV surveillance of minors. It presents a lightweight, real-time video processing solution that accurately identifies minors, enabling appropriate privacy-preserving measures. The approach is designed for efficient deployment on edge computing systems.

4."Protection or Punishment? Relating the Design Space of Parental Control Apps and Perceptions About Them to Support Parenting for Online Safety" by Ge Wang et al. (2021): This research analyzes 58 Android parental control apps, examining how features like granularity, feedback/transparency, and parent-child communication support are implemented. It explores how these design variations influence parents' and children's perceptions of the apps' effectiveness and impact on their relationship.

IV. EXISTING SYSTEM.

1. Angel Sense GPS Tracker:

Real-time GPS tracking with historical routes. Two-way voice communication. SOS alert button. Tamper detection. Secure geo-fencing alerts.

2. Jio bit Smart Tag:

Compact and lightweight design. Encrypted GPS location tracking. AI-powered location learning. Geo-fencing and real-time alerts.

3. Tick Talk 4 Smartwatch

GPS, Wi-Fi, and cellular tracking. Video calling, voice calling, and messaging. SOS emergency button. Fitness tracking.

4. Verizon Gizmo Watch 2

GPS location tracking via a dedicated app. Two-way calling with pre-approved contacts. Customizable safe zones and alerts. Water-resistant design.

5. Apple Air Tag (Paired with Accessories)

Uses Apple's Find My network. Precision tracking with Bluetooth and Ultra-Wideband (UWB). Alerts when separated from the child.

Advantages:

1. **Real-Time Location Tracking** – Parents can monitor their child's whereabouts instantly, ensuring safety and quick response in emergencies.
2. **Geo-Fencing Alerts** – Allows parents to set safe zones and receive notifications if the child leaves or enters designated areas.
3. **SOS Emergency Feature** – Most devices have an emergency button, enabling children to send distress signals to parents or authorities.
4. **Two-Way Communication** – Some devices support voice calls and messaging, allowing direct contact between parents and children.

Disadvantages:

1. **Battery Life Issues** – Frequent GPS updates drain battery power quickly, requiring frequent recharging.
2. **Signal Limitations** – Poor GPS and network coverage in remote or indoor areas can affect tracking accuracy.
3. **Privacy & Security Risks** – Potential data breaches or unauthorized tracking can compromise a child's safety.
4. **High Costs** – Some advanced devices require expensive subscriptions or cellular plans, making them less accessible.

V. PROPOSED SYSTEM

The proposed system enhances child safety with advanced GPS tracking, AI-powered geo-fencing, and real-time alerts. It integrates long-lasting battery life, encrypted data security, and offline tracking capabilities. Features include a tamper-proof design, two-way communication, and emergency SOS. Additional improvements include waterproof durability, improved signal reception, and AI-driven movement analysis. The device will support multiple connectivity options (Wi-Fi, Bluetooth, and LTE) for seamless tracking. A low-power mode ensures extended battery life. Enhanced parental controls, voice recognition for authentication, and cloud-based storage for location history provide additional security. Furthermore, the system will include fall detection, allowing automatic alerts in case of accidents. A noise-detection feature will notify parents of unusual surroundings. The companion mobile app will offer real-time notifications, historical route tracking, and customizable alert settings. A multi-user access function will enable caregivers to monitor the child. Biometric authentication will ensure only authorized users access the device data. The system aims to provide unmatched safety, reliability, and peace of mind for parents while fostering children's independence in a secure manner.

VI. SYSTEM ARCHITURE

This system architecture illustrates how the child protection device with GPS interacts with different components, including GPS satellites, communication networks, cloud services, and mobile applications to ensure child safety.

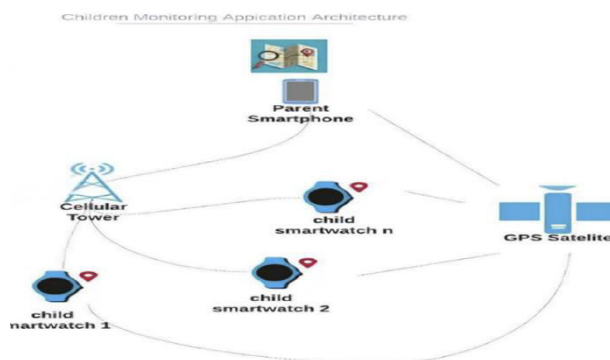


Fig1.1. system architecture.

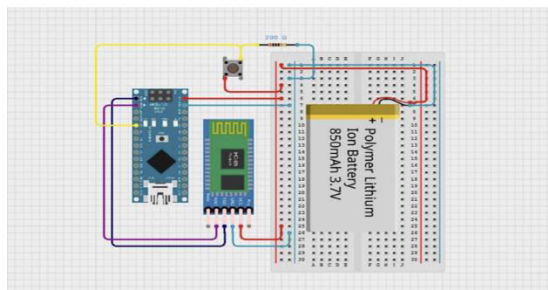


Fig2.1. composed design

Components requirements:

Slide Switch:

A slide switch can be employed to turn the device on or off, allowing users to conserve battery life when the device is not in use. This is particularly useful in a child monitoring system, where continuous operation may not be necessary. The slide switch can be designed to allow users to select different operational modes, such as "Tracking," "Emergency," or "Standby." This flexibility can enhance the functionality of the device, enabling it to adapt to various situations. Slide switches are straightforward to operate, making them user-friendly for both children and parents. The tactile feedback of a slide switch can help users confirm that the device is in the desired state. Slide switches are generally robust and can withstand repeated use, making them suitable for devices that may be handled frequently by children.

Push Button:

In the child monitoring project, the push button serves a critical role as a safety feature, providing a simple yet effective means for children to alert their guardians in emergency situations. This component is designed to be easily accessible, allowing children to quickly signal for help with minimal effort, which is essential in high-stress scenarios. When the child presses the push button, it triggers the ATmega328P microcontroller to initiate a series of actions. The microcontroller detects the button press and immediately activates the HC-05 Bluetooth module, which then sends an emergency alert to the parent's mobile application. This rapid response capability is crucial, as it ensures that guardians are notified of their child's distress in real time, allowing for prompt intervention. The push button is typically designed to be robust and user-friendly, often featuring a large surface area that is easy for children to press. It may also be encased in a protective housing to prevent accidental activation or damage, ensuring that it remains functional when needed. Additionally, the button can be integrated into wearable devices, such as wristbands or clothing, making it convenient for children to carry and use. Moreover, the push button can be programmed to perform multiple functions.

Battery:

Using a 4V lead-acid battery in the child monitoring project offers several advantages and some considerations that need to be addressed. The 4 volts lead-acid battery plays a vital role in powering various components of the child safety and tracking system outlined in the presentation. Its primary function is to provide a reliable and stable power source for the device, ensuring continuous operation and effective performance. Power Supply for Tracking Devices: The lead-acid battery supplies the necessary voltage to the GPS module, which is essential for real time location tracking. This capability allows parents to monitor their child's whereabouts continuously, providing peace of mind and enhancing safety. The battery's ability to deliver high surge currents is particularly beneficial during peak usage times, such as when the GPS is actively transmitting location data. Emergency Alert Functionality: In emergency situations, the battery powers the SOS button feature, enabling children to send immediate alerts to their parents or emergency services. This functionality is critical for ensuring a quick response in potentially dangerous situations, as the battery must maintain sufficient charge to operate the alert system reliably.

Communication Module Support:

The battery also supports the secure communication module, which allows encrypted messaging between parents and children. This ensures that communication remains private and secure, fostering trust and open dialogue while safeguarding sensitive information. Durability and Longevity: Lead-acid batteries are known for their durability and ability to withstand various environmental conditions. This makes them suitable for outdoor use, where the child

tracking device may be exposed to different weather elements. The battery's longevity ensures that the device remains operational over extended periods, reducing the need for frequent recharging.

Bluetooth:

The HC-05 Bluetooth module plays a crucial role in the child monitoring system by facilitating seamless communication between the child's tracking device and the parent's mobile application. This module is a versatile and widely used Bluetooth SPP (Serial Port Protocol) module that enables wireless data transmission over short distances, making it ideal for applications requiring real-time interaction. In the context of this project, the HC-05 module is integrated into the child's wearable device, which is equipped with a panic button. When the child feels threatened or is in an emergency situation, they can press this button, triggering the HC-05 to send a Bluetooth signal to the paired mobile application on the parent's smartphone. Upon receiving the signal, the mobile app utilizes the GPS capabilities of the smartphone to determine the child's current location. This location data is then transmitted to the parent via SMS or email, ensuring immediate notification of the child's whereabouts. The HC-05 module not only enables this critical emergency communication but also supports continuous location tracking. The app is designed to fetch and send the child's location to the parents at regular intervals, enhancing the monitoring capabilities. Furthermore, the HC-05 module is user-friendly and cost-effective, making it an excellent choice for this project. Its low power consumption ensures that the child's device can operate for extended periods without frequent recharging, which is essential for maintaining constant safety monitoring. Overall, the HC-05 Bluetooth module is integral to the functionality of the child monitoring system, providing a reliable and efficient means of communication that enhances child safety and parental peace of mind. AT Mega 328P

Micro Controller:

The ATmega328P microcontroller is a pivotal component in the child monitoring system, serving as the brain of the device that ensures efficient operation and functionality. This microcontroller is widely recognized for its versatility, low power consumption, and robust performance, making it an ideal choice for embedded systems like the child tracking device. One of its primary roles in this project is to manage the communication between various components, including the HC-05 Bluetooth module, GPS module, and the panic button. When the child presses the panic button, the ATmega328P processes this input and activates the HC-05 Bluetooth module to send an emergency alert to the parent's mobile application. This 43 immediate response is crucial in emergency situations, as it allows for quick notification of the child's location and status. The microcontroller also interfaces with the GPS module to retrieve real time location data, which it then formats and transmits via Bluetooth to the parent's device. This capability ensures that parents can monitor their child's whereabouts continuously. Additionally, the ATmega328P is programmed to handle periodic location updates, sending the child's GPS coordinates to the parent's app at regular intervals. This feature enhances the overall safety monitoring by providing parents with a consistent view of their child's location. The microcontroller's low power consumption is particularly beneficial, as it allows the device to operate for extended periods without frequent battery replacements, ensuring that the child's safety is continuously monitored. Moreover, the ATmega328P supports various programming environments, making it accessible for developers to customize and enhance the system's functionalities. Overall, the ATmega328P microcontroller is integral to the child monitoring system, enabling efficient communication, real time tracking, and reliable performance, all of which contribute to enhanced child safety and parental peace of mind.

Proposed Technologies & Algorithms:

1. **GPS & Location Tracking:** Global Positioning System (GPS) for real-time tracking. Assisted GPS (A-GPS) for improved accuracy. Wi-Fi and Bluetooth triangulation for indoor positioning.
2. **Communication Protocols:** LTE/5G for fast data transmission. MQTT and HTTP for secure cloud communication. End-to-end encryption for data security.
3. **Artificial Intelligence & Data Processing:** AI-based geo-fencing to detect unauthorized movement. Machine learning for anomaly detection (unusual improvement patterns). Cloud-based predictive analytics for proactive alerts.
4. **Battery Optimization:** Low-power GPS tracking mode. AI-driven power management based on usage patterns. Solar or kinetic energy harvesting for extended battery life.
5. **Security & Privacy Enhancements:** Biometric authentication for parental access. Blockchain-based encrypted location data storage. Tamper detection mechanisms to prevent device removal.

VII. RESULT & DISCUSSION

RESULT:

The application is designed with several key features that collectively enhance child safety. One of the most critical components is its real-time GPS tracking capability. This feature allows parents and guardians to monitor their children's locations continuously, providing peace of mind in an increasingly complex world. The GPS functionality is not only accurate but also user-friendly, ensuring that even those with limited technical skills can navigate the application effectively. In addition to location tracking, the application includes emergency alert functionalities. In the event that a child goes missing, guardians can activate an alert that immediately notifies other users within the community. This rapid dissemination of information is crucial in emergency situations, as it can significantly reduce the time it takes to locate a missing child. The application also allows for the sharing of location data with trusted contacts, further enhancing the safety net around children. The results of user testing indicate a high level of satisfaction among parents and guardians who participated in the pilot program. Feedback highlighted the application's intuitive design and the reassurance it provides. Many users reported feeling more secure knowing they could track their children in real-time and receive immediate alerts in case of emergencies. This positive reception underscores the application's potential to make a meaningful impact on child safety.

DISCUSSION:

The discussion section of the presentation delves into the broader implications of the application and its role in addressing the pressing issue of child safety. One of the primary challenges faced by existing child monitoring systems is their complexity and lack of user-friendliness. Many parents find current solutions cumbersome, which can lead to underutilization. The proposed application addresses this gap by offering a streamlined interface that prioritizes ease of use, making it accessible to a wider audience. Moreover, the application's design incorporates feedback from parents, child safety experts, and educators, ensuring that it meets the real-world needs of its users. This collaborative approach not only enhances the application's functionality but also fosters a sense of community among users. By encouraging parents to share information and support one another, the application creates a network of vigilance that can significantly enhance child safety. Another critical aspect discussed in the presentation is the importance of community involvement in child safety initiatives. The application is designed to facilitate communication among users, allowing them to report suspicious activities or share safety tips. This community-driven approach empowers parents and guardians, making them active participants in the safety of their children rather than passive observers. The presentation also addresses potential challenges and limitations of the application. For instance, concerns regarding privacy and data security are paramount when dealing with location tracking. The development team has implemented robust security measures to protect user data, including encryption and strict access controls. However, ongoing education about privacy settings and responsible usage will be essential to ensure that users feel comfortable and secure while using the application. Furthermore, the discussion highlights the need for continuous improvement and updates to the application. As technology evolves and new safety challenges emerge, the application must adapt to remain effective. This commitment to ongoing development will be crucial in maintaining user trust and ensuring the application meets the changing needs of families. In conclusion, the results and discussions presented in this project underscore the transformative potential of the mobile application for child safety and wellbeing. By combining advanced technology with community support, the application not only aims to track missing children but also seeks to empower parents and guardians. The commitment of the development team reflects a broader societal goal of ensuring the safety and wellbeing of future generations.

VIII. CONCLUSION

The "Conclusion" section of the "Comprehensive Mobile Solution for Child Safety and Wellbeing" project encapsulates the significance and impact of the developed child tracking application. It emphasizes the advancements made in child safety through the integration of modern technology and community support, ultimately creating a safer environment for children.

- **Technological Advancement:** The project showcases how innovative technologies, such as GPS, Bluetooth communication, and mobile application development, can be harnessed to address pressing safety concerns for children. By providing real-time location tracking and emergency alert features, the application empowers parents with

the tools they need to monitor their children's safety effectively. This technological advancement represents a significant leap forward in child protection, offering peace of mind to parents in an increasingly complex world.

- **Community Support:** The conclusion also highlights the importance of community involvement in enhancing child safety. The application encourages parents to engage with one another, fostering a sense of community vigilance. By sharing information and resources, parents can collectively contribute to a safer environment for all children. This collaborative approach not only strengthens the safety net for children but also builds trust and communication among families.

- **Future Implications:** The project suggests that the implementation of such a comprehensive mobile solution can pave the way for further innovations in child safety technology. As the application evolves, it can incorporate additional features based on user feedback and emerging technologies, ensuring that it remains relevant and effective in addressing the changing needs of families.

- **Call to Action:** The conclusion serves as a call to action for stakeholders, including parents, educators, and policymakers, to recognize the importance of child safety and to support initiatives that leverage technology for this purpose. By investing in such solutions, society can work towards creating a safer environment for children, where they can explore and grow with reduced risks. In summary, the "Conclusion" section emphasizes the transformative potential of the child tracking application in enhancing child safety. By combining technology with community support, the project not only addresses immediate safety concerns but also lays the groundwork for future advancements in child protection. This holistic approach ultimately aims to foster a safer, more secure environment for children to thrive.

IX. FUTURE SCOPE

The "Future Works" section of the "Comprehensive Mobile Solution for Child Safety and Wellbeing" project outlines the potential enhancements and developments that can be pursued to further improve the child tracking application. This section emphasizes the importance of continuous innovation and adaptation to meet the evolving needs of users and the challenges of child safety.

- **Feature Expansion:** One of the primary areas for future work involves expanding the application's features. This could include the integration of advanced functionalities such as facial recognition technology to identify children in public spaces, or the incorporation of artificial intelligence (AI) to analyse the behaviour patterns and predict potential safety risks. By leveraging these technologies, the application can provide even more robust safety measures for children.

- **Integration with Wearable Devices:** Future developments may also focus on integrating the application with wearable devices, such as smartwatches or fitness trackers designed for children. This would allow for more seamless tracking and communication, as these devices can be worn at all times, providing an additional layer of safety. Wearables could also include health monitoring features, alerting parents to any medical emergencies. The "Future Works" section of the "Comprehensive Mobile Solution for Child Safety and Wellbeing" project outlines the potential enhancements and developments that can be pursued to further improve the child tracking application. This section emphasizes the importance of continuous innovation and adaptation to meet the evolving needs of users and the challenges of child safety.

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