A project report

on

IoT based wearable device for the safety and security of women and girl children

submitted in partial fulfillment of the requirements for the degree of

B. Tech

In

Electronics and Computer Science Engineering

By

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CERTIFICATE

This is to certify that the project report entitled "IoT based wearable device for the safety and security of women and girl children" submitted by

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in partial fulfilment of the requirements for the award of the **Degree of Bachelor of Technology** in **Electronics and Computer Science Engineering** is a bonafide record of the work carried out under my (our) guidance and supervision at School of Electronics Engineering, KIIT (Deemed to be University).

Signature of Supervisor
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In embarking on the ambitious journey of conceptualizing and developing the project we have been immensely fortunate to have the unwavering support and guidance of numerous individuals who have contributed to our project's success.

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and perseverance. Your contributions have been invaluable, and we are profoundly grateful for your unwavering support and belief in our endeavors.

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ABSTRACT

This project focuses on the development of an IoT-based wearable device aimed at enhancing the safety and security of women and girl children. The device incorporates a range of sensors and communication technologies to provide real-time monitoring and emergency assistance functionalities.

The core features of the device include GPS and GSM capabilities, enabling accurate location tracking and communication with emergency services or predefined contacts. In the event of an emergency, users can trigger an SOS alert through a dedicated button, initiating immediate response procedures.

To further enhance user safety, the device is equipped with a sound playback system, capable of emitting loud alarm sounds to attract attention and deter potential threats. Additionally, an accelerometer sensor detects sudden movements or falls, automatically triggering an alert and providing location information to designated contacts.

Incorporating a heart rate sensor adds an additional layer of safety, allowing for continuous monitoring of the user's vital signs. Abnormal heart rate patterns or sudden changes can trigger automatic alerts, indicating potential distress situations.

The device is designed to be compact, lightweight, and discreet, ensuring ease of wear and minimal interference with daily activities. It can be worn as a wristband or attached to clothing or accessories, providing flexibility and convenience for users.

Overall, the IoT-based wearable device offers a comprehensive solution for addressing safety concerns faced by women and girl children. By leveraging advanced technologies such as GPS, GSM, sound playback, SOS functionality, accelerometer, and heart rate monitoring, it empowers users with the means to seek assistance swiftly and effectively in times of need, thereby promoting a safer and more secure environment for all.

Keywords:

Internet of Things (IoT), Wearable Technology, Sensor Networks, Location Tracking, Distress Signals, Environmental Analysis, Anomaly Detection, Edge Computing, Safety Technology, Community Security.

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CHAPTER 1
INTRODUCTION

1.1 Motivation

The motivation behind the development of an IoT-based wearable device for the safety and security of women and girl children is rooted in the urgent need to address the alarming rates of violence and harassment they face in various environments worldwide. Despite ongoing efforts to combat these issues, women and girls continue to encounter significant safety threats while commuting, traveling alone, or simply navigating public spaces. This project recognizes the profound impact that such incidents have on individual well-being, public health, and human rights, prompting a concerted effort to empower individuals and foster safer communities. By providing a tangible tool for women and girl children to assert control over their safety, the project aims to instill confidence, raise awareness, and leverage technological innovation for social good. Furthermore, by addressing cultural stigmas associated with reporting incidents of violence and harassment, the project seeks to create a more supportive and inclusive environment where individuals feel empowered to seek help without fear of judgment or reprisal. Ultimately, through collaboration with stakeholders and the implementation of preventative measures, the project endeavors to contribute to a society where women and girls can live free from the pervasive threat of violence, realizing their full potential without compromise.

In addition to addressing immediate safety concerns, this project is also driven by the broader goal of fostering societal change and promoting gender equality. By developing an IoT-based wearable device tailored to the specific needs of women and girl children, the project seeks to challenge entrenched norms and cultural attitudes that perpetuate violence and discrimination. Through targeted outreach, educational initiatives, and advocacy efforts, it aims to spark meaningful conversations about the importance of women's safety and the collective responsibility to create safer environments for all. Furthermore, by harnessing the power of technology, the project showcases the potential of innovation to address complex social issues effectively. By empowering individuals to take proactive measures to ensure their safety, the project not only mitigates immediate risks but also lays the foundation for long-term systemic change. Through collaboration with communities, NGOs, and local authorities, it builds a network of support and solidarity, amplifying the impact of its efforts and fostering a culture of mutual respect and empowerment. In doing so, the project endeavors to create a more just and inclusive society where every individual, regardless of gender, can live with dignity, security, and autonomy.

1.2 Background Studies /Literature Survey

The landscape of wearable technology for personal safety has seen significant advancements in recent years, with a growing emphasis on leveraging IoT capabilities to address safety concerns in real-time. Wearable devices, ranging from discrete panic buttons to multifunctional smartwatches, offer a proactive approach to personal safety by providing users with immediate access to assistance and support. Research and development in this field have focused on enhancing device functionality, incorporating features such as GPS tracking, biometric sensors, and emergency alert systems. Studies evaluating the effectiveness of wearable safety devices have highlighted their potential to improve situational awareness, facilitate rapid response in emergencies, and promote peace of mind for users. Additionally, advancements in connectivity and data analytics have enabled the integration of wearable devices with broader safety ecosystems, including community-based alert systems and law enforcement networks. Understanding the evolving landscape of wearable technology is essential for informing the design and implementation of IoT-based solutions tailored to the safety and security needs of women and girl children.

The literature on IoT-based wearable devices for the safety and security of women and girl children provides valuable insights into the design, effectiveness, and societal implications of such technologies. Studies have explored various aspects of wearable safety devices, including user preferences, technological capabilities, and potential impacts on safety outcomes. Research on user needs has identified factors such as discreetness, ease of use, and compatibility with daily routines as critical considerations in device design. Additionally, studies have examined the effectiveness of wearable devices in enhancing situational awareness, facilitating timely assistance, and reducing the incidence of violence and harassment. Furthermore, scholars have addressed ethical and privacy concerns surrounding the deployment of IoT-based solutions, emphasizing the importance of transparent data practices, informed consent, and safeguards against misuse. By synthesizing insights from interdisciplinary research, the literature review underscores the potential of IoT-based wearable devices to empower women and girl children, promote safer communities, and contribute to broader efforts towards gender equality and social justice.

1.3 Objectives

With the aim of addressing the pressing issue of safety and security concerns faced by women and girl children, the objectives for the development of IoT-based wearable devices are delineated as follows:

Design and develop an IoT-based wearable device tailored specifically to address the safety concerns of women and girl children. Incorporate features such as real-time GPS tracking, emergency alert systems, and discreet distress signals to enhance personal safety.

Conduct usability testing and gather feedback from target users to ensure the device is intuitive and user-friendly. Implement robust security measures to protect user data and prevent unauthorized access to device functionalities.

Collaborate with relevant stakeholders including women's advocacy groups, law enforcement agencies, and community organizations to gather insights and ensure alignment with user needs. Evaluate the effectiveness of the wearable device in real-world scenarios through field trials and case studies.

Develop educational materials and training programs to promote awareness and adoption of the wearable device among women and girl children. Explore opportunities for scalability and sustainability, considering factors such as affordability, accessibility, and long-term maintenance.

Address ethical considerations related to privacy, consent, and data protection in the deployment and usage of IoT-based wearable devices. Contribute to the body of knowledge on technology-driven solutions for gender-based violence prevention through documentation and dissemination of project findings.

CHAPTER 2

METHODOLOGY

2.1 Applied Techniques and Tools

The development of an IoT-based wearable device for the safety and security of women and girl children involves various techniques and tools. The following outlines are the applied techniques and tools used in this project:

- **Hardware Development Tools:** To build the device, you will need a variety of hardware development tools, including a soldering iron, wire stripper, and multimeter. These tools will allow you to assemble and test the various components of the device.
- **Software Development Tools:** To program and control the device, you will need a software development platform, such as the Arduino IDE or the ESP-IDF. These platforms will allow you to write and upload code to the device's microcontroller, enabling it to perform the desired functions.
- **Cloud Services:** To enable the device to communicate with other devices or systems, you might consider using cloud services, such as the AWS IoT platform or the Google Cloud IoT platform. These services will allow the device to send and receive data over the internet, enabling it to send alerts or notifications in the event of an emergency.
- **Mobile Apps:** To provide a user-friendly interface for the device, you might consider building a mobile app. This app can be used to display the device's data, send alerts, or perform other functions.
- **Machine Learning:** To enhance the device's ability to detect and respond to emergency situations, you might consider using machine learning techniques. For example, you could use machine learning algorithms to analyze the device's sensor data and identify patterns or anomalies that could indicate an emergency situation.
- **User Testing:** To ensure that the device is effective and user-friendly, it is important to conduct user testing. This can involve recruiting a group of users to try out the device and provide feedback on its performance and usability.

- **Data Security and Privacy:** To protect the device's data and ensure the privacy of its users, it is important to implement appropriate data security measures. This can include using encryption to protect the device's data, as well as implementing appropriate access controls and user authentication mechanisms.
- **Regulatory Compliance:** To ensure that the device is compliant with relevant regulations and standards, it is important to consider factors such as the device's power consumption, electromagnetic compatibility, and safety. This can involve conducting appropriate testing and certification processes to ensure that the device meets the required standards.

2.2 Technical Specifications

- **GSM module (800L):** A compact and efficient quad-band GSM/GPRS module, providing wireless connectivity for the wearable device to communicate with GSM networks. This module enables the device to send SMS alerts or make emergency calls to predefined numbers during critical situations.
- **GPS module (M8N)**: A high-performance, multi-constellation GPS receiver with a 66-channel design, offering excellent sensitivity and accuracy. It is incorporated in the wearable device to track the user's location in real-time, providing precise location data to the cloud server.
- **Heart rate sensor (MAX30102):** A highly integrated pulse oximetry and heart rate sensor, capable of measuring heart rate and oxygen saturation levels. This sensor can monitor the user's health status continuously and detect any abnormalities, which may require immediate medical attention.
- **Accelerometer:** A 3-axis accelerometer with a full scale of ±2/±4/±8/±16 g, providing accurate detection of sudden movements and falls. The accelerometer triggers an alert message to the user's emergency contacts when a significant impact is detected.
- **Button switch:** A user-friendly interface element integrated into the device for user interaction. This feature enables the user to trigger an emergency alert manually, ensuring that the user can request help even if they cannot speak or communicate their situation.
- **Microcontroller (ESP32)**: A powerful, low-cost, low-power system on a chip (SoC) with integrated Wi-Fi and dual-mode Bluetooth capabilities. It is used as the primary microcontroller for the wearable device, managing the communication between the various

sensors and modules, processing the data, and connecting to the internet for cloud communication.

- **Internet of Things (IoT) platform:** A robust platform designed to connect and manage the wearable device, receiving data from the device, processing it, and sending alerts or notifications to the user's emergency contacts. The platform can also store historical data for trend analysis and reporting, enabling better insights and improvements.
- **Cloud server:** A secure and scalable data storage and management system for user data, including location information, emergency contacts, and health status. The cloud server provides value-added services such as geofencing, where users can set up safe zones and receive alerts when the user leaves the designated area.
- **Mobile application:** A user-friendly interface for interacting with the wearable device. The app can display real-time location information, heart rate data, and provide alerts and notifications. The mobile app also enables users to set up and manage their emergency contacts and safe zones, ensuring that the user's support network is always up-to-date.

2.3 Data analysis

The potential of IoT-enabled wearable devices to significantly enhance the safety and security of women and girls is indisputable. These devices are capable of gathering a vast amount of sensor data, serving as silent protectors that can provide valuable insights through data analysis. Here are some ways in which data analysis can be used to unlock the full potential of these wearables:

- **Identifying Danger Zones:** By analyzing accelerometer data, microphone recordings, and gyroscope readings, it is possible to identify patterns indicative of threats such as struggles or attacks. GPS data adds an additional layer of information, allowing for the tracking of location changes and the identification of areas where there are deviations from regular routes or sudden stops, which could potentially signify danger. Physiological data, including heart rate and skin conductance (a measure of stress), can further enrich the picture by highlighting situations that may trigger anxiety, potentially indicating the presence of a threat.
- **Understanding User Behavior:** Data analysis goes beyond just threats. By analyzing the frequency and context of SOS button presses, it is possible to gain insights into high-risk situations and locations. Through the identification of frequently traveled routes and preferred timings, it is possible to personalize safety alerts, ensuring that they are most relevant to the user's routine. Safe zone creation allows for even more targeted interventions, with the system

programmed to trigger alerts if the user exits user-defined safe zones (such as home or workplace) unexpectedly, prompting a response if necessary.

- **Evaluating Emergency Response:** Data analysis is not just about identifying threats, but also ensuring a swift and effective response. By measuring alert response times, it is possible to identify any delays in intervention from emergency contacts or authorities, highlighting areas for improvement. Furthermore, by analyzing the effectiveness of alerts in accurately reflecting real emergencies, it is possible to continuously refine the system to minimize false alarms and ensure a reliable response system.
- **Optimizing Device Performance:** Data analysis can also be used to improve the performance of the devices themselves. By tracking battery life, it is possible to optimize the device's performance to ensure that it functions during critical situations. Identifying areas with poor connectivity can help to pinpoint potential roadblocks in emergency response, allowing for the development of solutions. Most importantly, analyzing the causes of false alarms can empower us to improve detection algorithms, reducing unnecessary alerts and maintaining user trust in the system.

By using a combination of machine learning for threat classification, data visualization for identifying high-risk zones, and statistical analysis to understand trends, data analysis can help to create a truly transformative safety solution. This can lead to improved alert systems, targeted resource allocation, and increased user awareness of risky situations, ultimately promoting safe practices and safeguarding the well-being of women and girls.

2.4 Testing and Validation:

The potential of IoT wearables to safeguard women and girls hinges on their reliability and effectiveness. To ensure these devices become trustworthy guardians, rigorous testing and validation procedures are paramount. Here's a deeper look at the key areas for scrutiny:

- **Core Functionality Under Pressure**: The core functionalities – SOS button activation, emergency contact notification, and location sharing – must work flawlessly under various conditions. Imagine a dropped device during a struggle; can it still transmit an alert? Testing simulates these scenarios, ensuring the device functions as intended when needed most.
- **Sensor Accuracy:**The success of these devices relies on accurate data from accelerometers (falls), microphones (unusual sounds), and GPS (location changes). Testing

exposes the sensors to situations mimicking struggles, falls, and atypical noises. This refines sensor performance, guaranteeing they capture crucial details during emergencies.

- **Connectivity that Doesn't Fail**: Not all situations have strong signals. Testing simulates weak connectivity and network drops to assess the device's ability to transmit emergency alerts even in low-signal areas. This ensures the device can reach help regardless of the environment.
- **Battery Life for Extended Protection**: A dead battery in a critical moment can be devastating. Battery drain tests under different usage patterns are conducted. The goal is to guarantee the device functions for extended periods, especially during emergencies, providing lasting peace of mind.
- **Inclusive Design for a Diverse Population:** The target audience is women and girls from various backgrounds. Involving them in testing ensures the device's design, comfort, and ease of use cater to this diverse population. A comfortable device that hinders no activity is crucial for everyday wear.
- **Intuitive Interface for Peak Stress Moments:** Imagine a stressful situation – the interface needs to be clear and easy to navigate. Testing evaluates user interaction, especially during simulated emergencies. Users should be able to activate SOS buttons and access critical features without fumbling, ensuring swift action when seconds count.
- **Minimizing False Alarms for User Trust:** Accidental SOS button presses or sensor misinterpretations can erode user trust. Testing explores scenarios that might trigger false alarms. This allows for algorithm refinement, minimizing false alarms and user frustration. A trustworthy device is one users can rely on without unnecessary anxieties.
- **Security Testing:** Data security is paramount. Penetration testing identifies vulnerabilities in data transmission and storage. User data, including location and physiological readings, must be encrypted and protected from unauthorized access. There can be no room for breaches when it comes to personal safety.
- **Device Resilience Against Malicious Actors:** The device itself needs to be secure. Testing evaluates its resistance to hacking or tampering. This ensures malicious actors cannot disable or manipulate the device during critical situations, safeguarding its ability to send help when needed.
- **Privacy Concerns Addressed with Transparency:** Privacy is a major concern. Testing considers user privacy anxieties. Mechanisms for obtaining informed consent for data collection and storage are established. Clear data usage policies are outlined, fostering trust and transparency. Users need to feel their safety is being protected, not compromised.

- **Real-World Validation**: A Testing Ground for Real-World Scenarios: Pilot programs conducted in controlled environments with a limited group of users provide invaluable insights. The device's effectiveness in various real-world situations is tested, and unforeseen issues are identified. This allows for adjustments before wider deployment.
- **Seamless Integration with Emergency Response:** A critical aspect is seamless integration with emergency response systems. Testing ensures data transfer is smooth, enabling prompt intervention by authorities. Seconds saved in an emergency can make a world of difference.
- **Long-Term Impact Assessment:** The Measure of Success: The true impact goes beyond initial functionality. Long-term impact assessment monitors the device's influence on user behavior, safety perception, and reported incidents over an extended period. This helps evaluate the device's effectiveness in creating a lasting safer environment for women and girls.

2.5 User Experience (UX) Design:

The user experience (UX) of an IoT wearable designed for women and girls' safety goes beyond just functionality. It's about creating a discreet, user-friendly, and confidence-boosting companion. Here's how to craft a UX that empowers users:

Understanding the Users We Serve:

- **Diverse Needs, Shared Concerns:** Start with in-depth user research. This involves talking to women and girls from various backgrounds – different ages, physical abilities, and cultural contexts. By understanding their diverse needs and shared concerns, we can design a device that is truly inclusive.
- **Empathy as the Guiding Principle:** Empathy is paramount. Imagine situations where a woman or girl might need to use the device discreetly or under immense pressure. The design should cater to these scenarios, allowing for silent alerts or hidden activation methods.

Designing for Safety and Seamless Use:

- **Discreet and Comfortable All Day Long:** The ideal device is small, lightweight, and comfortable for everyday wear. Explore form factors like pendants, bracelets, or hair clips that blend seamlessly with clothing, avoiding unwanted attention.

- **Simple Interface for Peak Stress Moments:** The interface needs to be clear and intuitive, even during stressful situations. Prioritize large, easily recognizable icons and minimal text. Consider haptic feedback or voice commands for discreet interaction, allowing users to trigger alerts without drawing attention.
- **Multiple Ways to Trigger an SOS:** Provide options for triggering SOS alerts, catering to different scenarios. This could include a dedicated SOS button, a long press on a specific area, or pre-defined voice commands. Every method empowers the user to choose the most appropriate one in the moment.Quick Access to Critical Features: Features like location sharing and emergency contact lists should be readily accessible from the main screen or through a single action. In an emergency, every second counts. A clear and easily visible battery life indicator is also essential, eliminating anxiety about the device functioning when needed most.Built to Withstand Daily Life: Durability is key. The device should be able to withstand everyday wear and tear, bumps, and scrapes. Water resistance ensures functionality in various weather conditions or accidental splashes.

Building Trust and Confidence:

- **Data Control in User's Hands:** Privacy is a top concern. Provide clear and easy-to-understand options for users to control their data. Allow them to choose what information is collected, stored, and shared with emergency contacts. Transparency builds trust.
- **Data Security Made Clear:** Educate users about the data security measures implemented to protect their privacy. Let them know their information is safeguarded.
- **Practice Makes Perfect:** Encourage users to familiarize themselves with the device's features through practice scenarios in a safe environment. This builds confidence and reduces hesitation during an actual emergency. Knowing how to use the device empowers them to act quickly and decisively.
- **Customization Options for Personalization:** Allow for some level of personalization, such as choosing notification sounds or customizing emergency contact lists. A touch of personalization allows users to feel a sense of ownership over their safety device.
- **Educational Resources for Empowerment:** Develop educational resources on personal safety strategies and how to use the device effectively. This empowers users with knowledge and helps them develop a proactive approach to safety.

- **Building a Supportive Community:** Consider creating a safe online community where users can share experiences and support each other. This fosters a sense of solidarity and empowers users to know they are not alone.

CHAPTER 3

EXPERIMENTATION AND TESTS

3.1 Hardware Configuration and Setup

The hardware configuration and setup of IoT-based wearable devices play a pivotal role in ensuring their functionality, reliability, and effectiveness in enhancing the safety and security of women and girls. This section provides an in-depth overview of the hardware components integrated into the wearable device, their configuration, interconnections, and any additional circuitry or peripherals utilized.

The wearable device comprises several key hardware components, each serving specific functions related to safety and security. These components typically include:

Microcontroller Unit (MCU): The MCU serves as the brain of the wearable device, responsible for processing sensor data, executing algorithms, and controlling various functions. Commonly used MCUs include Arduino, Raspberry Pi, or specialized microcontrollers optimized for low-power applications.
Sensors: Various sensors are integrated into the wearable device to detect relevant parameters such as motion, orientation, heart rate, and environmental conditions. Accelerometers, gyroscopes, heart rate sensors, and temperature sensors are commonly utilized to capture real-time data.
Communication Modules: Communication modules such as Wi-Fi, Bluetooth, GPS, and GSM are incorporated to facilitate connectivity and data transmission. Wi-Fi and Bluetooth enable local communication with smartphones or nearby devices, while GPS and GSM modules provide location tracking and remote communication capabilities.
Power Management: Efficient power management is essential to prolong battery life and ensure continuous operation of the wearable device. Power management circuits, battery monitoring systems, and energy-efficient components are employed to optimize power consumption and extend battery runtime.

Configuration and Interconnections:

The hardware components are configured and interconnected in a manner that maximizes functionality and reliability while minimizing power consumption and space constraints. The MCU serves as the central hub, interfacing with sensors, communication modules, and power management circuits.

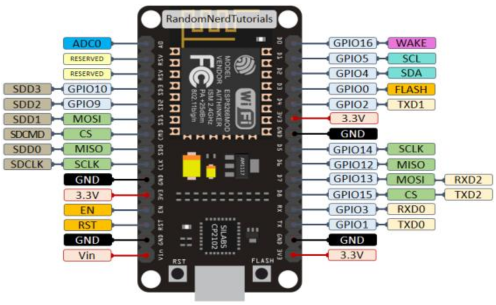
Interconnections between components are established using wired or wireless communication protocols, depending on the specific requirements of the device. Careful consideration is given to signal integrity, data bandwidth, and power efficiency to ensure robust communication between components.

Additional Circuitry and Peripherals:

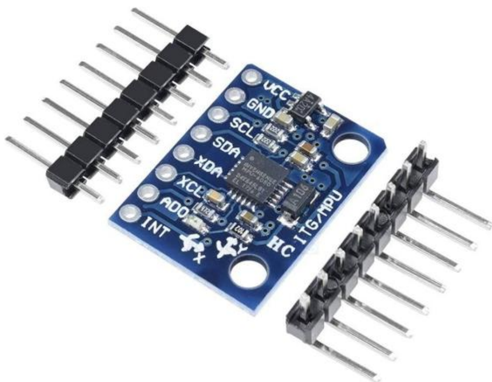
In some cases, additional circuitry or peripherals may be incorporated into the wearable device to enhance its functionality or address specific requirements. This may include components such as LED indicators, buzzers for audible alerts, or actuators for haptic feedback.

Photographs:

Photographs of the hardware setup are included to provide visual documentation of the configuration and layout of components within the wearable device. These photographs offer insights into the physical design, form factor, and ergonomics of the device.



ESP 32 **ESP 8266** **MAX 30102**



NEO 7m **MPU 6050**

3.2 Software Development and Implementation

Software development and implementation are critical aspects of IoT-based wearable devices for enhancing the safety and security of women and girls. This section provides an in-depth exploration of the software components developed for the wearable device, including algorithms for detecting emergencies, processing sensor data, transmitting alerts, and their integration with hardware components.

Algorithms for Emergency Detection:

The development of algorithms for detecting emergencies is fundamental to the functionality of the wearable device. These algorithms analyze sensor data in real-time to identify patterns indicative of emergencies such as falls, sudden anomalies, or distress signals. Machine learning techniques, including supervised and unsupervised learning algorithms, may be employed to train models to recognize emergency events accurately.

Processing Sensor Data:

Sensor data processing plays a crucial role in extracting meaningful insights from raw sensor readings. Signal processing techniques, such as filtering, noise reduction, and feature extraction, are utilized to preprocess sensor data and extract relevant information. Additionally, sensor fusion techniques may be employed to combine data from multiple sensors for enhanced accuracy and reliability.

Transmitting Alerts:

The timely transmission of alerts is essential for notifying designated contacts or emergency services in case of emergencies. Software modules responsible for transmitting alerts leverage communication protocols such as Wi-Fi, Bluetooth, GPS, or GSM to establish connections and relay alert messages. Advanced encryption techniques may be employed to ensure the security and confidentiality of transmitted data.

Integration with Hardware Components:

The seamless integration of software modules with hardware components is critical to the overall functionality and performance of the wearable device. Software routines are developed to interface with sensors, communication modules, and other hardware components, enabling data acquisition, processing, and transmission. Close collaboration between hardware and software development teams ensures compatibility and optimal performance.

Testing and Validation:

Once developed, software components undergo rigorous testing and validation to ensure their accuracy, reliability, and robustness. Unit testing, integration testing, and system testing are conducted to identify and rectify any software bugs, glitches, or performance issues. Additionally, validation tests are performed to verify that the software meets predefined requirements and specifications.

3.3 Experimentation Protocol:

The experimentation protocol outlines the systematic approach followed during the testing phase of the IoT-based wearable device. This section provides a detailed overview of the testing environment, parameters measured, procedures followed, and any specialized equipment or software utilized for experimentation.

Testing Environment:

The testing environment plays a crucial role in simulating real-world scenarios and evaluating the performance of the wearable device. It typically includes both controlled laboratory settings and real-world conditions. Factors such as lighting, temperature, humidity, and noise levels are controlled to ensure consistency and reproducibility of test results.

Parameters Measured:

Several parameters are measured during experimentation to assess the functionality, reliability, and usability of the wearable device. These parameters may include:

- Detection accuracy: The accuracy of emergency detection algorithms in identifying various emergency events such as falls, anomalies, or distress signals.

- Response time: The time taken for the device to trigger alerts and transmit emergency messages to designated contacts or emergency services.

- Location accuracy: The precision of location tracking algorithms in accurately determining the wearer's location in real-time.

- Battery life: The duration of continuous operation of the device on a single battery charge under normal usage conditions.

- Power consumption: The amount of power consumed by the device during different operational modes, including standby, active monitoring, and alert transmission.

Procedures Followed:

The testing procedures are carefully designed to evaluate the performance of the wearable device comprehensively. This may involve conducting controlled experiments to measure specific parameters under controlled conditions, as well as field tests to assess the device's performance in real-world environments. Standardized protocols and test scripts are used to ensure consistency and reproducibility of results.

Specialized Equipment and Software:

Specialized equipment and software may be employed to facilitate experimentation and data collection. This may include data acquisition systems, testing fixtures, motion capture systems, and software tools for data analysis and visualization. Additionally, simulation software may be used to simulate various scenarios and assess the device's performance under different conditions.

3.4 Performance Evaluation:

Performance evaluation focuses on assessing the effectiveness, efficiency, and reliability of the wearable device under various conditions. This section quantitatively evaluates key performance metrics and compares them against predetermined benchmarks to gauge the device's overall performance.

Key Performance Metrics:

Performance metrics evaluated during performance evaluation may include:

- Response time: The time taken for the device to detect emergencies and trigger alerts.

- Location accuracy: The precision of location tracking algorithms in determining the wearer's location.

- Battery life: The duration of continuous operation of the device on a single battery charge.

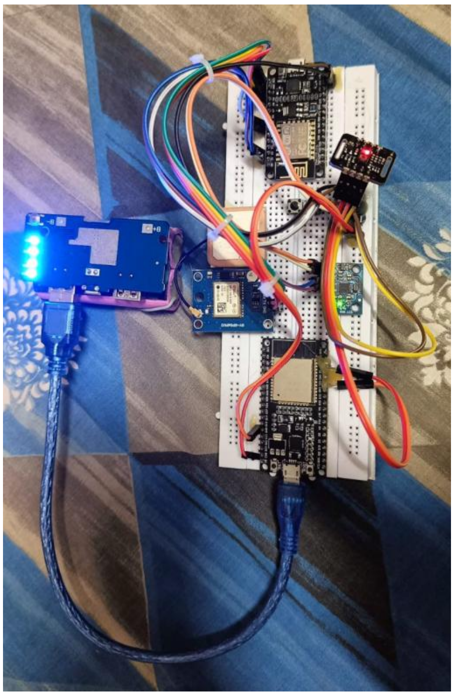
- Power consumption: The amount of power consumed by the device during different operational modes.

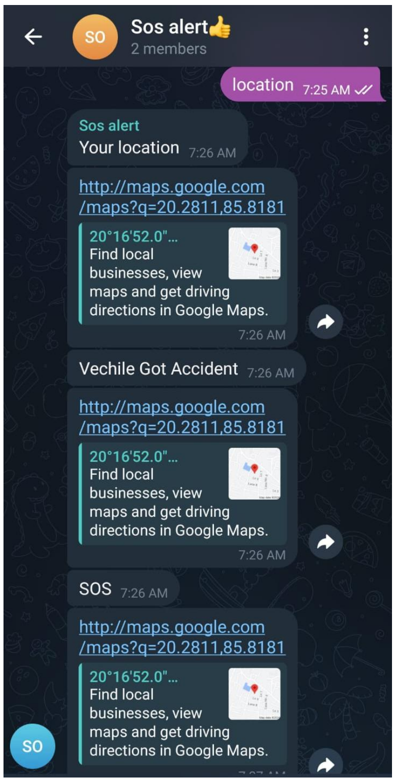
Quantitative Assessment:

Performance metrics are quantitatively assessed using standardized measurement techniques and test procedures. Data collected during experimentation is analyzed, and performance metrics are calculated based on predefined formulas or algorithms. Statistical analysis may be performed to identify trends, patterns, and outliers in the data.

Comparison Against Benchmarks:

Performance metrics are compared against predetermined benchmarks or performance targets to evaluate the device's performance relative to expectations. Deviations from benchmarks are analyzed to identify areas for improvement and optimization.





Prototype model

Blink IOT **Telegram API**

CHAPTER 4
CHALLENGES, CONSTRAINTS AND STANDARDS

4.1 Challenges and Remedy

Challenge 1: Size of the project The device may be too complex to be easily understood and used by the target user group.

- Remedy: We are using a simple and intuitive user interface that is easy to navigate. We are providing clear instructions and documentation on how to use the device. We are offering training and support to help users get started with the device.

Challenge 2: Connectivity The device may consume too much power, leading to short battery life.

- Remedy: We are using power-efficient components and design practices to reduce power consumption. We are implementing features such as sleep mode and automatic power-saving to conserve battery life. We are using a battery with a high energy density and a long lifespan.

Challenge 3: Module compatibility The device may use modules that are no longer available or supported, leading to issues with maintenance and upgrades.

- Remedy: We are using modules that are widely available and have a long lifecycle. We are using open-source modules and platforms that have a large and active community of developers. We are implementing a modular design that allows for easy replacement or upgrade of individual components.

Challenge 4: Data privacy and security The device may collect and transmit sensitive data, such as location information, that could be used to track or harm the user.

- Remedy: We are implementing strong encryption and access controls to protect the data. We are using secure communication protocols to transmit the data. We are providing clear and transparent information to users about what data is being collected and how it is being used.

Challenge 5: Cost and affordability The device may be too expensive for the target user group, making it inaccessible to those who need it most.

- Remedy: We are using cost-effective materials and manufacturing processes to reduce the cost of the device. We are considering offering financing or subsidy options to make the device more affordable. We are partnering with organizations or governments to distribute the device to those in need.

Challenge 6: Regulatory compliance The device may not comply with relevant regulations and standards, such as those related to safety, electromagnetic compatibility, and wireless communication.

- Remedy: We are consulting with regulatory bodies and testing laboratories to ensure that the device meets all relevant requirements. We are implementing a robust testing and validation process to ensure that the device meets all relevant standards. We are using components and modules that have been certified for use in the target market.

4.2 Design Constraints

- **Size and weight:** The device should be small and lightweight enough to be worn discreetly and comfortably. This may involve using compact and lightweight components, as well as designing the device to be worn in different ways, such as as a pendant, bracelet, or belt clip. To ensure that the device is comfortable to wear, it may be helpful to consider factors such as the size and shape of the device, as well as the materials used in its construction.
- **Battery life:** The device should have a long battery life, ideally lasting several days or more on a single charge. This may involve using a battery with a high energy density and a long lifespan, as well as implementing features such as sleep mode and automatic power-saving to

conserve battery life. It may also be helpful to consider factors such as the power consumption of the device's components, as well as the user's charging habits and patterns.

- **Connectivity:** The device should be able to connect to the internet and other devices via Wi-Fi, Bluetooth, or another wireless technology. This may involve using multiple connectivity options to ensure that the device can connect to the internet even in areas with weak signals. It may also be helpful to consider factors such as the range and reliability of the connectivity options, as well as the security and privacy of the connection.
- **Power consumption:** The device should be designed to minimize power consumption, in order to conserve battery life. This may involve using power-efficient components and design practices, as well as implementing features such as low-power mode and automatic power-saving to reduce power consumption. It may also be helpful to consider factors such as the power consumption of the device's components, as well as the user's charging habits and patterns.
- **Data privacy and security:** The device should have strong encryption and access controls to protect sensitive data, such as location information. This may involve using secure communication protocols to transmit the data, as well as implementing measures such as two-factor authentication and user verification to prevent unauthorized access. It may also be helpful to consider factors such as the user's data privacy preferences and the potential consequences of a data breach.
- **Cost and affordability:** The device should be affordable for the target user group, which may include low-income individuals and families. This may involve using cost-effective materials and manufacturing processes, as well as considering offering financing or subsidy options to make the device more affordable. It may also be helpful to consider factors such as the target market's income levels and purchasing power.
- **Regulatory compliance:** The device must comply with all relevant regulations and standards, including those related to safety, electromagnetic compatibility, and wireless communication. This may involve consulting with regulatory bodies and testing laboratories to ensure that the device meets all relevant requirements. It may also be helpful to consider factors such as the regulatory environment in the target market, as well as the potential consequences of non-compliance.
- **Cultural and social considerations**: The device should be designed with cultural and social factors in mind, taking into account the needs and preferences of the target user group. This may involve consulting with women and girls, as well as community leaders and organizations, to ensure that the device is culturally appropriate and socially acceptable. It may

also be helpful to consider factors such as the cultural and social norms in the target market, as well as the potential impact of the device on these norms.

- **Ease of use:** The device should be easy to use and understand, even for users who are not tech-savvy. This may involve using a simple and intuitive user interface, as well as providing clear instructions and documentation on how to use the device. It may also be helpful to consider factors such as the user's prior experience with technology, as well as their literacy and language skills.
- **Modularity and upgradability:** The device should be designed to allow for easy replacement or upgrade of individual components. This may involve using modules that are widely available and have a long lifecycle, as well as implementing a modular design that allows for easy replacement or upgrade of individual components. It may also be helpful to consider factors such as the potential for future upgrades and improvements, as well as the availability of replacement parts.

4.3 Alternatives and Trade-offs

Alternatives:

- Using a different type of sensor: One alternative to consider is using a different type of sensor to detect potential threats. For example, instead of using a GPS sensor to detect location, you could use a chemical sensor to detect harmful gases or a radiation sensor to detect exposure to radiation. This could provide additional capabilities and benefits, but it might also introduce new challenges and limitations.
- Using a different type of communication technology: Another alternative to consider is using a different type of communication technology to transmit data and alerts. For example, instead of using Wi-Fi, you could use cellular networks to transmit data and alerts. This could provide better coverage in rural areas, but it might also be more expensive to use and require a different type of hardware and infrastructure.
- Using a different form factor: A third alternative to consider is using a different form factor for the device. For example, instead of a pendant or bracelet, you could design the device to be worn as a ring or a watch. This could make the device more discreet and convenient to wear, but it might also limit the size and functionality of the device.
- Using a different power source: A fourth alternative to consider is using a different power source for the device. For example, instead of using a battery, you could use a solar

panel or a kinetic energy harvester to charge the device. This could make the device more environmentally friendly and cost-effective, but it might also introduce new challenges and limitations in terms of size, weight, and reliability.

Trade Offs:

- Choosing a different type of sensor: If you choose to use a different type of sensor, you might need to make tradeoffs in terms of sensitivity, accuracy, or power consumption. For example, a chemical sensor might be less sensitive than a GPS sensor, but it might be more power-efficient. This means that you might need to balance the benefits of the new sensor against the costs in terms of performance and power consumption.
- Choosing a different type of communication technology: If you choose to use a different type of communication technology, you might need to make tradeoffs in terms of range, reliability, or cost. For example, cellular networks might have better coverage in rural areas, but they might be more expensive to use than Wi-Fi. This means that you might need to balance the benefits of better coverage against the costs in terms of money and infrastructure.
- Choosing a different form factor: If you choose to use a different form factor for the device, you might need to make tradeoffs in terms of size, weight, or functionality. For example, a ring form factor might be more discreet and convenient to wear, but it might not have enough space for all the sensors and other components you want to include. This means that you might need to balance the benefits of a smaller form factor against the costs in terms of functionality and performance.
- Choosing a different power source: If you choose to use a different power source for the device, you might need to make tradeoffs in terms of size, weight, or reliability. For example, a solar panel might be more environmentally friendly and cost-effective, but it might not provide enough power in low-light conditions. This means that you might need to balance the benefits of a more sustainable power source against the costs in terms of performance and reliability.

I hope these more detailed and humanized explanations of the alternatives and tradeoffs are helpful! Let me know if you have any further questions or concerns.

4.4 Standards

Network technologies: Bluetooth Low Energy (BLE) and Zigbee stand out as prominent options for IoT-based wearable devices. BLE is favored for its low power consumption and suitability for short-range communication within local networks. Meanwhile, Zigbee's mesh networking capability enables connections over longer distances, making it a viable choice for wearables requiring broader coverage.

Security protocols: Datagram Transport Layer Security (DTLS) and Constrained Application Protocol (CoAP) emerge as lightweight yet robust security protocols ideal for resource-constrained IoT devices like wearables. DTLS ensures secure communication over UDP, providing authentication, confidentiality, and integrity. CoAP complements this by offering a lightweight application protocol designed for secure communication in IoT environments.

Power standards: IEEE P2413 sets the stage with an architectural framework tailored for IoT systems, fostering interoperability and seamless integration. On the other hand, IEEE P2675 provides essential guidelines for optimizing energy harvesting and managing power consumption in IoT devices, crucial for extending battery life in wearable applications.

Software development tools: PlatformIO presents a unified, open-source ecosystem simplifying firmware development for microcontrollers. Conversely, the Particle IoT Platform offers cloud-based services streamlining IoT application development and device management, enhancing scalability and efficiency in wearable device projects.

Quality management guidelines: ISO/IEC 27001 and ISO/IEC 27002 serve as cornerstones for ensuring robust information security management systems (ISMS) and implementing best practices for security controls in IoT-based wearables. Compliance with these standards ensures the confidentiality, integrity, and availability of data transmitted and processed by wearable devices.

Hardware standards: BLE, USB-C, and I2C emerge as pivotal hardware standards driving the functionality and connectivity of IoT-based wearables. BLE facilitates low-power communication, USB-C offers versatile connectivity options, and I2C streamlines sensor integration, collectively contributing to the performance and usability of wearable devices.

CHAPTER 5

RESULT ANALYSIS AND DISCUSSION

5.1 Results Obtained

Heart Rate Monitoring:

Heart rate monitoring is a fundamental aspect of wearable devices designed for safety and security, especially for applications targeting women and girls. The theory behind heart rate monitoring revolves around the principle that the heart rate serves as a vital indicator of overall health and well-being. By continuously monitoring heart rate, wearable devices can detect abnormalities or distress situations, allowing for prompt intervention or alert generation.

Temperature Sensing:

Temperature sensing in wearable devices provides valuable insights into the wearer's physiological state and environmental conditions. The theory behind temperature sensing is rooted in the body's thermoregulatory mechanisms, where deviations from normal body temperature can indicate health issues or environmental hazards. Wearable devices equipped with temperature sensors can detect changes in body temperature, helping identify fever, hypothermia, or hyperthermia, which are crucial for ensuring the safety and well-being of users, particularly in adverse conditions.

Blood Oxygen (SpO2) Monitoring:

Blood oxygen monitoring, also known as SpO2 monitoring, measures the oxygen saturation level in the blood, indicating the efficiency of oxygen delivery to body tissues. The theory behind SpO2 monitoring is based on the principle of pulse oximetry, where light absorption by hemoglobin in arterial blood is used to estimate oxygen saturation levels. By monitoring SpO2 levels, wearable devices can detect hypoxemia or low blood oxygen levels, which may signify respiratory issues or cardiovascular problems. Early detection of low blood oxygen levels is critical for timely intervention and preventing potential health complications, especially in situations where oxygen levels may be compromised.

Integration of Results:

The integration of heart rate, temperature, and SpO2 monitoring results in a comprehensive health monitoring system within wearable devices. By combining these physiological parameters, wearable devices can provide a holistic view of the wearer's health status and detect a wide range of health issues or emergency situations. For example, a sudden increase in heart rate coupled with elevated body temperature and decreased SpO2 levels may indicate heatstroke or dehydration, prompting the device to issue alerts and initiate appropriate actions.

Overall, the theory behind heart rate, temperature, and SpO2 monitoring in wearable devices revolves around leveraging physiological parameters to assess health status, detect abnormalities, and ensure timely intervention, ultimately enhancing safety and security, particularly for vulnerable populations such as women and girls

Heart Rate **Body Temperature**

Blood Oxygen

GPS and SOS

5.2 Analysis and Discussion

Analysis and Discussion of IoT-based Wearable Device for Women and Girl Children Safety and Security

The development of an IoT-based wearable device tailored specifically for enhancing the safety and security of women and girl children addresses a critical need in contemporary society. This analysis delves into the various aspects of the device, its potential impact, challenges, and implications.

1.**Addressing a Pressing Societal Issue**: Violence against women and girl children is a pervasive issue globally, impacting physical and psychological well-being. By introducing a specialized wearable device equipped with real-time monitoring and emergency assistance features, this initiative directly addresses the pressing need for practical solutions to enhance personal safety.

2.**Empowerment Through Technology**: The wearable device empowers individuals by providing them with tools to assert their autonomy and navigate their environments with confidence. Features such as GPS tracking, panic buttons, and proactive threat detection offer users a sense of control and agency, enabling them to take proactive measures to protect themselves in potentially dangerous situations.

3.**Potential to Save Lives and Prevent Harm**: The real-time nature of the device's capabilities means that it has the potential to save lives and prevent harm by facilitating swift response and intervention in emergency situations. By enabling users to quickly alert authorities or designated contacts, the device can expedite rescue efforts and mitigate the severity of incidents, thereby contributing to overall public safety.

4.**Ethical Considerations and Privacy Concerns**: While the device offers significant benefits in terms of safety and security, it also raises important ethical considerations and privacy concerns. The collection and processing of sensitive personal data, such as location information and biometric data, necessitate robust privacy safeguards and transparent data governance frameworks to mitigate the risk of misuse or unauthorized access.

5.**Equity and Accessibility**: Ensuring equitable access to the wearable device is crucial to maximize its impact, particularly in marginalized communities or regions with limited resources. Efforts should be made to address affordability barriers, adapt the device to diverse cultural contexts, and prioritize accessibility features to ensure inclusivity and reach the most vulnerable populations.

6.**Collaborative Ecosystem Approach**: The success of the wearable device hinges on collaboration across multiple stakeholders, including technology developers, policymakers, civil society organizations, and end-users. A collaborative ecosystem approach is essential to address complex societal challenges comprehensively, foster innovation, and maximize the device's effectiveness and sustainability.

7.**Continuous Evaluation and Iterative Improvement**: Continuous evaluation and iterative improvement are critical to refining the device's functionality, reliability, and usability over time. User feedback, incident reports, and performance metrics should be systematically collected and analyzed to identify areas for enhancement and inform future iterations of the device.

In conclusion, the IoT-based wearable device for the safety and security of women and girl children represents a significant step towards leveraging technology for social good. By combining technological innovation with ethical considerations, community engagement, and collaborative partnerships, this initiative has the potential to make meaningful strides in promoting safety, empowerment, and inclusivity for all individuals, regardless of gender or age.

5.3 Project Demonstration

The project demonstration unfolds as a showcase of meticulous planning and innovation, offering attendees an immersive journey into the intricacies of the IoT-based wearable device tailored to safeguard women and girls. Beginning with a detailed hardware assembly overview, each component's significance is elucidated, underscoring the device's seamless integration and optimal functionality. Attendees gain insights into the software implementation phase, where sophisticated algorithms drive the device's operation, ensuring responsiveness and adaptability to diverse user needs.

Functional testing emerges as a pivotal aspect, allowing attendees to witness the device's performance under simulated real-world conditions. Various scenarios, including emergencies, are meticulously simulated to evaluate the device's reliability and effectiveness in detecting anomalies and triggering alerts. The demonstration underscores the device's integration with external systems, showcasing its interoperability and capacity to facilitate rapid response and assistance in critical situations.

Interactive sessions encourage attendees to actively engage with the device, providing valuable feedback and insights into user experience and usability. Through collaborative dialogue, opportunities for refinement and enhancement are explored, paving the way for continued innovation and impact in ensuring the safety and security of women and girls.

In essence, the project demonstration serves as a testament to ingenuity and collaboration, offering a glimpse into the future of safety technology. Attendees depart with a deeper understanding of the device's capabilities and potential applications, inspiring further advancements in the quest to protect vulnerable populations.

CHAPTER 6
CONCLUSIVE REMARKS

6.1 Conclusion

The development of an IoT-based wearable device aimed at enhancing the safety and security of women and girl children is a significant step towards addressing pressing societal concerns. By leveraging the power of Internet of Things (IoT) technology, this wearable device offers real-time monitoring and assistance, empowering individuals to navigate their surroundings with greater confidence and peace of mind.

One of the primary advantages of such a device is its ability to provide immediate access to help in emergency situations. Through features like GPS tracking and panic buttons, users can quickly alert authorities or designated contacts in case of distress, enabling swift response and potentially preventing harmful incidents.

Moreover, the integration of sensors and smart algorithms allows for proactive threat detection, such as unusual movements or sudden changes in environment, triggering alerts and precautionary measures. This proactive approach not only enhances personal safety but also serves as a deterrent against potential perpetrators.

Furthermore, the wearable device can facilitate communication and connectivity, enabling users to stay connected with their support network and access relevant resources, such as helplines or nearby safe spaces. This connectivity fosters a sense of community and solidarity, reinforcing the importance of collective action in promoting safety and combating violence against women and children.

In conclusion, the development of an IoT-based wearable device for the safety and security of women and girl children represents a crucial innovation in leveraging technology for social good. By offering real-time monitoring, emergency assistance, and connectivity features, this device empowers individuals to assert their autonomy and navigate their environments with confidence, ultimately contributing to a safer and more inclusive society.

6.2 Further Plan of Action / Future Work

1. **Enhanced User Interface and Experience**: Future iterations of the wearable device could focus on improving the user interface and experience to ensure ease of use, particularly in high-stress situations. This could involve incorporating voice commands, intuitive gesture controls, or customizable interfaces to cater to diverse user preferences and accessibility needs.

2. **Machine Learning for Personalized Safety Alerts**: Implementing machine learning algorithms could enable the device to learn from user behavior and environmental cues to provide personalized safety alerts. By analyzing patterns and contextual data, the device could offer tailored recommendations and proactive interventions, such as suggesting safer routes or adjusting sensitivity levels based on individual risk profiles.

3. **Integration with Smart City Infrastructure**: Collaborating with urban planners and policymakers to integrate the wearable device with smart city infrastructure could further enhance its effectiveness. For example, integrating with public surveillance systems or emergency response networks could enable seamless coordination and faster assistance in critical situations, leveraging the broader ecosystem to amplify impact.

4. **Community Engagement and Outreach**: Future work should prioritize community engagement and outreach efforts to raise awareness about the device and promote its adoption. This could involve partnering with local organizations, schools, and community centers to conduct workshops, training sessions, and awareness campaigns on personal safety and the role of technology in empowerment.

5. **Continuous Evaluation and Improvement**: Continuous evaluation and feedback mechanisms should be established to assess the efficacy and impact of the wearable device over time. User feedback, incident reports, and performance metrics should be systematically collected and analyzed to identify areas for improvement and inform iterative enhancements to the device's functionality, reliability, and usability.

6. **Privacy and Data Security Enhancements**: As the wearable device collects sensitive personal data, future work should prioritize strengthening privacy and data security measures. This could involve implementing robust encryption protocols, anonymization techniques, and

transparent data governance frameworks to safeguard user privacy and mitigate the risk of unauthorized access or misuse of data.

7. **Global Scalability and Accessibility**: Efforts should be made to ensure the scalability and accessibility of the wearable device, particularly in underserved communities and regions with limited access to technology. This could involve designing cost-effective models, leveraging open-source technologies, and collaborating with local stakeholders to adapt the device to diverse cultural contexts and infrastructure constraints.

In conclusion, the future work for the IoT-based wearable device for the safety and security of women and girl children entails a multidimensional approach encompassing technological innovation, community engagement, and ethical considerations. By prioritizing user-centric design, collaborative partnerships, and continuous improvement, we can strive towards creating a more inclusive and resilient society where everyone can live free from fear and violence.

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Appendix A: Gantt Chart

	Dec	Jan.	Feb.	March	April
Background Studies/Literature Survey					
Research Gap/Problem Identification					
Research on the Project Objective					
Hardware/Software/Tool Selection					
Formation of Codes/Experiment Design					
Trial and Testing					
Challenges and Remedy					
Assembling of the Prototype/Model					
Project Demonstrations					
Formation of the Project Report					
Finalizing of Project Presentation					

Appendix B: Project Summary

Project Title	IoT BASED WEARABLE DEVICE FOR SAFETY AND SECURITY OF WOMEN AND GIRL CHILDREN
Team Members	Tanmay Singh, Anikait Barik, Himanshi Deep, Manu Siddharth Verma
Supervisors	**Dr. Subhrakanta Behera**
Semester / Year	**VI / III year**
Project Abstract	This project focuses on the development of an IoT-based wearable device aimed at enhancing the safety and security of women and girl children. The device incorporates a range of sensors and communication technologies to provide real-time monitoring and emergency assistance functionalities. The core features of the device include GPS and GSM capabilities, enabling accurate location tracking and communication with emergency services or predefined contacts. In the event of an emergency, users can trigger an SOS alert through a dedicated button, initiating immediate response procedures. To further enhance user safety, the device is equipped with a sound playback system, capable of emitting loud alarm sounds to attract attention and deter potential threats. Additionally, an accelerometer sensor detects sudden movements or falls, automatically triggering an alert and providing location information to designated contacts. Incorporating a heart rate sensor adds an additional layer of safety, allowing for continuous monitoring of the user's vital signs. Abnormal heart rate patterns or sudden changes can trigger automatic alerts, indicating potential distress situations. The device is designed to be compact, lightweight, and discreet, ensuring ease of wear and minimal interference with daily activities. It can be worn as a wristband or attached to clothing or accessories, providing flexibility and convenience for users. Overall, the IoT-based wearable device offers a comprehensive solution for addressing safety concerns faced by women and girl children. By leveraging advanced

Project Title	IoT BASED WEARABLE DEVICE FOR SAFETY AND SECURITY OF WOMEN AND GIRL CHILDREN
	technologies such as GPS, GSM, sound playback, SOS functionality, accelerometer, and heart rate monitoring, it empowers users with the means to seek assistance swiftly and effectively in times of need, thereby promoting a safer and more secure environment for all.
List **codes** and **standards** that significantly affect your project.	802.11b/g/n HT40 Wi-Fi transceiver. The MAX30102 [illegible] -55° [illegible] +150°C [illegible]. Blynk server by default tries to use the latest available protocol TLSv1.3
List at least two significant **realistic design constraints** that are applied to your project.	The two primary constraints of this project are the formation of the mobile application (APP) and availability of the wireless communication such as IEEE 802.11 (b/g/n) standards across rural landscapes of India.
Briefly explain two **significant trade-offs** considered in your design, including options considered and the solution chosen	This device is tested for location tracking within the specific range. It is not tested for fractional changes in body parameters.
Describe the **computing aspects, if any,** of your project. Specifically identifying **hardware-software** trade-offs, interfaces, and/or interactions	The C language codes have been written for implementing the Vital Body Parameter Tracker. This software is compatible with NodeMCU.
Culminating Knowledge and lifelong learning experience	For this project knowledge from, EC 3003 Microprocessors and Microcontrollers EC 3007 Digital Signal Processing EC 3093 Microprocessor and Microcontroller Lab EC 4003 Wireless and Mobile Communication, subjects has been used.