

PROJECT ABSTRACT

IoT Gym Equipment Usage Tracker

An IoT usage tracker for gym equipment: wireless sensor nodes detect real activity per machine from vibration signatures and a dashboard shows live IN USE / FREE status, utilization and peak hours. Delivered built-to-order with the sensor nodes, gateway firmware, working dashboard demo, report, PPT and viva kit.

Project type: Hardware + dashboard

Availability: Built to order

Suitable branches: IoT & Embedded, Electronics / E&TC, Computer / IT

Technologies: ESP32 sensor nodes, MPU6050 sensing, Wi-Fi telemetry, web dashboard, Arduino IDE

Price: Request a quotation

Prepared by Projectech · projectech.in — for academic project reference.

1. Title

IoT Gym Equipment Usage Tracker

2. Introduction / Background

A gym floor is full of expensive equipment and thin data. Owners know the membership count but not the machine count that matters: how many minutes each treadmill, cycle and bench station actually works per day, which hours saturate the floor, and which machines sit idle while members queue elsewhere. Manual observation does not scale, and billing software tracks memberships, not equipment. This project instruments the machines: compact wireless nodes detect real usage from vibration signatures and a dashboard turns it into utilization data for layout, maintenance and purchase decisions.

3. Problem Statement

Equipment decisions — buying another treadmill, retiring an idle machine, scheduling maintenance — are made on gut feel because per-machine usage data does not exist. Camera-based tracking is intrusive and manual logs are unreliable. This project provides a privacy-positive alternative: vibration-signature sensing that measures active minutes per machine with no cameras and no personal data, aggregated through a gateway into a dashboard that answers exactly which equipment earns its floor space.

4. Objectives

- Detect real machine activity per equipment with wireless vibration/motion sensor nodes.
- Classify IN USE vs IDLE with threshold-plus-debounce firmware logic.
- Aggregate active minutes per machine through a Wi-Fi gateway to a cloud backend.
- Render a live floor-status dashboard with utilization bars and peak-hour patterns.
- Support battery-efficient node operation (sleep, state-change reporting, heartbeat).
- Deliver the full kit: nodes, gateway firmware, dashboard demo, tuning guide, report, PPT and viva Q&A.;

5. Proposed Methodology

The system is built in three layers. (1) Nodes: an ESP32-class board with a motion sensor mounts on each machine, samples vibration energy at low duty cycle, and classifies active/idle with a tuned threshold plus debounce; state changes transmit immediately and heartbeats confirm liveness. (2) Gateway/backend: a gateway timestamps state changes and accumulates active minutes per machine. (3) Dashboard: the web UI renders the live floor map, utilization bars, the hourly peak pattern and the event log. Commissioning tunes the threshold per machine type with the tap-test and validates against a supervised workout.

6. System Architecture / Working

Each node watches its machine's vibration energy; sustained energy above the tuned threshold (after debounce) marks the machine IN USE, and sustained quiet marks it FREE — a bumped machine does not log a workout. State changes go immediately over Wi-Fi to the gateway, which accumulates active minutes per machine in the backend. The dashboard polls the backend to render the live floor map with IN USE / FREE badges, per-machine utilization bars, the peak-hours view and the node-health list with offline flags. The included single-file demo dashboard runs the same interface on simulated floor telemetry.

7. Hardware / Software Requirements

- ESP32-class sensor nodes (one per machine)
- MPU6050 / vibration sensor modules
- Wi-Fi telemetry to gateway and cloud backend
- Web dashboard (single-file HTML/CSS/JS demo included)
- Li-ion battery packs with charging modules
- Arduino IDE (C/C++ firmware)

8. Expected Outcomes

- A working floor monitor with live per-machine IN USE / FREE status.
- Per-machine utilization percentages and peak-hour patterns from real sensing.

- A documented threshold-tuning procedure validated against supervised workouts.
- Battery-budget analysis in the report.
- A complete report, PPT and viva Q&A; covering sensing, classification and the dashboard.

9. Applications

- Gym and fitness-center equipment management.
- Teaching wireless sensing and embedded classification.
- Utilization studies for any shared-equipment setting (labs, workshops).

10. Future Scope

- Rep/set estimation with advanced motion analysis per machine type.
- Member check-in integration for per-user (opt-in) statistics.
- Predictive maintenance from vibration-signature drift.
- BLE mesh networking for large floors.