VISHWAKARMA INSTITUTE OF TECHNOLOGY ,PUNE

# REAL-TIME ECG ANALYTICS AND ARRHYTHMIA DETECTION


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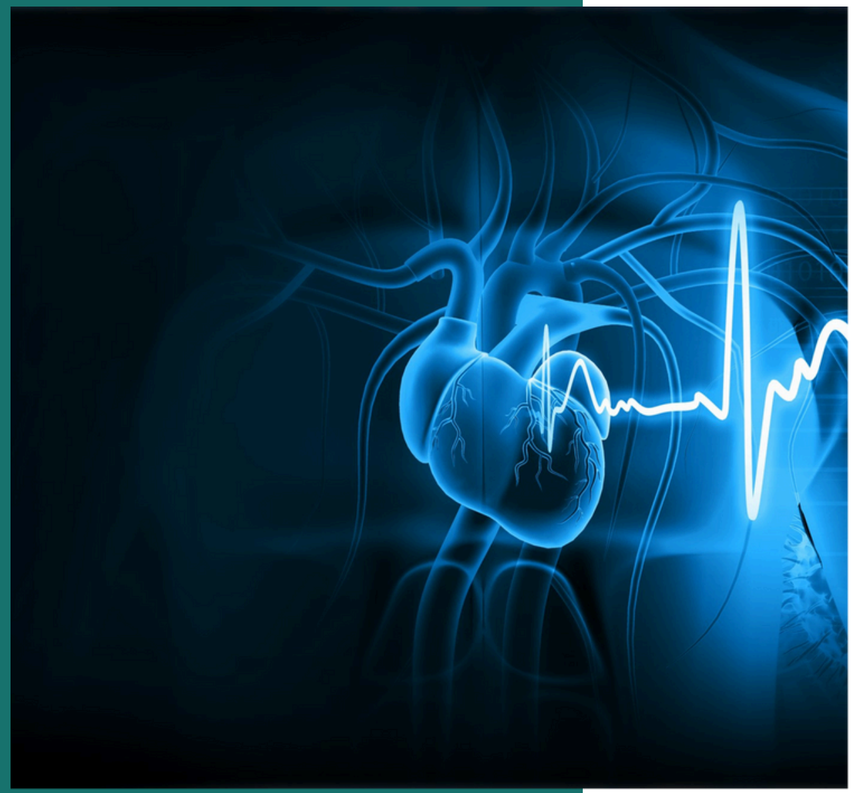
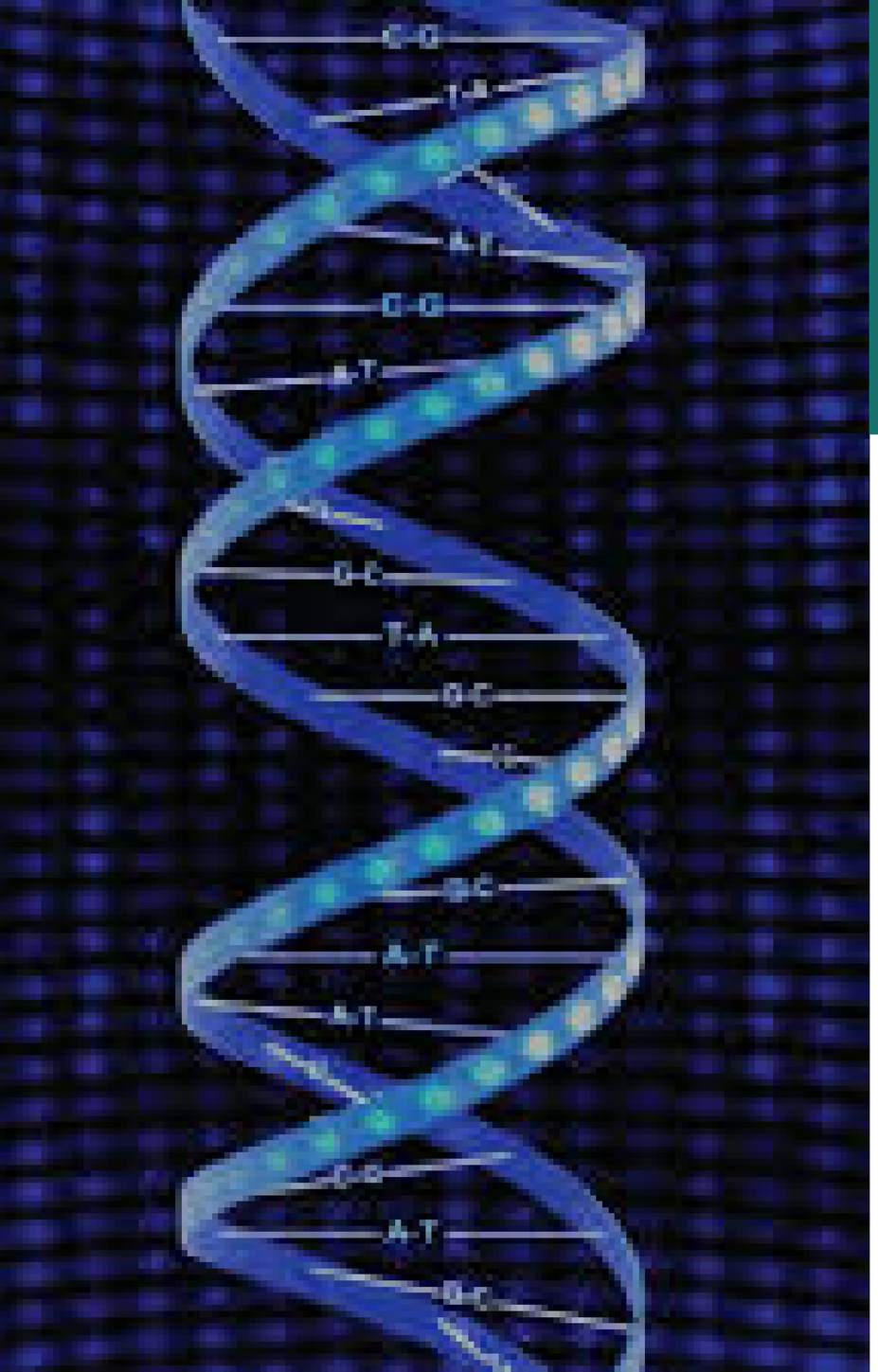
# INTRODUCTION



- The ECG-based arrhythmia detection project uses simple sensors to monitor heart activity and send the data over the internet.
- By capturing real-time heart signals, the system can spot irregular rhythms early on, helping doctors to detect potential problems before they worsen.
- The system looks for unusual patterns in the heart signals and can send alerts if it finds signs of an irregular heartbeat.



# LITERATURE REVIEW

**01**

1. "A Remote Cardiac Rhythm Monitoring System for Detecting Episodes of Atrial Fibrillation" (2017) by Nguyen T.T., Yuldashev Z.M., and Sadykova E.V.
This paper presents a method and system for remote online monitoring of patients' cardiac rhythm with the formation of an alarm signal upon detecting episodes of atrial fibrillation.

**02**

2."Ultra Low-Power System for Remote ECG Monitoring" (2019) by Ehsan Hadizadeh et al.
This paper describes a complete system for extracting ECG signals using a three-lead setup, including motion artifact removal in both analog and digital implementations.

**03**

3.“IoT based low-cost distant patient ECG monitoring system” (2017) by Parmveer Singh; Ashish Jasuja
IoT is revolutionizing healthcare by enabling remote monitoring through sensors, processors, and cloud-based platforms.

# PROBLEM STATEMENT

The current challenge in cardiac care is that many patients do not have continuous access to real-time heart monitoring, which can delay the detection of dangerous arrhythmias..

To address this, the project proposes an IoT-based ECG monitoring system that continuously collects heart data using simple sensors, detects arrhythmias in real time, and generates detailed health reports automatically.

# OBJECTIVES

1. Continuous Real-Time Monitoring: Ensure the system continuously tracks and records ECG signals to promptly detect any cardiac irregularities and critical events.

2. Accurate Signal Processing: Develop robust algorithms to filter out noise and interference, guaranteeing high accuracy in capturing the heart’s electrical activity.

3. User-Friendly Visualization: Create an intuitive dashboard that enables healthcare professionals and patients to easily monitor and interpret real-time heart activity data.

# EDI DOMAIN

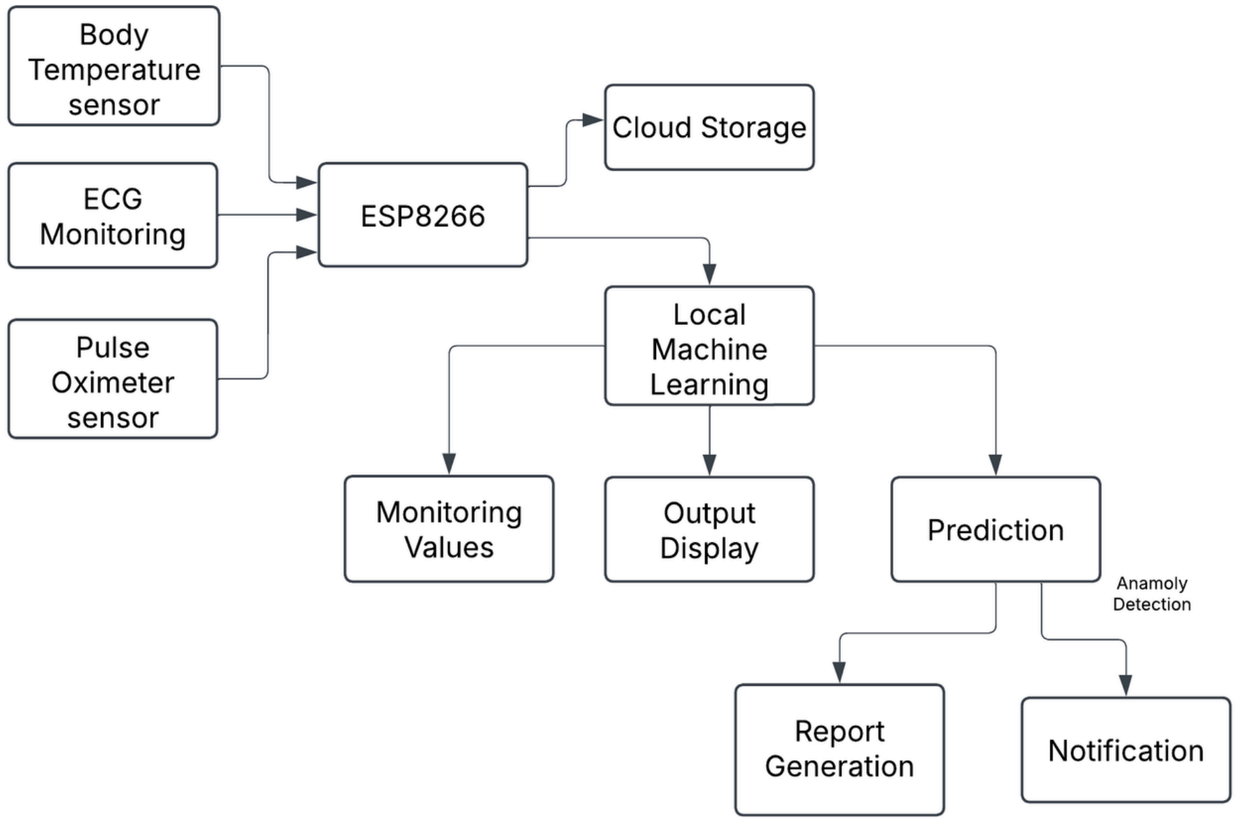
1. **Embedded Systems & IoT**
   - Using ESP32, Raspberry Pi, or Arduino for real-time data acquisition
   - Interfacing with ECG sensors (e.g. ADS1292R).

**2. Machine Learning**
   - Preprocessing ECG signals (filtering noise, baseline wandering removal)

**3. Cloud Computing**
   - Cloud computing plays a crucial role in storing real-time ECG data.

# WORKING

- **Body Temperature Sensor**: Collects real-time temperature data from the patient.
- **ECG Monitoring:** Uses ECG sensor like AD8232 to capture the electrical activity of the heart.
- **ESP8266** - Collects real-time ECG signals from the heartbeat and ECG sensors.
- **Cloud Storage** - Stores the ECG signal data for further processing.
- **Machine Learning** - Analyzes ECG signals using AI models (CNN) for arrhythmia detection.



# SYSTEM ARCHITECTURE

It has three key outputs:

- **1. Monitoring Values –** Displays real-time ECG values for patient observation.
- **2. Output Display –** Graphical representation of ECG signals, heart rate, and detected anomalies.
- **3. Prediction –** AI-based analysis to detect arrhythmias and abnormalities in ECG signals
- **4. Report Generation & Anomaly Detection-**

  **Report Generation:** Creates medical reports based on ECG trends and ML predictions.

  **Anomaly Detection:** Identifies abnormal heart rhythms (e.g., arrhythmia, AFib, tachycardia).

# TECHNOLOGIES USED

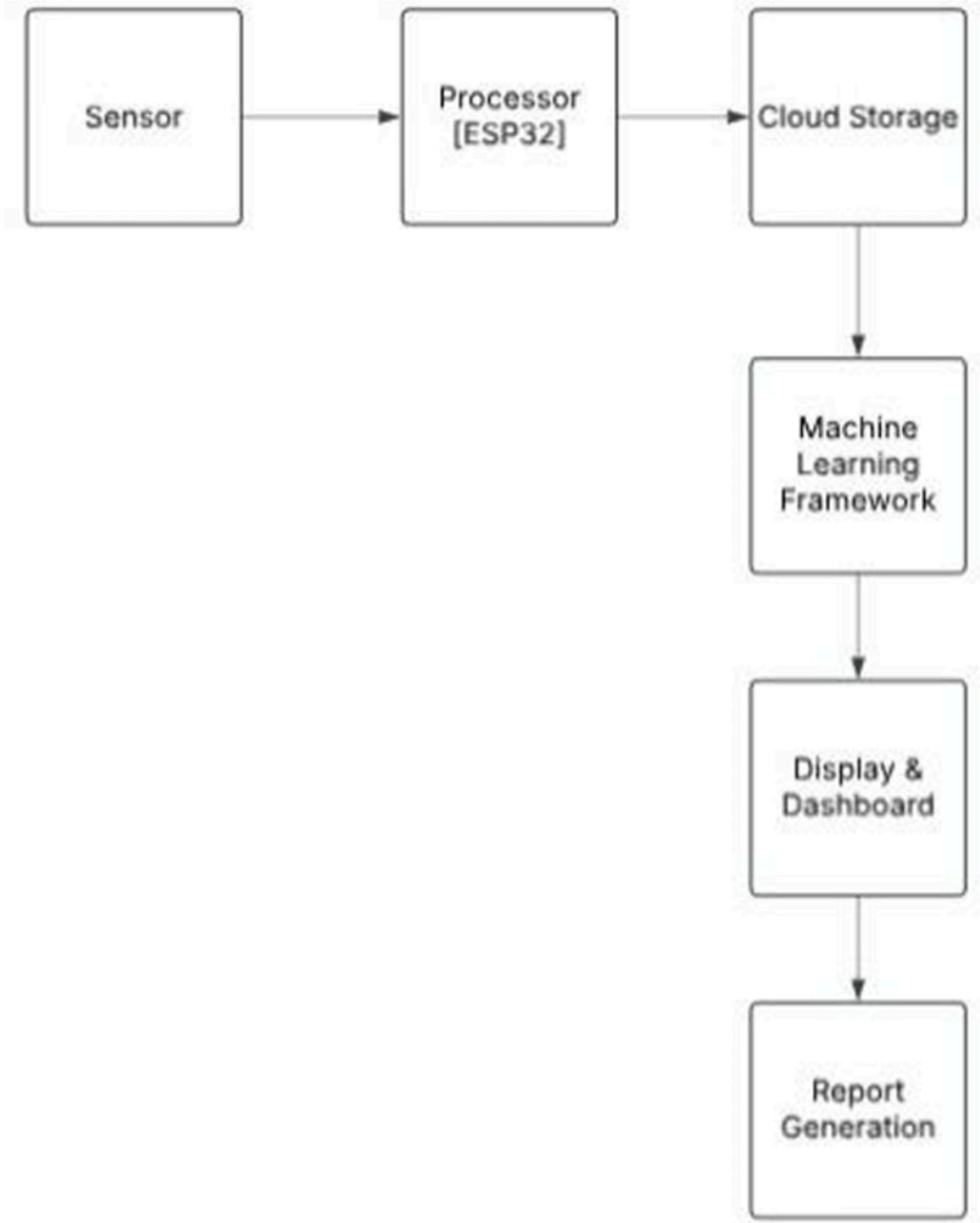
**Software Components:**

1. IoT Platform/Framework: Manages data collection from IoT sensors.
2. Data Analytics Software: Analyzes collected data for patterns and predictions (e.g., Python,).
3. Database Management System: Stores sensor data and logs.(e.g. Google Firebase)
4. Real-Time Monitoring Dashboard: Visualizes patient health and heart waves. (e.g. Using Blynk)
5. Alerting and Notification System: Sends real-time alerts.
6. Machine Learning/AI Model: Monitor and predict the health.

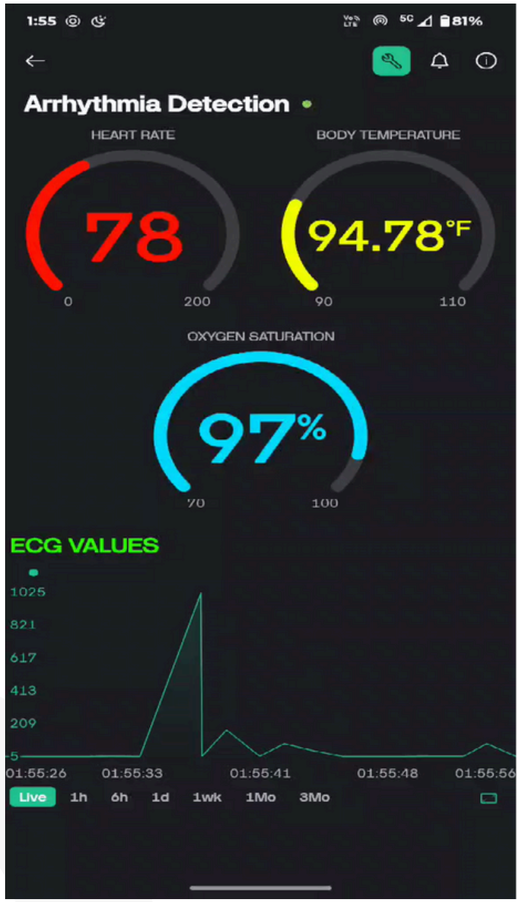
**Hardware Components:**

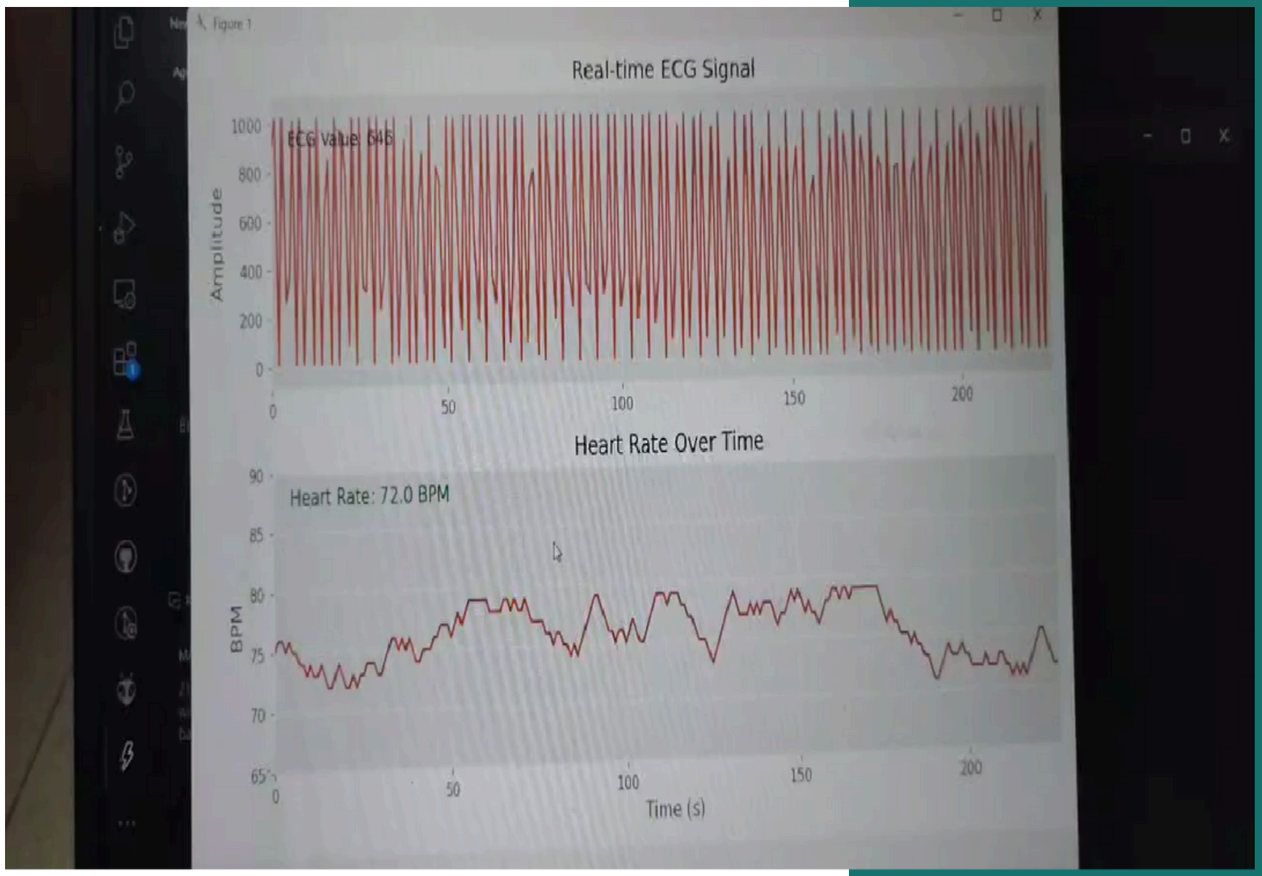
1. Microcontroller (e.g. Node MCU ESP32)
2. Storage Systems (e.g. Cloud Storage)
3. Power Supply
4. Sensors (e.g. Heartbeat sensor, ECG sensors)
5. Display Device

# BLOCK DIAGRAM



# EXECUTABLE PROJECT DEMO



# INDIVIDUAL RESPONSIBILITY

**Hardware Part Developed-** By Anurag Nimkande and Ayush Dhewale.

**Cloud & Backend Part Developed –** By Tanuj Keshattiwar and Pravin Pinjarkar.

**System Design Model Part Developed –** By All team members separately it include it’s subparts.

# CONCLUSION

Real-time ECG analytics and arrhythmia detection play a crucial role in modern healthcare by enabling early diagnosis of heart conditions. By using sensors, microcontrollers like ESP32, and cloud computing, real-time ECG monitoring becomes possible. Machine learning models analyze ECG signals to detect abnormalities and predict potential heart issues. The system provides continuous monitoring, generates reports, and alerts doctors or patients in case of anomalies.

# REFERENCES

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# THANK YOU