Cloud Monitoring Heart Beat Sensor Data For Worker and Soldier in Hostile Conditions

Report submitted to GITAM (Deemed to be University) as a partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in ELECTRONIC AND COMMUNICATION ENGINEERING

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NOV 2025

DECLARATION

We declare that the project work contained in this report is original and it has been done by me under the guidance of my project guide.

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Date: 2/09/2025

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CERTIFICATE

This is to certify that (S SHESHU, PRAJWAL KUMAR, SHRAVANI A) bearing (Regd.No.:BU22EECE0100088,BU22EECE0100444,BU22EECE0100447)has satisfactorily completed Mini Project Entitled in partial fulfillment of the requirements as prescribed by University for VIIth semester, Bachelor of Technology in "Electrical, Electronics and Communication Engineering" and submitted this report during the academic year 2025-2026.

[Signature of the Guide] [Signature of HOD]

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Chapter 1: Introduction

1.1 Overview of the problem statement

- Most existing heartbeat monitoring systems are **limited to local displays** (OLED/LCD) and **do not provide remote/cloud access**.
- Lack of **continuous monitoring** in hostile or remote environments (battlefields, disaster zones, mines).
- Soldiers and workers in extreme conditions are **exposed to high risk** without real-time health tracking.
- Existing research often focuses on **laboratory or hospital setups**, not on **field-deployable, IoT-enabled systems**.
- No integrated system that combines **pulse sensing + cloud storage + real-time visualization** for proactive health response.

1.2 Objectives and goals

The objective of this project is to design and implement a reliable **cloud-based heart rate monitoring system** that continuously measures and analyzes the heartbeat of workers and soldiers operating in **hostile or remote environments**. By integrating pulse sensors with IoT platforms, the system aims to:

- Ensure **real-time monitoring** of vital signs.
- Enable **remote access** to health data through cloud storage.
- Provide **early alerts** in case of abnormal heart activity.
- Enhance **safety, decision-making, and rapid medical response** in high-risk conditions where traditional healthcare access is limited.

Main Goals

- Continuous monitoring of heart rate using pulse sensors.
- Real-time transmission of heartbeat data to the cloud for remote access.
- Visualization of health status through OLED display and cloud dashboards.
- Early detection of abnormal heartbeat patterns with instant alerts.
- Reliable operation in hostile and remote environments.
- **Additional Goals**
- Ensure portability and low power consumption for field deployment.
- Provide secure data logging for long-term health analysis.
- Enable scalability to support multiple users (workers/soldiers) simultaneously.

Chapter 2 : Literature Review

Title and Author	Problem statement	Methodology	Result
Real-Time Health Monitoring and Tracking System of Soldiers Using IoT Aradhana Sahu, Pranali Ghotekar, Shrinivas Patil, Rutuja Ghodke	Soldiers in remote/hostile areas face health risks without immediate medical aid, and there is no system for continuous real-time monitoring of their health and location.	Wearable sensors for heart rate, ECG, and temperature • Arduino + GPS + GSM (SIM808) to collect & transmit data • Soldier node → Squadron node → Control center node • Panic button + alert system for emergencies	System enables real-time monitoring of soldier's health & location, generates emergency alerts, and improves safety and battlefield decision-making.
Online Monitoring Health Station Using Arduino Mobile Connected to Cloud service: "Heart Monitor" System Eman Abed-Alkareem Karajah, Isam Ishaq (Al-Quds University, Jerusalem, Palestine)	Many patients need continuous monitoring of vital signs (heart rate, body temperature). Existing solutions are costly, require hospital visits, and lack real-time remote monitoring.	Developed an Arduino Uno-based circuit with heart rate sensor (SN-11574), LM35 temperature sensor, HC-05 Bluetooth module. Data is sent to an Android app, displayed, stored in Google Sheets cloud, with alarms and automatic calling after 5 abnormal readings.	The proposed "Heart Monitor" system achieved 97.4% accuracy compared to an ECG device. It provides real-time monitoring, alarm alerts, and automatic calls during abnormal readings.

Title and Author	Problem statement	Methodology	Result
Health Monitoring System Prof. R. R. JainNidhi GuptaAnusha VartakRevati Tamboli	Bedridden and critical care patients require constant monitoring of vital parameters. Since doctors or relatives cannot be present all the time, delays in detecting issues like sudden temperature changes, falls, or diet irregularities can be life-threatening. Thus, a system for remote and continuous health monitoring is essential.	The system uses temperature, accelerometer, and vibration sensors to monitor patients. An embedded system processes the data and sends it via Bluetooth to a smartphone app, which tracks temperature, detects falls, monitors diet, and sends alerts. An admin PC stores patient data and diet schedules for doctor reference.	The system monitors body temperature, diet, and falls, sending alerts to doctors or relatives for timely response. While the prototype works, it needs further optimization for compactness and broader use.
IoT Based Health Monitoring System Prajoona Valsalan, Tariq Ahmed Barham Baomar, Ali Hussain Omar Baabood.	Healthcare faces challenges in timely diagnosis, especially during epidemics or in rural areas with limited facilities. Frequent hospital visits are costly, so a remote system is needed to monitor vital signs and share data with doctors for proper diagnosis.	An IoT-based health monitoring system was built with sensors to track vital signs, processed by a microcontroller and sent to the cloud. The data, stored on a medical server, is accessible to doctors for remote diagnosis using a rule-based system.	The prototype successfully monitored and transmitted sensor data to the IoT platform, enabling doctors to remotely diagnose patient conditions. This reduced hospital visits and supported timely intervention, proving effective for epidemics and rural healthcare.

Title and Author	Problem statement	Methodology	Result
Automated Remote Cloud-Based Heart Rate Variability Monitoring System Ahmed Faeq Hussein, Arun Kumar N, Marlon Burbano-Fernandez, Gustavo Ramírez-González, Enas Abdulhay, Victor Hugo C. De Albuquerque	Lack of effective heart health monitoring in remote areas; need for continuous, secure patient tracking	Wearable ECG sends data to the cloud, analyzed for heart rate variability using secure algorithms and web	High accuracy (>99%), enables easy remote monitoring and secure data access for doctors and patients
HealthCloud: A system for monitoring health status of heart patients using machine learning and cloud computing Forum Desai, Deepraj Chowdhury, Rupinder Kaur, Marloes Peeters, Rajesh Chand Arya, Gurpreet Singh Wander, Sukhpal Singh Gill, Rajkumar Buyya	Early heart disease detection and monitoring is challenging; existing self-diagnosis and home systems lack accuracy and reliability	Mobile application uses machine learning models (SVC, KNN, NN, LR, GBT) and cloud computing (Google Firebase) for heart disease prediction based on user data	Logistic Regression was most accurate (85.96%), efficient and responsive; system enables reliable health assessment and real-time monitoring for patients

Chapter 3 : Strategic Analysis and Problem Definition

3.1 SWOT Analysis:

Strengths

- Real-time monitoring
- Cloud access
- Alerts for safety

Weaknesses

- Needs internet
- Battery limit
- Sensor errors

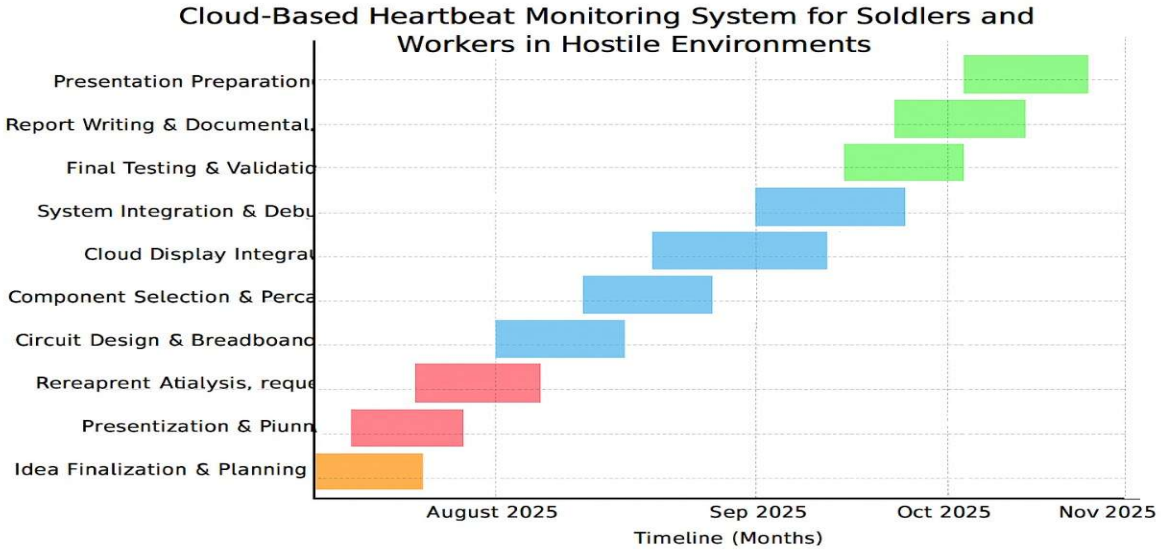
Opportunities

- Use in army, mines, rural health
- Can add AI/ML
- Growing wearable market

Threats

- Competition (smartwatches)
- High cost
- Data security issues

3.2 Project Plan - GANTT Chart



Chapter 4 : Methodology

Sensor Data Acquisition

Pulse sensor (HW-827) measures heartbeat signals.

DHT11 sensor collects temperature & humidity for health/environmental monitoring.

Signals are passed through ADS1115 (ADC) for accurate digitization.

Pre-Processing & Display

Node MCU ESP8266 receives digitized data from ADS1115.

Real-time ECG-like waveform is generated and displayed on OLED for local monitoring.

Potentiometer used to adjust waveform scaling on the OLED.

Cloud Transmission

Node MCU connects to Wi-Fi and transmits heartbeat and environmental data to a cloud database (e.g., Firebase/IoT platform).

Ensures continuous remote accessibility.

Remote Monitoring & Alerts

Data can be accessed via a web app/dashboard.

Alerts triggered in case of abnormal heart rate or dangerous conditions.

Validation & Testing

Test system on breadboard setup using jumper wires.

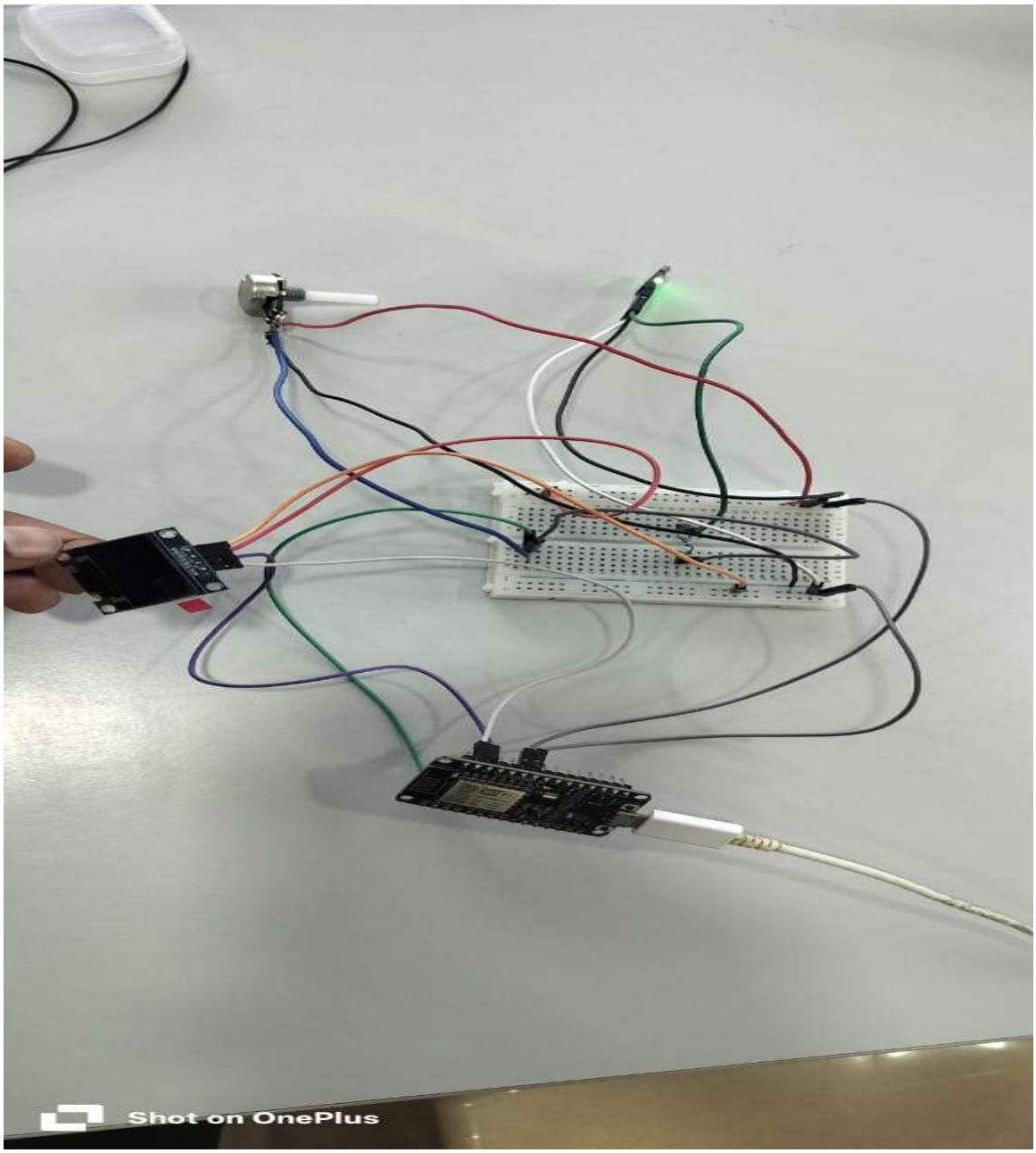
Verify accuracy of sensor readings and stability of cloud updates.

Adjust resistor & potentiometer values for signal noise reduction.

Chapter 5 : Implementation coe

```
#include <Wire .h>
#include <Adafruit _ GFX. h>
#include <Adafruit_SSD1306.h>

#define SCREEN_WIDTH 128
#define SCREEN_HEIGHT 64
Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, -1);

#define ANALOG_PIN A0      // Node MCU Analog pin
#define MAX_POINTS 128     // OLED width = 128 pixels
int y Values[MAX_POINTS];   // store waveform points
int index Pos = 0;

void setup() {
  Serial .begin(115200);

  if (!display .begin(SSD1306_SWITCHCAPVCC, 0x3C)) {
    Serial . print ln (F("SSD1306 allocation failed"));
    for (;;);
  }
  display. Clear Display();
  display .display();
}
void loop() {
  // Read sensor / potentiometer value
  int sensor Value = analog Read(ANALOG_PIN);
```

Chapter 6: Results



Chapter 7: Conclusion

- The proposed system successfully integrates **Pulse Sensor + ADS1115 + Node MCU + OLED + Cloud** to provide real-time heartbeat monitoring.
- It overcomes the limitation of existing systems by enabling **remote cloud access** rather than just local display.
- Ensures **safety and timely response** for soldiers and workers in critical environments.

Chapter 8 : Future Work

- Extend the system to support **multiple users simultaneously** (monitoring a fullsquad/unit).
- Improve **cloud dashboard visualization** (clearer waveforms, alerts, data history).
- Add **offline storage** on NodeMCU8266 (SD card) for backup when internet/cloud is unavailable.
- Enhance **security & encryption** for soldier/worker health data.
- Miniaturize the hardware into a **wearable device** (armband).

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