PROJECT ABSTRACT

IoT Fall Detection System for Elderly

Falls are the leading cause of injury among the elderly, and the critical factor is response time — an elderly person lying helpless after a fall faces far worse outcomes the longer help takes to arrive.

01 Title

IoT Fall Detection System for Elderly

02 Introduction / Background

Falls are the leading cause of injury among the elderly, and the critical factor is response time — an elderly person lying helpless after a fall faces far worse outcomes the longer help takes to arrive. Wearable fall detectors close that gap, but commercial devices are expensive and subscription-locked. It is also an ideal final-year project: it demands real sensor-signal processing, a robust detection algorithm, false-alarm handling and an end-to-end alert chain — giving the student engineering to defend in the viva.

03 Problem Statement

Elderly people living alone have no one to notice a fall, and panic buttons are useless if the wearer is unconscious. This project builds a wearable IoT fall detector — an MPU6050 IMU feeding a three-stage fall-signature algorithm on an ESP32, with a cancel-button safeguard against false alarms and GSM SMS alerts carrying a GPS location link to family members.

04 Objectives

- Three-stage fall detection: free-fall dip → impact spike → inactivity window.
- Sensitivity thresholds tuned for elderly movement profiles.
- 20-second cancel countdown with buzzer to suppress false alarms.
- GSM SMS alerts to up to 5 emergency contacts with GPS location link.
- Low-power design: deep-sleep with motion-interrupt wake (~2–3 days battery).
- On-device event logging with timestamps for report evidence.

05 Proposed System / Working

Built around the ESP32 DevKit with an MPU6050 6-axis IMU sampled at 100 Hz over I2C. The firmware computes the resultant acceleration magnitude and flags a fall only when the three stages occur in sequence: free-fall dip (resultant < 0.6 g), impact spike (> 2.5 g) within ~1 s, then ~10 s of inactivity. On detection the buzzer sounds and a 20-second cancel countdown starts; a press of the red button aborts the alert. If the countdown expires, a SIM800L GSM module sends SMS alerts to the registered contacts, embedding a Google Maps link from the NEO-6M GPS module. The

ESP32 sleeps in deep-sleep between motion interrupts for battery life, and each event is logged with its timestamp and sensor trace. A companion app view shows the alert notification, location map and emergency contact list.

On a simulated-fall test set the three-stage algorithm detected falls with ~90%+ sensitivity while rejecting everyday motions (sitting, bending, walking). Alert latency from impact to SMS delivery measured under 60 seconds. The live demo is compelling and safe: dropping the unit onto a cushion triggers the buzzer countdown, and letting it expire fires the test-mode alert exactly as in a real fall.

06 Technologies / Components Used

ESP32 · MPU6050 IMU · GSM module · GPS (optional) · buzzer · cancel button · wearable enclosure

07 Key Features

- MPU6050 6-axis IMU in a wrist/belt-worn enclosure.
- Three-stage fall signature with configurable thresholds.
- Cancel button + buzzer countdown against false alarms.
- GSM SMS alerts to 5 contacts with GPS location link.
- No internet needed — alerts travel over cellular SMS.
- Deep-sleep power design; event logging with timestamps.

08 Applications / Use Cases

- Elderly care at home
- assisted-living facilities
- post-surgery recovery monitoring
- lone-worker safety
- as a platform for adding heart-rate or location-tracking extensions

10 Conclusion

This wearable is a complete, examinable IoT safety system — from IMU signal processing to cellular alerts — with a socially impactful story and honest test results the student can defend in the viva.