UNIVERSITI TEKNOLOGI MARA

JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM 2024

PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)

"Flourish and Nurturing Sustainable Innovation for a Prosperous Nation"

JOHOR INTERNATIONAL INNOVATION, INVENTION COMPETITION AND SYMPOSIUM

Editorial Board

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector

Assalamualaikum warahmatullahi Wabarakatuh, Salam Sejahtera, Salam Malaysia MADANI and Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most Merciful.

It is a great honor to welcome you to the Johor International Innovation, Invention, Competition, and Symposium 2024 (JIIICaS 2024). This event connects various disciplines, focusing on education and engaging educators, students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and determination to turn those ideas into reality. The remarkable projects showcased today highlight the dedication and spirit of all participants. Initiatives like this not only explore new technologies but also cultivate skills and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor Branch, we are fully committed to fostering a dynamic culture of innovation, promoting the commercialization of new products, and encouraging meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all sponsors, judges, the College of Computing, Informatics and Mathematics, UiTM Pasir Gudang Campus as the event organizer, as well as to the researchers and participants for their hard work in making this event a success. Let us continue striving for innovation and excellence. May the ideas presented today inspire us and lay the groundwork for future achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
Johor Branch

(A-ST161) SMART SAFEGUARD CANE

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ABSTRACT

Blindness and vision impairment remains one of the major problems in Malaysia present among the population in substantial percentages. The latest available figures show that there are 180,000 blind and more than half a million living with moderate to severe vision impairment in Malaysia. Vision impairment challenges include access barriers to information, mobility, social interaction, comprehensive support and healthcare. In response to these challenges, an innovative solution “Smart Safeguard Cane” has been developed. The cane has built-in GPS for navigational assistance, a fall detection system with emergency notification alert, and an user-friendly mobile application designed for visually impaired. The app allows users to find such facilities as toilet or bus stops on their own, which improves equality and sense of secure. The most distinctive characteristics of the Safeguard Cane consist of a fall detector that employs IMU sensors, which trigger GPS-based emergency notifications through Bluetooth to emergency contacts. The emergency buttons on cane also ensure safety by producing an alarming sound and getting attention of surrounding people. The mobile application, created with Kodular, allows simple interaction using swipe and tap gestures and includes text-to-speech option. It supports customizable fonts and high contrast visual themes that help the user to navigate through without any assistance so as to enhance independence. Thus, the low-cost Safeguard Cane not only increases the mobility but also provide the second chance for disabled people in Malaysia to gain independency, and it also can achieve the SDG goals 10 to reduce inequalities.

Keywords: emergency, fall detection, GPS, mobile application, navigation

1.0 INTRODUCTION

According to the 2023 survey of World Health Organization (WHO) about 2.2 billion of people have near or distance vision impairment (WHO, 2023). In Malaysia alone, the latest available figures show that there are 180,000 blind and more than half a million living with moderate to severe vision impairment (IAPB, 2023). In 1996, the Malaysian National Eye Survey (NES I) reported blindness at 0.29% and low vision at 2.44% (IAPB, 2023). The number of blind Malaysians climbed to 1.2% by the year 2022 (IAPB, 2023).

When faced with unfamiliar environments or terrains, visually impaired people have difficulty navigating to their desired destinations and can feel unsafe without pedestrian tactile facilities (Kim and Cho, 2013; Ramirez *et al*., 2012; Hoogsteen, 2022; Nazri *et al*., 2021; Mai et al., 2023). Consequently, calling emergency services requires

more time. This might lead to a delay when crucial assistance is needed. In situations where a person with vision impairments falls and is unable to get in touch with the person responsible, things may get worse if they are in an area with few people. In addition, if the person's cane falls free from them, urgent action needs to be taken.

While some of them rely on guide dogs but this solution has limitations (Hoogsteen, 2022; Nazri *et al*., 2021; Kumar *et al*., 2021; Mai *et al*., 2023). Guide dogs need to be well trained and taken care; it will make mistakes due to lack off effective communication with humans (Hoogsteen, 2022; Nazri *et al*., 2021; Kumar *et al*., 2021; Mai et al., 2023). Beside of visually impaired individuals, elderly is also one of the populations that highly need attention (WHO, 2021; Kim and Cho, 2013). Falls are a significant global public health issue, causing an estimated 684,000 deaths annually, the second highest for unintentional injuries after road traffic accidents (WHO, 2021).

In contrast, a smart emergency cane that goes under the name “Smart Safeguard Cane” helps people with various types of vision impairments feel secure. For individuals with vision impairments, the Safeguard Cane with GPS for precise navigation, a fall detector with an automated emergency alert system, and a smart mobile app with a feature that allows them to navigate to the closest restroom or bus stop is the ideal way to train themselves independently, regain their sense of equality like normal people, and boost their self-esteem and sense of security

2.0 OBJECTIVE

The primary goal is to create a Smart Safeguard Cane equipped with navigation and fall detection systems. This cane will be integrated with a user-friendly app designed for individuals with low vision, blindness, the elderly, patients, and hikers in Malaysia.

3.0 METHODOLOGY

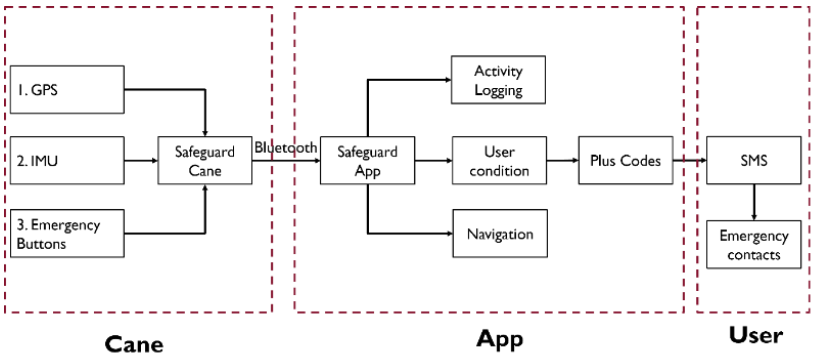


Figure 1: Overall Block Diagram

Figure 1 displays the overall block diagram of the Safeguard Cane and Safeguard App. The Smart Safeguard Cane is equipped with hardware components including a LilyGo microcontroller, GPS, IMU sensor, micro SD card, and battery. This cane provides robust emergency features alongside advanced navigation capabilities, designed to improve safety and independence for visually impaired individuals. A key feature is the integrated fall detector, which continuously monitors user movements through the IMU sensor. The app's "Automatic Emergency Alert System" effectively manages notifications, ensuring swift assistance during emergencies.

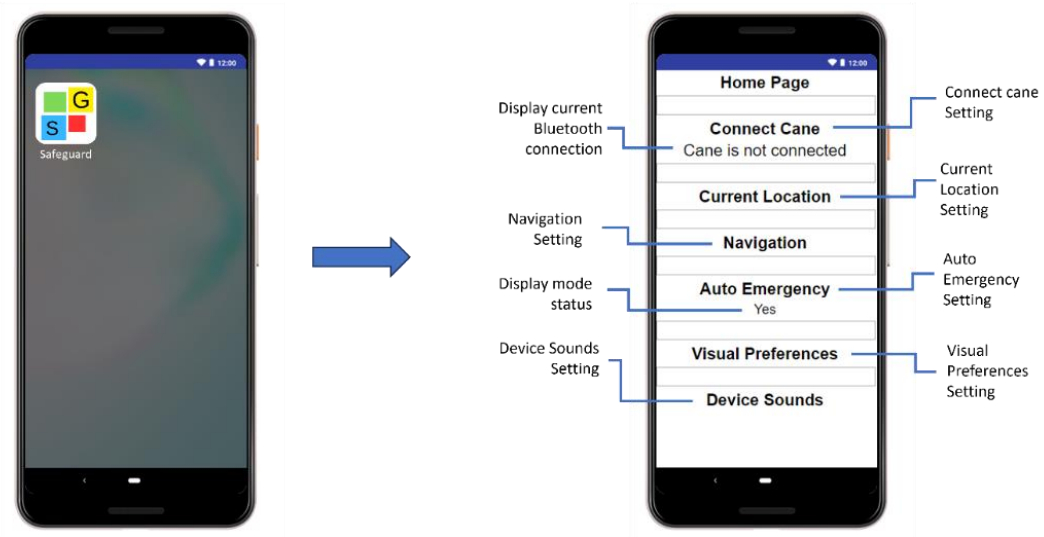


Figure 2: Smart Safeguard App features

Figure 2 presents the features of the Safeguard App, including navigation mode, cane connection, auto-emergency mode, and various other settings. The Smart Safeguard App is designed with gesture detection, text-to-speech capabilities, and high-contrast text options, making it especially accessible for users with visual impairments. The user interface is streamlined to allow navigation through swipe and tap gestures anywhere on the screen, removing the need for precise button presses or touches on the phone.

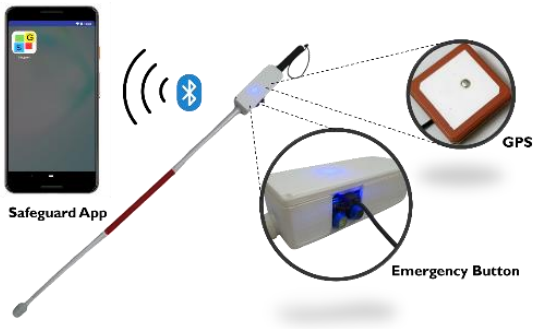


Figure 3: Overview of Smart Safeguard Cane and Smart Safeguard App

Figure 3 illustrates the Smart Safeguard Cane, which features a GPS and an emergency button. These components are integrated with the Smart Safeguard App to facilitate navigation and emergency situations. The emergency button, equipped with a buzzer function, allows the user to summon assistance when needed.

4.0 RESULTS

Figure 4 shows the Safeguard App preference setting. The app offers visual customization for low vision users, including theme options and font size adjustments for accessibility. The app provides three themes: default black on white, white on black, and yellow on black. These high-contrast visual themes enhance visibility and accommodate different user needs.

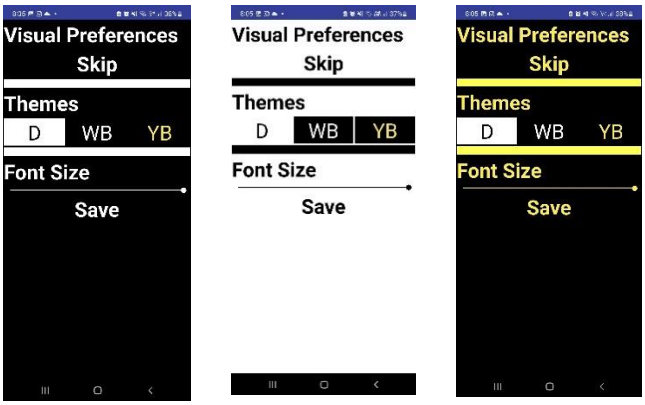
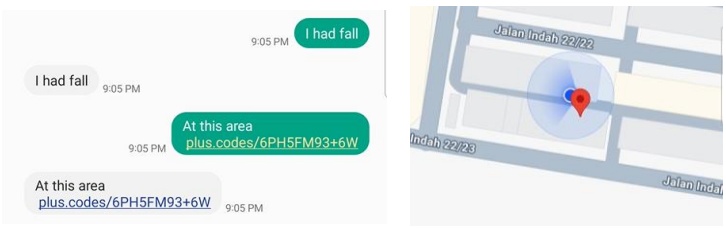


Figure 4: Visual Preferences Themes in Safeguard App Setting

Figure 5 shows the auto emergency mode enabled and fall detected. During auto-emergency mode, the cane's fall detector triggers GPS data transmission to the mobile app via Bluetooth. Coordinates are converted into Plus Codes, quickly notifying emergency contacts via SMS within seconds.



(a) (b)

Figure 5: Auto-Emergency Mode Enabled and fall detected (a)SMS (b)Plus Codes

Figure 6 shows the routh when the user enables the navigation mode. The routh will be shown in the screen as shown in Figure 6. The path will be converted into voice to inform the user through “text-to-speech” function. This can assist the vision impairment patient to increase their mobility and travel to work as a normal people.

Figure 6: Navigation

5.0 CONCLUSION

In conclusion, the Smart Safeguard Cane and Smart Safeguard App empower the blind and visually impaired with advanced navigation features, enhancing independence and safety while saving time and costs. By seamlessly integrating advanced features like GPS, navigation, and intuitive mobile app functionalities, this innovative cane redefines the navigation experience for the blind community.

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