Accelerometer and Gyroscope based IoT System for Activity Classification

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***Abstract*—This document is a model and instructions for LaTeX. This and the IEEEtran.cls file define the components of your paper [title, text, heads, etc.]. *CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract.**

***Index Terms*—component, formatting, style, styling, insert.**

I. Introduction

Blah Blah

A. Problem Statement

Statement

B. Need for IoT system

Wearable sensors and cloud integration enables scalable real time monitoring.

C. Aim and Objectives

Acquire inertial data (accel + gyro) using Feathersense board.

Transmit via BLE to IoT gateway.

Perform preprocessing (feature extraction: jerk, magnitude, etc.) at the gateway.

Prepare pipeline for ML in Deliverable II.

II. System Design

A. Block diagram of the IoT system

Sensor Node (Feathersense: accelerometer, gyroscope, BLE)

Communication layer (BLE GATT protocol)

IoT Gateway (Raspberry Pi 4, receiving, preprocessing, visualization)

Cloud platform (for future phases, just note it)

B. Simplified IoT architecture

Perception Layer – Feathersense (sensors)

Network Layer – BLE (UART attempt → too slow, GATT → selected)

Edge Layer – Raspberry Pi (data reception, feature computation: jerk, orientation, etc.)

Application Layer – For Deliverable I: visualization, plots. For future: ML in cloud.

III. Component Selections

A. Sensor Node

Feathersense board (justification: built-in accel/gyro, BLE support, low-power).

B. Gateway

Raspberry Pi 4 (justification: computing capacity, BLE support, Python libraries).

C. Communication

BLE GATT (justification: faster, lightweight vs BLE UART).

D. Power

(Feathersense USB/battery powered, mention suitability for prototyping).

Provide comparisons if possible (e.g. why not ESP32, why GATT over UART).

IV. Prototype Design Plan

A. Subsystems

B. Integration Plan

C. Verification Plan

V. Implementation

A. Feathersense Node Setup

how you collected accel/gyro.

B. BLE Protocol

initial trial with UART + CBOR (limitations), decision to switch to GATT.

C. Data Transmission

sampling frequency, packet size, latency.

Include screenshots/plots of transmitted data (e.g. raw accel/gyro traces).

VI. Implementation of Gateway Device

A. Data collection on Raspberry Pi

connection with Feathersense via BLE GATT.

B. Streaming Visualisation

live plotting of received sensor data.

(Screenshots/graphs of plots go here.)

VII. Edge/Fog Processing

Jerk calculation (derivative of acceleration).

Magnitude of accel/gyro.

Other features relevant for ML (you can mention RMS, variance, etc. if planned).

Show small plots of raw vs processed features.

A. Discussion & Conclusion

Summary: successful acquisition, transmission, preprocessing.

Limitations: still simulated/early prototype, real-world testing needed.

Next steps (for Deliverable II): deploy ML in cloud, integrate with Power BI.

References

Cite like so [6].

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