

**CSC2106**

**IoT Protocols and Networks**

**Project Proposal Report**

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# 1. Problem Statement

Falls among the elderly, particularly those living alone, pose a significant health risk. Without timely intervention, falls can result in severe injuries, prolonged hospitalizations, or even fatalities.

According to a study by the National University Health System (NUHS, 2023), **nearly one-third of Singaporeans aged 65 and above** have experienced at least one fall, **with 40% of these incidents leading to injury-related fatalities**. This highlights the urgent need for a **real-time, precise, and responsive fall detection system.**

Singapore is experiencing a rapidly aging population. As of 2023, over **19% of Singapore’s population was aged 65 and above**, and this figure is projected to reach **25% by 2030** (Department of Statistics Singapore, 2023). This demographic shift increases the demand for elderly-focused smart technologies to improve independent living and ensure timely emergency interventions.

Existing fall detection solutions often lack **accurate fall detection** and **instant emergency alert mechanisms**, limiting their effectiveness in HDB flats where many seniors reside. For example, the iWOW fall detection system relies on **camera-based monitoring**, which raises privacy concerns and may not be effective for real-time tracking in personal spaces like bedrooms and bathrooms (iWOW Solutions, 2024). Other solutions such as **bed pressure sensors** and **motion-detection cameras** do not provide **real-time fall detection outside predefined areas**. This project aims to address these shortcomings by integrating **wearable IoT technology with real-time fall detection and location tracking**.

# 2. Importance & Relevance

## Industry

With **Singapore’s aging population**, demand for **innovative eldercare solutions** is increasing (Smart Nation Singapore, 2024). A **reliable fall detection system** can be integrated with **smart home technologies**, opening up opportunities in the healthcare and IoT markets.

## Academia

This project advances research in **IoT applications for healthcare**, providing valuable **data on elderly mobility patterns** and evaluating the effectiveness of **technology-based fall prevention strategies** (Li, 2023).

## Society

Enhancing **elderly safety and independence** while reducing the burden on **caregivers and healthcare services**, ultimately providing **peace of mind** to families and support networks.

# 3. Potential Impact

1. Quicker response times during emergencies, potentially reducing morbidity associated with falls.
2. Empowerment of elderly individuals to live independently, improving their quality of life.
3. Alleviation of caregiver stress by offering reliable and automated fall monitoring.

# 4. Specific Gap or Challenge Addressed

Most existing fall detection solutions fail, which is crucial in dense living environments like HDB flats. This project addresses this limitation by:

* Ensuring seamless integration with emergency services and caregiver alert systems.
* Providing a non-invasive, wearable alternative to camera-based solutions, enhancing privacy and comfort for elderly individuals.

# 5. Main Goals of the Project

1. Develop a wearable fall detection device using the M5StickC Plus.
2. Implement a scalable backend architecture using containerization to grow with the number of active fall trackers.
3. Establish a reliable and scalable communication network between the fall tracker, transmitters, and the monitoring office.
4. Enable automated emergency alerting to caregivers and medical response teams.
5. Design a user-friendly mobile interface for monitoring and managing alerts.

**Communication Flow**

Wearable Device (M5StickC Plus) → Floor via MQTT → Office via LoRaWAN → Emergency Services via Internet

# 6. Expected Outcomes

# A functional prototype capable of detecting falls in real time.

# Seamless network integration to ensure rapid alert dispatch.

# Comprehensive testing in an HDB setting to validate accuracy, reliability, and response effectiveness.

# References and Resources

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