Universiti Teknologi MARA
Cawangan Melaka

PCMJ

Progress in Computing and Mathematics Journal

volume 1

https://fskmjebat.uitm.edu.my/pcmj/

Progress in Computing and Mathematics Journal
College of Computing, Informatics, and Mathematics
Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin
77300, Merlimau, Melaka Bandaraya Bersejarah

PCMJ

Progress in Computing and Mathematics Journal

volume 1

Progress in Computing and Mathematics Journal (PCMJ)
College of Computing, Informatics, and Mathematics
Universiti Teknologi MARA Cawangan Melaka, Kampus Jasin
77300, Merlimau, Melaka Bandaraya Bersejarah

EDITORS

PCMJ
Progress in Computing and Mathematics Journal
volume 1

PREFACE

Welcome to the inaugural volume of the **Progress in Computing and Mathematics Journal (PCMJ)**, a publication proudly presented by the College of Computing, Informatics, and Mathematics at UiTM Cawangan Melaka.

This journal represents a significant step in our commitment to fostering a vibrant research culture, initially providing a crucial platform for our undergraduate students to showcase their intellectual curiosity, dedication to scholarly pursuit, and potential to contribute to the broader academic discourse in the fields of computing and mathematics. However, we envision PCMJ evolving into a beacon for researchers both nationally and internationally. We aspire to cultivate a space where groundbreaking research and innovative ideas converge, fostering collaboration and intellectual exchange among established scholars and emerging talents alike.

The manuscripts featured in this first volume, predominantly authored by our undergraduate students, are a testament to the hard work and dedication of these budding researchers, as well as the guidance and support provided by their faculty mentors. They cover a diverse range of topics, reflecting the breadth and depth of research interests within our college, and set the stage for the high-quality scholarship we aim to attract in future volumes.

As editors, we are honored to have played a role in bringing this journal to fruition. We extend our sincere gratitude to all the authors, reviewers, and members of the editorial board for their invaluable contributions. We also acknowledge the unwavering support of the college administration in making this initiative possible.

We hope that PCMJ will inspire future generations of students and researchers to embrace research and innovation, to push the boundaries of knowledge, and to make their mark on the world of computing and mathematics.

Editors
Progress in Computing and Mathematics Journal (PCMJ)
College of Computing, Informatics, and Mathematics
UiTM Cawangan Melaka

TABLE OF CONTENTS

PCMJ

Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

VEHICLE ACCIDENT ALERT SYSTEM USING GPS AND GSM

DEANIAL FIKRI BIN MAT DESA
deanialfikri@yahoo.com

Article Info

Received: February 2024
Accepted: August 2024
Available Online: October 2024

Abstract

This paper presents the design and implementation of a Vehicle Accident Alert System (VAAS) leveraging advanced technologies including the MPU6050 accelerometer, GPS Neo-6M module, TTGO ESP32 microcontroller, SIM800H GSM module, and an alert button. The VAAS aims to enhance road safety by promptly detecting and reporting vehicle accidents to emergency responders and designated contacts. The MPU6050 accelerometer detects sudden changes in acceleration indicative of a collision, while the GPS Neo-6M module provides accurate location data. The TTGO ESP32 microcontroller serves as the central processing unit, coordinating communication between components and executing accident detection algorithms. Upon detection, the system utilizes the SIM800H GSM module to send automated alerts via SMS or call to emergency services and pre-registered contacts. Additionally, an alert button allows users to manually trigger emergency notifications. This abstract highlights the integration of cutting-edge technologies to create an efficient and reliable system for mitigating the consequences of vehicular accidents and facilitating rapid emergency response.

Keywords: Vehicle Accident Alert System, MPU6050, GPS Neo-6M, TTGO ESP32, SIM800H, alert button, road safety, collision detection, emergency response, microcontroller, accelerometer, GSM module, GPS module, SMS alert, call alert, automated notification.

INTRODUCTION

The project's introduction highlights the urgent problem of rising accidents caused by the increasing use of vehicles, underscoring the necessity for sophisticated methods to reduce risks. The proposed solution entails the implementation of a vehicle accident alert system utilising GPS and GSM technologies. The ESP32-powered system utilises a variety of sensors to promptly detect accidents and subsequently notifies registered contacts, hospitals, and police stations. The system utilises GPS and GSM modules to track vehicle movements and detect abrupt changes that suggest accidents. Moreover, the inclusion of the MPU6050 sensor improves the precision of accident detection, guaranteeing a prompt reaction to critical situations.

The problem statement emphasises the challenges of delayed medical assistance in areas with limited network coverage, underscoring the urgent need for enhanced infrastructure and dependable sensor technologies. The statement emphasises the significance of precise location tracking and monitoring of vital signs to assist emergency responders, particularly in isolated or areas with weak signal coverage (Yellamma et al., 2021). The importance of striking a balance between reducing false alarms and guaranteeing swift response to legitimate emergencies is also stressed, promoting the adoption of intelligent algorithms and real-time verification mechanisms to enhance the efficiency of the emergency alert system.

The project aims to develop a vehicle accident alert system utilising ESP32 and evaluate its functionality, reliability, and effectiveness. The scope involves the integration of hardware components, software development, and thorough testing to create a resilient alarm system for vehicles that are involved in accidents.

The project's importance lies in its capacity to augment road safety and emergency response capabilities. The main advantages consist of enhanced emergency response times, dependable accident location tracking enabled by GPS technology, and rapid communication via GSM technology (Musa et al., 2019) The system's cost-effectiveness and ease of use make it applicable to a wide range of vehicles, discouraging hit-and-run incidents and facilitating data gathering for well-informed decision-making and focused accident prevention strategies.

The project's objective is to tackle crucial problems related to vehicle accidents by utilising ESP32, GPS, and GSM technologies to develop a dependable and effective accident alert system. This system will ultimately lead to safer roads and improved emergency response capabilities.text directly by using the other controls on the Home tab. Most controls offer a choice of using the look from the current theme or using a format that you specify directly (Li & Gramatica, 2020; Tropsha, 2021).

PCMJ

Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

LITERATURE REVIEW

Vehicles play a vital role in modern life, facilitating transportation, communication, and commerce. However, they also pose inherent risks, with speed being a significant factor contributing to accidents and fatalities. Despite awareness campaigns, accidents persist, necessitating swift emergency responses to mitigate harm. To address this, a system leveraging advanced technology like the ESP32 microcontroller, GPS, GSM modules, and various sensors has been proposed. This system detects accidents through sensors like accelerometers and gyroscopes, promptly alerting emergency services and designated contacts with precise location data. Additionally, the integration of UAVs and machine learning algorithms enhances accident detection accuracy and response efficiency, potentially saving lives by reducing emergency response times (Prof. Girija Chiddarwar et al., 2022).

The Main Control Module

The main control module of the system utilizes the ESP32 microcontroller, chosen for its advanced capabilities including dual-core processing, integrated Wi-Fi and Bluetooth, and ample memory capacity. This microcontroller offers extensive connectivity options with 34 programmable digital I/O pins and 18 analog input pins, making it suitable for interfacing with various circuits and expansion boards. Its built-in Wi-Fi and Bluetooth capabilities enable seamless communication with other devices and networks, while programming can be done using the Arduino IDE, ensuring accessibility for developers.

Gps Modem

For GPS functionality, the system utilizes the NEO-6M GPS chip from u-blox, renowned for its sensitivity and power efficiency. This chip tracks up to 22 satellites on 50 channels and features a Power Save Mode (PSM) to minimize power consumption. With pins for UART communication, it interfaces effectively with the microcontroller. The GSM modem, employing the SIM800L GSM module, facilitates GSM/GPRS communication, supporting voice, SMS, and data transmission (Vashista B., 2021). Despite its compact dimensions, the SIM800L offers comprehensive functionality and low power consumption, making it suitable for various applications.

Gsm Modem

A GSM modem is a device that can be a cell phone or a modem that lets a computer or other machine talk to each other over a network. A SIM card is needed to use a GSM modem, and it only works on the network area that the network operator has paid for. It can link to a computer through a serial cable, a USB cable, or Bluetooth. The GSM modem can be used for a wide range of things, such as transaction terminals, supply chain management, security applications, weather units, and remote data logging using the GPRS mode. The SIM800L GSM module is utilized in the system, providing a comprehensive solution for GSM/GPRS communication. This module offers full Quad-band GSM/GPRS support and is designed in a compact surface-mount technology (SMT) package, making it suitable for seamless integration into diverse customer applications. The SIM800L is known for its cost-effectiveness and compact dimensions, providing an industry-standard interface for efficient communication in GSM/GPRS networks operating at 850/900/1800/1900MHz frequencies.

Accelerometer And Gyroscope

To detect accidents, the system utilizes an accelerometer and gyroscope. The accelerometer measures acceleration forces along the X and Y axes, detecting changes indicative of a crash (Saitharun B., 2021). Coupled with GPS data, this information is used to pinpoint the accident location and notify emergency contacts. The gyroscope, with a range of +/-500 degrees per second, determines the tilt of the vehicle post-crash, aiding in rollover detection. Once thresholds are met, the system promptly notifies family members and nearby hospitals, ensuring swift response in emergency situations. Together, these components form a robust and effective vehicle accident alert system, enhancing safety on the roads.

METHODOLOGY

The model of the waterfall is used in this project framework, and the five phases are requirements analysis, design, implementation, testing, and maintainance. Figure 3.3 shows the

PCMJ
Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

project's framework, and table 3.1 provides an overview of the phases of the vehicle accident alert system using gps and gsm ,based on the waterfall model.

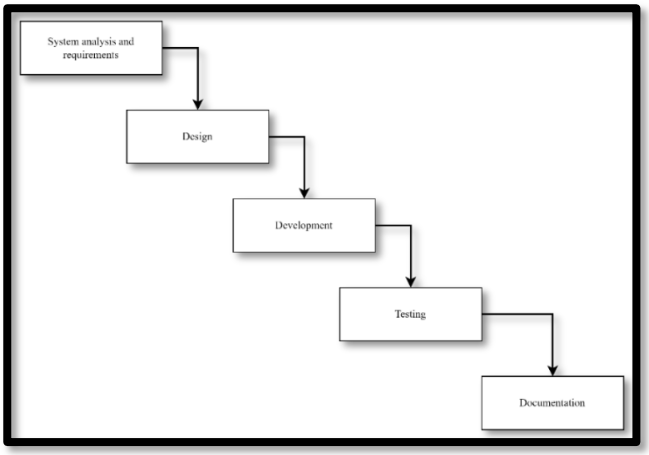

Figure 1 Vehicle accident alert system framework

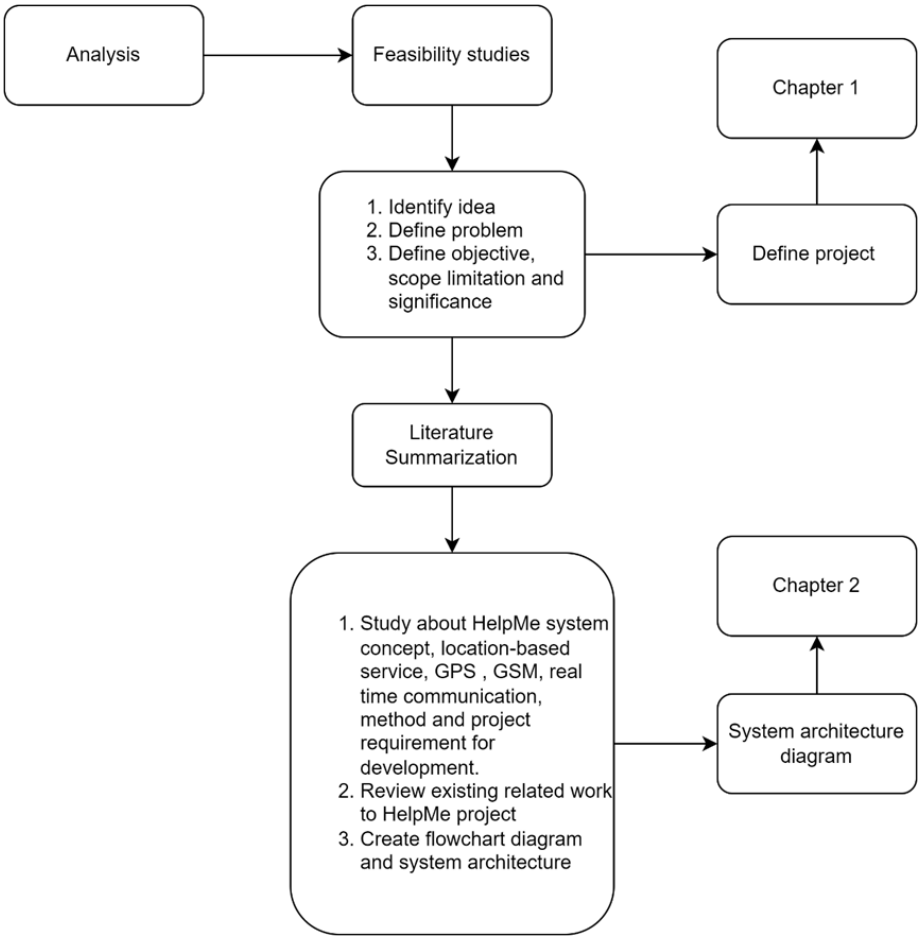

Figure 2 Requirement analysis phase

PCMJ
Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

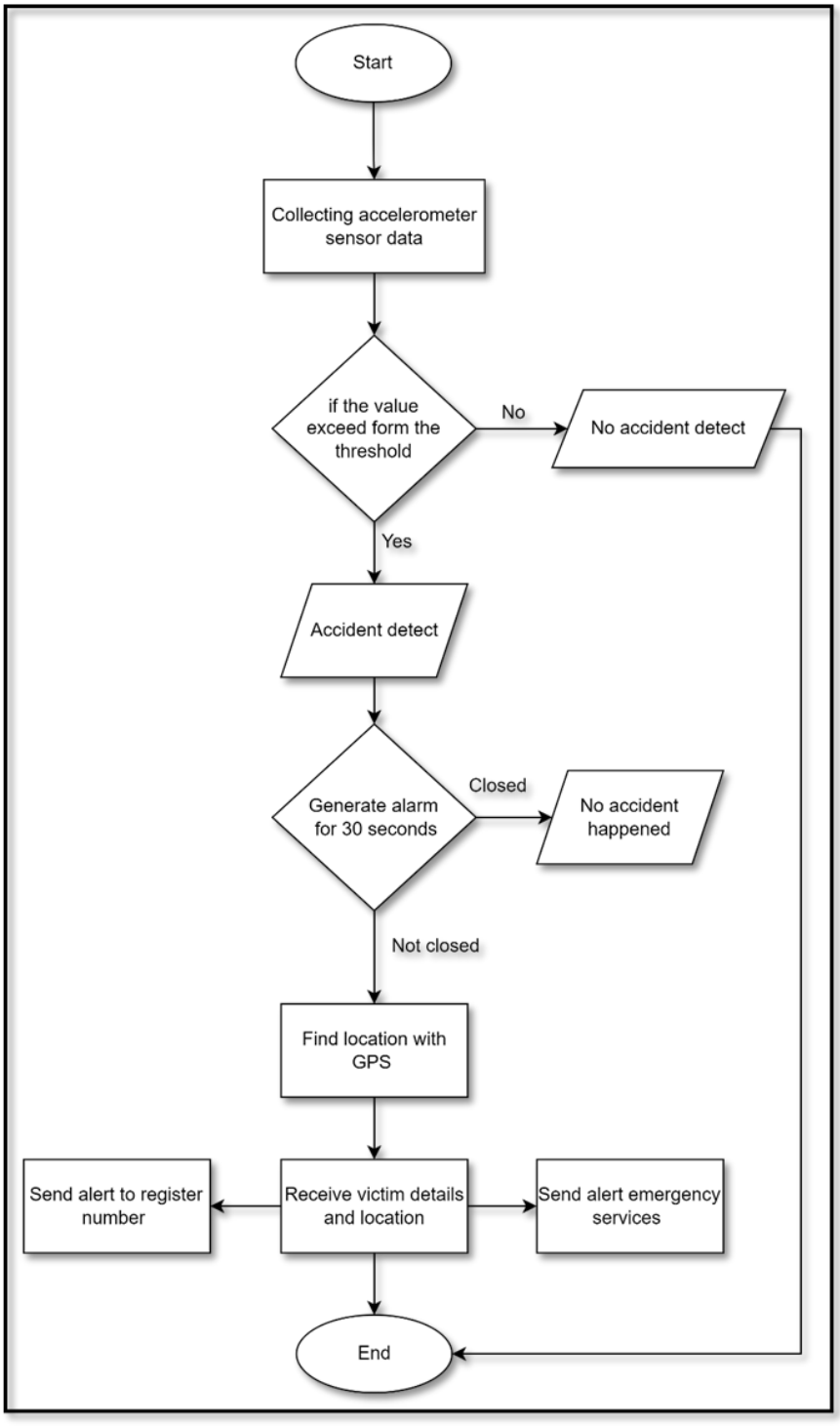

Figure 3 System flowchart

Figure 3 shows the test for entire system. Firstly, Esp32 will collect the accelerometer data.If the value is exceed form the threshold the accident will be detected.It will generate alarm for 30 seconds which can be closed by victim if false alarm.If not closed it will automatically sent alert cause of accident happened. The vehicle alert system will find location

of the victim with gps sensor.The alert will be sent to two responder which register number and emergency services.

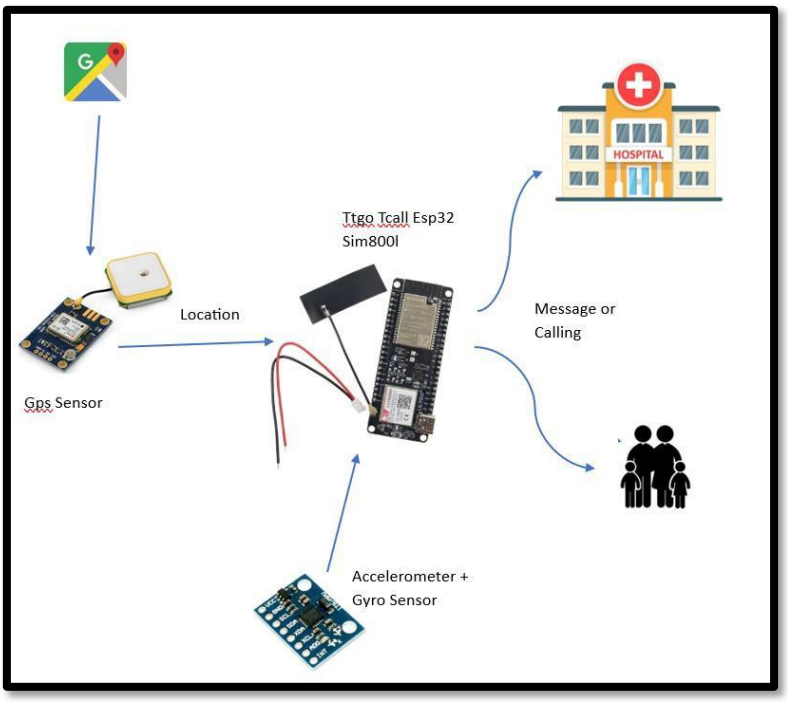

Figure 4 System Architecture

The Vehicle Accident Alert System architecture integrates components such as the MPU6050 accelerometer, GPS NEO-6M module, TTGO ESP32 microcontroller, SIM800H GSM module, and an alert button. The TTGO ESP32 serves as the central processing unit, coordinating communication and data processing among all components. The MPU6050 accelerometer detects sudden changes in acceleration, signaling a potential accident, while the GPS module provides precise location data. Upon detecting an accident, the ESP32 triggers the SIM800H GSM module to send alert messages containing the vehicle's location to designated contacts or emergency services. Additionally, an alert button allows manual initiation of emergency alerts beyond accidents. This integrated system ensures swift accident detection and timely dissemination of critical information, enhancing emergency response capabilities and potentially saving lives.

PCMJ
Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

RESULT AND DISCUSSION

The Vehicle Accident Alert System, incorporating GPS, GSM, and motion sensing technologies, utilizes TTGO T-Call ESP32 with SIM800H, GPS Neo-6M, MPU6050, and the Blynk app. This section presents the results and analysis of the system's performance.

Accident Dashboard On Blynk

The "Accident Location Dashboard" on Blynk is a graphical user interface designed to display and interact with real-time data from a vehicle accident alert system. The dashboard incorporates various widgets to visualize and control the system's features. Here's an explanation of the key elements on the Accident Location Dashboard:

Longitude and Latitude Widgets

- Display the real-time geographical coordinates (longitude and latitude) of the vehicle.Provides precise information about the vehicle's location on a map.

Google Maps URL Widget

- Generates a dynamic Google Maps URL based on the current longitude and latitude.Enables users to access the vehicle's location directly on Google Maps by clicking the URL.

Speed Widget

Displays the real-time speed of the vehicle.Offers insights into the vehicle's speed at the time of the accident.

SMS Button Widget

Initiates the sending of an SMS alert to predefined contacts. Allows users or the system to manually trigger an SMS alert in case of an accident or emergency.

PCMJ
Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

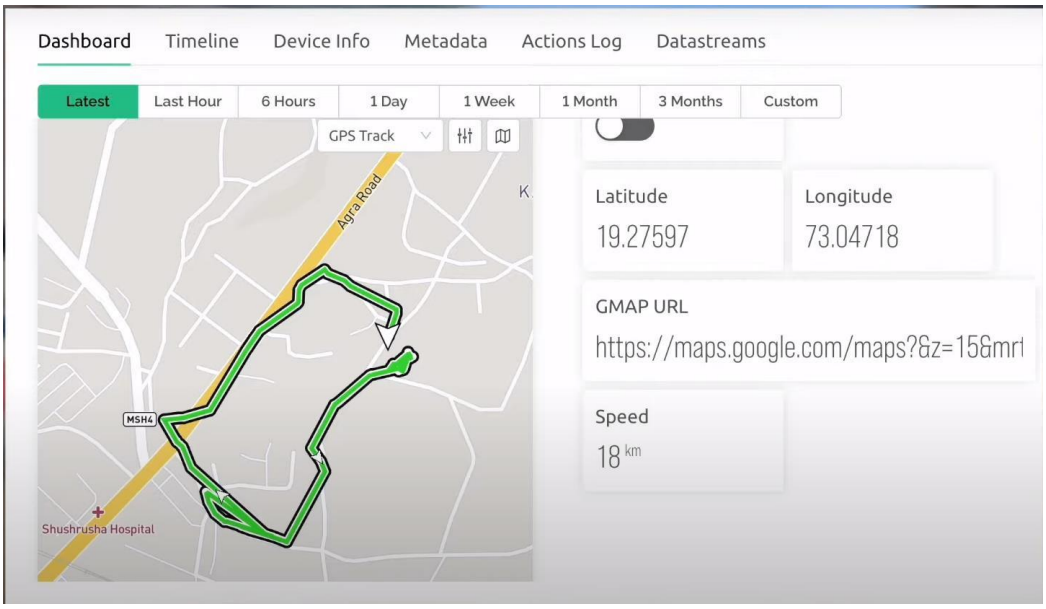

Figure 5 Blynk web dashboard design

Accident alert call

Initiates a phone call to predefined emergency contacts. When an accident is detected (based on MPU6050 data or other criteria), the system triggers the Call Alert functionality. The ESP32 communicates with the SIM800H GSM module to initiate a phone call to predefined contacts. Recipients receive the call and can assess the situation, providing immediate assistance.

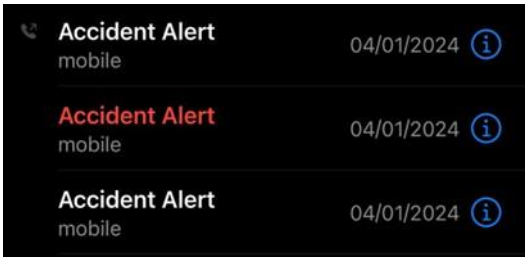

Figure 6 Accident alert history

Accident alert sms notifications

Sends an SMS alert to predefined contacts with details about the accident. Upon accident detection, the system sends relevant information, such as longitude, latitude, and speed, via SMS using the SIM800H module. Recipients receive the SMS alert on their mobile devices, providing critical details for a prompt response.

PCMJ
Progress in Computer and Mathematics Journal (PCMJ)
volume 1 [October, 2024]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

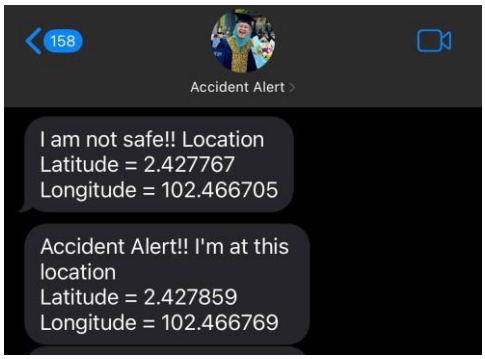

Figure 7 Accident alert message notification

Gps location

Read the GPS data (latitude and longitude) from the Neo-6M module using the ESP32.Utilize the appropriate library or communication protocol (such as NMEA) to extract the GPS coordinates

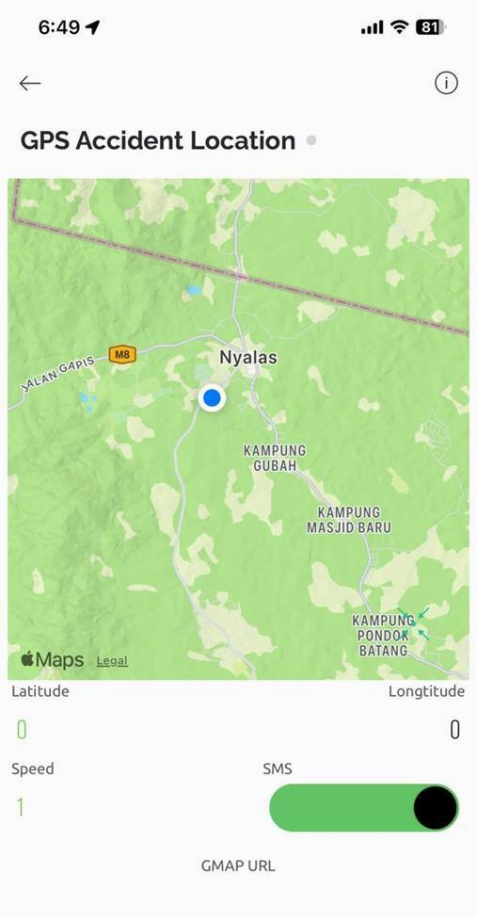

Figure 8 Blynk interface on phone

CONCLUSION

In conclusion, the development of the Vehicle Accident Alert System represents a significant stride towards improving road safety and emergency response mechanisms. By harnessing state-of-the-art technologies such as the TTGO T-Call ESP32, SIM800H GSM module, GPS Neo-6M, MPU6050, and Blynk app, the project demonstrates a commitment to leveraging innovation for societal benefit. Through rigorous evaluation and consideration of security implications, the system addresses critical concerns surrounding IoT device vulnerabilities, ensuring robust performance and reliability. With features like precise location tracking, rapid accident detection, and intuitive user interface provided by the Blynk app, the system offers a comprehensive solution to mitigate road accidents and expedite emergency assistance. As technology continues to evolve, endeavors like the Vehicle Accident Alert System pave the way for safer and more efficient transportation systems, ultimately saving lives and reducing the impact of road accidents on communities.

REFERENCES

Jeon, B., & (2013). A system for detecting the stray of objects within user-defined region using location-based services. *International Journal of Software Engineering and Its Applications*.

Kao, C. H. (2017). A hybrid indoor positioning for asset tracking using Bluetooth low energy and Wi-Fi. In *2017 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW)* (pp. 63-64). IEEE.

Kaur, G., & (2012). Mobile Client's Access Mechanism for Location based Service using Cell ID.

Kim, M. (2015). "The effect of push notification alerts on mobile application usage habit." *Society for Journalism and Communication Studies*, 358–387.

Mall, R. (2009). *Real-time systems: theory and practice*. Pearson Education India.

Martin, J. (1991). *Rapid Application Development*. Macmillan.

Merriam-Webster. (2011). In *Merriam-Webster.com dictionary*. https://www.merriamwebster.com/dictionary/key%20chain

Song, D. S. (2015). A Privacy-Preserving Continuous Location Monitoring System for Location Based Services. *International Journal of Distributed Sensor Networks*, 2015, 1–10.

KumarA, A., Scholar, U., & Professor, A. (2018). Accident Detection and Alerting System Using Gps & Gsm. *International Journal of Pure and Applied Mathematics*, *119*(15).

Musa, A., Mashood, S., Patrick, S., & Ahmed, A. (2019). Vehicle Tracking and Accident Alert System Using GPS and GSM Modules. *ABUAD Journal of Engineering Research and Development (AJERD)*, *2*(2).

Prof. Girija Chiddarwar, Sanket Dhivar, Atharva Kulkarni, Bodhisatva Gajbhiye, & Nishant Chaudhari. (2022). Accident Alert System Using IoT. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*. https://doi.org/10.32628/cseit2282125

Yellamma, P., Chandra, N. S. N. S. P., Sukhesh, P., Shrunith, P., & Teja, S. S. (2021). Arduino Based Vehicle Accident Alert System Using GPS, GSM and MEMS Accelerometer. *Proceedings - 5th International Conference on Computing Methodologies and Communication, ICCMC 2021*. https://doi.org/10.1109/ICCMC51019.2021.9418317

Shaik, A., Bowen, N., Bole, J., Kunzi, G., Bruce, D., Abdelgawad, A., & Yelamarthi, K. (2018). *Smart Car: An IoT Based Accident Detection System*. In *2018 IEEE Global Conference on Internet of Things (GCIoT).*

Sharma, S., & Sebastian, S. (2019). *IOT Based Car Accident Detection and Notification Algorithm for General Road Accidents. International Journal of Electrical and Computer Engineering (IJECE)*, October 2019, Volume 9, Issue 5.

Khaliq, K. A., Qayyum, A., & Pannek, J. (2017). *Prototype of Automatic Accident Detection and Management in Vehicular Environment Using VANET and IoT*. In *2017 11th International Conference on Software, Knowledge, Information Management and Applications (SKIMA).*

Karmokar, P., Bairagi, S., Mondal, A., Nur, F. N., Moon, N. N., Karim, A., & Yeo, K. C. (2020). *A Novel IOT Based Accident Detection and Rescue System*. In *Proceedings of the Third International Conference on Smart Systems and Inventive Technology (ICSSIT 2020)*.

Chandran, S., Chandrasekar, S., & N, E. E. (2016). *Konnect: An Internet of Things (IoT) based Smart Helmet for Accident Detection and Notification*. In *2016 IEEE Annual India Conference (INDICON)*, Pages 1-4.

Nanda, S., Joshi, H., & Khairnar, S. (2018). *An IOT Based Smart System for Accident Prevention and Detection*. In *2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)*, Pages 1-6.

Mohapatra, B. N., Wavare, K., Patil, V., & Buttepatil, K. (2020). *IOT and Sensor-Based Vehicle Diagnosis System for Improved Road Safety*. *International Journal of Research in Engineering Science and Management*, July 2020, Volume 3, Issue 7, Pages 181-183.

Kumar, H. N., & G., D. (2017). *Accident Detection and Intelligent Navigation System for Emergency Vehicles in Urban Areas using IoT*. *International Journal of Engineering and Techniques*, November-December 2017, Volume 3, Issue 6.

Desima, M. A., Ramli, P., Ramdani, D. F., & Rahman, S. (2017). *Alarm System To Detect the Location of IOT based Public Vehicle Accidents*. In *International Conference on Computing, Engineering and Design (ICCED)*, 2017, Pages 1-5.

Kumar, N., Acharya, D., & Lohani, D. (2021). *An IoT-Based Vehicle Accident Detection and Classification System using Sensor Fusion*. *IEEE Internet of Things Journal*, January 2021, Volume 8, Issue 2, Pages 869-880.

Al Wadhahi, N.T.S., Hussain, S.M., Yosof, K.M., Hussain, S.A., & Singh, A.V. (2018). Accidents detection and prevention system to reduce traffic hazards using IR sensors. In *7th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)*, pp. 737–741.

Ali, A., & Eid, M. (2015). An automated system for accident detection. In *IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings*, pp. 1608–1612.

PCMJ

Progress in Computing and Mathematics Journal

UNIVERSITI TEKNOLOGI MARA
Cawangan Melaka

eISSN 3030-6728