SSBS: IOT-ENABLED EMERGENCY ALERT SYSTEM ENHANCING SAFETY FOR ELDERLY, PERSONS WITH DISABILITIES, AND PREGNANT WOMEN

A Thesis Presented to the Faculty
of the College of Science
Technological University of the Philippines
Manila

by

Ethel A. Cacayan
Shayna Lorraine R. Laureta
Michael Angelo P. Par
Daniel I. Perez

In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Information Technology

June 2024

This thesis hereto entitled:

SSBS: IOT-ENABLED EMERGENCY ALERT SYSTEM ENHANCING SAFETY FOR ELDERLY, PERSONS WITH DISABILITIES, AND PREGNANT WOMEN

prepared and submitted by **ETHEL A. CACAYAN, SHAYNA LORRAINE R. LAURETA, MICHAEL ANGELO P. PAR and DANIEL I. PEREZ** in partial fulfillment of the requirements for the degree **BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY** has been examined and is recommended for approval and acceptance**.**

PROF. DARWIN C. VARGAS
Adviser

Approved by the Committee on Oral Examination with a grade of **PASSED** on May 31, 2024.

DR. FRANCIS A. ALFARO
Chairman

DR. WELLANIE M. MOLINO
Member

PROF. FERNANDO L. RENEGADO
Member

PROF. JAN EILBERT L. LEE
Member

PROF. FRANCIS L. DELA CRUZ
Member

PROF. DOLORES L. MONTESINES
Department Head

Accepted in partial fulfillment of the requirements for the degree **BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY.**

Date: ____________

DR. JOSHUA T. SORIANO
Acting Dean

ACKNOWLEDGEMENT

First, we want to start by thanking God for guiding us throughout this research. We are truly grateful for the wisdom, strength, and inspiration He has given us, which helped make this research possible.

We would like to express our sincere gratitude to our thesis adviser, Prof. Darwin C. Vargas, for his support, guidance, patience, and vast knowledge that he has provided us with during our research project. His piece of advice and guidance have greatly contributed to our growth as students.

To our thesis professor, Dr. Francis A. Alfaro, for his invaluable expertise, pieces of advice, and constant support during our research journey.

Along with Dr. Francis A. Alfaro, we would like to thank the panel members who have been present since the very beginning of our research journey: Dr. Wellanie M. Molino, Prof. Fernando L. Renegado, Prof. Jan Eilbert L. Lee, and Prof. Francis L. Dela Cruz. Their insightful comments, recommendations, and encouragement since the proposal defense up to our final defense have been remarkable and have helped us improve our paper and our research project.

We would also like to express our appreciation to Prof. Priscilla Sotelo-Bator for her assistance and guidance during the formulation of our research topics.

To our fellow classmates, for their collaborative discussions and meetings that gave us ideas for improvement and made this research an immensely enriching experience.

Finally, we want to express our gratitude to our families and friends, whose unwavering encouragement, understanding, care, and support have been a constant source of strength throughout this research journey.

The Researchers

ABSTRACT

The aim of this study is to track the real-time location and monitor the health of elderly individuals, pregnant women, and persons with disabilities using a wearable device and a web application. Guardians can monitor a user's health and location in real time with the help of this type of technology. It guarantees the health and well-being of those in need by integrating health monitoring with location monitoring. The device can track body temperature and heart rate in addition to the user's location. Through the use of the IoT platform and programming tools, the project improves its functionality and makes data administration and communication between the guardian and wearable gadget easier. It was put together with the body temperature and heart rate sensors on the A9G module and the NodeMCU ESP32 module. In addition, the implementation makes use of the IoT platform and computer languages such as JavaScript, CSS, and HTML. Thirty-five individuals assessed and tested the system; these included elders and their guardians and caregivers, IT students, IT professionals, and healthcare workers. The results revealed how the system—which is supported by evolving technology—simplifies user monitoring. The study's findings demonstrated the system's effectiveness and usefulness, which facilitates the monitoring and assurance of older citizens', pregnant women, and persons with disabilities' well-being. At a grand weighted mean of 3.53, interpreted as “Highly acceptable”, the system review's findings demonstrated that it functions and satisfies standards. With this technology, guardians and caregivers can keep an eye on the user all the time, which improves the quality of care and the speed with which help can be sent in an emergency.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

Ensuring the safety and well-being of Elderly, Persons with Disabilities, and Pregnant Women is a significant concern, especially for family-oriented people out there. Some elderly individuals prefer to live independently, but what if there is an emergency? Like something about their health condition or just trouble at home with or without their caregivers to help them? The same cases apply to Persons with Disabilities and Pregnant women who live alone and are in need of assistance and support whenever something is troubling them. So, to find a solution for these kinds of issues, this research aimed to develop an Internet of Things also known as IoT-based emergency alert system, maximizing the NodeMCU ESP32, A9g module, sensors, IoT application, and Firebase database. The system will also have a Global Positioning System (GPS) to accurately determine the geolocation of the person in distress and transmit the emergency alerts to their guardians, caregivers, or even neighbors or family members who live close by.

Technologies' constant evolution from the past and up to now has undeniably simplified people’s everyday lives, from facilitating connections regardless of geographical distances to satisfying human needs in the comfort of their homes. There are many technological advancements that are now popular and used widely. One of them is the creation of wearable devices. These innovative gadgets can be fastened to one’s clothing or even be worn directly on the body of the user, which can serve as a pathway for information such as vital medical, biological, and exercise-related information to be sent to a centralized database. The data transfer can happen smoothly through the user's clothing or especially directly from their body.

The ability to analyze and collect data in real-time is one of the reasons why wearable devices are becoming popular. They give quick insights into different areas like a person’s current health status and progress in staying fit. That is why devices like these have a fundamental role in entertainment, health, fitness, and many more. It dramatically impacts people’s well-being and quality of life while at the same time giving convenience.

In today's world, where people are surrounded by a variety of electronics, microcontrollers and sensors are vital components. For instance, Arduino is famous for being open–source and ideal for creating electronic devices. It is a well-known microcontroller, and it includes user-friendly software (IDE) that can simplify the process of adding code to the hardware so it can work effortlessly.

Background of the Study

The community around the globe is still young, but it is slowly aging. According to Booth (2021), people aged 60 years old and above are considered elderly. The increasing elderly population necessitates constant monitoring and support for geriatric conditions, putting financial and emotional burdens on caregivers. Wearable devices are developed to address these needs. As per the findings of Ometov, Shubina, Klus, Skibinska, Flueratoru, Saafi, and Simona (2021), the latest smartphones and tablets provide enhanced features, including real-time health monitoring, scanning, and tracking capabilities, in comparison to existing devices.

Wearable technology is being researched and developed for its use in tracking location and health, primarily targeting the senior population. Caregivers or guardians can monitor elderly individuals who are at risk of displacement due to Alzheimer's and dementia by utilizing loT-enabled wearables that offer vital signs and health indicators (Rane, 2020). Kekade, Hsieh, Islam et al. (2018) discovered that more than 60% of senior citizens are interested in making use of wearable technologies to boost their physical and mental activity. The survey questionnaire and systematic review confirmed the conclusion that the intention to use wearable technology, privacy and security concerns, and plans to do so are significant. As a result of being more susceptible to conditions such as Alzheimer's and dementia, elderly people frequently experience cognitive confusion, which develops as low memory loss and an inability to respond to their environment (Neubauer, Miguel-Cruz & Liu, 2021). Caregivers face challenges in ensuring safety and well-being of elderly individuals, leading to a need for tracking systems for continuous monitoring and oversight. Sharma and Morwal (2018) developed a system called Location Tracking using Google Geolocation API. This system uses the Geolocation API to monitor the location of various users, including kids, travel agencies, and online e-commerce websites. It is not necessary to use GPS devices for address localization, as this feature makes it a valuable tool for various applications.

The system uses IoT technology to track the real-time location and physiological parameters of the elderly, enabling regular monitoring for caregivers and guardians.

Furthermore, the older individuals afflicted with dementia and Alzheimer's disease are especially prone to experiencing falls and accidents. The study conducted by Hollinghurst, Williams, Pedrick-Case, North and Fry (2022) examined the influence of dementia on elderly individuals residing in the United Kingdom. Between 2020 and 2021, a total of 2,268 elderly individuals out of 20,609 in the United Kingdom with dementia were hospitalized as a result of falling accidents. Such occurrences typically hapeen when guardians and caregivers lack awareness and knowledge about these critical incidents. This leads to subpar monitoring efficiency. This is the point at which the Internet of Things (IoT) is taken into account. Stavropoulos, Papastergiou, Mpaltadoros, Nikolopoulos, and Kompatsiaris (2020) suggested that IoT wearables and other linked sensing devices have the potential to provide an objective, reliable, and remote method for monitoring and assessing the environment. IoT devices are crucial for elderly emergency systems, providing real-time monitoring and immediate alert generation, with extensive research on their integration in healthcare. Numerous applications have already been commercialized and are currently accessible in the market (Wan, 2018). The IoT device uses sensors and monitoring devices to collect vital signs, activity levels, and ambient factors, ensuring constant monitoring of the older person's well-being and safety.

Many researchers and developers have made a contribution to the current rise in popularity of wearable devices by designing them with convenience and efficiency in mind. In addition, Sumathy Kavimullai, Shushmithaa, and Amusha (2021) reported that they successfully constructed an IoT-based healthcare monitoring system that enables continuous monitoring of a person's vital signs. The researchers proposed a system integration combining tracker and health monitoring sensors to address Alzheimer's disease and dementia complications, primarily focusing on health analytics and tracking. A case study (2018) proposed that the implementation of such technology might simplify the monitoring and tracking of elderly people diagnosed with Alzheimer's disease, which is common among those aged sixty-five and above.

The "SSBS: IoT-Enabled Emergency Alert System Enhancing Safety for Elderly, Persons with Disabilities, and Pregnant Women" (SSBS stands for "Small in Size, Big in Safety") uses GPS and GSM to track vital signs and real-time location. Hardware includes a microcontroller, contactless temperature detector, and oximeter. This system could benefit government, non-government, and healthcare sectors, and serve as a reference for future research.

Objectives of the Study

This study aimed to develop a wearable device integrated with the Internet of Things platform that will simultaneously monitor a user's vital signs and keep track of his/her real-time location. Specifically, this study aimed to create an affordable and easy-to-use wearable device that will ease the difficulties of monitoring the Elderly, Persons with Disabilities, and Pregnant Women while increasing the assurance regarding the well-being of their loved ones.

1. Design a system that will:
    a. Monitor the real-time location of user and display it to the IoT platform.
    b. Read and track the user’s vital sign (heart rate and body temperature)
    c. Send an alert SMS and notification to its guardian when sensors detect abnormalities in:
        - Heart Rate
        - Body Temperature

d. Send an alert notification when the user's distance to his/her guardian exceeds to 20 meters and another warning message when it exceeds to 40 meters.

2. Construct a prototype using NodeMCU ESP32, A9G GPS and GSM Module, heart rate sensor, LM35 temperature sensor.
3. Determine the prototype's level of acceptability using the TUP Evaluation for Prototype Instrument.

Scope and Limitation of the Study

The goal of this research is to develop a wearable emergency device specifically designed for individuals who are sixty (60) years of age or older, Persons with Disabilities, and Pregnant Women. The system concentrates on: 1) Tracking the real-time location of the user through geolocation using the A9G GPS and GSM Module. 2) Monitor the user's vital signs (heart rate and body temperature). 3) Send an SMS notification to the guardian/caregiver that contains a warning message and link of IoT Web Application of where the user is. The readings of vital signs will be displayed in the IoT platform dashboard of the guardian/caregiver.

The system will be used for both outdoors and indoors. Its GPS might be affected by the inaccurate signal when indoors due to obstacles such as walls and doors, however, it can run smoothly near open windows and doors. This would not likely be a major issue given that the user and the caregiver are mostly in the same location. And by that, it is ideal to use outdoors with a strong data connection and open area. Additionally, it will not be sure whether the users' activities (movements or workouts), or the sun's heat is to blame for the abrupt rise in body temperature and heart rate.

This study was focused primarily on monitoring particular vital signs, namely body temperature and heart rate. It does not encompass the monitoring of any other vital signs. Furthermore, it will be run through the utilization of a mobile data or internet connection. The device also uses 18650 Battery as its power source, despite ensuring that the device is energy-efficient, and the battery has a high capacity for longer use the prototype lacks alert when the battery is running low.

Significance of the Study

Technology is rapidly emerging, and by emerging, various technologies are introduced in the world including wearable emergency devices. These devices are proven effective in the field of tracking and locating individuals as well as monitoring their health analytics. This study hopes to contribute to existing technology by innovating and providing a cost-effective device with a tracker and health analytics features. It will ease the challenges of caregivers/guardians, especially for the Elderly, Persons with Disabilities, and Pregnant Women. It will also help the future generation as this study utilizes the Google Maps Coordinates, IoT platforms, and sensors. More specifically, the efficiency and accomplishment of the advancement of this study will benefit diverse sectors of society including the following:

The Elderly

This study will provide an innovative wearable device for better monitoring of the real-time location and health analytics regularly and ensure safety of the elderly.

Persons with Disabilities

People with disabilities (Persons with Disabilities and Children with Special Needs specifically) will benefit a lot from this study as they are vulnerable to accidents and need an immediate response from their guardian or caregivers.

Pregnant Women

This study will extend its benefits to pregnant women as they become augmented and require constant monitoring as well as prompt assistance in the event of emergencies or complications.

Guardians and Caregivers

This research will alleviate the challenges of guardians and caregivers in taking care of and monitoring their loved ones. As they can monitor them regularly and constantly give them the assurance of their well-being.

The Healthcare Sector

The success of this study will benefit the Healthcare Sector considering that the elderly, persons with disabilities, and pregnant women can monitor their vital signs regularly without going physically to the hospital. This can result in better patient satisfaction, increased trust in healthcare services, and the potential for reduced healthcare costs through the prevention or timely management of emergencies.

Future Researchers

Future researchers can utilize this study as a baseline for the expansion of wearable tracking devices integrated with IoT Health Analytics. This will allow the development and improvement of the existing system or comparable systems.

Chapter 2

CONCEPTUAL FRAMEWORK

This chapter discusses relevant literature and studies on the topic of the study. It includes the conceptual model of the study and the definition of terms used in the study.

Review of Related Literature

This section presents key concepts and ideas on the relevant topics to the study. It includes discussion on elderly people, pregnant women, people with special abilities, firebase, NodeMCU ESP32, GPS and GSM module, wearable devices, among others.

Elderly People

In the article “Emergency Care for the Elderly: A Review of the Application of Health Information Technology” (2022), the difficulties caused by an aging population and the rising need for emergency care for the elderly were highlighted. It emphasized how critical health information technology is as a potential means of raising the caliber and effectiveness of care for this population. It also emphasized the need for additional geriatric emergency medicine research to find potential for resource optimization and improved care quality.

According to the study by Winny (2022), health emergencies can happen to anyone regardless of how careful they are and how healthy their lifestyle is, but the elderly and people with disabilities are the most vulnerable when it comes to the long and short-term effects of these accidents. It is not guaranteed for a guardian or caregiver to protect them from such situations all the time. So a wearable emergency button is one of the best solutions to ensure the well-being of one's loved ones and have access when an emergency occurs. These are the five reasons why an Emergency Button is essential. "(1) 24/7 Monitoring and Alerts Ensure Safety of the Elderly. (2) The Risk of Medical Emergencies and Hip Fractures. (3) Independent Living and Aging in Place. (4) Save Money on Room and Board by Aging in Place. (5) Comfort and Peace of Mind."

As stated by Abalos (2018), "the aging situation in the Philippines is still young but it is slowly aging". The finding is primarily based on the 2013 Philippines National Demographic and Health Survey (NDHS) and the 1990, 2000, and 2010 Philippine Census of Population and Housing (CPH). Elders choose to live in remote places, it was concluded in the survey. At least one functional problem affects one out of every five elderly Filipinos. It was also stated that the older population is considered as a vulnerable group when it comes to rapid changes in demographics and economics. Within this group, there is a particular section that needs special attention. As they are the ones who suffer significant disadvantages in terms of functional difficulty, social support, and health insurance.

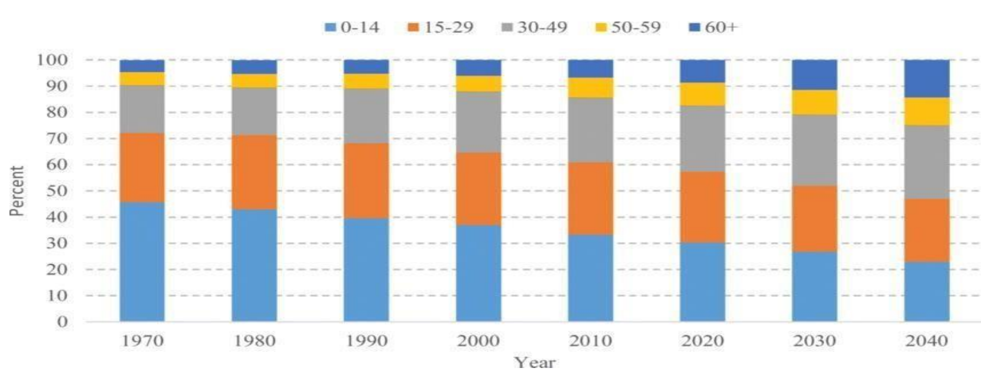


Figure 1. "Distribution of the Philippine Population by Age Group, 1970–2040."

As stated by Jadloc (2017), Filipinos aged 60 years old and above are considered elderly. These people are generally not materially wealthy, have little education, and about half believe their health is ordinary as they cannot afford to have good use of health services. They also accept the fact that it is best to live alone by themselves. These were the results of the study “Aging in the Philippines: Findings from the 2007 Philippine Study on Aging (PSOA)” by Cruz, Natividad, Gonzales, and Saito. It was also concluded in this study that older Filipinos have low incomes and assets, these circumstances pushed them to work after the considered retirement age which is 65 years old for government service and 60 years old for the private sector. Other findings of this study include, (1) Education, most of the older Filipinos have a relatively poor educational profile. (2) Health and care, about half of older Filipinos have reported having a functional disability. It also cited that 1 out of 4 older Filipinos are dealing with mental health. (3) Living with children, the study also revealed that older Filipinos are still giving financial support to their grandchildren.

The first multi-actor longitudinal study on aging in the Philippines with information from older Filipinos, caregivers, and adult children is The Longitudinal Study of Ageing and Health in the Philippines (LSAHP) Cruz & Saito (2019), It was conducted to (1) explore the status of health and well-being, as well as their connection, of Filipinos aged 60 years old and above; and (2) assess the different factors that influence health status and how it transitions in health status and general well-being. The response rate for the baseline survey, which included 5,985 older adults (OPs) 60 years of age and older, was 94%. Provinces served as the primary sample units for the survey, barangays served as the secondary sampling units, and OPs served as the final sampling units.

This study concluded that a significant number of older Filipinos are dealing with different health issues including self-assessed health, diagnosed illnesses, oral health, sleep, pain, falls, and incontinence, among others.

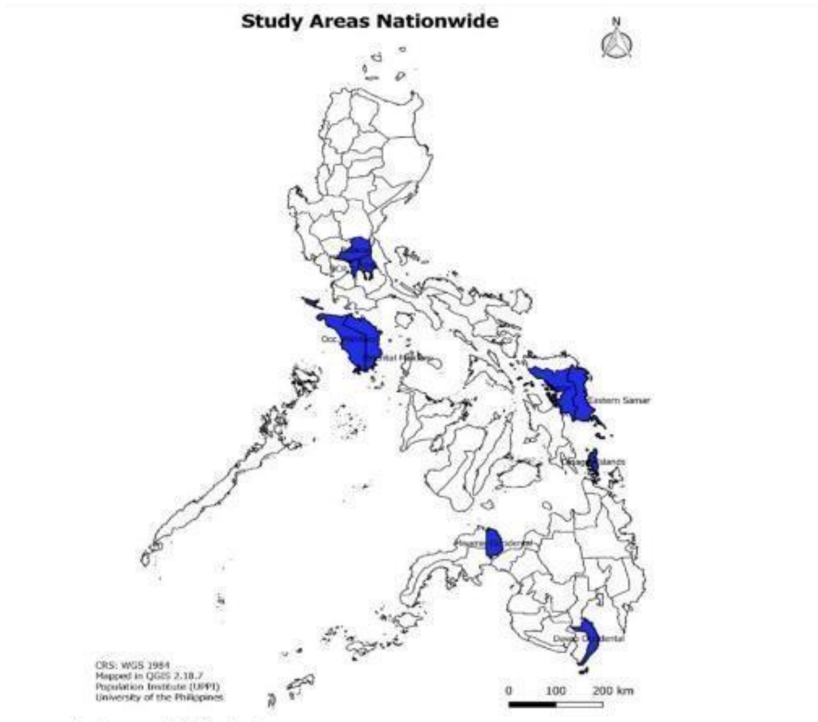


Figure 2. “Map of the 2018 Longitudinal Study of Ageing and Health in the Philippines Sample Area”

Referencing Kaplan (2023), older adults in the United States are living alone. About 28% (14.7 million) including 21% of older men and 34% of older women. As people get older the proportion of people living alone increases, as they reach this age they are more likely to be poor. Countless people claim to be lonely and a percentage of 25 with age 65 years old and above felt isolated. Health issues are often not recognized. Some elderly individuals who live alone are not getting proper nutrition and a balanced diet due to physical implications that result in undernutrition.

In order to increase the safety and independence of elderly persons and people with impairments, "The Scientific World Journal" (2020) stated that usability testing and the creation of emergency alarm systems suited to their needs are essential. Making efficient and inclusive technologies that enable quick access to emergency assistance requires user-centered design, accessibility features, and usability testing as key building blocks.

Firebase

According to Karaduman (2018), it was suggested that a library fire detection system built on ContikiOS would use a multi-hop wireless sensor network to boost performance while covering a sizable physical area. Additionally, the system features an Android application that notifies users in the event of an emergency and uses Google's Firebase clouding capability to store data online. Moreover, it is possible to grow the network without adding new sink nodes for data collection. In the event that the transmission power between the sink node and additional source nodes is low, the multi-hop network enables the relay nodes to transmit temperature values. The system used a multi-hop network to respond to temperature changes and provide a warning or alert message in around 4 seconds, based on the test findings. The system can also alert users in the event of an emergency.

The goal of this article is to design a prototype model for a real-time mobile GIS land usage and land information system for the Homagama Divisional Secretariat Division of Sri Lanka. For real-time updates using Firebase support tools, the system comprises a Google maps app. Basic users, supervisory managers, and database administrators are among the hierarchy levels that are served by the mobile application. Public sector field officers should be able to handle land use planning issues with the aid of this mobile mapping tool (Jayapathma, 2021).

NodeMCU ESP32

Based on the research study of Hercog, Težak, Lerher, and Truntič, (2023) the researchers indicated that the Node MCU ESP32 proves to be a reliable and affordable platform for developing Internet of Things applications. For IoT projects, this provides an ideal feature set. Along with a dual-core CPU, integrated Wi-Fi and Bluetooth, and an extensive number of general-purpose input/output (GPIO) interfaces, the ESP32 boasts remarkably low power consumption. Increased processing capability in the Santa Clara, California, USA-made Tensilica Xtensa LX6 microprocessor in the ESP32 allows for efficient handling of complicated tasks and multitasking. In addition, the built-in Bluetooth and Wi-Fi interfaces enable connections and communications with other devices or networks. Power-efficient architecture of the ESP32 facilitates development of energy-efficient Internet of Things applications. For projects using batteries or having little resources, its sleep and power management modes cut down on power consumption. Smooth integration with touchscreens, displays, or LED signaling provides operators or staff with an intuitive interface. Technically, a large variety of programming languages and development environments are compatible with the ESP32. The most often utilized of them is C++; well-known programming environments are PlatformIO and the Arduino IDE. Furthermore, developers can make use of the whole ESP-IDF (Espressif IoT programming Framework) library and tool set designed especially for ESP32 programming.

LM35 Body temperature

According to Ramos (2020), temperature monitoring sensors integrated into concrete buildings have huge potential to improve building methods and preserve the integrity of the existing environment. Given that LM35 temperature sensors provide an affordable means of real-time temperature monitoring during the important concrete curing process, their application becomes very intriguing in such situations. The innovative work of earlier researchers has demonstrated that it is possible to include LM35 sensors into solid matrices, enabling accurate assessment of the dynamics of internal temperature. Through rigorous laboratory research based on these basic discoveries, the initiative sought to confirm and expand upon past findings. Building on the results of laboratory testing, the research project started a large-scale field experiment in which 32 LM35 sensors were positioned over various concrete structures. Before anything else, resilience and reliability across a range of environmental circumstances were evaluated in this extensive study to determine the viability and effectiveness of sensor integration in actual building contexts. Temperature monitoring methods for the built environment can be made more dependable and stable by significantly boosting the effectiveness and application of LM35 temperature sensors in concrete construction.

GPS and GSM module

Ndungu and Mixon (2021) stated that mobile phone users in Europe and other countries of the world extensively use the Global System for Mobile (GSM), a digital mobile network. The most widely used of all three digital wireless telephony technologies—TDMA, GSM, and code-division multi-access (CDMA)—it makes use of a variation of TDMA. Two more user data streams, each with a set time slot, are delivered over a channel together with information that has been digitally transformed and compressed. Working frequencies for this system are 1,800 MHz and 900 MHz. GSM and other technical developments have helped to progress wireless phone systems. This development comprises the technologies referred to as Universal Mobile

Telecommunications Service (UMTS), General Packet Radio Service (GPRS), Enhanced Data GSM Environment (EDGE), and High-Speed Circuit-Switched Data (HSCSD).

According to Benefits Of GSM (2023) GSM, also known as the Global System for Mobile Communications, acts as a crucial global communication framework for mobile devices. Due to its broad use, it now has a user base of more than 3 billion people. Notably, GSM outperforms CDMA in a number of ways, and usage of the technology is growing over time. The widespread use of text messaging, which is now a crucial component of daily communication in many parts of the world, especially developing countries, is a notable effect of GSM technology.

1. **Emergency Response**

112 is an emergency number that is well-known throughout GSM networks. As long as they are connected to a GSM network, users can make emergency calls and request assistance no matter where they are in the world.

2. **Technological Growth**

The proliferation of telecommunications technology has been driven by intense global rivalry, facilitated by the widespread adoption of the Global System for Mobile Communications (GSM). Consequently, this has generated a reliable cellular service and enhanced the dependability and usefulness of connection.

3. Universal Data Transfer

Due to the fact that GSM is a universal standard, it provides dependable and effective data transmission, including the ability to send text messages and photographs from any area that is covered by the system.

4. Better Sound

A GSM cell phone's digital nature results in greater call clarity by successfully filtering out background noise, enabling smooth conversation even across long distances.

5. Greater Security

The GSM architecture requires a request for access before placing a call, acting as a security mechanism to guarantee that only the intended parties are speaking.

6. Has international capabilities

Despite the fact that GSM phone costs can occasionally be high. They already come with built-in global capabilities. These phones offer a significant advantage in facilitating international contact, despite possible charges varying depending on the call's destination region.

Figure 3. A9G GSM/GPRS+GPS Module

Internet of Things

IoT devices, which may transmit data over the Internet or other networks, are hardware intended for specific applications and include sensors, actuators, gadgets, appliances, or machines. They can be included in various mobile devices, industrial machinery, environmental sensors, medical devices, and other gadgets (Arm Ltd., n.d.). IoT gadgets might be anything from straightforward kitchen appliances to sophisticated industrial instruments, according to Duggal (2022). Every loT component has a unique identification (UID) and is capable of transmitting data without the need for human involvement.

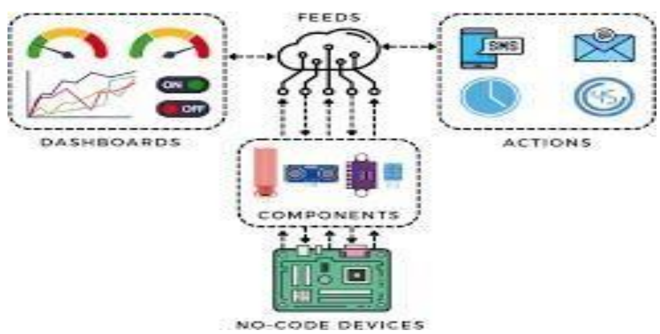


Figure 4. Internet of Things

According to Mohapatra, Mohanty, and Subhadarshini (2019), their system aimed to create a scalable, reliable, and cost-efficient solution for the healthcare industry. The researchers utilized an Adafruit Cloud as a means to communicate with the data. Furthermore, both IFTTT (IF This Then That) and the Adafruit cloud provide notification services. If the consumed value crosses the threshold value, an emergency message including the vital information will be sent to either the doctor or the patient's family, enabling them to instantly implement the necessary precautions. In addition, the developers utilized Adafruit IoT Cloud to store, track, and showcase the vital signs and live whereabouts of the elderly. Furthermore, the advanced system also incorporated the IFTTT functionality, which promptly distributes push alerts to the mobile devices of the caregivers/guardians in the event of any abnormality in the elderly individual's vital signs, together with their current position in real-time.

As stated by Peerbits (2022), because of the Internet of Things (IoT) it brought significant improvements to healthcare for elderly patients and many more. It allows for remote health monitoring through connected devices, like smartphones, etc. That is why doctors can now monitor or track vital signs, such as heart rate, pulse rate, oxygen levels, blood pressure and blood sugar, in real time. This data can be sent to the doctor's cloud platform to analyze it. IoT has expanded into wearable devices like hearables, ingestible sensors, and smart devices for various healthcare applications, enhancing the comfort and well-being of elderly individuals.

Microcontroller

People today are surrounded by the advancement of technology, most of the components of devices and technology are now embedded and operated automatically. The Arduino Uno 17-9 microcontroller board, as explained by Hidyani, Lestari, and Anwar (2020), is based on the ATMega 328. This microcontroller has a 16 MHz crystal oscillator, six analogue inputs, six digital inputs, a USB connection, and a power port. The device includes a reset button, an ICSP header, and other components. In order to establish serial connection with a computer via a USB port, this microcontroller requires the use of a USB-to-serial converter.

To operate, it requires 5 V of energy. Additionally, according to Iskandar, Rouhan, and Koestoer (2019), the Arduino Uno is a microprocessor that will gather data and display it how the user specifies.

Furthermore, Chaudry (2020) claimed that the physics/astronomy community is becoming more interested in Arduino microcontrollers. In addition to light and optics, magnetism and electricity, and mechanics, these instruments can be utilized to conduct a variety of comprehensive laboratories. Ashely (2021) stated that the "Arduino Uno is a cost-effective, adaptable, and user-focused open-source microcontroller board that is programmable." Moreover, it is capable of handling a wide range of electrical applications. This board has interfaces for controlling relays, LEDs, servos, motors, and other output devices that are compatible with Arduino, Arduino shields, and Raspberry Pi boards.

The Arduino is likewise similar to a computer motherboard, which also has a processor behind the cooler, claim (Rusyn, Subbotin, & Sambas, 2020). The motherboard's processor handles tasks that the Arduino Uno performs exactly the same way. It is also connected to extras like the display, disc drives, and hard drives. It is also possible to connect a lot more devices.

Figure 5. Arduino UNO

Pregnant Women

As mentioned in IEEE Xplore (2017), "Smart Care" is a framework designed to guide expectant mothers during their crucial time, offering personalized dietary advice and essential information for different pregnancy stages.

Ayad Ghany Ismaeel and Emad Khadhm Jabar (2013), proposed a health system for pregnant women using mobile GIS to locate nearby care centers or hospitals. The system uses SMS messages with the woman's ID and coordinates, allowing for quick and easy local registration. This system is more cost-effective due to its economic mode of operation and ability to provide emergency assistance.

Ismaeel and Rizqo (2013), proposed a mobile tracking system for pregnant women, based on their location. The system uses WCF technology to provide 24/7 online support, allowing patients to submit a request via SMS. The patient's information is retrieved from a database and the server locates the patient on Google Maps. The system can handle high volumes of requests quickly and is cost-effective due to data transmission across the GPRS network and the Internet.

In Bangladesh (2010), mobile customers can subscribe to the S SMS service for health-related messages at a discounted rate. Health professionals can use this as a case study to send patients SMS messages in rural areas. Pregnant mothers can register their mobile number for prenatal advice. However, previous eHealth and mHealth platforms have flaws, such as not offering internet services. Pregnant women can register from home, choose the nearest care center, and receive emergency transportation.

As stated by Blaya et al. (2017), prior to smartphones, Personal Digital Assistants (PDAs) were employed to enhance decision-making, management, education, and health monitoring. In Peru, they were more dependable and effective than data collecting done on paper. Electronic health record keeping, storage, and communication systems were launched after PDAs, automating testing and reporting as well as early disease warning. Short Message Service (SMS) was used for reminders, monitoring, health education, and asynchronous communication in remote areas. For example, a mobile phone-based system was implemented in Rwanda to monitor pregnancy and newborn information, reducing delays in healthcare interventions. A cluster-randomized controlled trial showed that mobile phone interventions improved newborn health and were suggested for policymakers in low resource settings. eHealth applications were also developed to improve maternal health outcomes, such as PotM, a mobile health application for managing pre-eclampsia.

People with Disabilities

According to Lersilp, Putthinoi, Lerttrakarnnon, and Silsupadol (2020), assistive technology (AT) enhances the quality of life for dependent people and their caregivers by improving daily living, work, leisure, education, and social participation. AT is essential for balancing everyday activities and guaranteeing safety with the growing number of dependents and the shortage of caregivers. Even while living alone worries some, numerous caregivers like looking after their family and going to social events.

As stated by Chittaro, Carchietti, De Marco, & Zampa (2011), emergency medical services (EMS) may rely on conventional operating procedures for routine cases rather than considering specific situations involving impaired patients. Their paper proposed an adaptive information system called PRESYDIUM (Personalized Emergency System for impaired Humans) and a thorough patient model for EMS to provide medical first responders who deal with impaired individuals with customized instructions. The ICF standard-abiding design and development process of the system includes its web-based architecture, stakeholder interfaces, end-user validation, and usability testing.

Based on EMYNOS (2015) findings, the platform is a Next Generation emergency platform intended to offer IP-based services and customized communication for people with disabilities. Through the integration of social media, user profiles, and contextual data, it allows browser-to-browser webRTC communication in real time. This platform also serves as a backup in case of infrastructure collapse.

Security

According to Ravshanov (2021), the Latin word "Securitas" means security. Ancient Romans developed the concept of "Securitas" as a means to prevent danger and maintain safety and security. The name is a mix of the terms "se" and "cura," and it denotes "to be free from anxiety and at peace." According to Asimov (2021), security has evolved over time, moving from the most basic interactions to the most complex systems, such as the modern world. Since it continues to affect the mind, it has allowed people to create a vast array of risk expressions, including their types, techniques, mechanisms, means to defeat or eliminate them, and means to avoid them. In this sense, security-related projects can be said to have had a considerable impact on the development of human awareness, thought, and knowledge.

As stated by Ravshanov and Asimov (2019), the classification of security as subjective or objective by Wolfer is purportedly a common approach in field research.

Wolfer's viewpoint, however, that objective security is a situation in which there is no risk and subjective security is a state in which the risk of a hazard is unpredictable and unafraid, is important. In a nutshell, subjective security relates to the belief that no threat exists, whereas objective security refers to the belief that uncertainty does not pose a threat.

Baldwin's definition of security and organization of security studies revolve around the idea that their goal is to help decision-makers accurately determine the relative attention to devote to various threats as mentioned by Lotfi (2018) in his book Security: A New Framework for Analysis as the most sophisticated and consistent attempt at defining security and organizing security studies. Furthermore, it goes beyond merely tagging societal, environmental, and economic challenges with the word "security". The larger objective must be advanced by carefully examining what security is and applying that knowledge to various dynamics.

Wearable Devices

Through the years, people have witnessed the rise of popularity of wearable gadgets that one can strap on or wear on his or her body. Based on the study of Hossain, Mokter (2022) entitled “Wearable Devices to Revolutionize Health Care " the popular usage of wearable technology for health monitoring. These gadgets make it simple to monitor the heart rate, calories burnt, steps taken, blood pressure, biochemical release, exercise duration, and physical effort. The development of smart shoes and socks, as well as the ability to implant breasts and monitor infants, are all made possible by a wide range of artificial intelligence and Internet of Things technology. Their study also mentioned that wearable technology provides important insights that help to live comfortably, especially in those in need. They are useful for keeping an eye on physical fitness and training as well as warning of serious medical issues. Soon, wearable technology is anticipated to assess blood alcohol content, sports performance, cardiac condition, and age-related disorders in addition to predicting changes in health, mood, and stress.

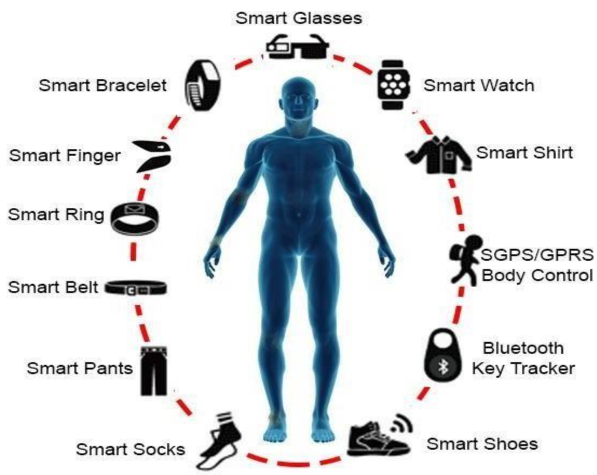


Figure 6. Wearable Devices

Do Wearable Devices Connect People to the Internet of Things?

The article of Kemper (2019), presented a survey regarding the consumer Internet of Things (IoT) technology that is most visible is wearables. The Internet of Things (IoT) describes technological gadgets that can connect to internet networks. Wearables, which include virtual reality (VR) headsets, smart glasses, and necklaces, connect users to the "internet of things" by coming into direct contact with their bodies. Smartwatches and fitness trackers are examples of wearables. Smart Glasses are another type. Over 500 connected device owners were polled by Clutch to find out how they use common consumer IoT technology. Their first article in a three-part series on this data concentrated on the types of IoT devices that consumers own and employ. Also, they discovered that although almost everyone who owns a wearable gadget, such as a smartwatch or fitness tracker, connects it to their cellphones, they rarely utilize it for anything other than a few essential tasks. Wearables do not encourage owners to purchase additional Internet of Things (IoT) devices because they are only used for a few, specific purposes. The data of their research can be used by companies and developers of wearable technology to comprehend why users restrict their gadget use.

Communication Between ESP32 and GPS System

The integration of ESP32 microcontrollers with GPS systems is essential for creating effective emergency alert systems. According to Smart Projects (2020), the ESP32 Devkit 1 is highly regarded for its processing power and multiple communication interfaces, making it ideal for IoT applications. However, it requires Wi-Fi connectivity, typically provided by a tethered smartphone, which can be a limitation for elderly users who may struggle with smartphone settings. The V KEL VK2828U7G5LF TTL GPS module communicates with the ESP32 via UART using the NMEA2 protocol, providing vital location data such as latitude and longitude. Working on both 3.3V and 5V, this module has a reasonable cost and adaptable to a variety of development boards. Usually including these parts, emergency alarm systems have a big button that, when hit, communicates the GPS coordinates to a family member or caregiver via Telegram, greatly shortening emergency response times. Easy integration of sensors and connectivity modules is made possible by the Arduino IDE programming of the ESP32. This technology balance improves quick reaction and real-time monitoring, which increases senior and other at-risk group safety.

Limitations of GPS Technology in Indoor Environments

The main difficulties GPS technology has when utilized inside buildings are covered by Fredrick (n.d.). At 1575.42 MHz, a high frequency, GPS signals find it difficult to get through tough materials like wood, metal, and brick. Because of the resulting affecting or distortion of the signals, precise indoor location is made challenging. Furthermore, complicating GPS reliability indoors is interference from other ultra-high frequency sources, such TV antennas.

To address these challenges, companies like Google, Microsoft, and Nokia are developing Indoor Positioning Systems (IPS). These systems use alternative signals like Wi-Fi hotspots, Bluetooth, and cellphone signals to accurately track locations inside buildings. As technology analyst Bruce Krulwich noted in a 2011 Forbes article, IPS is expected to be a major growth area in mobile technology, offering a promising solution to the limitations of GPS indoors.

Women Safety Device based on "Internet of Things (IoT)"

Based on the research of Pilania, Nair, Arora, & Kadian, (2018), their study was about how the IoT is a network connectivity system that connects peripheral devices or objects that have been fitted with various types of sensors, electronic devices, software, and actuators. It is mostly used for data and information sharing through networks. People are aware that a number of incidents involving women are occurring at an alarming rate every day. The government must take specific measures to ensure the safety of women if it wants to stop and end these crimes. In India this year, there have been a number of astounding incidents. On January 17, 2018, a startling rumor surfaced. So in this paper, the researchers put forth some ideas to ensure the safety of women by a device that will not only have a buzzer in it but also be able to locate a woman's location using GPS (Global Positioning System) technique. Once this buzzer is pressed in case of an emergency, it will get the exact location of the victim and then it will be sent to the nearest police station so that police force can take immediate action.

Elderly Fall Detection and Location Tracking System Using Heterogeneous Wireless Networks

A system was created by Fung, Ann, Tung, Kheau, and Chekima (2020) to identify elders who fall and to locate them using a heterogeneous wireless network. The developers tracked the elder's whereabouts using a GPS module, and they detected the elder's fall using an accelerometer sensor. Furthermore, in the event of a fall incident, the system has the capability to transmit an SMS alert to the relative or guardian of the elder. This is accomplished through the utilization of a GSM module that incorporates the elder's location via a Google Map link. Email services such as Gmail and cloud servers are also retrieved via a WiFi module. By clicking the offered Google Map link, the elder's caregiver, guardian, or family members can find out where the elderly person is. The developed system has a web application that runs on a loT cloud server platform. It has a history of recorded falls that guardians, relatives, or other caregivers can check and keep an eye on. The system's designers added a button that serves as an elders' emergency panic button. When there is an emergency, the elderly can manually send alert messages to their caregiver, guardian, or family members by hitting the system's on-board button. The hardware of the system was controlled via Arduino UNO by the developers.

A button was also included by the developers in accordance with the system they had created. It functions as a button for assistance. Elders can touch the button whenever they require assistance, and when they do, it will use IFTTT to alert caregivers or guardians. The web application of the system will be utilized by the caregivers/guardians to store, display, and monitor the vital signs and real-time location of the elderly. The creators also employed a loT cloud server platform like Adafruit. The Node MCU (ESP 32) microcontroller was employed by the creators as the system's controller and brain.

IoT-Based Smart Health Monitoring System for COVID-19

A system was created by Bhardwaj, Joshi, and Gaur (2022) to support COVID-19. They created the method to avoid the necessity for patient and healthcare professional gatherings and in-person hospital visits. To keep track of a person's vital signs, the Internet of Things was used. Their study involved the use of several hardware components, such as a microcontroller equipped with an integrated ADC, a contactless temperature detector, an oximeter, and a blood pressure sensor. The Raspberry Pi was used in combination with the aforementioned devices to gather data, transmit it to the cloud for storage, and then analyze it.

The creators of the devised system additionally used Internet of Things (loT) technology to track the elders' physiological temperature, heart rate, oxygen saturation, and current location. This will make it easier for elderly caregivers and guardians to regularly check on their vital indicators.

VITAL APP: Development and User Acceptability of an IoT-Based Patient Monitoring Device for Synchronous Measurements of Vital Signs

In 2019, Vital App was an application developed by Garcia, Pilueta, and Jardiniano. It is an Internet of Things device that provides real-time vital sign readings. Other medical professionals can utilize the accurate readings of the patient's body temperature, blood pressure, and pulse in order to categorize medical conditions. Body temperature measurements made with the LM35 precision integrated circuit body temperature sensor are guaranteed to be within 0.5°C of the true range. Through the use of Analogue to Digital Converter (ADC) pin connections to microcontrollers, temperature readings are captured. The pulse rate is determined through the utilization of a pulse oximeter, which rises two distinct wavelengths in order to quantify the frequency of heart beat per minute. A sphygmomanometer is also employed for the purpose of measuring blood pressure.

The system's designers also made use of loT technology, which allows for the collection, storage, and display of vital indicators as well as the real-time location of an older. This allows guardians and carers to keep an eye on the elder's health and location.

Iot Based Real-Time Monitoring and Control System for Smart Indoor Hydroponic Vertical Farming System

Researchers Yusuf, Sahrani, Sarker, and Samah (2022) created a system that uses loT to continually monitor and regulate the environment. They used the ESP32 module and Adafruit IO to create this system. A system can be measured in real-time and have its characteristics changed right away by incorporating sensors and actuators inside of it. The Adafruit IO Cloud then receives the values, and the dashboard displays the measurements for each parameter. The system's controls for the pumps that deliver water, nutrients, and light have also been automated thanks to the use of Adafruit IO cloud. In the event that any critical system conditions develop, Adafruit IO will notify the user via an alert message.

As the primary controller of the researchers' system, the ESP32 microcontroller development board natively supports the MQTT protocol, which is a compilation of rules based on standards used for machine-to-machine communication. The ESP32 is connected to the DHT22 ultrasonic sensor, the TDS (Total Dissolved Solids) sensor that measures the concentration of dissolved organic and inorganic compounds in water, and the TDS (Total Dissolved Solids) sensor." The researchers also changed the system's power source from an AC-DC converter and charging mechanism to the 12 VDC battery to an AC power outlet.

The central processing unit of the system is an ESP 32 module, which was also utilized by the developers to connect the system to WIFI and loT. The device tracked, displayed, and stored the elder's location in real time as well as the value of their vital indicators using the LoT cloud platform Adafruit 10.

Health Monitoring Smart Glove System

The issues faced by people who are bedridden, paralyzed, or deaf are efficiently addressed by a device created by Jahnavi, Thumma, Teja, Gunasree, and Kiran (2022) called Health Monitoring Smart Glove using ESP32 Microcontroller. Its intuitive design allows the user and his or her carer to communicate and interact in real time.

In order to collect real-time data on vital signs and elders' locations, the developers additionally included an ESP 32 that links the device to WIFI and loT.

IoT Based Health Monitoring System

In his Internet of Things-based health monitoring system, Devanshu (2022) utilized an ESP 32 microcontroller. Using affordable, locally available sensors, the project intended to develop a remotely accessible health monitoring system. More features, such as ambulance services, a list of well-known physicians and their qualifications, a list of hospitals and their specialized facilities, and more, might be added to the mobile app, claim the authors.

A further component of the system was the Node MCU (ESP 32), which over the IoT cloud platform enables guardians and caregivers to track the vital signs and real-time whereabouts of the elderly. Its aim was also to reduce the difficulties guardians and caregivers experience in monitoring the elderly.

COVID-19 Patient Health Management System Using IoT

In Rao, Prasad, Chitti, and Kumar's (2021) system, an ESP32 serves as the control unit. Using an output sensor linked to the ESP32 and the remote alert switch feature of the liquid crystal display, the patient's condition is tracked in real time. The research's results indicated that, especially in the healthcare industry, an IoT-based system provides an acceptable alternative for effectively monitoring isolated patients. It allows doctors to detect illnesses from any location, save confidential data about an individual securely in the cloud, and—above all—shorten hospital stays for routine tests.

Additionally, an IoT-enabled device was employed by the developers to effectively monitor the elder's whereabouts and real-time vital signs. Furthermore, the developers established a connection to the IoT cloud platform by utilizing the data or WiFi connectivity of the ESP 32.

Individual protective equipment (PPE) for health-care workers (HCWs) and COVID-19 patients includes a smart facial shield for monitoring COVID-19 physiological parameters.

Syed, Zahid, Mushtaq, Baig, and Umar (2022) devised a system that is intended for medical personnel during the pandemic. Health care professionals are struggling to save the lives of millions of COVID-19 patients. Because of this, it is crucial to make sure they get adequate covid protection. Face masks and face shields are some of their equipment, although these are insufficient to ensure their safety. As a result, they created a smart face shield for their system that could keep an eye on their vital indicators. The Heart Rate and LM35 Body Temperature Sensor, which is incorporated, can read a person's heart rate, oxygen saturation, and body temperature. The smartphone application The ESP8266 module is linked to Thing Speak in order to facilitate the continuous monitoring of their physiological attributes in real-time. In general, their system has demonstrated its capability to provide precise measurements and findings, as well as monitor the essential elements of COVID-19.

The developers employed MAX30102 to measure the heart rate, Sp02, and body temperature of elderly people. In addition, the current study made use of the NodeMCU (ESP32) to connect the sensor and transmit data to the Adafruit cloud platform.

An IoT-Based Oxygen Saturation and Heart Rate Alert System for COVID-19 Wards

Ravindran and Jumadi (2022) have developed a device with the purpose of monitoring individuals inflicted with COVID-19. In addition to alerting users to sudden decreases in the patient's pulse rate and oxygen saturation (Sp O2), the device is capable of delivering practical assistance in such situations. They built their hardware with a MAX30102 sensor, NodeMCU ESP8266, an Arduino UNO, two OLED screens, and two buzzers. Monitoring and displaying the heart rate and SpO2 is facilitated by the IoT cloud platform ThingSpeak, it will be integrated to send the data. An alert signal will be delivered if the Sp02 drops below 94%, the BPM is between 60 and 120, or both.

The MAX30102 sensor was utilized by the system's designers to measure the elderly person's body temperature, Sp02 (oxygen concentration), and heart rate. The developers also integrated the NodeMCU (ESP32) Wi-Fi module in order to establish a connection with the sensor and transmit the collected data to the Adafruit IoT cloud platform. Evidently, the programmers also incorporated the IFTTT platform.

IoT-enabled emergency information supply chain architecture for the elderly

Based on the system designed by Gill, Phennel, Lane, and Phung (2019), "IoT-enabled emergency information supply chain architecture for elderly people: The Australian context" their research focused on how to effectively communicate emergency information to the elderly. Taking care of them might be difficult because doing so could affect their well-being. The proper information does not get through to them. This review focuses on finding a solution to this problem. Resalert's applicability was assessed utilizing a test case, a portable Raspberry Pi-based system prototype, and a user evaluation. The results of this study indicate that the suggested strategy has the potential for the efficient communication of emergency information to older people.

Wearable IoT-enabled real-time health monitoring system

According to Wan, Al-awlaqi, Li, et al. (2018), maintaining independent living is becoming more and more important as the age profile of many societies rises and the number of people suffering from chronic illnesses like diabetes, cardiovascular disease, obesity, and so forth rises. Sensing, remote health monitoring, and eventually daily life activity recognition have shown promise. The Internet of Things (IoT) is gaining rapid appeal in several domains, especially in the realm of personalized healthcare, from a technological perspective. Body area sensor networks (BASN) are extensively used in the framework of the Internet of Things (IoT), particularly for the purpose of ongoing health monitoring. ECG monitoring is frequently used as a crucial method of heart disease diagnosis.

Conceptual Model of the Study

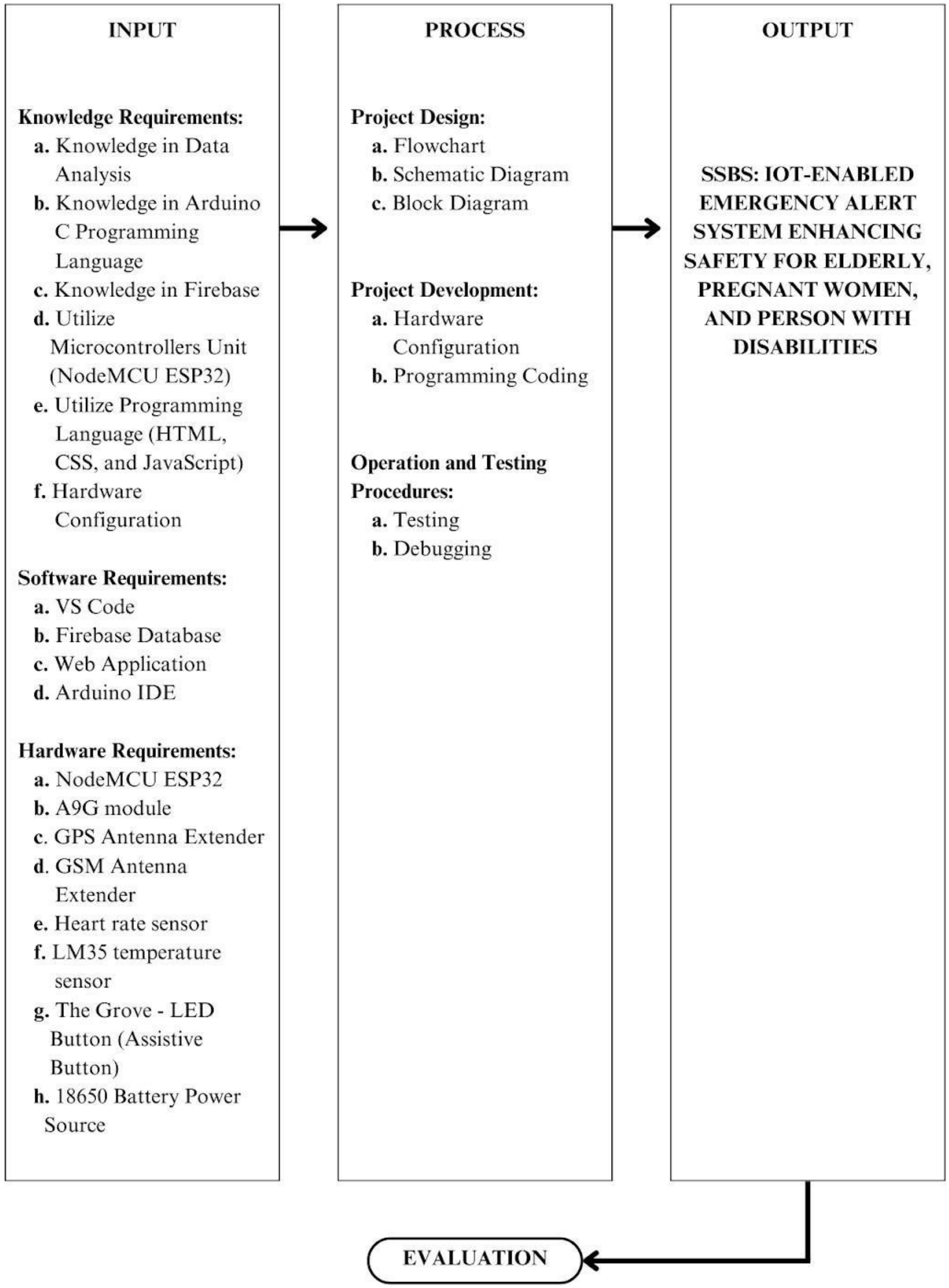


Figure 7. Conceptual Model of the Study

Input

The input requirements (as displayed in Figure 7) for the research study are divided into three categories in the conceptual model: Knowledge Requirements, Software Requirements, and Hardware Requirements. The researchers need to determine each category to build the system. Knowledge Requirements are the theoretical knowledge and information about the system that the researchers need to know as a basis and foundation for the system development. Software Requirements are the software tools that the researchers used to develop the system including the VS Code, Firebase Database, Web Application, and Arduino IDE. Hardware Requirements are the physical components that the researchers used to completely build the system. They were made up of NodeMCU ESP32, A9G module, GPS Antenna Extender and GSM Antenna Extender, Heart Rate sensor, LM35 Temperature sensor, The Grove - LED Button (Assistive Button), and 18650 Battery Power Source. As all the important requirements were mentioned, they are recognized as instruments and tools that the researchers used to finalize the implementation of this device.

Process

The process phase of the system was divided into three stages: Project Design, Project Development, Operation and Testing Procedures and Evaluation. The Project Design is indicated by using the Block Diagram, Flowchart, and Schematic Diagram. Project Development covers the process on how the researchers developed and built the system which consists of program coding and hardware assembling. while Operation and Testing Procedures include ensuring the system testing, efficiency, reliability, and safety of the system’s process.

Output

An IoT-Enabled Emergency Alert System is a wearable device with health analytics for the elderly, persons with special abilities, and pregnant women. It is the expected result through implementing the knowledge, software, and hardware requirements as well as the procedures undertaken starting from Project Design through Project Development to Operation and Testing Procedures.

Evaluation

After the system has been developed and structured, the following phase is the Evaluation, which involves implementing and testing the system. The system underwent evaluation by the target participants, who assess its quality standard and compliance.

Operational Definition of Terms:

A full description of the technical terms and measures utilized in the study are presented below.

Elderly - People aged 60 years old and above. The system's intended users, who will wear the device and whose whereabouts, body temperature, and heart rate are being tracked by caregivers or guardians.

Firebase - Google's Firebase simplifies app development, management, and growth without programming.

User - an individual who operates or interacts with a device, system, or application. This person utilizes the features and functionalities of the device.

Guardians/Caregivers - Individuals who will be in charge of keeping track of the elders' whereabouts, body temperature, and heart rate in real-time.

Persons with Special Abilities - refers to individuals who have long-term physical, mental, intellectual, or sensory impairments which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others, they include children with special needs.

Integrated - Refers to the combination and connection of both hardware and software systems.

Location - Relates to the area where the elders, persons with disabilities, and pregnant women are.

Temperature - Relates to the body's level of internal heat in a patient.

Vital Signs - In particular, the body temperature and pulse rate from the clinical assessments should be cited.

Wearable Device - Includes any Internet of Things (IoT) device that can be connected to the system and is able to provide data to the system's server.

Chapter 3

METHODOLOGY

This chapter presents the project design, project development, operation and testing procedure, and evaluation procedure.

Project Design

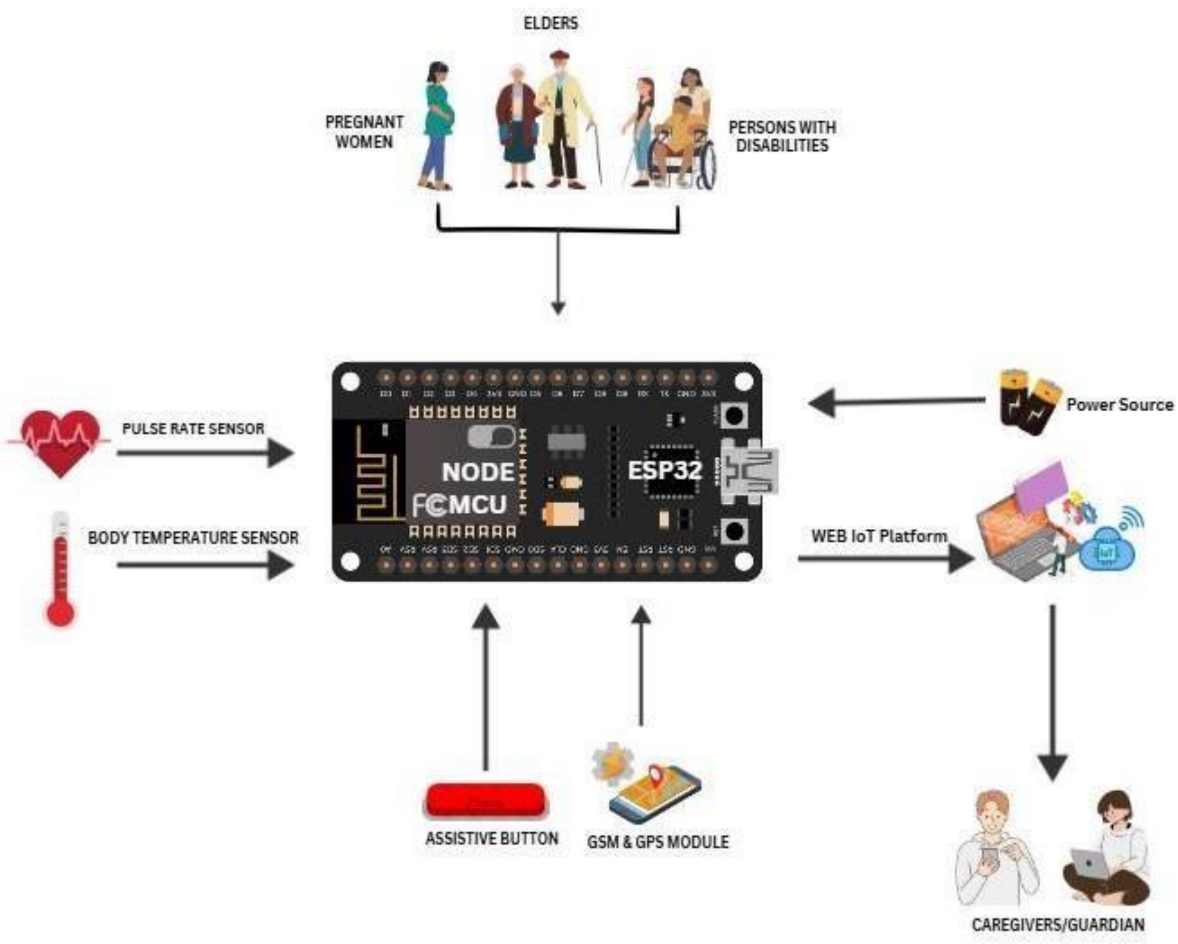


Figure 8. Block Diagram of the SSBS Wearable Device

Figure 8 shows that the NodeMCU ESP32 of the wearable tracking device is the central processing unit. The NodeMCU ESP32 collects and gets data gathered from the sensors called the Heart Rate Sensor and LM35 Sensor for body temperature. This sensor can read Heart Rate and Body Temperature. The figure also displays the use of an A9g GPS and GSM Module which enables tracking the movements of the user in real time. The location of the user can be monitored by the caregiver/guardians through a map interface that is integrated into the IoT cloud platform. The GPS coordinates (latitude and longitude) will be sent to NodeMCU ESP32 to the IoT platform and displayed and monitored by the caregiver/guardians in their phones or computers. The NodeMCU ESP32 is powered by an external power supply.

In addition, there will be an IoT Web platform that will receive the sensor's data that can be accessed by the guardian or caregivers whether they are using a laptop, mobile phone, and a browser. It makes it easier for caregivers/guardians to access such data enabling them to monitor the elder's pulse, vital signs, and real-time location.

Flowchart

The flowchart as shown in Figure 9 illustrates the initiation of a comprehensive emergency monitoring system of the SSBS. It begins with powering the system and activating critical components, including GPS and GSM Module for location tracking and communication. It also encompasses the startup of sensors such as the body temperature and heart rate sensors, which continually monitor these vital health parameters. By combining these elements, the system can provide real-time health and location data, allowing for prompt emergency response and alerts to guardians, caregivers or relevant parties in situations where the user's well-being is at risk.

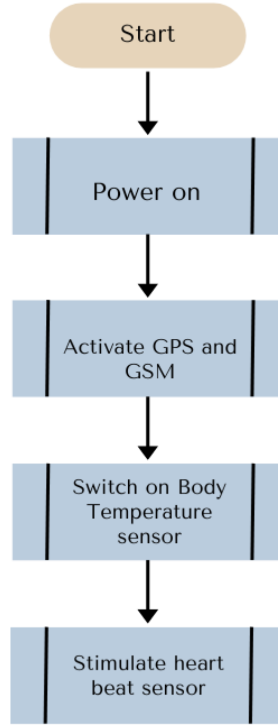


Figure 9. Flowchart of the SSBS's IoT-Enabled Emergency Alert System

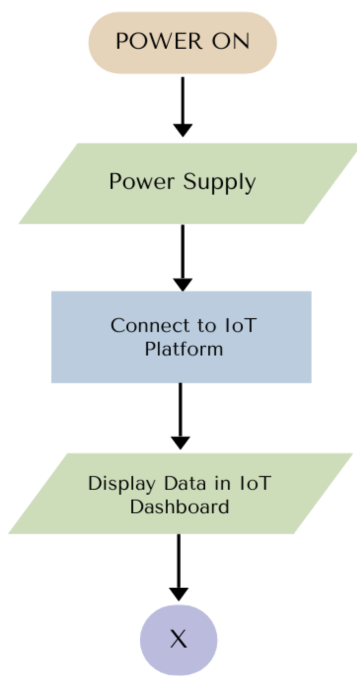


Figure 10. Flowchart of powering on the SSBS's IoT-Enabled Emergency Alert System

From figure 10, the main functionality of the emergency alert system can be seen. It starts with the Power On of the device, after the power initialization of the device the Power Supply goes on, and the components are attached to it. When the system is successfully connected to the IoT platform, the system will display the result/data of the device in the IoT dashboard. Following that, the system will proceed to process X.

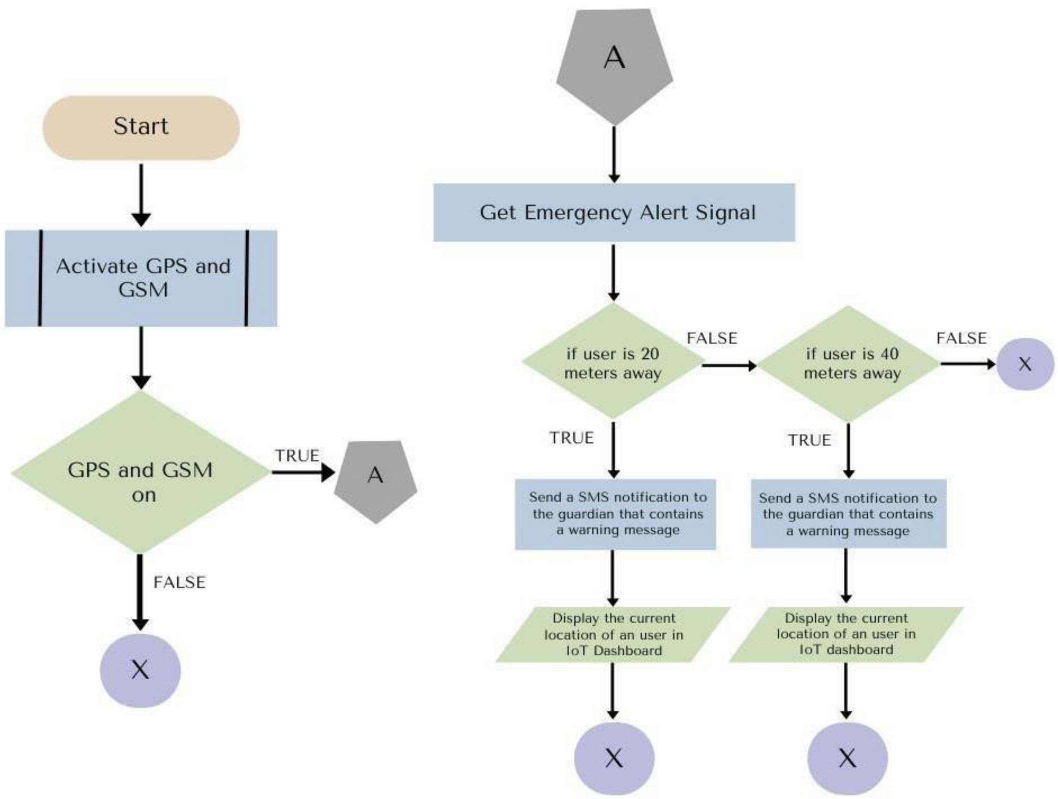


Figure 11. Flowcharts of Getting the Location

The figure above discusses how to get the current position of the user's devices. It begins the activation of the GPS and GSM. If the GPS and GSM fail to turn on, the device will continue to reconnect until it successfully connects to the present location of a user. After successfully activating the GPS and GSM, the device will proceed to A. If the user gets the emergency alert signal and if the user is 20 meters away or 40 meters away from the guardian. The location of the user will be shown/seen on the Internet of Things (IoT) dashboard and the guardian will receive a notification alert that contains a warning message.

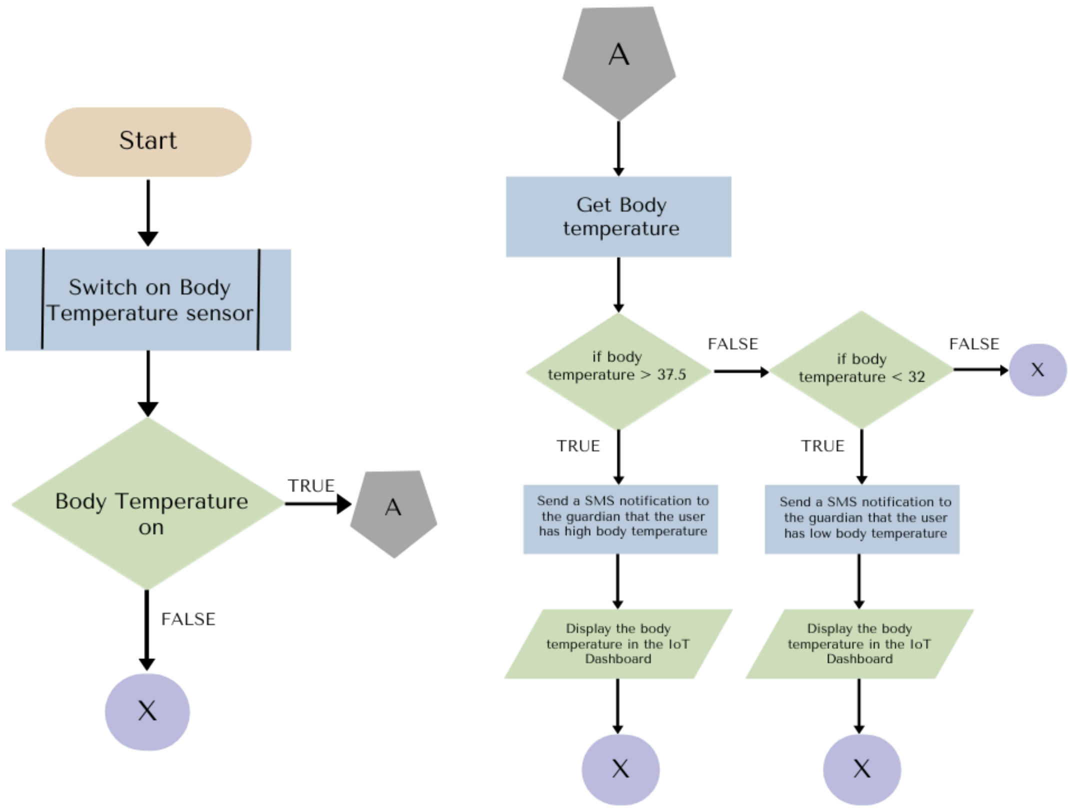


Figure 12. Flowcharts of the Body Temperature Notification

As presented in figure 12, the user's body temperature is initially determined using a sensor. To determine if the user has a high body temperature, a conditional statement is used to check if his or her temperature exceeds 37.5 degrees Celsius. This temperature is commonly recognized as a threshold for indicating the presence of an illness or fever. When the condition is met (specifically, when the user shows a high body temperature), an SMS notification will be sent to the user's guardian or caregiver. Informing the caregivers/guardians of the rise in temperature is a vital step that would enable them to respond properly, including seeking medical attention, should the need occur. The higher body temperature reading is synchronously stated on an IoT dashboard, this feature enables the monitoring and tracking of temperature data in real-time. When the initial condition is not met (i.e., the user's body temperature does not exceed 37.5 degrees Celsius), the condition then checks if the Body Temperature < 32. if the condition is met (the user has a low body temperature), the caregiver/guardian is notified via SMS. Similar to situations involving high body temperature, it is important to inform him or her when the user's body temperature drops to that level. Like the scenario that involves raised body temperature, the IoT Dashboard additionally displays the low body temperature reading, providing a complete temperature history.

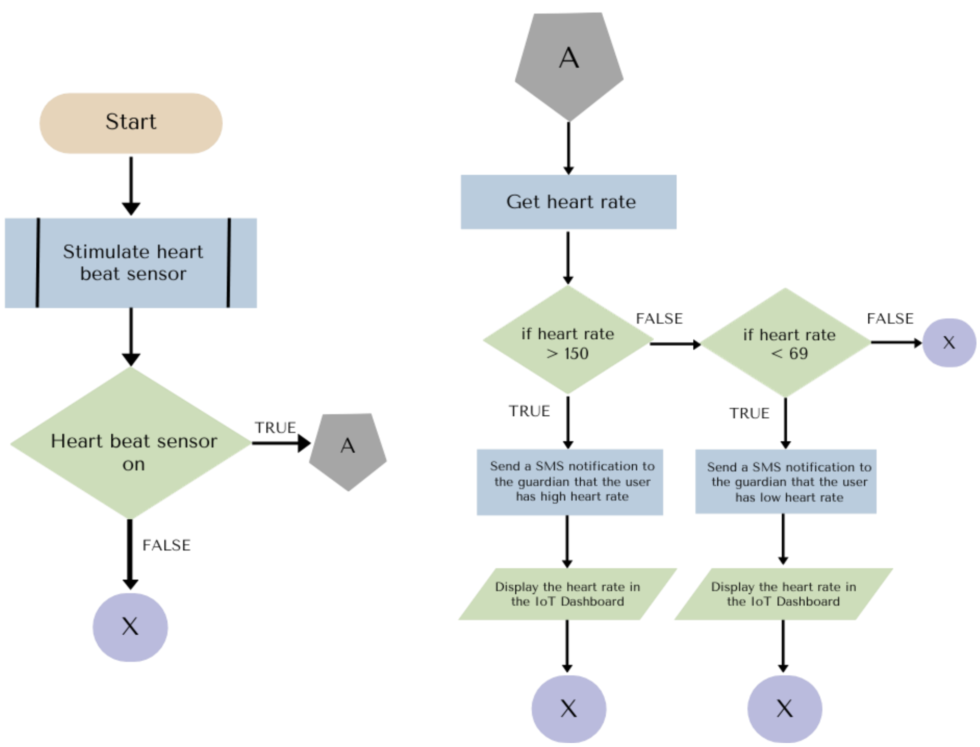


Figure 13. Flowcharts of the Heart Rate Notification

Figure 13 provides details of a heart rate monitoring process that utilizes a heart rate sensor. It starts by measuring the user's heart rate. If the heart rate goes above 150 beats per minute, a high heart rate alert is sent to the caregiver/guardian through SMS. Simultaneously, the heart rate reading is displayed on an IoT dashboard. Also, if the heart rate falls below 69 BPM, indicating a low heart rate, a notification is sent to the caregiver/guardian, and the heart rate data is shown on the IoT platform. This device promptly notifies caregivers/guardians when heart rates are either too high or too low, and it also maintains a record of heart rate data for immediate tracking and decision-making.

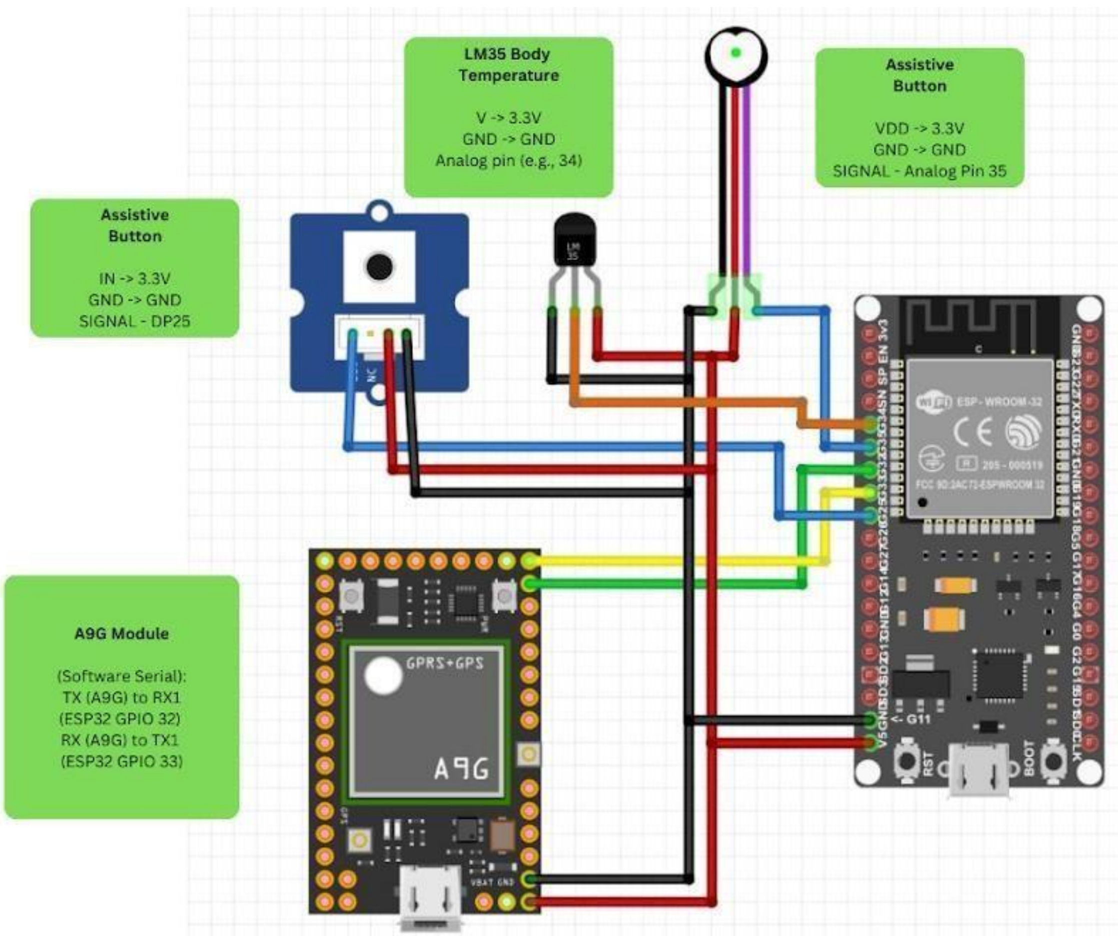


Figure 14. Schematic Diagram for SSBS

This schematic diagram illustrates an electronic circuit featuring multiple interconnected components, mainly centered around the NodeMCU V2 module, serving as the primary microcontroller board. Connected via colored wires, it interfaces with various elements including the LM35 temperature sensor, the HW-827 sound sensor, and a button for digital input. Powered by two AA batteries, the figure showcases the connections and power flow within this circuit setup.

Project Development

The following step-by-step procedures were done during the development of the project prototype.

Hardware Requirements

1. Collected and secured the required parts for the Emergency Alert System.
2. Assessed all the hardware requirements needed to build the prototype:
   a. NodeMCU (ESP32)
   b. A9G Pudding Module (GPS and GSM module)
   c. GPS Antenna Extender
   d. GSM Antenna Extender
   e. LM35 Body Temperature
   f. Heart Rate Sensor
   g. The Grove - LED Button (Assistive Button)
   h. 18650 Battery Power Source
   i. 5G Sim Card
3. Assembled the hardware components.

a. For NodeMCU ESP32 and A9G Pudding Module configuration

i. Attached the GPS and GSM module to the A9G Pudding Module.

ii. Attached the 5G SIM card to the A9G Pudding Module.

iii. Connected the A9G Pudding Module to NodeMCU ESP32 using male-to-female jumper wires.

iv. Connected the A9G Pudding Module to a power source.

b. NodeMCU (ESP32)

i. Attached the LM35 for body temperature sensor

ii. Attached the Heart Rate Sensor

iii. Attached the Assistive Button

iv. Connected the NodeMCU (ESP32) to the computer to upload a code.

4. Tested the prototype system.

Software Requirements

1. Developed a system's flow algorithm for the Emergency Alert System.
2. Installed all the needed software applications.

a. Arduino IDE - an integrated development platform for programming and uploading code to Arduino.

b. Visual Studio Code - is a lightweight, cross-platform source code editor with powerful features, essential for efficient software development.

c. IoT Platform - a framework that allows the development and management of Internet of Things (IoT) applications and devices.

d. Firebase - Firebase is a comprehensive mobile and web application development platform that provides real-time database, authentication, hosting, and other cloud-based services for building scalable and dynamic applications.

3. Created a program using the HTML, CSS, and JavaScript programming language for the Emergency Alert System.
4. Executed the program to test functionalities depending on its features.
5. Debugged the program to establish its reliability.

Operation and Testing Procedures

The operation and testing procedures of the Emergency Alert System were performed to test its functionalities and reliability.

1. The procedures undertake to get the Body Temperature and Heart Rate are as follows:
   a. Started the device by pressing the power button.
   b. Internet or data access is required for users.
   c. The user's body or clothing must be covered by the gadget, which must be worn by the user.
   d. The device will read the user's body temperature and heart rate.
   e. The caregiver/guardian will receive the results on their IoT platform.
2. The procedures undertaken to get the real-time location of the user are as follows:
   a. Powered on the device.
   b. The user is required to have an internet or data connection.

c. The device will get the GPS and GSM (latitude and longitude coordinates) automatically.
d. The coordinates will be sent and displayed in the IoT platform dashboard.

Testing Procedure

To accurately assure the system's quality, it was evaluated in a real-life scenario based on its functionalities and accuracy. The following procedures were performed in determining the functionality and accuracy of the project.

1. Checked if the device is giving a valid and accurate location of the user.
2. Checked if the location is sent through SMS and displayed in the IoT platform dashboard.
3. Checked if the LM35 sensor was able to analyze body temperature.
4. Checked if the heart rate sensor was able to analyze heart rate.
5. Checked if the Body Temperature and Heart Rate are displayed in the IoT platform dashboard.
6. Checked if an alert notification is sent to the guardian/caregiver if the temperature is too low or too high.
7. Checked if an alert notification is sent to the guardian/caregiver if the heart rate is too low or too high.
8. Checked if an alert notification is sent to the guardian/caregiver if the button is pressed.
9. Checked if an alert notification is sent to the guardian/caregiver and contains a warning message.

Functionality Test

The system's performance and functionality were evaluated to ensure they are aligned with the system's structure and the expected outcomes.

After the creation stage, the examiner executed the subsequent procedures for the functioning test. The following are subsequent procedures the researchers performed for the functionality test of the project:

1. Test cases were developed to assess the functionality of each module within the system.
2. The test cases were executed.
3. The results of the test were documented.

Table 1.

Test Case Procedure for Location

	Steps Undertaken	**Expected Result**
Location	Powered on the device, got connected to the internet and went to the IoT platform dashboard.	Show the real-time location of the user in guardian's IoT platform dashboard.

Table 2.

Test Case Procedure for Sensors

	Steps Undertaken	**Expected Result**
Body Temperature	Powered on the device, got connected to the internet, wore the device, and went to the IoT platform dashboard.	Read and show the body temperature of the user in guardian’s IoT platform dashboard.
Heart Rate	Power on the device, connect to the internet, wear the device, and go to the IoT platform dashboard.	Read and show the heart rate of the user in guardian’s IoT platform dashboard.

Table 3.

Test Case Procedure for Alert Notification

	Steps Undertaken	**Expected Result**
High Temperature	The user Body Temperature is greater than 37.5° C	The guardian/caregiver will receive an Alert Notification telling that the Body Temperature is high.
Low Temperature	The user Body Temperature is less than 37.5° C.	The guardian/caregiver will receive an Alert Notification telling that the Body Temperature is low.
High Heart Rate	The user Heart Rate is ranging from 131 BPM to 150 BPM.	The guardian/caregiver will receive an Alert Notification telling that the Heart Rate is high.
Low Heart Rate	The user Heart Rate is ranging from 40 BPM to 59 BPM.	The guardian/caregiver will receive an Alert Notification telling that the Heart Rate is low.
Location is situated 20 or 40 meters away	The user's Location is 20 or 40 meters away from the guardian/caregiver.	The guardian/caregiver must receive an alert notification continuously that the user is 20 or 40 meters away and contains a warning message.

Table 4.

Test Case Procedure for Assistive Button

	Steps Undertaken	**Expected Result**
Assistive Button	Powered on the device, set up a connection to the internet, and clicked the assistive button connected to the device.	Sends an alert to notify the caregiver/guardian device that the user has pressed the button.

Table 5.

Test Case Procedure for Power Supply

	Steps Undertaken	**Expected Result**
Power Supply	Powered on the device using the power supply.	The device will run and start

Evaluation Procedure

The project's acceptability was assessed using the TUP evaluation instrument after the prototype has been validated through several tests. The evaluation forms were sent out to the respondents including IT professionals, healthcare workers, elders, and guardians or caregivers.

Steps involved in the evaluation process include:

1. Preparing the survey questionnaire utilizing the TUP evaluation instrument, the evaluation process was conducted.
2. Before evaluation, the researchers discussed the system's aims, functions, capabilities, limits, and operation to the respondents.
3. Then the respondents evaluated the system.
4. Each respondent received an evaluation form to rate the system according to several factors. The scale of ratings was based on table 6. It shows the Likert Scale's numerical rating and its descriptive rating. The highest rating is 4 meaning "Highly Acceptable", and the lowest rating is 1 described as "Not Acceptable".

Table 6.

Four-Point Likert Scale

Numerical Rating	Descriptive Rating
4.0	Highly Acceptable
3.0	Very Acceptable
2.0	Acceptable
1.0	Not Acceptable

5. The survey forms that have been completed were collected, tallied, and the weighted means were determined. They were interpreted using Table 7.

Table 7.

Range of Weighted Mean Values and its Verbal Interpretation

Numerical Rating	Verbal Interpretation
3.26 - 4.0	Very Acceptable
2.51 - 3.25	Acceptable
1.76 - 2.50	Fairly Acceptable
1.0 - 1.75	Not Acceptable

Chapter 4

RESULTS AND DISCUSSION

This chapter covers the project's description, project structure, project capabilities, limitations, and evaluation results.

Project Description

"SSBS: Iot-Enabled Emergency Alert System Enhancing Safety for Elderly, Pregnant Women, And Persons With Disabilities" is a wearable device that combines affordable health monitoring for body temperature and heart rate with real-time patient location tracking. There is only one component to the wearable device:

Figure 15. SSBS Emergency Alert Device

The primary function of the SSBS IoT-Enabled Emergency Alert System was to enhance the safety of elderly individuals, pregnant women, and persons with disabilities. An Internet of Things (IoT) platform-integrated wearable technology was developed to accomplish this. Simultaneously, the gadget can track the user's real-time location and track vital indications including body temperature. Real-time movement tracking was made possible by the gadget using Google Maps coordinates and a NodeMCU ESP32 as the central processor unit, along with a heart rate sensor and an LM35 body temperature sensor. A warning feature built into the device also notifies authorized caregivers/guardians by SMS when variations in temperature or irregularities in heart rate are noted. The main goal is to provide vulnerable people a user-friendly and cost-effective solution that makes monitoring them easier and gives their loved ones' peace of mind.

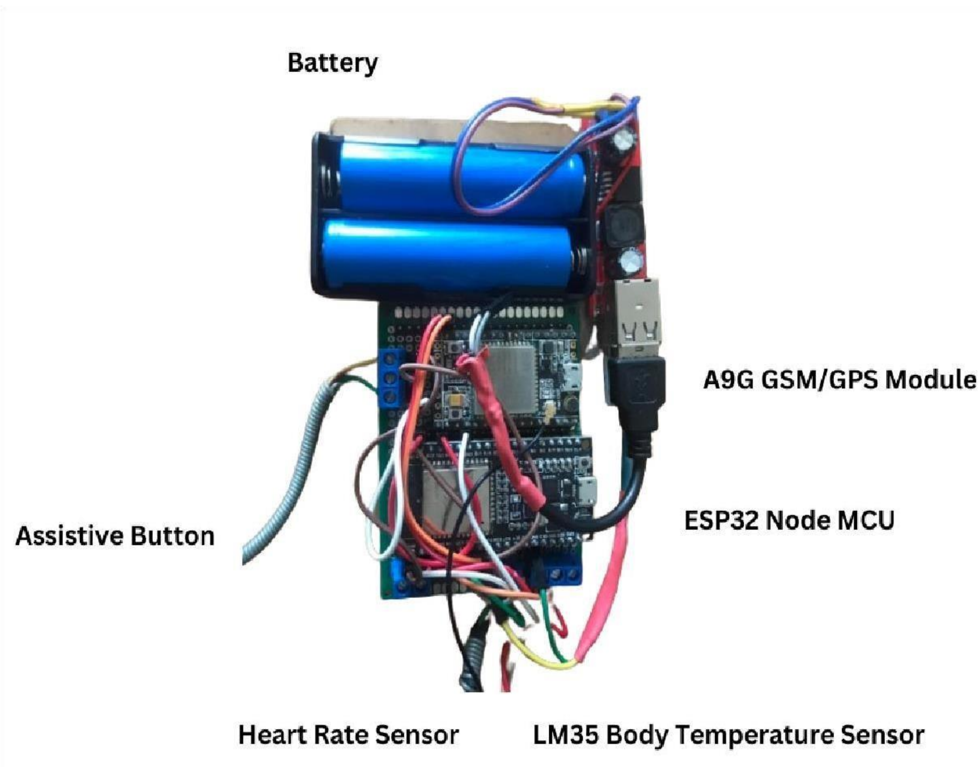


Figure 16. The System Components: SSBS Wearable Device

Project Structure

"SSBS: Iot-Enabled Emergency Alert System Enhancing Safety For Elderly, Pregnant Women, And Persons With Disabilities" is outlined in the following figures with all the hardware and software components:

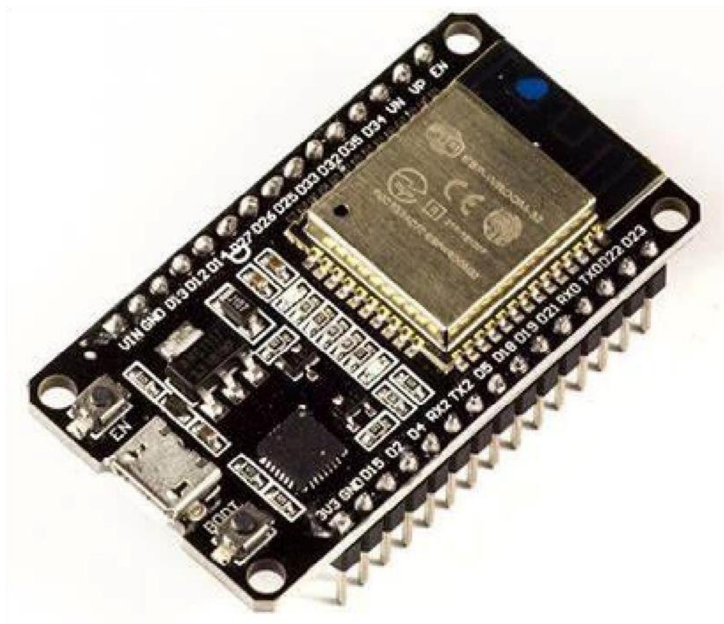


Figure 17. NodeMCU ESP32

Especially in IoT applications, the ESP32 chip serves as a powerful hub, allowing devices to connect across Bluetooth and Wi-Fi. "ESP32" can refer to development boards and modules that use this chip in addition to its actual form. Mobile devices, wearables, and an increasing number of IoT projects choose it a lot. One useful ESP32 IoT Starter Kit may be found on platforms like Mongoose OS by both developers and fans. With constant improvement of resources and capabilities, the ESP32 is today an ideal choice for both personal and business IoT projects.

Figure 18. A9g Module

The research objectives were achieved in majority thanks to the A9G module, which provides a wide range of capabilities. Small and flexible, the A9G module was developed by AI-Thinker and is renowned for its data processing, positioning, and communication capabilities. Geolocation capabilities of the project are improved by precise location tracking and geo-fencing capabilities offered by the integrated GPS capability of the A9G module. Applications needing fleet management, geographic data analysis, and asset tracking will find great use for this.

Figure 19. GPS Antenna Extender

Through the role of a force multiplier, the GPS antenna extension in the design enhances the performance and effectiveness of the GPS module. Since it reduces interference and signal attenuation, which raises the accuracy and dependability of GPS-based locating systems, the project offers precise geographical capabilities. Additionally, the seamless integration of the GPS antenna extension within the project's infrastructure and its connection with the current GPS modules reduce deployment difficulties and simplify operation processes. Applications of positioning technology in ground-based vehicles, unmanned aerial vehicles (UAVs), and permanent installations show the commitment to achieving technological excellence.

Figure 20. Indoor Stick GSM Router Antenna

In this project, increasing the range and stability of GSM communication networks depend significantly on the GSM antenna extender. Its improvement of signals, signal quality, and coverage range allows real-time data interchange and remote command execution, which ensures seamless connection and communication among project components. Furthermore, the simplicity with which the GSM antenna extender may be included into the project structure and its compatibility with the current GSM infrastructure reduce deployment difficulties and maximize operational efficiency. Installed in mobile platforms, IoT devices, or remote monitoring systems.

Figure 21. Heart Rate Sensor

A portable heart rate monitor allows people to record their heart rate for later study or to measure and show it in real time. Its main use is to record heart rate while engaging in various kinds of physical activity.

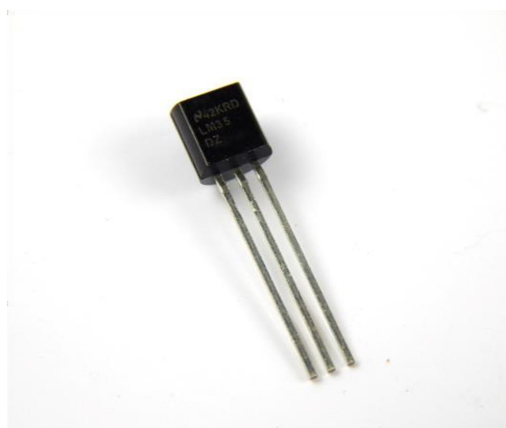


Figure 22. LM35 Body Temperature Sensor

A body temperature sensor is a medical equipment used to monitor the temperature of the human body properly. Usually, a thermal probe placed on a specific section of the body is used to measure the skin's interior temperature. Hospital facilities regularly use these sensors to track patients' body temperatures who would need constant observation, such those with fevers or other medical conditions.

Figure 23. LED Button (Assistive Button)

A basic part of the control system and user interface in the project architecture is the Grove - LED Button. Users may easily start tasks or enter orders thanks to its user-friendly button interface, and the LED indicator gives instant feedback, improving usability and user involvement. In addition, the Grove - LED Button's smooth connection with Grove-compatible platforms expedites development and shortens the time to market, freeing the researchers up to concentrate on the essential features and creativity of the project. Whether used in smart appliances, interactive displays, or do-it-yourself electronics projects, it is a prime example of the dedication to using user-centric design concepts and easily available technology solutions.

Figure 24. 18650 External Power Supply

An external power supply, also called a PSU (Power Supply Unit), is a device used to convert the alternating current (AC) power coming from an electrical socket into direct current (DC) power that is required for the operation of many electronic devices, such as servers, laptops, and computers. Usually, it includes several output connectors that allow several devices to be connected at once.

System Development Method

The researchers used a Prototyping Method for the system entitled IoT-Enabled Emergency Alert System Enhancing Safety for Elderly, Pregnant Women, and Persons with Disabilities. Martin (2023) regarding the Prototyping Methodology allows the researchers to design a prototype for a solution. In line with this, it consists of Requirement Analysis, Design, Building and Prototyping, Evaluation by User, Refining Prototype, and Final Product for the system. Its main goal is to demonstrate to the users how the prototype works and give them a concrete example of the suggested solution.

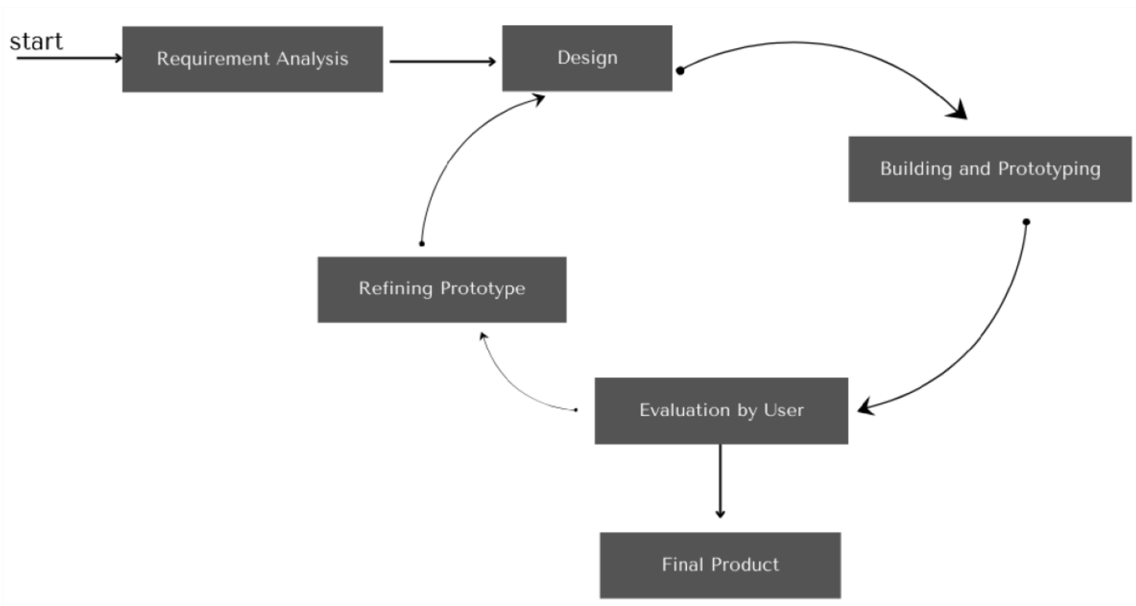


Figure 25. System Development Mehod

Requirement Analysis

This begins with Requirement Analysis, a starting point for designing a prototype model. The system was intended to define the specifications required for the device's development. In addition, the researchers created a Conceptual Model of the Study, which was presented in the previous chapter two, where the researchers assessed in relation to the study's objectives.

Design

The second stage in developing a system is design. In this phase, the system’s design framework was developed. The researchers used a flowchart to explain and illustrate the primary function of the system as well as a block diagram for the study that illustrates the various key components for the construction of the SSBS device.

Building and Prototyping

The third stage consists of the acts of creating and prototyping. This stage involved the creation of a physical prototype, which was accomplished by making use of the information obtained during the initial design phase. During this phase, the researchers started the building and development of the system in accordance with the specified requirements and functions of the system.

Evaluation

Following the completion of construction and prototyping, the primary evaluation by the client takes place. This step serves to pinpoint the positive and negative aspects of the operational model. Valuable inputs and recommendations were gathered from clients and communicated to the developers, contributing to the enhancement and advancement of the prototype. In this phase, the assessment process was conducted, involving the utilization of a structured questionnaire designed by the researchers for various stakeholders to fill out. The objective of this methodical approach was to optimize the performance and efficiency of the SSBS device.

Refining Prototype

Following this, prototype refinement occurs. Until all user-specified requirements are satisfied, this phase will continue. The construction of the final system, which strictly adheres to the approved final prototype, begins only after the user shows satisfaction with the developed prototype. Additionally, a thorough testing procedure was carried out to verify the functionality and dependability of the final system, which was constructed upon the approved final prototype. Also incorporated in this is the device's maintenance. The system is made available for production use after undergoing successful testing.

System Architecture

SSBS: IoT-Enabled Emergency Alert System Enhancing Safety for Elderly, Persons with Disabilities, and Pregnant Women is composed of only one device: The device serves the purpose of monitoring and reading vital signs, as well as determining the user's location through GPS coordinates, specifically latitude and longitude.

Figure 26. SSBS Architecture

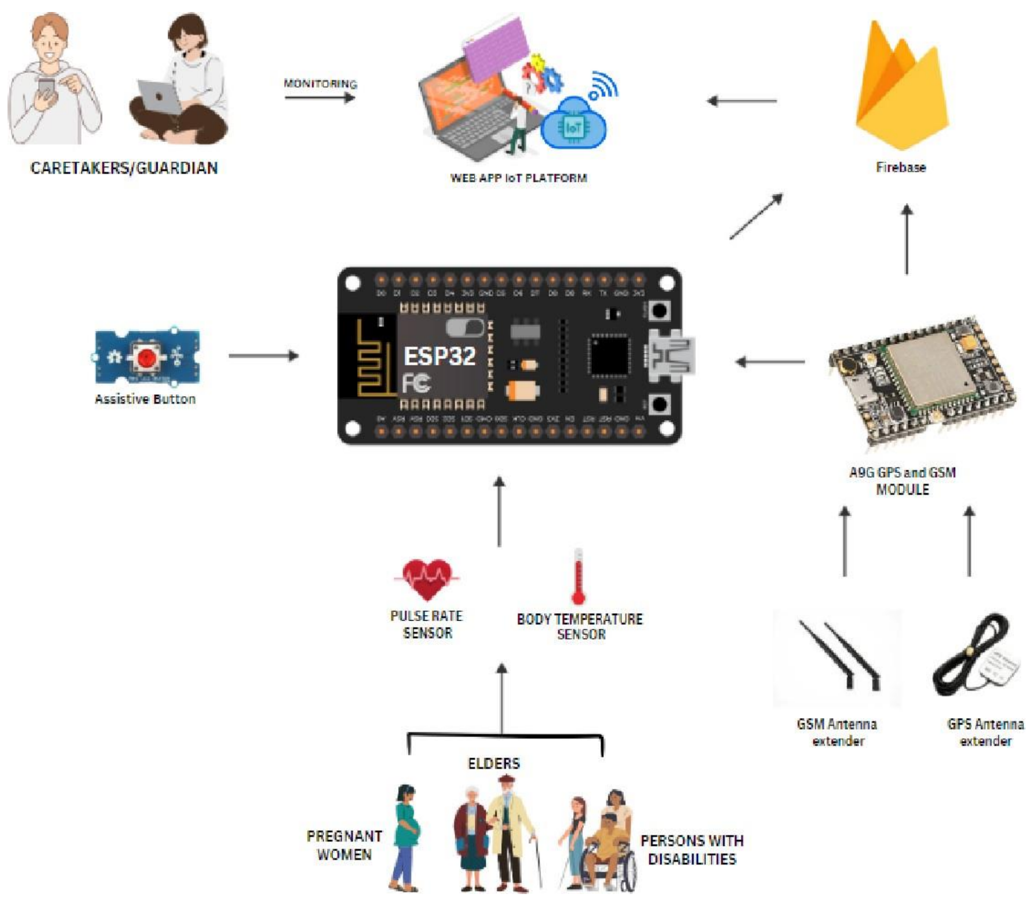


Figure 27. System Architecture of SSBS

System Capabilities and Limitations

The following are the Capabilities of the *SSBS: IoT-Enabled Emergency Alert System Enhancing Safety For Elderly, Pregnant Women, And Persons With Disabilities*

1. The system developed can locate the real-time location of the user.
2. The system developed can read and monitor the following user's vital signs:
    2.1. Body Temperature
    2.2. Heart Rate
3. The system developed can send an alert notification to caregivers/guardians of the user if:
    3.1. High Body temperature
    3.2. Low Body temperature
    3.3. High Heart rate
    3.4. Low Heart rate
    3.5. User's location
    3.6. Clicked the Assistive Button
4. The system developed has an assistive button and users can press it, whenever they need assistance.
5. The system developed can support multiple devices in monitoring the vital signs and location of the user.
6. The system developed can be accessed through PC/laptop and mobile phone devices using a browser.
7. The system developed can send an alert message when the user’s location exceeds 20 meters and 40 meters away from the caregiver’s/guardian’s location.

The following are the Limitations of the SSBS: Iot-Enabled Emergency Alert System Enhancing Safety For Elderly, Pregnant Women, And Persons With Disabilities

1. The system developed can only read and monitor the Body Temperature, and Heart Rate of the user.
2. The system developed can only be used with a stable data or internet connection since the device is an loT-based system.
3. The system developed may be unable to locate the exact location of the user, especially in indoor or closed areas. This is due the reason that the signal is weak, and the system cannot get the GPS coordinates of the user.
4. The SMS notification only contains a warning message and information about vital signs.
5. The system developed only relies on a continuous power supply. Power outages or battery depletion could render the system ineffective during emergencies.
6. The system is a one-way communication only. The caregiver/guardian cannot contact the user directly using the device.

System Testing

The researchers' system was developed primarily utilizing the NodeMCU ESP32, A9G GPS and GSM Module, Grove - LED Button (Assistive Button), LM35 body temperature sensor, heart rate sensor, 18650 Battery Power, Firebase Database, and HTML/CSS and JavaScript programming language. To make sure the built system satisfies the objectives and structure of the system, the system's functionality and accuracy were assessed by the researchers.

Functionality Test Result

This part presents the outcomes acquired during the Operation and Testing Procedures carried out by the researchers by obtaining the user's location and health analytics. The accuracy and functionality of test results for the developed system are detailed on the tables that follow:

Table 8.

Test Result of Location

	Steps Undertaken	Expected Result	Actual Result	Remarks
Location	Powered on the device, got connected to the internet and went to the IoT platform dashboard.	Show the real-time location of the user in guardian’s IoT platform dashboard.	The developed system successfully pinpointed the user's location, which was eventually displayed on the IoT Dashboard.	PASSED

Table 9.

Test Result of Sensors

	Steps Undertaken	**Expected Result**	**Actual Result**	**Remarks**
Body Temperature	Powered on the device, got connected to the internet, wore the device, and went to the IoT platform dashboard.	Read and show the body temperature of the user in guardian’s IoT platform dashboard.	The user's body temperature was visible on the caregiver’s/guardian's IoT dashboard, enabling precise monitoring for his or her well-being.	PASSED
Heart Rate	Power on the device, connect to the internet, wear the device, and go to the IoT platform dashboard.	Read and show the heart rate of the user in guardian’s IoT platform dashboard.	The caregiver’s /guardian's IoT platform dashboard effectively displayed the user's heart rate for easy monitoring.	PASSED

Table 10.

Test Result of Alert Notification

	Steps Undertaken	Expected Result	Actual Results	Remarks
High Temperature	The user Body Temperature is greater than 37.5° C	The guardian/caregiver will receive an Alert Notification telling that the Body Temperature is high.	The developed system was capable of transmitting an alert notification in the case of a higher than normal body temperature.	PASSED
Low Temperature	The user Body Temperature is less than 37.5° C.	The guardian/caregiver will receive an Alert Notification telling that the Body Temperature is low.	The developed system was capable of transmitting an alert notification in the case of a lower than normal body temperature.	PASSED
High Heart Rate	The user Heart Rate is ranging from 131 BPM to 150 BPM.	The guardian/caregiver will receive an Alert Notification telling that the Heart Rate is high.	The developed system was capable of transmitting an alert notification in the case of a higher than normal heart rate.	PASSED

Low Heart Rate	The user Heart Rate is ranging from 40 BPM to 59 BPM.	The guardian/caregiver will receive an Alert Notification telling that the Heart Rate is low.	The developed system was capable of transmitting an alert notification in the case of a lower than normal heart rate.	PASSED
Location is situated 20 or 40 meters away	The user's Location is 20 or 40 meters away from the guardian/caregiver.	The guardian/caregiver must receive an alert notification continuously that the user is 20 or 40 meters away and contains a warning message.	The developed system was capable of receiving an alert notification continuously containing the warning message and information about the user's location 20 or 40 meters away.	PASSED

Table 11.

Test Result of Assistive Button

	Steps Undertaken	**Expected Result**	**Actual Result**	**Remarks**
Assistive Button	Powered on the device, set up a connection to the internet, and clicked the assistive button connected to the device.	Sends an alert to notify the caregiver/guardian device that the user has pressed the button.	When the button was pressed, the developed system would sent a notice alert.	PASSED

Table 12.

Test Result of Power Supply

	Steps Undertaken	**Expected Result**	**Actual Result**	**Remarks**
Power Supply	Powered on the device using the power supply.	The device will run and start.	The device can run and start.	PASSED

Table 13.

Test Case Summary

TEST EXECUTION	EXPECTED RESULT	ACTUAL RESULTS
SUCCESSFUL	100%	100%
FAILED	0%	0%

The outcome summary of the test case utilized to evaluate the functionality of the system is presented in Table 13. It can be seen in the table that all implemented system functions were operational, as each of the evaluated test cases achieved a success rate of 100%.

Accuracy Test Result

The operational testing procedures conducted by the researchers in order to measure the accuracy produced the data presented in Table 4. To compare system results, the researchers utilized a thermal scanner and pulse oximeter. Following a series of 10 trials in which the researchers attempted to detect vital signs, the average percentage error of the 10 trials was calculated. **Percentage Error = | (Measured Value - Known Value) | / Known Value * 100%**

Table 14.

Accuracy Test Result of Heart Rate

Trial Number	SSBS Heart Rate	Pulse Oximeter BMP	Percentage Error
1	88	92	4.35%
2	80	79	1.27%
3	92	89	3.37%
4	74.84	93	19.53%
5	104	102	1.96%
6	78	90	13.33%
7	70	89	21.35%
8	89	88	1.14%
9	78	91	14.29%
10	73	91	19.78%
		Average:	**10.04%**

The heart rate measurements obtained from the developed system are presented in Table 14. The finding revealed that, the pulse rate result generated by the developed system shows an average error of 10.04%.

Table 15.

Accuracy Test Result of Body Temperature

Trial Number	SSBS Body Temperature	Thermometer Temperature	Percentage Error
1	34	33.59	1.22%
2	34.25	34	0.74%
3	35.33	35.20	0.37%
4	33.20	35	0.57%
5	33	33.70	2.08%
6	34.44	34	1.30%
7	34.08	33.70	1.13%
8	33.94	33	2.85%
9	35	35.43	1.21%
10	34.23	34	0.68%
		Average:	**1.22%**

Table 15 presents each result of 10 trials, including the percentage error of the developed system and the results of body temperature readings. The findings indicated the body temperature reading produced by the developed system exhibits an average error of 1.22%.

Table 16.

Summary of Accuracy Result

	PERCENTAGE ERROR
SSBS HEART RATE	10.04%
BODY TEMPERATURE	1.22%

The percent error summary of the SSBS results is presented in Table 16. The results indicated that the system has an error of 10.04% in determining the heart rate, and 1.22% in determining the body temperature.

System Evaluation

The system developed was evaluated by 35 respondents including IT Professionals, Elders, Pregnant women, Persons with Disabilities, Guardians/Caregivers, and Healthcare sectors.

Table 17.

Evaluation Result for Functionality

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Functionality		
Ease of Operation	3.51	Very Acceptable
Provision for Comfort and Convenience	3.37	Acceptable
User-Friendliness	3.62	Very Acceptable
Overall Weighted Mean	**3.50**	**Very Acceptable**

The first table for the system evaluation results focuses on functionality. The initial functionality indicator (Ease of Operation) received a weighted mean of 3.51, described as very acceptable. The second indicator (Provision for Comfort and Convenience) had a mean of 3.37, described as very acceptable, and the third indicator (User-Friendliness) achieved a weighted mean of 3.62, also described as very acceptable. Overall, functionality received an overall weighted mean of 3.50, described as very acceptable. These results indicate that the developed system offers convenient functions.

Table 18.

Evaluation Result for Aesthetics

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Aesthetics		
Appeal of the Color	3.48	Very Acceptable
Attractiveness of the Design	3.43	Very Acceptable
Appropriateness of Size	3.43	Very Acceptable
Overall Weighted Mean	**3.45**	**Very Acceptable**

Table 18 presents the evaluation results for aesthetics. The first indicator of aesthetics (Appeal of the Color) received a weighted mean of 3.43, described as very acceptable, while the next two indicators (Attractiveness of the Design and Appropriateness of Size) each had a weighted mean of 3.43 also described as very acceptable. Overall, the aesthetics achieved an overall weighted mean of 3.45, also interpreted as very acceptable. This result indicates that the developed system provides an appealing appearance for the device.

Table 19.

Evaluation Result for Workability

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Workability		
Availability of Materials	3.49	Very Acceptable
Availability of Technical Expertise	3.54	Very Acceptable
Availability of Tools	3.49	Very Acceptable
Overall Weighted Mean	**3.51**	**Very Acceptable**

Table 19 shows the evaluation results for workability. The two indicators (Availability of Materials and Availability of Tools) received weighted means of 3.49, described as very acceptable, and one indicator (Availability of Technical Expertise) obtained a weighted mean of 3.54 described as very acceptable. Overall, workability had an overall weighted mean of 3.54, described as very acceptable. This result suggests that the developed system is workable.

Table 20.

Evaluation Result for Durability

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Durability		
Quality of Materials	3.54	Very Acceptable
Quality of Workmanship	3.46	Very Acceptable
Quality of Design	3.51	Very Acceptable
Overall Weighted Mean	**3.50**	**Very Acceptable**

The table above is the evaluation result for durability. The first indicator of durability (Quality of Materials) was rated as very acceptable with a weighted mean of 3.54. The second one (Quality of Workmanship) was rated as very acceptable with a weighted mean of 3.46. While the third indicator (Quality of Design) had a weighted mean of 3.51, which is a very acceptable rating. The three indicators had an overall weighted mean of 3.50, a very acceptable rating.

Table 21.

Evaluation Result for Economy

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Economy		
Economy in terms of materials need	3.60	Very Acceptable
Economy in terms of time/labor spent	3.69	Very Acceptable
Economy in terms of machine/s required	3.60	Very Acceptable
Overall Weighted Mean	**3.63**	**Very Acceptable**

Table 21 displays the evaluation results for the criterion economy. All three indicators were rated as very acceptable, with weighted means of 3.60, 3.69, and 3.60, respectively. Overall, the economy achieved an overall weighted mean of 3.63, also described as very acceptable.

Table 22.

Evaluation Result for Safety

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Economy		
Absence of toxic/hazardous material	3.46	Very Acceptable
Absence of sharp edges	3.60	Very Acceptable
Provision for Protection device	3.69	Very Acceptable
Overall Weighted Mean	**3.58**	**Very Acceptable**

Table 22 shows the evaluation result for the safety of the project. Safety had an overall weighted mean of 3.58, which is described as very acceptable. Indicator 3 (Provision for Protection device) obtained the highest weighted mean of 3.60, closely followed by Indicator 2 (Absence of sharp edges) with a weighted mean of 3.60. Indicator 1 (Absence of toxic/hazardous materials) obtained the lowest weighted mean (3.46). All these values fall in the scale value described as very acceptable. The grand weighted mean was 3.50 described as very acceptable. This result indicates that the system developed passed all the criteria set for the study. The grand weighted mean was 3.50 described as very acceptable. This result indicates that the system developed passed all the criteria set for the study.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is an overview of the key findings of the research study which contains the summary of findings, conclusions, and recommendations of the developed system.

Summary of Findings

Based on the tests and evaluation conducted on the SSBS: IoT-Enabled Emergency Alert System, which aims to enhance safety for the elderly, pregnant women, and individuals with disabilities, the study yielded the following findings:

The designed prototype met the objectives set out in the study. Developed to detect a user's real-time position and monitor vital signs like heart rate and body temperature, the SSBS system sends this information to an IoT platform. The device promptly informs a caregiver/guardian of any deviation from normal values in any of the vital signs. This particular emergency notification system had to be thoroughly reviewed and several necessary components had to be included. Among its many noteworthy features are an LM35 temperature sensor for accurate body temperature measurement, a heart rate sensor for real-time pulse monitoring, and an A9G module for effective SMS notification delivery.

Questionnaires were distributed among a range of people to evaluate the features and impacts of the device. Five IT experts, five students, five caretakers, five expecting moms, five senior citizens, and five disabled people made up the group. This extensive sample does a good job of illustrating how easy to use and adaptable the device is.

The prototype, evaluated using the prototype evaluation form developed by the Technological University of the Philippines, received a grand weighted mean value of 3.53.

This favorable rating indicates that the gadget not only fulfilled but exceeds expectations in terms of satisfaction. Medical specialists with expertise in healthcare technology emphasized the device's significant value in emergency situations. Further data gathered throughout testing offered a far more complete overview of the device's capabilities. GPS positional accuracy was influenced by the surroundings and increases when used outside. Measures of body temperature and heart rate can also be affected by outside influences. These exact features are necessary for accurate data processing and understanding of possible reading inconsistencies by patients as well as healthcare professionals.

The SSBS system efficiently showed that it was capable of wide monitoring and surveillance of elderly, pregnant women, and individuals with disabilities by integrating sensors with the IoT platform, GPS, and GSM. When in-person interaction is not possible, the seamless integration of different technologies guarantees that these vulnerable people receive efficient care and assistance. Real-time data collection, location monitoring, and communication solutions can help caregivers enhance the general safety and well-being of their clients. Following that, they can monitor vital signs and act right away to fix any abnormalities that arise.

The SSBS project effectively achieved its primary objectives of implementing real-time location tracking as well as vital sign monitoring for the elderly, the pregnant, and the disabled by means of GPS, GSM, sensor integration, and the IoT. By the application of contemporary technology, the project greatly improved the ability to track, monitor, and help these people. The ability of the system to provide precise swift information ensures that caregivers/guardians can make wise decisions, which raises the standard of care and protection provided to these populations at risk.

Conclusion

Considering the results of the evaluation and testing of the SSBS Emergency Alert Device together with the goals of the study, the following conclusions were derived:

1. The SSBS Emergency Alert Device was successfully built with the following features:
    a. Able to read and monitor the user's heart rate.
    b. Able to read and monitor the user's body temperature
    c. Get the real-time GPS location of the user.
    d. Implemented Assistive Button
    e. Sends an alert notification to the caregivers/guardians if the user clicked the Assistive Button
    f. Sends an alert notification when the user's location exceeds 20 meters and 40 meters away from his/her caregiver/guardian.
2. The SSBS Emergency Alert Device was proven to send alert signals when there are changes in body temperature and heart rate.
3. The device was successfully developed using Visual Studio IDE, HTML, CSS, JavaScript and Arduino C Programming Language.
4. The SSBS Emergency Alert Device was successfully tested and proved to be functional, durable, safe to use, and evaluated with an overall rating of very acceptable.

Recommendations

The following recommendations are proposed to further enhance the existing prototype:

1. Improve the design of the prototype.
2. Improve the system by integrating additional sensors for other vital signs.
3. To get accurate location data, even when inside room or in a building, look into more advanced GPS technology or a hybrid method that combines GPS with other
4. positioning technologies.
5. Implement a feature that will make the system a two-way communication.
6. Implement a feature that allows the device to monitor and distinguish between typical daily activities and emergency situations.
7. Apply geofencing for more accurate and detailed location.
8. Implement a feature that will make the patient's vital signs and location, specifically who has the lowest or highest heart rate and body temperature, appear on the dashboard for the caregiver or guardian to monitor carefully.
9. Implement a feature where multiple devices are consolidated into a single interface for monitoring a single guardian/caregiver.

REFERENCES

Abalos, J. B. (2018). Older Persons in the Philippines: a Demographic, Socioeconomic and Health Profile. *Ageing International*, *45*(3), 230–254. https://doi.org/10.1007/s12126-018-9337-7

Adeniyi, E. (2021). *IOMT-Based Wearable Body Sensors Network Healthcare Monitoring System*. https://www.semanticscholar.org/paper/IoMT-Based-Wearable-Body-Sensors-Network-Healthcare-Adeniyi-Ogundokun/d0c3cd166a771b46a31a5328539cccefcc9aac88

Ahmad, N., & Zulkifli, A. M. (2022). Internet of Things (IoT) and the road to happiness. *Digital Transformation and Society*, *1*(1), 66–94. https://doi.org/10.1108/dts-05-2022-0009

Alrababah, Z. (2020). Privacy and security of wearable devices. *ResearchGate*. https://www.researchgate.net/publication/347558128_Privacy_and_Security_of_Wearable_Devices

Arm Ltd. (n.d.). *What are IoT Devices*. Arm | the Architecture for the Digital World. https://www.arm.com/glossary/iot-devices

Ayad Ghany Ismaeel, "Effective System for Pregnant Women using Mobile GIS ", paper appears in International Journal of Computer Applications (0975 – 8887) Volume 64– No.11, pages 1-7 February 2013.

Ayad Ghany Ismaeel and Sanaa Enwaya Rizqo, "Optimal Productivity of Succoring Patients System using Mobile GIS Based on WCF Technology" (IJCNWC), ISSN: 2250-3501 Vol.3, No2, pages 1-9 February April 2013.

Bhardwaj, V., Joshi, R., & Gaur, A. (2022). IoT-Based Smart Health Monitoring System for COVID-19. *SN Computer Science*, *3*(2). https://doi.org/10.1007/s42979-022-01015-1

BasuMallick, C. (2022c, August 26). Spiceworks. *Raspberry Pi models and features.* https://www.spiceworks.com/tech/networking/articles/what-is-raspberry-pi/

Bogdanchikov, A., Zhaparov, M., & Suliyev, R. (2013). Python to learn programming. *Journal of Physics*, *423*, 012027. https://doi.org/10.1088/1742-6596/423/1/012027

Business Law Today. (2019, March 27). *The Power of Place: Geolocation Tracking and Privacy - Business Law Today from ABA*. Business Law Today From ABA. https://businesslawtoday.org/2019/03/power-place-geolocation-tracking-privacy/

Chaudry, A. M. (2020). Using Arduino Uno microcontroller to create interest in physics. *The Physics Teacher*, *58*(6), 418–421. https://doi.org/10.1119/10.0001841

Chawla, N. (2020). AI, IOT and wearable technology for smart healthcare -A review. *ResearchGate*. https://www.researchgate.net/publication/344469618_AI_IOT_and_Wearable_Technology_for_Smart_Healthcare_-A_Review

Chittaro, L., Carchietti, E., De Marco, L., & Zampa, A. (2011). Personalized emergency medical assistance for disabled people. *User Modeling and User-Adapted Interaction*, *21*(4–5), 407–440. https://doi.org/10.1007/s11257-010-9092-2

Christina. (2010, September 16). *Benefits Of GSM - Benefits Of*. Benefits Of. https://benefitof.net/benefits-of gsm/#:~:text=The%20Global%20System%20for%20Mobile%20Communications

%20allows%20for,background%20noise.%20This%20makes%20communication%2C%20despite%20distance%2C%20easy

C, K. G. (n.d.). Internet of Things (IoT) characteristics. *www.linkedin.com*. https://www.linkedin.com/pulse/internet-things-iot-characteristics-kavyashree-g-c

Cruz G. T., Cruz C.J.P., and Villegas, J.A. (2019). Disability levels and differentials among Older Filipinos (UPPI Working Paper Series No. 2019-01). Diliman, Quezon City: University of the Philippines Population Institute.

Duggal, N. (2023). What are IoT devices? definition, types, and 5 most popular for 2023. *Simplilearn.com*. https://www.simplilearn.com/iot-devices-article

EMYNOS: A next generation emergency communication platform for people with disabilities. (2015, December 1). IEEE Conference Publication | IEEE Xplore. https://ieeexplore.ieee.org/abstract/document/7399986

Fanariotis, A., Andriopoulou, F., Orphanoudakis, T., & Politis, I. (2019b). An embedded framework enabling access of elderly and disabled persons to IP-based emergency communications. *Microprocessors and Microsystems*, *68,* 74–83. https://doi.org/10.1016/j.micpro.2019.05.006

Frankenfield, J. (2021). Geolocation: What it is, How it Works, Examples. *Investopedia*. https://www.investopedia.com/terms/g/geolocation.asp#:~:text=Geolocation%20refers%20to%20the%20use%20of%20location%20technologies,the%20movements%20and%20location%20of%20people%20and%20surveillance.

Fredrick, H. (n.d.). *Why Doesn't GPS Work Inside a Building?* ItStillWorks. Retrieved from https://itstillworks.com/doesnt-gps-work-inside-building-18659.html#google_vignette

Garcia, M. B. (2019). *VITAL APP: Development and user acceptability of an IoT-Based patient monitoring device for synchronous measurements of vital signs*. VITAL APP: Development and User Acceptability of an IoT-Based Patient Monitoring Device for Synchronous Measurements of Vital Signs. https://manuelgarcia.info/publication/vital-app?view=full

Gomez, S. M. (2020). MUSICHUB: a web and Android based rehearsal studio locator and reservation system in Davao City utilizing geolocation API and Rabin-Karp algorithm. *International Journal of Advanced Trends in Computer Science and Engineering*, *9*(3), 3746–3751. https://doi.org/10.30534/ijatcse/2020/189932020

Gupta, P. (2021). What is Arduino UNO? *EDUCBA*. https://www.educba.com/what-is-arduino-uno/

Hart, K. (2021). Raspberry Pi Pico: Review the specs. *All3DP*. https://all3dp.com/2/raspberry-pi-pico-review-specs/

Hossain, M. (2022). Wearable devices to revolutionize health care. *ResearchGate*. https://www.researchgate.net/publication/362593490_Wearable_Devices_to_Revolutionize_Health_Care

How do I use Raspberry Pi for development of IoT applications? (2022, February 7). https://www.hitaltech.com/en/articles/how-do-i-use-raspberry-pi-for-development-of-iot-applications/

Janice, J. H., & Jingle, D. J. (2020). An IoT-Based FOG computing approach for retrieval of patient vitals. In *Lecture notes in networks and systems*. https://doi.org/10.1007/978-981-15-5309-7_18

Karaduman, B., Asici, T. Z., Challenger, M., & Eslampanah, R. (2018, June 19). *A Cloud and Contiki based Fire Detection System using Multi-Hop Wireless Sensor Networks*. https://doi.org/10.1145/3234698.3234764

Kaur, D. C. (2022, June 6). *The cloud computing and internet of things (IoT).* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4129188

Kebe, M., Gadhafi, R., Mohammad, B., Sanduleanu, M., Saleh, H., & Al-Qutayri, M. (2020). Human Vital Signs Detection Methods and Potential Using Radars: A review. *Sensors*, *20*(5), 1454. https://doi.org/10.3390/s20051454

Kekade, S., Hseieh, C., Islam, M., Atique, S., Khalfan, A. M., Li, Y., & Abdul, S. S. (2018). The usefulness and actual use of wearable devices among the elderly population. *Computer Methods and Programs in Biomedicine*, *153*, 137–159. https://doi.org/10.1016/j.cmpb.2017.10.008

Khan, M. M., Alanazi, T. M., Albraikan, A. A., & Almalki, F. A. (2022). IoT-Based health monitoring system development and analysis. *Security and Communication Networks, 2022*, 1–11. https://doi.org/10.1155/2022/9639195

Khanum, S., De Lourdes De Souza, M., Sayyed, A., & Naz, N. (2017). Designing a pregnancy care network for pregnant women. Technologies (Basel), 5(4), 80. https://doi.org/10.3390/technologies5040080

Katapally, T. R., Bhawra, J., & Patel, P. (2020). A systematic review of the evolution of GPS use in active living research: A state of the evidence for research, policy, and practice. *Health & Place, 66,* 102453. https://doi.org/10.1016/j.healthplace.2020.102453\

Koohang, A., Sargent, C. S., Nord, J. H., & Paliszkiewicz, J. (2022). Internet of Things (IoT): From awareness to continued use. *International Journal of Information Management*, *62*, 102442. https://doi.org/10.1016/j.ijinfomgt.2021.102442

Lee, W., & Lee, W. (2018, October 24). 5 reasons why emergency buttons can help the elderly. *Medical Alert Buyer's Guide*. https://www.medicalalertbuyersguide.org/articles/5-reasons-why-emergency-buttons-can-help-the-elderly/

Lersilp, S., Putthinoi, S., Lerttrakarnnon, P., & Silsupadol, P. (2020b). Development and Usability Testing of an Emergency Alert Device for Elderly People and People with Disabilities. *The Scientific World Journal*, *2020*, 1–7. https://doi.org/10.1155/2020/5102849

Leszczynski, A. (2019). Platform affects of geolocation. *Geoforum*, *107*, 207–215. https://doi.org/10.1016/j.geoforum.2019.05.011

Liao, Y., Thompson, C. A., Peterson, S. K., Mandrola, J., & Beg, M. S. (2019). The future of wearable technologies and remote monitoring in health care. *American Society of Clinical Oncology Educational Book*, *39*, 115–121. https://doi.org/10.1200/edbk_238910

Loh, H. W., Xu, S., Faust, O., Ooi, C. P., Barua, P. D., Chakraborty, S., Tan, R., Molinari, F., & Acharya, U. R. (2022). Application of photoplethysmography signals for healthcare systems: An in-depth review. *Computer Methods and Programs in Biomedicine*, *216*, 106677. https://doi.org/10.1016/j.cmpb.2022.106677

Mann, W. C., Belchior, P., Tomita, M., & Kemp, B. J. (2005). Use of personal emergency response systems by older individuals with disabilities. *Assistive Technology*, *17*(1), 82–88. https://doi.org/10.1080/10400435.2005.10132098

Mohapatra, S., Mohanty, S., & Mohanty, S. (2019). Smart Healthcare: An approach for ubiquitous healthcare management using IoT. In *Elsevier eBooks* (pp. 175–196). https://doi.org/10.1016/b978-0-12-818146-1.00007-6

Muthu, B., Sivaparthipan, C. B., Manogaran, G., Sundarasekar, R., Kadry, S., Shanthini, A., & Dasel, A. A. (2020). IOT based wearable sensor for diseases prediction and symptom analysis in healthcare sector. *Peer-to-peer Networking and Applications*, *13*(6), 2123–2134. https://doi.org/10.1007/s12083-019-00823-2

Office, D. I. (2021). Aging in the Philippines. *University of the Philippines Diliman*. https://upd.edu.ph/aging-in-the-philippines/

Pedamkar, P. (2023). Orange Pi vs Raspberry Pi. *EDUCBA*. https://www.educba.com/orange-pi-vs-raspberry-pi/

Qananwah Q, Dagamseh A, Alquran H, Ibrahim KS, Alodat M, Hayden O. A comparative study of photoplethysmogram and piezoelectric plethysmogram signals. Phys Eng Sci Med. 2020 Dec;43(4):1207-1217. doi: 10.1007/s13246-020-00923-x. Epub 2020 Aug 31. PMID: 32869130. https://pubmed.ncbi.nlm.nih.gov/32869130/

Rajiv. (2022). Characteristics of Internet of Things (IoT). *RF Page*. https://www.rfpage.com/characteristics-of-internet-of-things/

Raspberry Pi Pico microcontroller: specifications, features and RP2040 — The MagPi magazine. (n.d.). The MagPi Magazine.

https://magpi.raspberrypi.com/articles/raspberry-pi-pico-microcontroller-specifications-features-and-rp2040

UNO R3 | Arduino Documentation. (n.d.). https://docs.arduino.cc/hardware/uno-rev3?ref=engineeracar.com

Using Raspberry Pi computers in education. (2019, May 1). IEEE Conference Publication | IEEE Xplore. https://ieeexplore.ieee.org/abstract/document/8756967

Shagerdi, G., Ayatollahi, H., & Hemmat, M. (2022). Emergency care for the elderly: A review of the application of health information technology. *Health Policy and Technology*, *11*(1), 100592. https://doi.org/10.1016/j.hlpt.2021.100592

Smart care: An intelligent assistant for pregnant mothers. (2017, September 1). IEEE Conference Publication | IEEE Xplore. https://ieeexplore.ieee.org/abstract/document/8255455

Smart Projects. (2020, June 26). How to communicate a ESP32 with a GPS System. *hackster.io*. Retrieved from https://www.hackster.io/smartprojects/how-to-communicate-a-esp32-with-a-gps-system-63ca58

Stavropoulos, T. G., Papastergiou, A., Mpaltadoros, L., Nikolopoulos, S., & Kompatsiaris, I. (2020). IoT Wearable Sensors and Devices in Elderly Care: a literature review. *Sensors*, *20*(10), 2826. https://doi.org/10.3390/s20102826

Stefan Brahler, "Analysis of the Android Architecture- KIT", KIT, 2 Jun. 2010– 6 Oct. 2010. https://www.google.iq/search?hl=en&noj=1&q=analysis+of+the+android+ar

Stihy. (2022, September 17). *Raspberry Pi 4: Review, buying guide and how to use*. Tom's Hardware. https://www.tomshardware.com/reviews/raspberry-pi-4

Tamura, T., Maeda, Y., Shimizu, M., & Yoshida, M. (2014). Wearable PhotoPlethysmographic Sensors—Past and Present. *Electronics*, *3*(2), 282–302. https://doi.org/10.3390/electronics3020282

Teixeira, E., Fonseca, H., Diniz-Sousa, F., Veras, L., Boppre, G., Oliveira, J., Pinto, D., Alves, A. J., Barbosa, A., Mendes, R., & Marques-Aleixo, I. (2021). Wearable Devices for Physical activity and healthcare monitoring in Elderly people: A Critical review. *Geriatrics*, *6*(2), 38. https://doi.org/10.3390/geriatrics6020038

Wan, J., A. A. H. Al-awlaqi, M., Li, M. et al. Wearable IoT enabled real-time health monitoring system. J Wireless Com Network 2018, 298 (2018). https://doi.org/10.1186/s13638-018-1308-x

Welcome to Python.org. (2023, October 17). Python.org. https://www.python.org/?ref=softhints-python-linux-pandas

Appendices

APPENDIX A

EVALUATION INSTRUMENT FOR SSBS: IOT-ENABLED EMERGENCY ALERT SYSTEM ENHANCING SAFETY FOR ELDERLY, PREGNANT WOMEN, AND PERSON WITH DISABILITIES

Technological University of the Philippines
College of Science
Department of Computer Studies
Ayala Boulevard Corner San Marcelino St. Ermita Manila
Tel. No. +63 (2) 301.3001 to 62

Name(Optional):____

Category of Respondent:

___Elders ___Guardian ___Students ___IT Professional ___Person with Disabilities

Instruction: SSBS is an IoT-enabled emergency alert system designed to enhance safety for vulnerable groups such as the elderly, pregnant women, and persons with special abilities. This system utilizes cutting-edge technology to provide immediate assistance during emergencies, ensuring timely response and support for those who need it most. Using the scale below, please evaluate the SSBS by putting a check (✓) on the appropriate column of your rating.

Numerical Rating	Descriptive Rating
4.0	Very Acceptable
3.0	Acceptable
2.0	Fairly Acceptable
1.0	Not Acceptable

INDICATOR	4	3	2	1
A. Functionality				
1. Ease of Operation				
2. Provision for Comfort and Convenience				
3. User-Friendliness				
B. Aesthetics				
1. Appeal of the Color				
2. Attractiveness of the Design				
3. Appropriateness of Size				
C. Workability				
4. Availability of Materials				
5. Availability of Technical Expertise				
6. Availability of Tools and Materials				
D. Durability				
7. Quality of Materials				
8. Quality of Workmanship				
9. Quality of Design				
E. Economy				
10. Economy in terms of materials needed				
11. Economy in terms of time/labor spent				

12. Economy in terms of machine/s required				
F. Safety				
13. Absence of toxic/hazardous material				
14. Absence of sharp edges				
15. Provision for Protection device				

APPENDIX B

B.1. Percentage Error Computation for Heart Rate

Table 14

Accuracy Test Result of Heart Rate

Trial Number	SSBS Heart Rate	Pulse Oximeter BMP	Percentage Error
1	88	92	4.35%
2	80	79	1.27%
3	92	89	3.37%
4	74.84	93	19.53%
5	104	102	1.96%
6	78	90	13.33%
7	70	89	21.35%
8	89	88	1.14%
9	78	91	14.29%
10	73	91	19.78%
		Average:	**10.04%**

$$\%error = \frac{|88 - 92|}{92} \cdot 100 = 4.35$$

$$\%error = \frac{|80 - 79|}{79} \cdot 100 = 1.27$$

$$\%error = \frac{|92 - 89|}{89} \cdot 100 = 3.37$$

$$\%error = \frac{|74.84 - 93|}{93} \cdot 100 = 19.53$$

$$\%error = \frac{|104 - 102|}{102} \cdot 100 = 1.96$$

$$\%error = \frac{|78 - 90|}{90} \cdot 100 = 13.33$$

$$\%error = \frac{|70 - 89|}{89} \cdot 100 = 21.35$$

$$\%error = \frac{|89 - 88|}{88} \cdot 100 = 1.14$$

$$\%error = \frac{|878 - 91|}{91} \cdot 100 = 14.29$$

$$\%error = \frac{|73 - 91|}{91} \cdot 100 = 19.78$$

Total %error = 100.37 100.37 / 10 *(No. Of Trials)* **%error = 10.04%**

B.2. Percentage Error Computation for Body Temperature

Table 15

Accuracy Test Result of Body Temperature

Trial Number	SSBS Body Temperature	Thermometer Body Temperature	Percentage Error
1	34	33.59	1.22%
2	34.25	34	0.74%
3	35.33	35.20	0.37%
4	35.20	35	0.57%
5	33	33.70	2.08%
6	34.44	34	1.30%
7	34.08	33.70	1.13%
8	33.94	33	2.85%
9	35	35.43	1.21%
10	34.23	34	0.68%
			Average: 1.22%

$$\%error = \frac{|34 - 33.59|}{33.59} \cdot 100 = 1.22$$

$$\%error = \frac{|34.44 - 34|}{34} \cdot 100 = 1.30$$

$$\%error = \frac{|34.25 - 34|}{34} \cdot 100 = 0.74$$

$$\%error = \frac{|34.08 - 33.70|}{33.70} \cdot 100 = 1.13$$

$$\%error = \frac{|35.33 - 35.20|}{35.20} \cdot 100 = 0.37$$

$$\%error = \frac{|33.94 - 33|}{33} \cdot 100 = 2.85$$

$$\%error = \frac{|35.20 - 35|}{35} \cdot 100 = 0.57$$

$$\%error = \frac{|35 - 35.43}{35.43} \cdot 100 = 1.21$$

$$\%error = \frac{|33 - 33.70|}{33.70} \cdot 100 = 2.08$$

$$\%error = \frac{|34.23 - 34|}{34} \cdot 100 = 0.68$$

Total %error = 12.22 12.22 / 10 *(No. Of Trials)* **%error = 1.22%**

B.3. Summary of Respondents

Respondents	**Functionality**			**Aesthetics**			**Workability**			**Durability**			**Economy**			**Safety**		
Healthcare Professional	3	2	3	2	2	2	4	2	2	2	2	2	3	4	3	1	2	2
Guardian	4	4	4	3	3	2	4	4	3	4	4	4	3	4	4	4	4	4
Student	4	4	4	4	4	4	4	4	4	4	3	4	4	4	3	2	2	4
Special Needs	3	3	4	4	3	3	3	4	4	3	4	4	4	4	4	4	4	4
Student	4	4	4	4	3	3	4	4	4	4	4	4	4	3	4	4	4	4
Student	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4
Pregnant Woman	4	4	4	3	4	4	4	4	4	3	4	4	4	4	4	4	4	4
IT Professional	3	1	3	3	3	3	3	3	3	2	3	2	2	3	2	4	4	3
Healthcare Professional	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	4
Pregnant Woman	3	4	3	4	3	3	4	4	4	4	4	4	4	4	4	4	4	3
Student	4	3	3	4	4	4	3	4	3	3	3	4	4	3	4	4	3	4
Special Needs	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Elderly	3	3	4	3	3	3	3	3	3	3	4	3	4	4	4	4	4	4
Healthcare Professional	4	4	4	3	4	4	3	4	4	4	3	4	4	3	4	4	4	4
Guardian	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Healthcare Professional	4	3	3	3	4	4	3	3	3	3	3	3	3	3	3	3	4	3
Student	4	3	4	2	3	3	3	3	3	4	3	4	4	4	4	3	3	4
IT Professional	3	3	3	3	3	2	2	4	2	3	3	3	3	3	3	3	4	4
Guardian	4	3	4	4	3	3	4	4	3	4	3	3	4	3	4	4	4	3
Guardian	4	3	4	4	3	4	4	3	4	4	4	3	4	3	3	4	4	4
IT Professional	3	4	4	3	3	4	3	4	4	3	4	4	4	4	3	3	4	4
Guardian	4	4	4	3	3	2	4	4	3	4	4	3	3	3	3	4	3	3
Pregnant Woman	4	4	4	4	4	4	3	4	4	4	3	4	4	4	4	3	3	4
IT Professional	4	4	4	4	4	4	4	4	4	4	4	3	3	4	4	2	4	3

Healthcare Professional	2	2	3	3	3	3	3	2	2	3	2	2	2	3	3	3	3	3
Elderly	3	3	4	4	4	4	3	3	3	3	4	3	3	4	3	3	3	4
Elderly	3	3	3	4	3	4	3	4	4	4	3	4	4	4	3	3	3	4
Pregnant Woman	3	3	3	4	4	4	3	3	4	4	4	3	3	4	4	3	3	4
Special Needs	3	4	3	4	4	3	4	3	4	3	3	4	4	4	3	3	3	4
Pregnant Woman	3	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4
Elderly	3	4	4	3	4	4	3	2	3	4	4	3	4	3	3	4	4	3
Special Needs	4	4	4	3	4	3	4	4	4	4	4	4	4	4	4	4	4	4
Elderly	4	4	4	3	3	3	3	3	3	3	3	4	3	4	4	3	4	3
Special Needs	4	3	4	4	4	4	4	4	3	4	3	4	3	4	4	4	4	4
IT Professional	2	2	4	3	2	4	3	3	4	3	2	3	4	4	4	4	4	4
Overall Mean	**3.50**			**3.45**			**3.51**			**3.50**			**3.63**			**3.58**		
Descriptive Rating	**Highly Acceptable**			**Very Acceptable**			**Highly Acceptable**			**Highly Acceptable**			**Highly Acceptable**			**Highly Acceptable**		

B.4. Mean Computation for System Evaluation

Table 17.

Evaluation Result for Functionality

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Functionality		
Ease of Operation	3.51	Very Acceptable
Provision for Comfort and Convenience	3.37	Acceptable
User-Friendliness	3.62	Very Acceptable
Overall Weighted Mean	**3.50**	**Very Acceptable**

$$mean\,\frac{3+4+4+3+4+4+4+3+4+3+4+4+3+4+4+4+4+3+4+4+3+4+4+4+2+3+3+3+3+3+3+4+4+4+2}{35} = 3.51$$

$$mean\,\frac{2+4+4+3+4+4+4+1+4+4+3+4+3+4+3+3+3+3+3+3+4+4+4+4+2+3+3+3+4+4+4+4+4+3+2}{35} = 3.37$$

$$mean\,\frac{3+4+4+4+4+3+4+3+4+3+3+4+4+4+3+3+4+3+4+4+4+4+4+4+3+4+3+3+3+3+4+4+4+4+4}{35} = 3.62$$

$$overall\,weighted\,mean = \frac{3.51 + 3.37 + 3.62}{3} = 3.50$$

Table 18.

Evaluation Result for Aesthetics

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Aesthetics		
Appeal of the Color	3.48	Very Acceptable
Attractiveness of the Design	3.43	Very Acceptable
Appropriateness of Size	3.43	Very Acceptable
Overall Weighted Mean	**3.45**	**Very Acceptable**

$$mean\frac{2+3+4+4+4+4+3+3+4+4+4+4+3+3+4+3+2+3+4+4+3+3+4+4+3+4+4+4+4+4+3+3+3+4+3}{35} = 3.48$$

$$mean\frac{2+3+4+3+3+4+4+3+4+3+4+4+3+4+4+4+3+3+3+3+3+3+4+4+3+4+3+4+4+3+4+4+3+4+2}{35} = 3.43$$

$$mean\frac{2+2+4+3+3+3+4+3+4+3+4+4+3+4+4+4+3+2+3+4+4+2+4+4+3+4+4+4+3+4+4+3+3+4+4}{35} = 3.43$$

$$overall\,weighted\,mean = \frac{3.48 + 3.43 + 3.43}{3} = 3.45$$

Table 19.

Evaluation Result for Workability

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Workability		
Availability of Materials	3.49	Very Acceptable
Availability of Technical Expertise	3.54	Very Acceptable
Availability of Tools	3.49	Very Acceptable
Overall Weighted Mean	**3.51**	**Very Acceptable**

$$mean\,\frac{4+4+4+3+4+4+4+3+4+4+3+4+3+3+4+3+3+2+4+4+3+4+3+4+3+3+3+3+4+4+3+4+3+4+3}{35} = 3.49$$

$$mean\frac{2+4+4+4+4+4+4+3+4+4+4+4+3+4+4+3+3+4+4+3+4+4+4+4+2+3+4+3+3+4+2+4+3+4+3}{35} = 3.54$$

$$mean\frac{2+3+4+4+4+4+4+3+4+4+3+4+3+4+4+3+3+2+3+4+4+3+4+4+2+3+4+4+4+4+3+4+3+3+4}{35} = 3.49$$

$$overall\,weighted\,mean = \frac{3.49 + 3.54 + 3.49}{3} = 3.51$$

Table 20.

Evaluation Result for Durability

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Durability		
Quality of Materials	3.54	Very Acceptable
Quality of Workmanship	3.46	Very Acceptable
Quality of Design	3.51	Very Acceptable
Overall Weighted Mean	**3.50**	**Very Acceptable**

$$mean\,\frac{2+4+4+3+4+4+3+2+4+4+3+4+3+4+4+3+4+3+4+4+3+4+4+4+3+3+4+4+3+4+4+4+3+4+3}{35} = 3.54$$

$$mean\frac{2+4+3+4+4+4+4+3+4+4+3+4+4+3+4+3+3+3+3+4+4+4+3+4+2+4+3+4+3+4+4+4+3+3+2}{35} = 3.46$$

$$mean\frac{2+4+4+4+4+4+4+2+4+4+4+4+3+4+4+3+4+3+3+3+4+3+4+3+2+3+4+3+4+4+3+4+4+4+3}{35} = 3.51$$

$$overall\,weighted\,mean = \frac{3.54 + 3.46 + 3.51}{3} = 3.50$$

Table 21.

Evaluation Result for Economy

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Economy		
Economy in terms of materials need	3.60	Very Acceptable
Economy in terms of time/labor spent	3.69	Very Acceptable
Economy in terms of machine/s required	3.60	Very Acceptable
Overall Weighted Mean	**3.63**	**Very Acceptable**

$$mean \frac{3+3+4+4+4+4+4+2+4+4+4+4+4+4+4+3+4+3+4+4+4+3+4+3+2+3+4+3+4+4+4+4+3+3+4}{35} = 3.60$$

$$mean \frac{4+4+4+4+3+4+4+3+4+4+3+4+4+3+4+3+4+3+3+3+4+3+4+4+3+4+4+4+4+4+3+4+4+4+4}{35} = 3.69$$

$$mean \frac{3+4+3+4+4+4+4+2+4+4+4+4+4+4+4+3+4+3+4+3+3+3+4+4+3+3+3+4+3+4+3+4+4+4+4}{35} = 3.60$$

$$overall\,weighted\,mean = \frac{3.60 + 3.69 + 3.60}{3} = 3.63$$

Table 22.

Evaluation Result for Safety

CRITERION	WEIGHTED MEAN	DESCRIPTIVE RATING
Economy		
Absence of toxic/hazardous material	3.46	Very Acceptable
Absence of sharp edges	3.60	Very Acceptable
Provision for Protection device	3.69	Very Acceptable
Overall Weighted Mean	**3.58**	**Very Acceptable**

$$mean \frac{1+4+2+4+4+4+4+4+3+4+4+4+4+4+4+3+3+3+4+4+3+4+3+2+3+3+3+3+3+4+4+4+3+4+4}{35} = 3.46$$

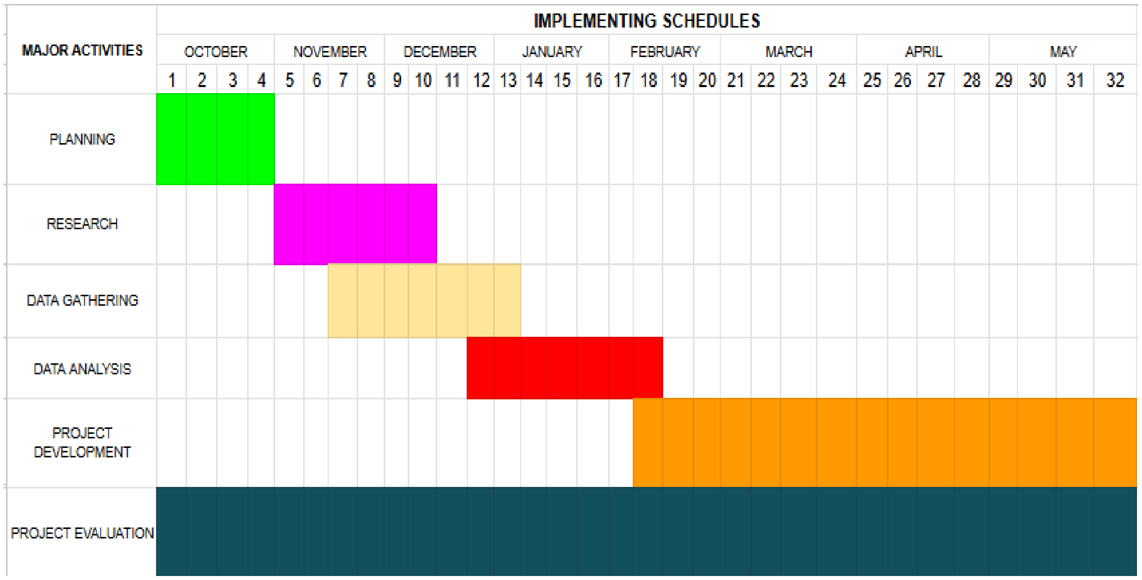
$$mean \frac{2+4+2+4+4+4+4+4+3+4+3+4+4+4+4+4+3+4+4+4+4+3+3+4+3+3+3+3+3+4+4+4+4+4+4}{35} = 3.60$$

$$mean \frac{2+4+4+4+4+4+4+3+4+3+4+4+4+4+4+3+4+4+3+4+4+3+4+3+3+4+4+4+4+4+3+4+3+4+4}{35} = 3.69$$

$$overall\,weighted\,mean = \frac{3.46 + 3.60 + 3.69}{3} = 3.58$$

APPENDIX C

GANTT CHART



APPENDIX D

BILL OF MATERIALS

Quantity	Materials	Price	Total Price
1 pc	ESP 32 Module	₱180.00	₱180.00
1 pc	A9G Development Board	₱820.00	₱820.00
2 pcs	18650 Battery	₱200.00	₱400.00
2 pcs	Universal PCB	₱75.00	₱150.00
1 pc	Heart Rate Sensor	₱150.00	₱150.00
1 pc	LM35 Body Temperature Sensor	₱138.00	₱138.00
1 pc	Hostinger Website Hosting	₱350.00	₱350.00
1 pc	Leather Bag	₱500.00	₱500.00
1 pc	GPS Antenna Extender	₱135.00	₱135.00
1 pc	GSM Antenna Extender	₱111.00	₱111.00

APPENDIX E

USERS MANUAL

SYSTEM OVERVIEW

The system is composed of one wearable device. The SSBS wearable wristband is responsible for reading and monitoring the user's heart rate, body temperature, and real time location. The device is connected to the IoT Cloud Platform that is used by the caregiver/guardian to monitor the user.

Getting Started

1. Ensure the wearable device is fully charged and turned on.
2. Connect the smartphone/laptop of the caregiver/guardian to the internet, either through Wi-Fi or mobile data so he or she can view the web IoT platform where the data of the user will be uploaded. Also, make sure the user's device has a signal in order to send the data to the web IoT platform.
3. Wait for the wristband to measure the user's body temperature and heart rate. Once the readings are taken, they are automatically sent to a monitoring system.
4. Also wait for it to acquire the user's location using GPS coordinates (latitude and longitude). Once the location is obtained, the data is sent to a monitoring system.
5. The caregiver/guardian should access the monitoring system using a web browser or dedicated application. He or she can go to the link of the web IoT platform to view the data collected from the device.

APPENDIX F

GRAMMARIAN CERTIFICATE

	TECHNOLOGICAL UNIVERSITY OF THE PHILIPPINES Ayala Blvd., Ermita, Manila, 1000, Philippines Tel No. +632-5301-3001 local 608| Fax No. +632-8521-4063 Email: cos@tup.edu.ph | Website: www.tup.edu.ph	Index No.	REF-COS-3.5-INT-TGC
		Revision No.	00
		Effectivity Date	06132022
VAA-COS	**THESIS GRAMMARIAN CERTIFICATE**	Page	1 / 1

THESIS GRAMMARIAN CERTIFICATE

This is to certify that the thesis entitled,

SSBS: IOT-ENABLED EMERGENCY ALERT SYSTEM ENHANCING SAFETY FOR ELDERLY, PREGNANT WOMEN, AND PERSONS WITH DISABILITIES

authored by

Ethel A. Cacayan
Shayna Lorraine R. Laureta
Michael Angelo P. Par
Daniel I. Perez

has undergone editing and proofreading by the undersigned.

This Certification is being issued upon the request Ethel A. Cacayan, Shayna Lorraine R. Laureta, Michael Angelo P. Par, Daniel I. Perez for whatever purposes it may serve them.

marilyn m. Ignacio

MARILYN M. IGNACIO
Grammarian

June 7, 2024
Date of Issuance

Transaction ID	TUPM-COS-APS-WMM-01262024 -0244PM
Signature	

RESEARCHERS' PROFILE

ETHEL CACAYAN

Amparo, Caloocan City | August 1, 2001
09947197117 / 09952266032
cacayanethel@gmail.com · linkedin.com/in/ccynethel

Seeking a challenging career with a progressive organization that provides an opportunity to capitalize my skills and abilities in the field of Information Technology (IT).

EDUCATION

SEPTEMBER 2020 – PRESENT
BS INFORMATION TECHNOLOGY, TECHNOLOGICAL UNIVERSITY OF THE PHILIPPINES – MANILA

- Dean's Lister – 2020 – 2022

2018 – 2020
SENIOR HIGH SCHOOL (STEM STRAND), OUR LADY OF FATIMA UNIVERSITY – QC CAMPUS

- With Honors

2014 – 2018
JUNIOR HIGH SCHOOL, MATER CARMELI SCHOOL

- With Honors

2007 – 2014
AMPARO ELEMENTARY SCHOOL

SKILLS

- Software
  - Canva, Notion, MS Word, PPT, and Excel
- Soft skills
  - Able to communicate effectively through written forms, relies on discipline instead of motivation, attention to detail.

AWARDS / CERTIFICATIONS

- SHS – ICT Microsoft Office Proficiency Exam
- Excellence in Information and Communication Technology
- Excellence in Media and Information Literacy
- Excellence in Empowerment Technology

SHAYNA LORRAINE R. LAURETA

IT STUDENT

CONTACT

+639981901377

lauretashay@gmail.com

168 M. Santos St., Pasay City

EDUCATION

Tertiary *2020-Present*

Technological University of the Philippines

Ayala Blvd, Ermita, Manila

- Bachelor of Science in Information Technology

Secondary *2018-2020*

AU-JAS Campus SHS

3058 Taft Avenue, 1630, Pasay City

- Science, Technology, Engineering and Mathematics

2014-2018

AU-JAS Campus JHS

3058 Taft Avenue, 1630, Pasay City

PROJECTS DONE

- Escafe Sales Management and Inventory System - *Frontend Developer*
- Fun-Tea Café Sales Management and Product Inventory System (FC-PIMS) with QR code - *Frontend Developer*
- Development of Website using CRUD Operation for an E-commerce Marvels Movies - *Developer*
- Silayan Art Gallery Website Design Mock-up - *Website & Graphic Designer/ UX Designer*

PROFILE

Seeking a career opportunity within a company where I can apply my existing skills while acquiring new knowledge and strategies to support the achievement of organizational goals. Eager to enhance my expertise in a challenging environment that fosters both personal growth and company success.

SKILLS

- **Soft Skills:** Creativity, Team-oriented, Attention to detail, Interpersonal Skills, Work Ethic
- **Technical Skills:**
  - Front-end web development (HTML, CSS, JavaScript, Bootstrap)
  - Editing creative materials and videos
  - Basic Operation and Troubleshooting of desktops, laptops, and printer
  - Computer Networking and Arduino

ACHIEVEMENTS, AWARDS & AFFILIATIONS

Technological University of the Philippines

- Dean's lister – 1st semester, 1st year
- President's lister – 2nd semester, 1st year
- Dean's lister – 1st semester, 2nd year
- Dean's lister – 2nd semester, 2nd year
- President's lister – 1stsemester, 3rd year
- Dean's lister - 2nd semester, 3rd year
- President's lister - 1st semester, 4th year

Arellano University Jose Abad Santos Campus HS

- Promising Achiever (Media and Information Literacy)
- Certificate of Completion for STEM (Science, Technology, Engineering and Mathematics)
- Graduated with honors

Andres Bonifacio Elementary School

- Secretary in Information and Communications Technology (ICT) Club
- Certificate of Participation in the MTAP-DepEd-NCR

WORK EXPERIENCE

- Worked in Armed Forces of the Philippines Pension and Gratuity Management Center (AFPPGMC) as an IT Infrastructure intern for 3 months.

(March 2024-Present)

Michael Angelo Par

INFORMATION TECHNOLOGY

About me

Dynamic computer software expert with a proven track record in virtual assistance, BPO, and photobooth photography. Demonstrated proficiency in client management, programming, and customer service, underscored by meticulous attention to detail and adept multitasking abilities. Passionate about delivering excellence and fostering collaborative success, ensuring impactful outcomes across various platforms.

Work Experience

2018 - Present
Pretty Prints Photobooth

PHOTOBOOTH SUPPLIER

Experienced Assistant Photographer skilled in photo booth setup, guest interaction, prop management, and file organization. Proficient in camera operation, basic computer tasks, and photo editing software. Strong communication and multitasking abilities in fast-paced settings. Available evenings, weekends, and holidays.

June 2023 - October 2023
RAVA Digital Marketing Services

VIRTUAL ASSISTANT

Proven success in generating leads, optimizing social platforms, managing schedules, handling email, and creating engaging content. Creating website using wordpress

October 2022 - December 2022
RAVA Digital Marketing Services

VIRTUAL ASSISTANT INTERNSHIP

Efficiently managed client emails and scheduled meetings, while also sourcing leads for corporate events.

July 2022 - Novermber 2022
TTEC

CHAT AND EMAIL SUPPORT

Providing exceptional chat and email support for eBay, skilled in addressing customer inquiries, resolving issues, and ensuring satisfaction, with in-depth product knowledge, strong communication abilities, multitasking skills, and proficiency in support systems and tools.

April 2024
SeeYouDoc

WEB DEVELOPER - INTERN

Web developer proficient in building scalable web applications using the Elixir programming language and the Phoenix framework. Passionate about leveraging functional programming principles to create efficient and reliable web solutions.

Projects Done

EMERGENCY ALERT DEVICE (2023-PRESENT)
Software and Hardware Developer

PERSONAL PORTFOLIO USING WORDPRESS (2022-2023)
Backend and Frontend Developer

E-COMMERCE WEBSITE USING WORDPRESS (2022-2023)
Backend and Frontend Developer

BARANGAY MANAGEMENT SYSTEM (2022-2023)

Contact

+63 991 118 7812
parmichael81@gmail.com
31 Okra St. Tumana, Marikina City

Education

2020 - 2024
Technological University of the Philippines
BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

2018 - 2020
Pamantasan ng Lungsod ng Marikina
SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS

2014 - 2018
Santa Elena High School

Skills

- Computer Operating System Proficiency (Windows, MacOS, and Linux)
- Web Development (HTML, CSS, JavaScript, Figma, Tailwind CSS, Elixir, and Wordpress)Virtual Assistance (Content Creation, Email Management, and Lead Generation)
- Photo and Video Editing
- Virtual Assistance (Content Creation, Email Management, and Lead Generation)
- Customer Service Representative (Chat and Email Support
- Computer Networking (IP, DHCP, and DNS)
- Computer Hardware

Seminars Attended

- "Current Trends and Job Outlook for IT Careers" held on January 23, 2023
- "Cybersecurity in 21st Century" held on January 11, 2023.
- "The future of Computing: An Exploration of Cloud Computing, Cloud Migration, and Growth of IoT Networks (November 14, 2022)
- "Quantum Computing: Are You Ready for the Future of Computing?" (November 7, 2022)

Daniel Perez

IT STUDENT

CONTACT

+63 916 4488 610

daniel.perez@tup.edu.ph

Baclaran, Parañaque City

https://www.linkedin.com/in/danielperezxcv/

ACHIEVEMENTS & CERTIFICATES

2024, June 14th
- Academic Excellence Award - Deans Lister 4th Year, 2nd Semester

2024, February 25th
- Academic Excellence Award - Deans Lister 4th Year, 1st Semester

2023, January 23rd
- Certificate of Participation - Current Trends and Jobs Outlook for IT Careers

2023, January 11th
- Certificate of Participation - Cybersecurity in 21st Century

2022, December 15th
- Certificate of Participation - Cloud Computing Utilization of Cloud Services Solutions

2022, September 22nd
- Academic Excellence Award - Deans Lister 2nd Year, 2nd Semester

2020, June 15th
- Academic Excellence Award - with Honors during 12th Grade

2019, May 29th
- Academic Excellence Award - with Honors during 11th Grade

2018, March 23rd
- Certificate of Competency - Computer Hardware Servicing

PROFILE SUMMARY

a candidate graduating IT student, eager to secure a supervised industry training to augment my skills in alignment with my academic program. Seeking a professional working in a dynamic environment where I can apply my theoretical knowledge, gain hands-on experience, and contribute to real-world projects in the ever-evolving IT landscape and to grow professionally with the company.

AREAS OF EXPERTISE

Technical Skills
- Microsoft 365 Proficiency
- Technology Literacy
- Computer Hardware Knowledge
- Software Productivity
- Graphic Designer

Professional Skills
- Netiquette on Internet
- Technology Adaptability
- Data Analyst
- Problem-Solving
- Teamwork & Collaboration

WORK EXPERIENCE

National Reinsurance Corporation of the Philippines, Makati Mar - Jun 2024

Supervised Industry Training - Data Analyst, System Integration Personnel and Junior Database Administrator
- Phase 1 - Data Extraction
- Phase 2 & Phase 3:
  - Bordereaux Analysis & BM Tool Mapping
  - Data Extraction
  - Name Clean up and Summary Reconciliation
  - Cession Loading

CREOTEC Philippines Inc, Manila Nov 2019 - Jan 2020

Work Immersion - Quality Assurance
- Worked to maintain outstanding attendance record, consistently arriving to work ready to start immediately.
- Implemented rigorous quality control procedures to maintain the integrity of the prototype.
- Carried out day-to-day duties accurately and efficiently.

EDUCATIONAL ATTAINMENT

Technological University of the Philippines - Manila 2020 - 2024

Bachelor of Science in Information Technology
- College Scholar

Philippine Christian University - Manila 2018 - 2020

Graduated with the strand of Science, Technology, Engineering and Mathematics (STEM)
- Graduated with Honors

CHARACTER REFERENCE

Jennifer Perez
Team Leader
Tokyo Milk Cheese

Ryan Misterio
System Engineer
Hewlett Packard Enterprise (HPE)

signature over printed name