

Project Title: Detecting Heart Attack by Measuring Cardiac Parameters Using Arduino ECG module AD8232.

● Project Member's Information:

Group No : 03

Member's Details:

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- **Project Proposal:**

1. Overview of Project Proposal:
(i) Background (ii) Problem Definition (iii) Specific Objectives
<p><u>(i)Background:</u></p> <p>Cardiovascular diseases, including heart attacks, are a leading cause of mortality worldwide. The ability to detect early signs of a heart attack is crucial for timely medical intervention and improved patient outcomes. Electrocardiography (ECG) is a widely used diagnostic tool for monitoring and assessing cardiac activity. It measures the electrical signals generated by the heart, providing valuable insights into its health and functioning.</p> <p>The project aims to leverage the power of ECG technology for early detection of heart attacks by utilizing the Arduino platform in conjunction with the AD8232 ECG module. Arduino, an open-source electronics platform, provides an accessible and flexible environment for collecting and processing ECG data. The AD8232 ECG module is a specialized integrated circuit designed to amplify and filter cardiac signals, making it an ideal choice for this application.</p> <p>The core concept of this project involves developing a portable and cost-effective system that can continuously monitor a person's ECG signals. By analyzing these signals in real-time, abnormal patterns or anomalies indicative of a heart attack can be detected promptly. This allows for a rapid response and timely medical assistance, potentially saving lives.</p> <p><u>(ii)Problem Definition:</u></p> <p>1. Late Detection of Heart Attacks:</p> <p>Heart attacks can occur suddenly, and the symptoms are not always easily recognizable. Patients may experience chest pain, shortness of breath, or other symptoms, but these can vary widely among individuals. As a result, many heart attack victims do not seek medical help promptly, leading to delayed diagnosis and treatment.</p> <p>2. Limited Access to Continuous Monitoring:</p> <p>Traditional methods of ECG monitoring typically require patients to be in a clinical setting, limiting continuous monitoring opportunities. This poses a challenge for those at risk of heart attacks, such as individuals with pre-existing heart conditions or a family history of heart disease.</p> <p>3. High Cost and Resource Constraints:</p> <p>Conventional ECG monitoring equipment can be expensive and may not be readily available, especially in resource-constrained environments. This restricts access to critical cardiac monitoring for a significant portion of the population.</p> <p>4. Need for Early Warning Systems:</p> <p>There is a growing need for affordable and portable early warning systems that can continuously monitor cardiac parameters and alert individuals, caregivers, or healthcare professionals to irregularities, which might indicate a potential heart attack.</p> <p>In response to these challenges, the project aims to develop an innovative solution that leverages the Arduino platform and the AD8232 ECG module to create a cost-effective, portable, and user-friendly system capable of monitoring and analyzing ECG signals in real-time. By identifying abnormal cardiac patterns associated with a heart attack, this system will provide early warnings and enable timely medical intervention, potentially saving lives and improving patient outcomes. The project addresses the critical problem of delayed heart attack detection and aims to contribute to enhanced cardiac healthcare by ensuring that individuals at risk have access to continuous monitoring and early intervention.</p> <p><u>(iii) Specific Objectives</u></p>

1. Develop an ECG monitoring system using AD8232 and Arduino.
2. Ensure real-time data acquisition from users.
3. Implement signal preprocessing for noise reduction.
4. Create algorithms for ECG signal analysis.
5. Develop anomaly detection for heart attack signs.
6. Design an alert system for prompt notifications.
7. Build a user-friendly interface for data visualization.
8. Include data storage and logging capabilities.
9. Ensure electrical safety and regulatory compliance.
10. Maintain a cost-effective solution.
11. Thoroughly test and validate the system's accuracy.
12. Provide user education and training materials.
13. Create comprehensive project documentation.
14. Disseminate findings and knowledge.
15. Seek user feedback and evaluate system performance.

2. Methodology and Work Plan (Within 600 Words)

- (i) The theory behind the proposed idea (ii) Model or Implementation Flow Chart (iii) Plan of activities to implement the proposed project

(ii)The theory behind the proposed idea:

A heart attack can be detected from an ECG waveform and heart rate by observing specific patterns and deviations in the ECG signal:

ST-Segment Elevation/Depression: One of the most critical signs is the elevation or depression of the ST-segment in the ECG waveform. An elevated ST-segment may indicate a heart attack, while a depressed ST-segment can suggest myocardial ischemia.

T-wave Changes: Abnormalities in the T-wave shape or amplitude can also be indicative of a heart attack. Inverted or flattened T-waves may signal cardiac distress.

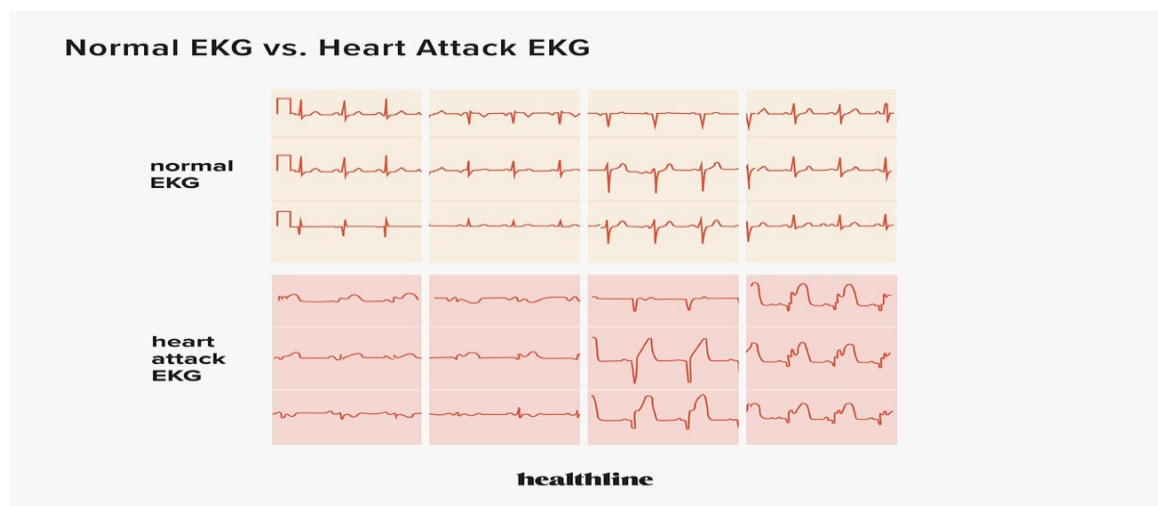
Q-Wave Appearance: The appearance of Q-waves on the ECG, especially in specific leads, can be a sign of prior myocardial infarction (heart attack).

Arrhythmias: Irregular heart rhythms, such as ventricular tachycardia or fibrillation, may occur during or after a heart attack, and these arrhythmias can be detected by analyzing the ECG.

Heart Rate Abnormalities: An abnormally fast or slow heart rate (tachycardia or bradycardia) can also indicate heart problems. A rapid, irregular heart rate may be associated with a heart attack.

Heart Rate Variability: Decreased heart rate variability, which refers to the variation in time between successive heartbeats, may indicate autonomic nervous system dysfunction, often seen in individuals with a history of heart attacks.

The combination of these factors, along with a comprehensive analysis of the ECG waveform, helps medical professionals diagnose a heart attack. An ECG is a valuable tool for identifying cardiac abnormalities and guiding clinical decisions for patients suspected of having a heart attack.



(iii) Model or Implementation Flow Chart

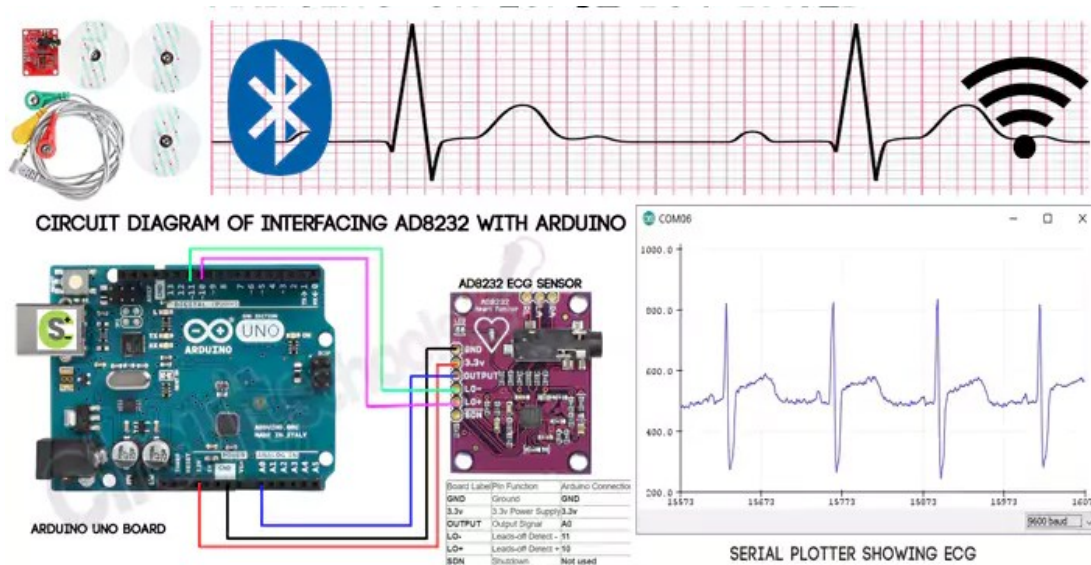


Fig .2.CIRCUIT DIAGRAM

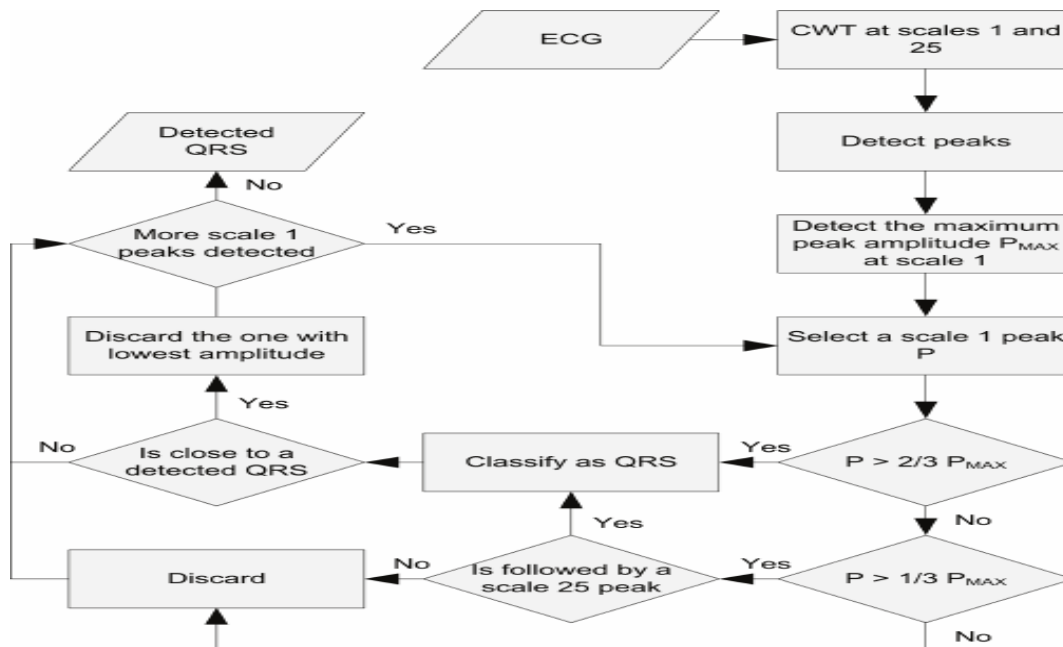


FIG.3,ALGORITHM FOR DETECTING HEART ATTACK

(iii)Plan of activities to implement the proposed project

- ✓ We will design a enclosure box and make it handy for patient
- ✓ Make a robust algorithm to mitigate the error
- ✓ Make a Body sensor network system for remote monitoring and evaluation
- ✓ Detection make semi-automated
- ✓ Using notification and approval from physician for perfect decision.
- ✓ Use the data to feed a Neural network for various purposes
- ✓ Use some other sensors here to collect and evaluate some physiological parameters

3. Expected Results and List of Deliverables (Within 300 Words)

(i) The expected results based on mentioned objectives (ii) List of deliverables after completion of the project

(i)The expected results based on mentioned objectives:

- Real-time Monitoring
- Signal Preprocessing
- ECG Analysis
- Anomaly Detection
- User-Friendly Interface
- Data Storage
- Safety Compliance
- Affordability
- Heart Attack Detection
- User Feedback
- Documentation
- Knowledge Sharing
- Continuous Improvement

(ii) List of deliverables after completion of the project

- 1.R wave amplitude data
- 2.ST segment data
- 3.Abnormality altering system
4. Real time monitoring interface
- 5.Heart rate detection
- 6.Body temperature detection
- 7.Notification suggestion for different stage of heart.
- 8.Wearable and handy device

4. Applications and Impact (Within 300 Words)

(i) Applications area (ii) Impact on Society in the context of Bangladesh

(i) Applications area

The project, "Detecting Heart Attack by Measuring Cardiac Parameters Using Arduino ECG Module AD8232," has various potential application areas, including:

1. **Home Healthcare:** Individuals with a history of heart problems or at-risk populations can use the device for continuous heart monitoring at home.
2. **Telemedicine:** Remote patient monitoring, especially for cardiac patients, can benefit from early heart attack detection and data transmission to healthcare providers.
3. **Emergency Medical Services:** Paramedics and first responders can use the device to assess patients in emergency situations quickly.
4. **Hospitals and Clinics:** Medical professionals can employ the system for routine monitoring and early detection of heart attack signs in clinical settings.
5. **Rehabilitation Centers:** Patients recovering from heart-related procedures or conditions can have their cardiac health closely monitored during rehabilitation.
6. **Athlete Training:** Athletes can utilize the system for monitoring their cardiac health during training and competitions.
7. **Research and Clinical Trials:** Researchers can gather valuable data for clinical studies and trials related to heart health and monitoring.
8. **Health and Wellness Monitoring:** Individuals interested in tracking their cardiac health as part of a broader wellness plan can benefit.
9. **Geriatric Care:** The elderly population, particularly those with cardiovascular concerns, can receive continuous care and monitoring.
10. **Educational Tools:** The project can serve as an educational tool for students and healthcare professionals to understand cardiac health monitoring.
11. **Resource-Constrained Environments:** In areas with limited access to healthcare resources, the device can serve as an affordable and accessible diagnostic tool.
12. **Preventive Healthcare:** By identifying cardiac anomalies early, the project supports preventive healthcare efforts in managing heart health proactively.

These application areas demonstrate the versatility and potential impact of the proposed project in enhancing heart attack detection and cardiac health monitoring across various settings and user groups.

(ii) Impact on Patients in the context of Bangladesh

Early Detection and Timely Treatment: Bangladesh faces challenges in providing timely medical attention to patients during a heart attack. This project can help detect heart attacks early, allowing patients to receive prompt treatment and potentially saving lives. Rural Healthcare: Rural areas in Bangladesh often lack access to advanced healthcare facilities. The portable and cost-effective nature of the device can extend cardiac monitoring and early warning systems to underserved communities. Reduced Healthcare Costs: By enabling early detection and intervention, the project can potentially reduce the long-term healthcare costs associated with heart disease, which is a significant economic burden in Bangladesh. Health Awareness: The project can increase awareness about the importance of cardiac health monitoring and early intervention, leading to more informed and proactive patient behavior. Telemedicine: In a country with limited healthcare infrastructure, telemedicine can become more effective with the availability of devices that can transmit ECG data to healthcare professionals in urban areas for remote consultation. Empowering Patients: Patients can take more control of their health by monitoring their cardiac parameters regularly, especially for those with pre-existing heart conditions or risk factors. Reduced Mortality: The potential to detect heart attacks early could lead to a reduction in mortality rates, addressing a significant public health concern in Bangladesh. Data for Research and Policy: The data collected through the project can contribute to research on heart health in Bangladesh and inform healthcare policies and interventions. Access to Healthcare: The device can help bridge the gap in access to cardiac healthcare services, particularly for patients in remote or economically disadvantaged areas. Patient Well-Being: The knowledge that they have a portable heart monitoring system can provide peace of mind to patients and their families, enhancing overall well-being. Improved Quality of Life: Early detection and management of heart issues can result in an improved quality of life for patients by preventing severe cardiac events. Increased Healthcare Efficiency: With early warning systems in place, healthcare resources can be utilized more efficiently, and emergency services can respond to cases more effectively.

5. Time Frame, List of Devices and Accessories, Budget

- (i) Time schedule for project implementation at Fab Lab KUET (ii) Required devices and accessories with prices (iii) Total Budget

(i) Time schedule for project implementation
It needs **2 week** complete the project.

(ii) Required devices and accessories with prices

1. Arduino -1150tk
2. HC 05 Bluetooth module-350tk
3. LM35 Temperature sensor-20tk
4. OLED Display-325 tk
5. AD8232 ECG module -720 tk
6. Jumper wire, resistor, capacitor, bread board-200 tk

- 7.Module box fabrication -free (FABLAB)
- 8.Textile fabric -100 tk

(iii) Total Budget
Total Budget-2800tk