H&W Band: A Smart Wearable System for Post-Hospital Patient Monitoring Using IoT

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Abstract: The rise in outpatient recovery and the strains on healthcare infrastructure over the past few years have highlighted the need for accessible, intelligent patient monitoring systems. This paper introduces and discusses the H&W Band, an IoT enabled wearable device that has been designed to track vital health parameters – heart rate, SpO2, and body-temperature – and respond to any emergencies in real-time, while also providing these metrics to overseers. It has been designed keeping efficiency and affordability in mind, using components such as the Arduino Nano 33 IoT, MAX30102, MLX90614, GPS Modules, speaker and microphone modules.

Unlike conventional commercial wearables that are often too expensive, limited to passive tracking or inaccurate measuring, the H&W Band includes customizable threshold-triggered alerts, real-time data logging and escalation protocols. The system has been tailored keeping recently discharged patients in mind along with those in remote areas and limited access to immediate care.

This paper discusses the design, architecture, use-case justification of the device, along with a comparison with pre-existing solutions and future improvements in the H&W Band.

Keywords – IoT in Healthcare, Wearable Devices, Post-Hospital Monitoring, Arduino Nano 33 IoT, Real-Time Alert Systems

1. Introduction

The demand for effective remote patient care has never been greater. Healthcare systems worldwide are under ongoing pressure from aging populations, chronic disease, and resource limitations. After getting discharged from the hospital—particularly after surgical recovery or intensive care—patients are still at risk of relapse, infection, or acute deterioration, but many are simply left to monitor themselves at home without adequate supervision.

Conventional follow-ups and telephone checks do not possess the immediacy and automation needed to identify early warning signs of health issues. [10][14] Here, wearable technologies became revolutionary devices, providing non-invasive checks on critical health parameters. Most off-the-shelf devices like the Apple Watch or Fitbit, however, are based on fitness-oriented consumers [1][2], not on high-risk post-operative patients. These devices infrequently have automated emergency procedures, two-way interaction, or the capacity to escalate warnings depending on context-relevant thresholds.

1.1 The HealthCare Gap

Hospital-discharged patients frequently experience difficulty with follow-up appointments, medication adherence, and symptom management. Time lags in symptom recognition, including rising temperature or declining oxygen saturation, can lead to re-admission, heightened healthcare expenditures, or death. For individuals residing in rural or underserved areas, access to prompt professional intervention is even further restricted.

This reality requires a system that not only tracks patient vitals in real-time but also knows when to step in, even without explicit user intervention. The system needs to be dependable, cost-effective, and user-friendly—particularly for seniors or technology-novices.

1.2 The H&W Band Vision

The Health & Wellness Band (H&W Band) address this need. It is a low-cost wearable device that allows the continuous measuring and monitoring of heart rate, temperature and SpO2 levels while providing real time alerts, automated location dispatches in case of non-responsiveness, two-way voice communication and customizable firmware for addition of extra or specific sensors.

Unlike pre-existing solutions, the H&W Band is designed around open-source hardware and prioritizes emergency response, not just passive tracking.

2. Current Solutions

The worldwide wearable technology sector has come on incredibly over the last few years, but most devices are still fitness and wellness focused and not clinical monitoring focused. As consumer electronics and health monitoring converge, it's important to measure these solutions not only for richness of feature, but for medical reliability, responsiveness, and their capability to escalate care.

This part discusses current technologies—both commercial and research-based—and compares them to the H&W Band along with their major capabilities, weaknesses, and intended use.

2.1 Limitations of Current Wearables

a. Consumer-Grade Wearables

Wearables like Apple Watch Series 8, Fitbit Charge 5, and Samsung Galaxy Watch 6 include heart rate monitoring, SpO_2 measurements, and even ECG in a few instances. [1][2] These wearables, however:

- Are highly dependent on smartphone pairing
- Lack automatic emergency procedures
- Render no voice calls
- Usually demand subscription-based apps for added features
- Come at a cost of more than USD 150–400, making them out of reach for most users

Although their reliability is adequate for use in fitness purposes, they fall short of the reliability standards of post-surgery patient monitoring where missing alarms (false negatives) can have disastrous outcomes.

b. Medical-Grade Devices

Devices such as BioIntelliSense BioSticker or Masimo MightySat provide FDA-cleared clinical monitoring.[3] They are:

- Highly accurate
- Designed for healthcare integration
- Typically used in institutional or research settings

But they are expensive, not very customizable, and not intended for direct patient interaction. They are mostly single-function devices and do not have features such as GPS, real-time alerts, or local feedback in the form of screens or audio.

2.2 Component-Level Accuracy Comparison

Function	Component	Accuracy	Comparable Device	Remarks
Heart Rate	MAX30102	±2 BPM at rest	BioSticker, Apple Watch	High accuracy under low-motion conditions
SpO2	MAX30102	±2% in normal perfusion	Fitbit, Masimo MightySat	Sensitive to motion; comparable at rest
Temperature	MLX90614	±0.2°C (±0.36°F)	BioSticker, ThermoScan	Suitable for fever detection
Location Tracking	GPS Module	<5m accuracy outdoors	None (most use phones)	Self-contained GPS; no smartphone needed
Audio Interaction	Mic + Speaker	Manual control	None	Voice communication not in wearables
Display Feedback	1.8" TFT LCD	Local vital sign display	Fitbit, Samsung	Immediate, readable feedback

2.3 Comparison Table

Ref. #	**Device/Study**	**Metrics Monitored**	**Target Audience**	**Limitations Identified**
[1]	Apple Watch Series 8	HR, ECG, SpO_2, fall detection	General consumers	Expensive, no automatic escalation,

				dependent on phone
[2]	Fitbit Charge 5	HR, SpO_2, skin temp	Fitness users	No GPS, no alerts, low SpO_2 accuracy in motion
[3]	BioIntelliSense BioSticker	HR, RR, Temp	Hospitals, clinics	High cost, limited accessibility, no user interaction
[4]	IoT Smart Patch for Elderly Care [academic]	Temp, movement, emergency	Elderly at home	Weak data escalation and no audio/GPS support
[5]	H&W Band (this work)	HR, SpO_2, Temp, GPS, Voice	Post-discharge patients	Prototype stage; cloud integration in progress

2.4 Unique Contribution of the H&W Band:

• Initial low-cost open-source wearable with voice, GPS, display, and alerting
• Planned for high-risk patients, not merely typical consumers
• Modularly upgradeable with features like Bluetooth fallback, fall detection, or EMR syncing
• Does not rely on smartphone, unlike 90% of current wearables

The H&W Band builds upon academic and industrial insights but pushes the frontier by combining multi-sensor health tracking with real-time emergency intervention in a patient-centric design. In the next section, we'll explore the system design and architecture that brings this functionality together.

3. System Design and Architecture

The H&W Band is designed as a compact, patient-centric, IoT-based wearable that optimizes affordability, precision, and durability. It facilitates the effortless collection and transmission of biometrics and instant, context-aware alerts. The architecture of the system is based on a modular microcontroller-based module that supports component upgrades and functional expansion.

3.1 Overall Acrchitecture

The architecture comprises of three major subsystems:

1. Sensing and Data Acquisition
2. Data Processing and Local Display
3. Communication and Emergency Response

The central unit – the Nano 33 IoT – interfaces with all the sensors and modules and behaves as the brain of the system.

3.2 Hardware Components and Roles

Component	Model	Function
Microcontroller	Arduino Nano 33 IoT	Sensor integration, data processing, Wi-Fi
Heart Rate & SpO_2	MAX30102	Optical detection via infrared photodiode
Body Temperature	MLX90614	Non-contact IR thermometer
GPS Module	NEO-6M	Latitude and longitude tracking
Display	1.8” TFT LCD (SPI)	Shows vitals and alerts
Motion Detection	HC-SR501 PIR	Activates screen on movement (power saving)
Speaker + Mic	8Ω speaker + ECM mic	Audio alerts and patient voice communication
Power Source	5V 1500mAh Li-Po	Portable rechargeable supply

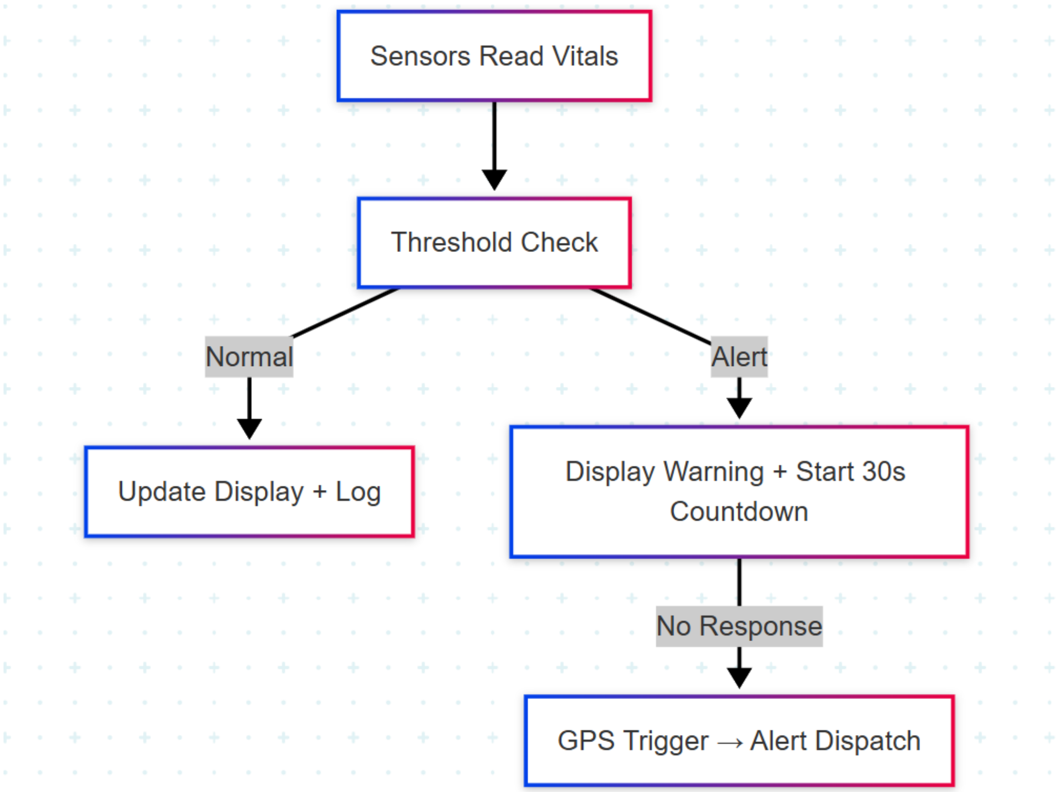
3.3 Sensor and Microcontroller Integration

Each sensor operates on 3.3–5V logic and interfaces with the Arduino using either **I2C** (MAX30102, MLX90614) or **UART/SPI** (GPS, TFT). The sensors sample data every 5–10 seconds and store it in a local buffer. The TFT screen updates in real-time, showing readable indicators such as:

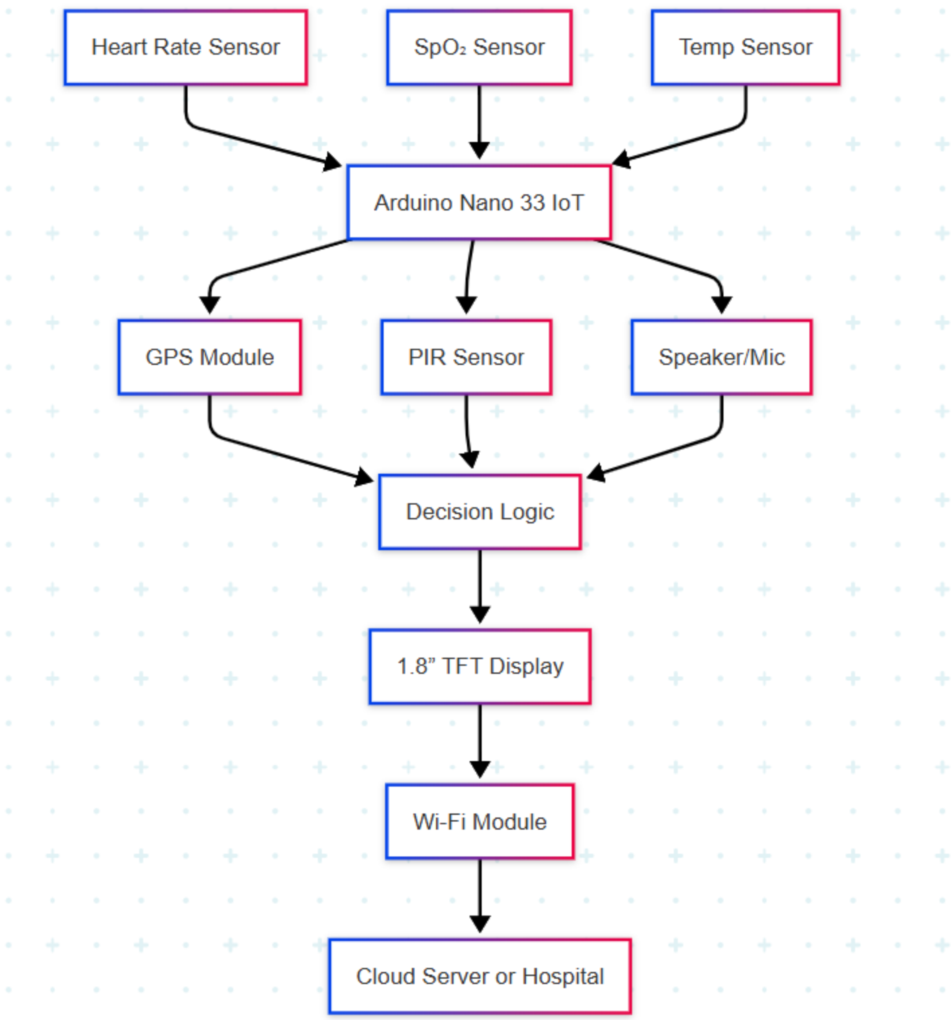
- HR: 86 BPM (green if normal, red if alert)
- Temp: 98.3°F (yellow if near threshold)
- SpO_2: 94% (red below 92%)

Alerts are triggered based on programmable logic and thresholds, which are adjustable by healthcare providers

3.4 Data Flow and Event Logic



Voice input or a manual button (planned) can cancel alert escalation. Otherwise, the GPS sends coordinates via Wi-Fi to the cloud server.



3.5 Power Management Strategy

- **Display Timeout:** Powered down when PIR detects no motion
- **Sensor Sleep Mode:** Triggered during idle periods
- **Wi-Fi Burst Transmission:** Sends data in intervals to save power

Battery life tests indicate ~10–12 hours of operation in normal conditions with one recharge per day recommended.

3.6 Customization and Expansion Potential

- Supports additional sensors (e.g., ECG, accelerometer) via available GPIO/I2C lines
- Future BLE module addition planned
- Codebase modularized in Arduino IDE for easy updates

4. Software Architecture

The H&W Band's firmware is structured to balance continuous vital monitoring with battery efficiency and real-time response. Its core design principles include non-blocking execution, responsive alerting, reliable communication, and modular task separation.

The firmware is implemented in C++ using the Arduino library. Its design adheres to a real-time task loop with interrupt-safe functions and conditional state logic. The primary modules are:

• Vitals Monitoring

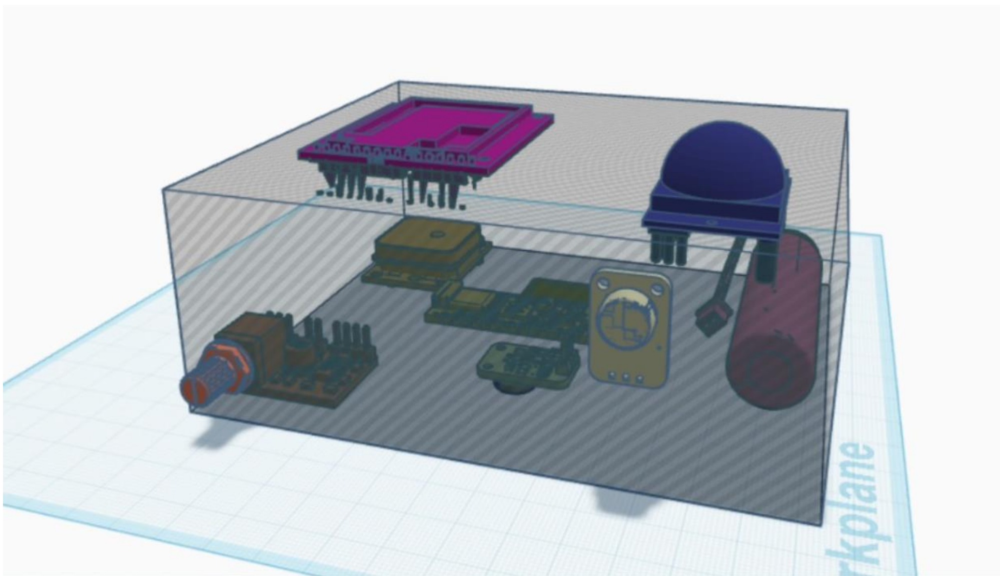
• Threshold Detection and Alert Trigger

• Countdown and Escalation Management

• Wi-Fi and Server Communication

• Power Management Control

• Audio Feedback and Interaction



4.1 Thresholds and Trigger Conditions

Parameter	Normal Range	Alert Condition
Heart Rate	60–100 BPM	<40 or >110 BPM
SpO_2	≥95%	<92%
Temperature	97°F – 99°F	>101°F (alert), >103°F (critical)

Thresholds can be reconfigured via firmware or future mobile dashboard.

When any of the vitals cross their threshold value:

1. Visual Alert – TFT flashes alert in red with critical metric.
2. Audio Prompt – A tone (or voice prompt in future) notifies the user.
3. Countdown Timer (30s) – Begins waiting for user interaction.
    - If response is received, the alert is canceled.
    - If no response, the emergency protocol is initiated.

Future iterations will support keyword detection via analog microphone and lightweight ML model inference (e.g., “I’m okay” to cancel alert).

Integration will use TensorFlow Lite for Microcontrollers or Vosk offline models.

Backup manual cancel button will be added as a fallback.

4.2 Power Optimization

- PIR-Triggered Wake/Sleep: Screen and sensors are disabled when no motion is detected for 60 seconds.
- Wi-Fi Sleep Mode: Enabled between transmissions.
- Sensor Low-Power Modes: Controlled via I2C commands.

Estimated power savings: ~25–35% over always-on behaviour.

4.3 Fail-Safe and Redundancy

- Watchdog Timer: Auto-reset in case of firmware freeze.
- Retry Protocol: Server transmission retried up to 3 times.

- Offline Buffering: EEPROM used to store last 5 alerts if Wi-Fi is unavailable.

5. Value Analysis

The economic feasibility of any healthcare solution is no less crucial than its clinical efficacy, particularly in today's global scenario where affordability and accessibility hold primacy. In this section, the cost framework of the H&W Band is compared with other available solutions today and its overall value proposition to patient care is assessed.

5.1 Approximate Breakdown of H&W Band Cost

The H&W Band was designed with cost as a goal. The approximate component-level cost for a unit is:

Component	Approx. Cost (INR)
Arduino Nano 33 IoT	₹1,000
MAX30102 (Heart Rate, SpO_2)	₹300
MLX90614 (Temperature)	₹250
NEO-6M GPS Module	₹300
1.8" TFT LCD Display	₹200
PIR Motion Sensor	₹100
Speaker and Microphone	₹150
Li-Po Rechargeable Battery	₹300
Miscellaneous (PCB, casing)	₹200–₹400
Total Estimated Cost	₹2,000–₹2,500

Equivalent to approximately $25–$30 USD.

5.2 Cost of Commercial Alternatives

Device	**Price (INR)**	**Key Limitations**
Fitbit Inspire 3	₹8,499	No GPS dispatch, no emergency alerts
Fitbit Charge 6	₹13,999	Passive monitoring, no voice communication

Apple Watch SE	₹24,900	Requires iPhone, no automatic emergency escalation
Apple Watch Series 9	₹43,900	Expensive, tied to iOS ecosystem
Apple Watch Ultra 2	₹89,900	Professional-grade, but cost-prohibitive

Fitbit devices lack GPS autonomy, real emergency alerts, and two-way communication, while Apple Watches offer broader features at very high prices. [1][2]

5.3 Hospital Stay Costs

The average cost of a hospital night stay in India ranges between:

- ₹4,000–₹8,000 per night (general ward)
- ₹10,000–₹20,000 per night (private room or ICU)

Thus, a 3-day extended stay post-discharge could cost ₹12,000–₹24,000—several times the cost of the H&W Band itself. [9]

5.4 Value Proposition of the H&W Band

Metric	H&W Band	Fitbit/Apple Watch	Hospital Stay
Initial Cost	₹2,000–₹2,500	₹8,499–₹89,900	₹12,000–₹24,000 per 3 days
Emergency Alerts	Yes	No	Yes
Real-Time GPS Dispatch	Yes	No (dependent on smartphone)	Not Applicable
Voice Communication	Yes	No	Yes (hospital staff)
Continuous Monitoring	Yes	Yes	Yes

Accessibility (Low Cost)	Very High	Medium to Low	Low
User Dependency	None	Requires Smartphone	None

5.5 Financial Impact Projection

Assuming a patient uses the H&W Band for a month instead of extending hospitalization:

- Cost of H&W Band: ~₹2,500 (one-time)
- Cost of extra hospital stay: ₹40,000–₹80,000 (for 10–15 nights)

Potential Savings: Up to ₹77,500 per patient within the first month alone.

When scaled across hundreds of patients, especially in overwhelmed healthcare systems or low-income communities, the financial benefit of deploying H&W Bands becomes extremely significant

6. Development Timeline

Proper project management ensures that complex, multidisciplinary systems like the H&W Band are delivered effectively. A Gantt chart visually tracks project tasks against time, showing dependencies and overlapping phases.

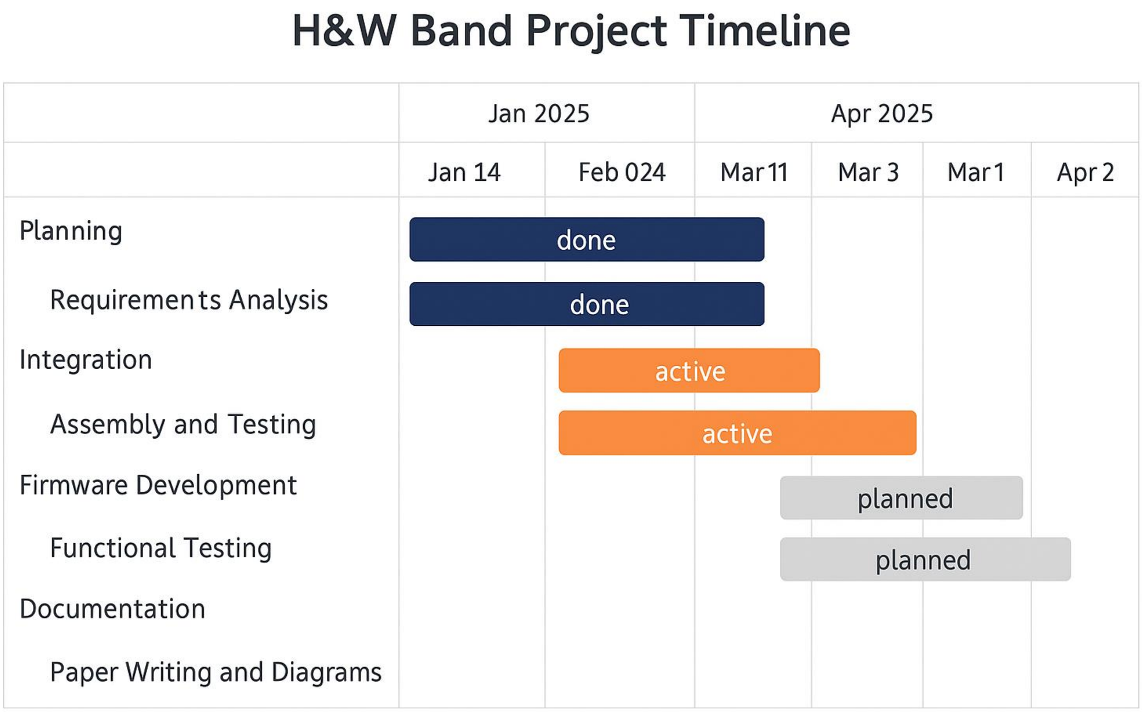
The development of the H&W Band was divided into five main stages:

6.1 Project Stages

Phase	**Activities**	**Duration**
Planning and Research	Requirements analysis, feasibility study, literature review	2 weeks
Hardware Design	Component selection, circuit design, procurement	3 weeks
Assembly and Integration	Wiring, soldering, breadboard testing	2 weeks
Firmware Development	Sensor interfacing, display control, Wi-Fi communication	3 weeks

Testing and Validation	Functional tests, threshold tuning, alert protocol trials	2 weeks
Documentation and Analysis	Paper writing, diagrams, survey design	2 weeks

6.2 Gantt Chart Representation:



7. Future Enhancements

While the current iteration of the H&W Band provides a solid foundation for remote health monitoring, healthcare technology must evolve continually to meet user needs, regulatory standards, and technological advances. This section outlines the future directions of the project and provides final reflections on its impact.

7.1 Planned Future Enhancements

7.1.1 Integration with Bluetooth and Smartphones

- Offline Sync: Add Bluetooth Low Energy (BLE) capability to allow data transmission to a paired smartphone when Wi-Fi is unavailable.

- Mobile App Dashboard: Create a companion app to visualize vitals, view alerts, and modify alert thresholds easily.

7.1.2 AI-Powered Predictive Analytics

- Trend Analysis: Use machine learning models (TinyML, TensorFlow Lite) embedded on the device to detect deteriorating health patterns early.
- Personalized Baselines: Adapt thresholds based on historical data rather than relying solely on fixed thresholds.

7.1.3 Hospital EMR System Integration

- FHIR/HL7 Compliance: Enable the band to push patient health data directly into Electronic Medical Record (EMR) systems used by hospitals, simplifying documentation and proactive interventions. [13]

7.1.4 Expanded Sensor Suite

- ECG Measurement: Integrate AD8232-based ECG modules to detect arrhythmias.
- Fall Detection: Add an accelerometer (e.g., MPU6050) for fall detection alerts in elderly patients.

7.1.5 Hardware Miniaturization

- Move from prototyping breadboards to customized PCBs (Printed Circuit Boards) for compact, durable, and wearable designs.

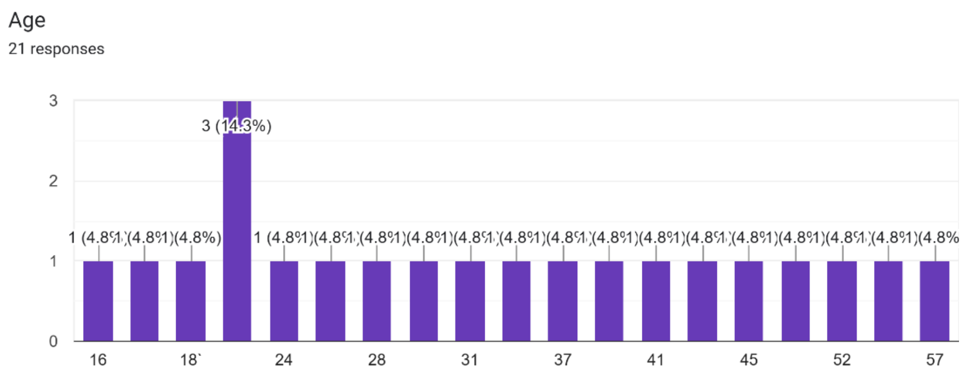
7.1.6 Security and Privacy Upgrades

- Data Encryption: Implement end-to-end encryption for all Wi-Fi transmissions.
- Consent Mechanisms: Allow patients to control when and how their data is shared, ensuring compliance with future privacy regulations (e.g., India’s DISHA Act).

8. Survey Results

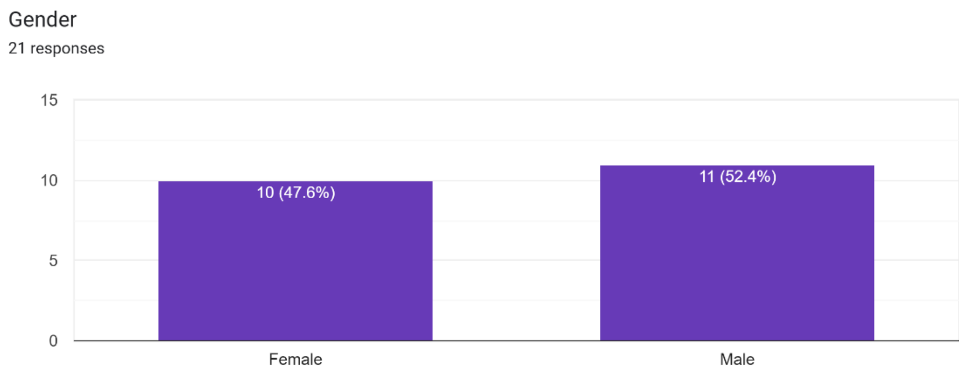
To further prove my results, I had conducted a survey, in which I ended up getting the following results:

1. Age Chart of People Surveyed:

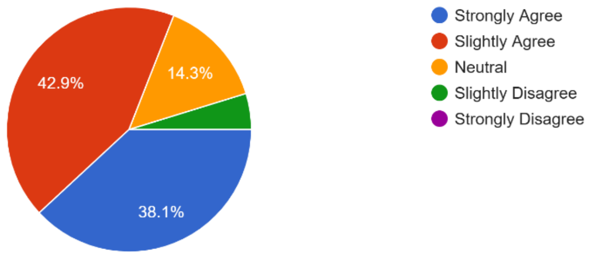


As seen above, mostly youngsters had answered, but I had tried to include as many millennials as possible.

2. Gender Chart:

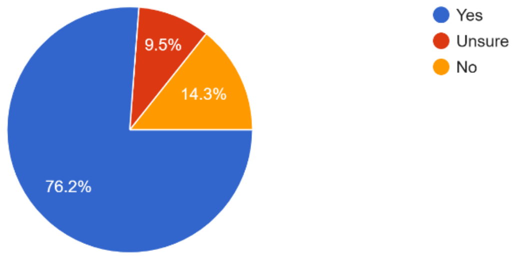


1. Would you prefer using a wearable health monitor at home instead of returning to the hospital for checkups?
21 responses



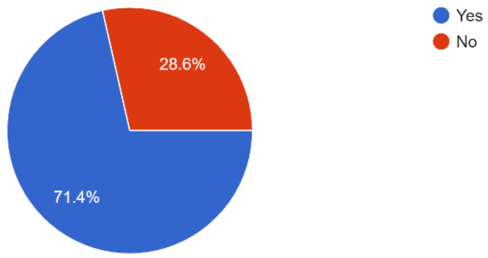
3.

2. Trust in wearable devices to automatically alert medical professionals in emergencies?
21 responses



4.

3. Perceived usefulness of voice communication between patient and doctor
21 responses



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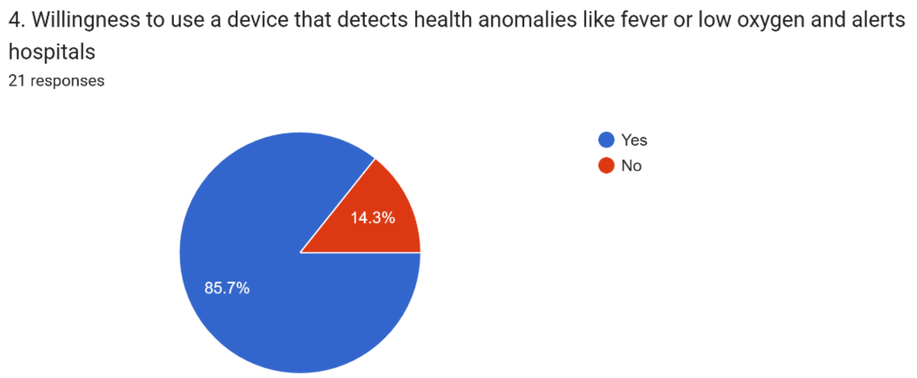

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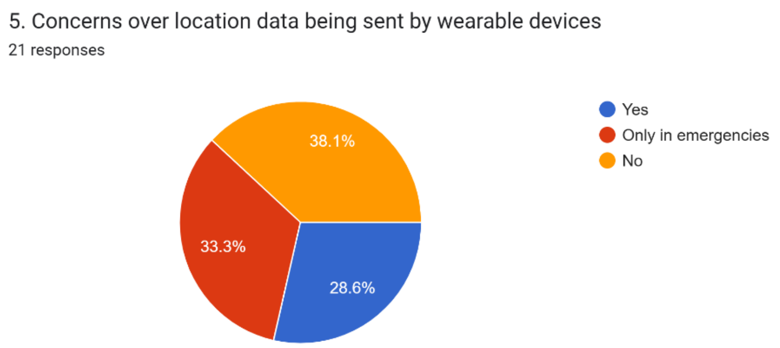

7.

As seen by the survey results:

- High Trust in Emergency Alerts: Most participants (76.2%) trust wearable devices to alert medical professionals automatically in an emergency.
- Support for Remote Health Monitoring: A large majority (81%) prefer wearable devices over frequent hospital visits for health monitoring.
- Voice Communication Feature: The majority (71.4%) find the voice communication feature useful for doctor-patient interactions.
- Willingness to Use Health Anomaly Detection: 85.7% would use a wearable that detects and alerts medical staff in case of critical health issues.
- Privacy Concerns: While a significant portion (38.1%) is concerned about location data, many (33.3%) are okay with sharing location data only in emergencies.

9. Conclusion

The H&W Band project bridges a crucial gap in post-hospital care, offering patients a low-cost, scalable, and intelligent alternative to expensive hospital stays or dependence on passive consumer fitness trackers.

By integrating real-time vitals monitoring, emergency escalation protocols, GPS tracking, and planned voice communication into a single device, the H&W Band redefines what is possible with affordable wearable health technology. Unlike commercial wearables that require smartphones or expensive ecosystems, the H&W Band empowers vulnerable patients—particularly in low-resource settings—to remain safely monitored during critical recovery periods.

Compared to alternatives like the Apple Watch Series 9 or Fitbit Charge 6, the H&W Band delivers tailored functionality at less than one-tenth the cost, making proactive healthcare accessible and democratized. Its modular, open-source design encourages further community-driven improvements, research, and innovation.

Future enhancements, including Bluetooth fallback, AI-driven analytics, and hospital EMR integration, will strengthen the system's clinical relevance and make it a cornerstone technology for telemedicine and decentralized healthcare systems globally.

In an era where health equity demands technological solutions that are smart, affordable, and empathetic, the H&W Band stands as a compelling blueprint for the future of patient-centered healthcare innovation. [9][14]

10. Literature Review Table:

Ref No.	Source	Main Focus	Relevance to H&W Band
[1]	Apple Inc., Apple Watch Series 9	Consumer wearable; heart rate, SpO_2, ECG	Benchmarked against H&W Band capabilities
[2]	Fitbit, Fitbit Charge 6	Fitness tracker; passive health metrics	Compared in cost and feature set
[3]	BioIntelliSense, BioSticker	FDA-cleared continuous monitoring device	Demonstrates clinical-grade expectations
[4]	Huawei Band 4	Low-cost fitness tracker	Highlights H&W Band's added emergency features
[5]	Lenovo HW01 Smart Band	Budget fitness tracker	Compared as cost reference
[6]	Validation of Wearable Heart Rate Monitors	Heart rate measurement validation studies	Justifies performance targets for H&W Band
[7]	Circuit Digest, MAX30102 Heart Rate Sensor	Technical guide and accuracy of MAX30102	Supports sensor choice for heart rate monitoring
[8]	Melexis, MLX90614 Datasheet	Temperature sensor specs	Supports temperature monitoring reliability
[9]	WHO, Future of Digital Health	Trends in global telehealth and wearable health adoption	Contextualizes project in broader healthcare trends
[10]	Trends in Wearable Health Monitoring (IEEE Access)	Challenges and advancements in wearable health	Supports system design choices

		systems	
[11]	Accuracy of Wearable Heart Rate Sensors Using MAX30102	Research on accuracy of MAX30102 module	Validates technical feasibility
[12]	Government of India, DISHA Act Draft	Data privacy standards for health information	Highlights privacy considerations
[13]	Smart Health Monitoring Systems Using IoT and Wearables	Integration challenges for IoT in healthcare	Supports planned future enhancements
[14]	Emergency Health Monitoring Using IoT-Based Systems	Need for remote health emergency detection	Validates emergency alert system design

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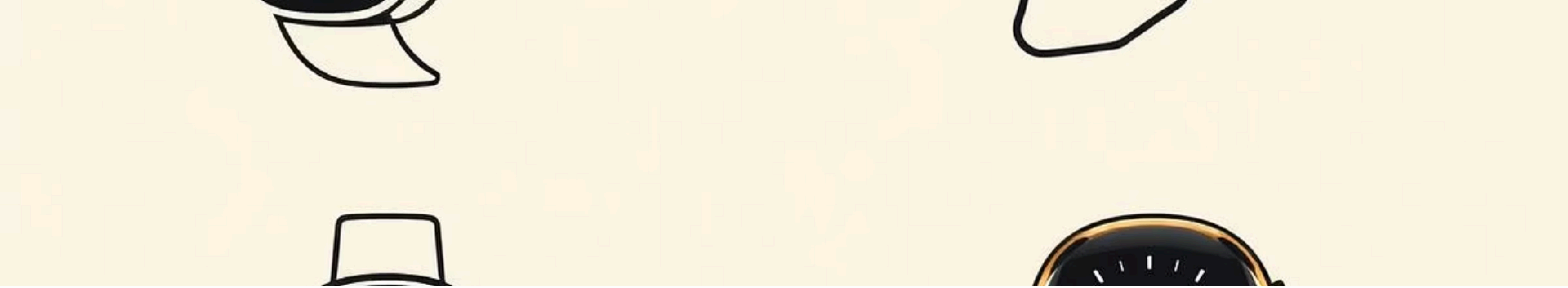


Abstract Overview

Need

Growing outpatient recovery demands smart remote tracking

Features

Heart rate, SpO_2, body temperature monitoring

Goals

Affordable, real-time emergency response, accessible globally

Hardware

Arduino Nano IoT, MAX30102, MLX90614, GPS, voice modules

Healthcare Gap and

The Problem

- Post-hospital monitoring gaps, especially rural
- Delayed, manual follow-ups

Our Vision

- Affordable, autonomous health monitoring
- Real-time alerts, GPS dispatch
- Two-way communication

Current Solutions & Limitations

Consumer Devices

Expensive, phone-dependent, no emergency escalation

Medical Devices

Accurate, costly, limited interactivity

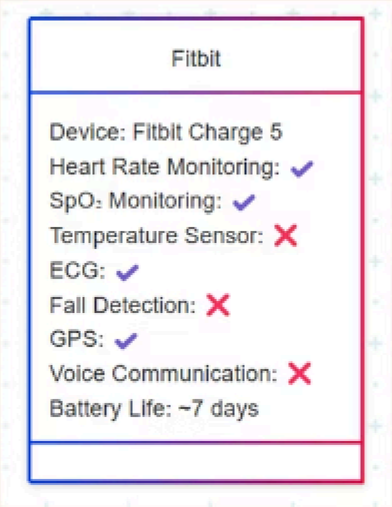
Market Need

Affordable, autonomous, patient-centered wearable

COMPARISON TABLE B/W

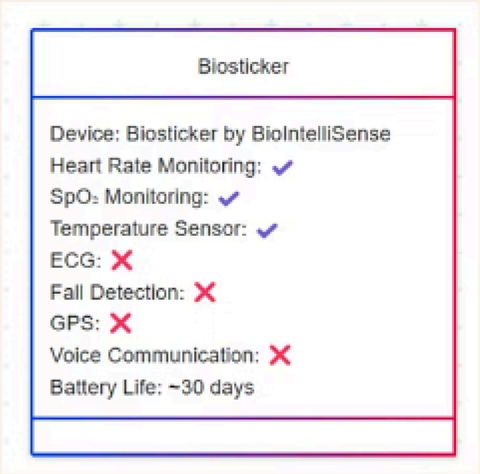
AppleWatch

Device: Apple Watch Series 9
Heart Rate Monitoring: ✓
SpO_2 Monitoring: ✓
Temperature Sensor: ✓
ECG: ✓
Fall Detection: ✓
GPS: ✓
Voice Communication: ✓
Battery Life: ~18 hrs



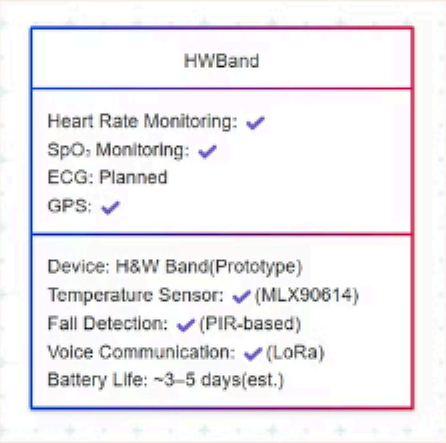
Fitbit

Device: Fitbit Charge 5
Heart Rate Monitoring: ✓
SpO_2 Monitoring: ✓
Temperature Sensor: ✗
ECG: ✓
Fall Detection: ✗
GPS: ✓
Voice Communication: ✗
Battery Life: ~7 days



Biosticker

Device: Biosticker by BioIntelliSense
Heart Rate Monitoring: ✓
SpO_2 Monitoring: ✓
Temperature Sensor: ✓
ECG: ✗
Fall Detection: ✗
GPS: ✗
Voice Communication: ✗
Battery Life: ~30 days



HWBand

Heart Rate Monitoring: ✓
SpO_2 Monitoring: ✓
ECG: Planned
GPS: ✓

Device: H&W Band(Prototype)
Temperature Sensor: ✓ (MLX90614)
Fall Detection: ✓ (PIR-based)
Voice Communication: ✓ (LoRa)
Battery Life: ~3–5 days(est.)

H&W Band vs Existing Devices

Device	Metrics	Audience	Limitations
Apple Watch 8	HR, SpO_2, ECG	Consumers	Expensive, no emergency
Fitbit Charge 5	HR, SpO_2	Fitness	No GPS, no alerts
BioSticker	HR, Temp, RR	Hospitals	High cost
H&W Band	HR, SpO_2, Temp, GPS, Voice	Post-hospital Patients	Prototype, cloud expansion

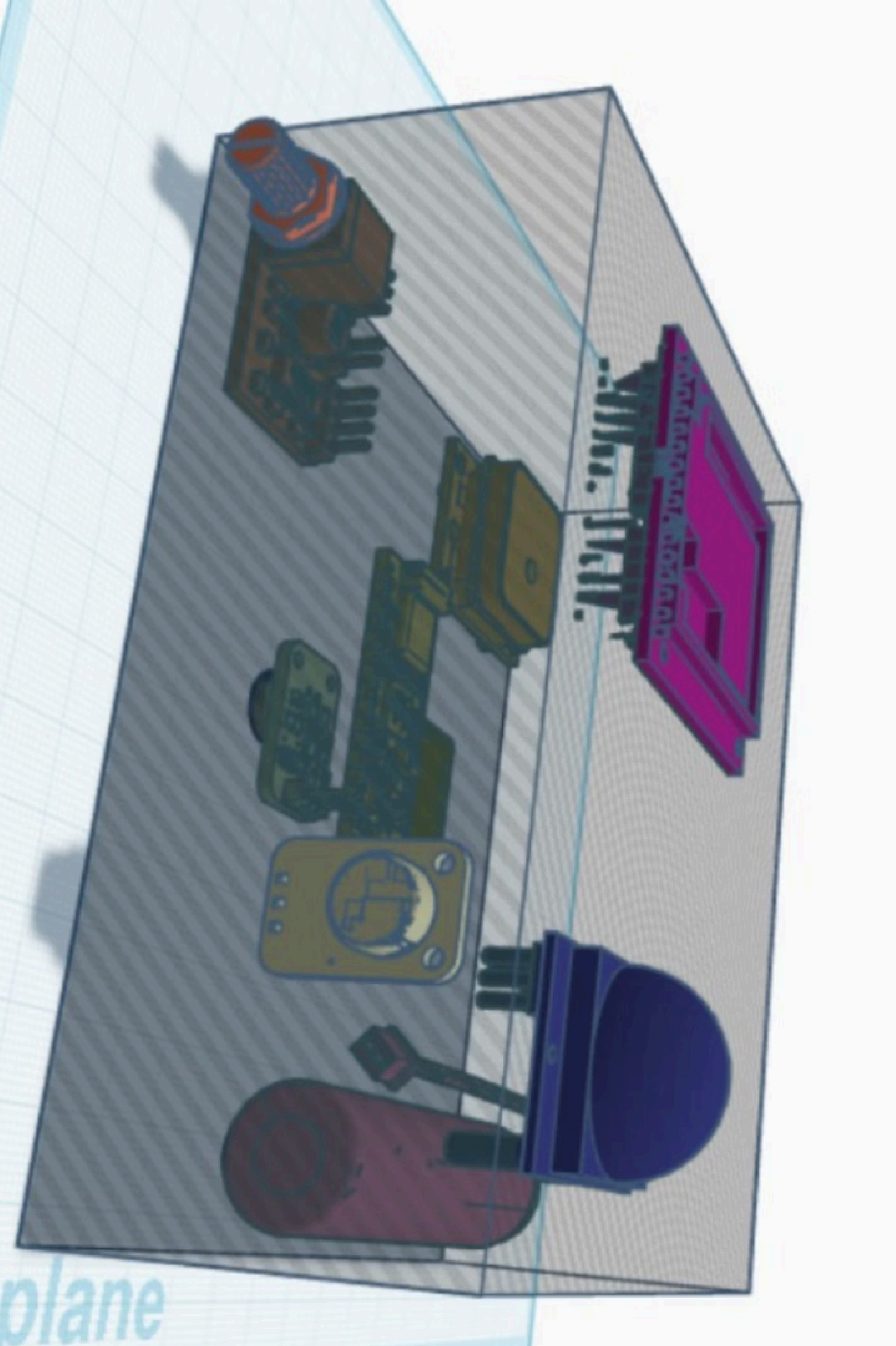
System Design &

Subsystems

- Sensing: Heart rate, temperature, SpO_2
- Processing: Arduino Nano 33 IoT
- Communication: Wi-Fi, GPS, Voice modules

Key Components

- MAX30102 (HR & SpO_2 sensor)
- MLX90614 (Temperature sensor)
- NEO-6M GPS module
- 1.8" TFT LCD display
- PIR sensor, Speaker, Microphone



Architecture & Data Flow

1. **Data Sampling**

   Every 5–10 seconds

2. **Threshold Monitoring**

   Immediate alerts on anomalies

3. **Wi-Fi Dispatch**

   Emergency location transmission

4. **Power Saving**

   PIR-triggered sleep, Wi-Fi burst mode

Software & Alert Mechanism

Firmware Features

- C++ using Arduino IDE
- Non-blocking loops
- Threshold-based alerts

Alert Chain

1. Vital crosses threshold → Visual + audio alert
1. 30-second countdown
1. No response → GPS & emergency escalation

Cost Analysis & Value

H&W Band Cost

₹2,000–₹2,500 (~$25–30)

Commercial Wearables

₹8,000–₹90,000+

Hospital Stay

₹4,000–₹20,000 per night

Benefit

Huge savings with accessible monitoring

Conclusion & Future Work

Impact

Reliable, low-cost post-hospital monitoring

Functional prototype ready

Next Steps

- Cloud integration
- Fall detection & mobile dashboard
- Keyword audio commands & BLE fallback