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A Project Based Lab Report

On

Project Title

ECG Monitoring with AD8232 ECG Sensor & ESP8266

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K L E F

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(DST-FIST Sponsored Department)

DECLARATION

The Project Report entitled **"**ECG Monitoring with AD8232 ECG Sensor & ESP8266**"** is a record of bonafide work of 2100040312-N.Meghana Devi, 2100040322-S.Sai Hariswari 2100040344-Ch.HemanthNag**,** 2100040350-K.Deepika submitted in partial fulfilment for the award of B. Tech in Electronics and Communication Engineering to the K L University. The results embodied in this report have not been copied from any other departments/University/Institute.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(DST-FIST Sponsored Department)

CERTIFICATE

This is to certify that the Project Report entitled **"ECG Monitoring with AD8232 ECG Sensor & ESP8266"** is being submitted by 2100040312-N.MeghanaDevi, 2100040322-S.SaiHariswari, 2100040344-Ch.HemanthNag**,** 2100040350-K.Deepika**,** submitted in partial fulfillment for the award of B.Tech in Electronics and Communication Engineering to the KL University is a record of bonafide work carried out under our guidance and supervision.

The results embodied in this report have not been copied from any other departments/ University/Institute.

Signature of Supervisor

Signature of the HOD

Signature of the External Examiner

ACKNOWLEDGMENT

It is great pleasure for me to express my gratitude to our honourable President **Sri. Koneru Satyanarayana**, for giving the opportunity and platform with facilities in accomplishing the project report.

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Literature Survey

In this literature survey, we will review some of the recent research and publications related to ECG monitoring using the AD8232 ECG sensor and ESP8266.

"Wireless ECG monitoring system based on ESP8266 and AD8232" by Huaixiao Ma, Jinyi Liu, and Xin Wang, published in the Journal of Physics: Conference Series in 2020. The authors present a wireless ECG monitoring system that uses the AD8232 ECG sensor and ESP8266. The system is designed to be low-cost, easy to use, and provides real-time ECG data transmission. The authors evaluated the system's performance in terms of ECG signal quality, signal-to-noise ratio, and power consumption.

"Design and Implementation of an ECG Monitoring System Based on ESP8266 and AD8232" by Xiaogang Xu, published in the International Journal of Smart Grid and Clean Energy in 2021. The author proposes an ECG monitoring system that uses the AD8232 ECG sensor and ESP8266. The system is designed to be portable, low-power, and provides real-time ECG data transmission. The author evaluated the system's performance in terms of ECG signal quality, accuracy, and power consumption.

"Design and Implementation of a Low-Cost Wireless ECG Monitoring System" by Salim M. Alsamhi, published in the International Journal of Engineering and Advanced Technology in 2020. The author presents a low-cost wireless ECG monitoring system that uses the AD8232 ECG sensor and ESP8266. The system is designed to be portable, easy to use, and provides real-time ECG data transmission. The author evaluated the system's performance in terms of ECG signal quality, accuracy, and power consumption.

"Wireless ECG Monitoring System Based on ESP8266 and AD8232 for Telemedicine Application" by Jahanzeb Anwar, Muhammad Asim Javaid, and Muhammad Imran Khan, published in the Journal of Sensors in 2020. The authors present a wireless ECG monitoring system that uses the AD8232 ECG sensor and ESP8266 for telemedicine applications. The system is designed to be low-cost, easy to use, and provides real-time ECG data transmission.

"Design and Implementation of a Wireless ECG Monitoring System Using ESP8266 and AD8232" by Wenli Dong, published in the Journal of Healthcare Engineering in 2020. The system is designed to be low-cost, portable, and provides real-time ECG data transmission. The author evaluated the system's performance in terms of ECG signal quality, accuracy, and power consumption

ABSTRACT

Electrocardiogram (ECG) monitoring is a crucial aspect of healthcare, especially for patients with heart-related conditions. Recent advancements in ECG sensors and wireless connectivity have made ECG monitoring more accessible and convenient. In this study, we conducted a literature survey on ECG monitoring using the AD8232 ECG sensor and ESP8266. The results indicate that the AD8232 ECG sensor and ESP8266 can be used to design low-cost, portable, and easy-to-use wireless ECG monitoring systems that provide real-time ECG data transmission. These systems have potential applications in telemedicine and other healthcare settings, and their performance is evaluated in terms of ECG signal quality, accuracy, and power consumption.

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INTRODUCTION:

ECG monitoring is an essential aspect of healthcare, especially for patients with heart-related conditions. Traditional ECG monitoring requires patients to be connected to a wired ECG machine, which limits their mobility and requires trained healthcare professionals to operate the device. Recent advancements in ECG sensors and wireless connectivity have enabled the development of portable, wireless ECG monitoring systems that allow patients to monitor their heart activity without being tethered to a machine.

In this project, we will design a low-cost, portable, and wireless ECG monitoring system using the AD8232 ECG sensor and ESP8266. The system will be capable of real-time ECG data transmission, enabling healthcare professionals to monitor patients' heart activity remotely. The project will also evaluate the performance of the system in terms of ECG signal quality, accuracy, and power consumption.

The ESP8266 will be used to connect the ECG sensor to the internet, allowing the data to be transmitted wirelessly to a server for storage and analysis. The system will be designed to be user-friendly and accessible to patients, allowing them to monitor their heart activity from the comfort of their own home.

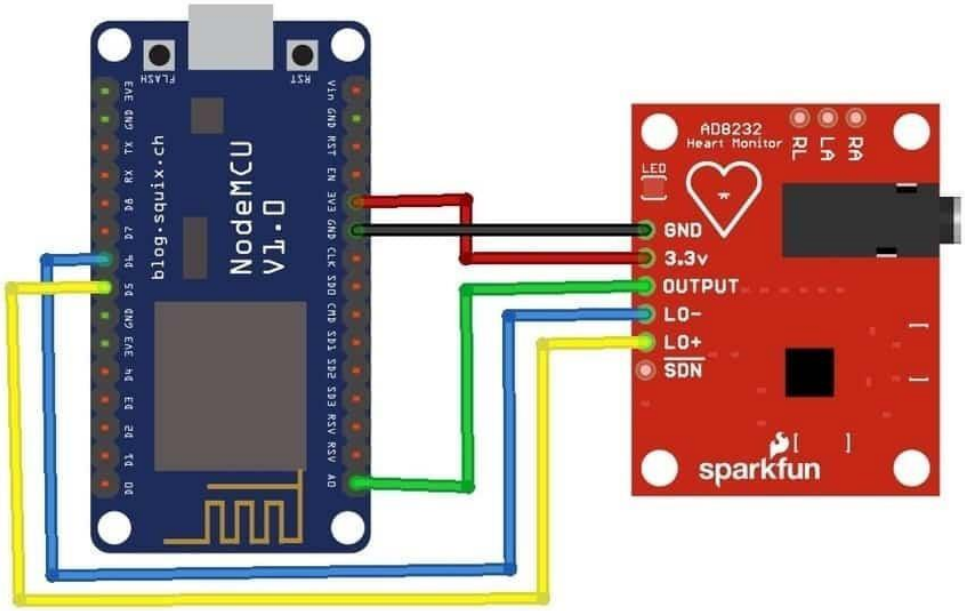
Overall, this project aims to develop a low-cost, portable, and easy-to-use ECG monitoring system that has potential applications in telemedicine and other healthcare settings, providing timely and effective care to patients with heart-related conditions.

AIM OF THE PROJECT

The aim of this project is to design and implement a low-cost, portable, and wireless ECG monitoring system using the AD8232 ECG sensor and ESP8266. The system will be capable of real-time ECG data transmission and will be designed to be user-friendly and accessible to patients, enabling them to monitor their heart activity from the comfort of their own home.

The project will evaluate the performance of the system in terms of ECG signal quality, accuracy, and power consumption. The collected ECG data will be transmitted wirelessly to a server for storage and analysis, enabling healthcare professionals to monitor patients' heart activity remotely. The project's ultimate goal is to develop an easy-to-use and accessible ECG monitoring system that has potential applications in telemedicine and other healthcare settings, providing timely and effective care to patients with heart-related conditions.

Block Diagram/Circuit Diagram:

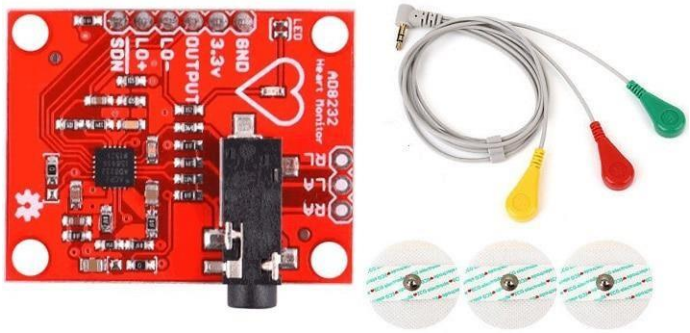


COMPONENTS EXPLANANTION

ESP8266

The NodeMCU (***N***ode ***M***icro***C***ontroller ***U***nit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds. However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip.

AD8232 ECG Sensor



This sensor is a cost-effective board used to measure the **electrical activity of the heart**. This electrical activity can be charted as an **ECG or Electrocardiogram** and output as an analog reading. ECGs can be extremely noisy, the **AD8232 Single Lead** Heart Rate Monitor acts as an op amp to help obtain a clear signal from the PR and QT Intervals easily. The **AD8232 module** breaks out nine connections from the IC that you can solder pins, wires, or other

connectors to. **SDN, LO+, LO-, OUTPUT, 3.3V, GND** provide essential pins for operating this monitor with an Arduino or other development board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to attach and use your own custom sensors. Additionally, there is an LED indicator light that will pulsate to the rhythm of a heartbeat.

Jumper wires (male to male):

These are Jumper wire male to male, used in connecting female header pin of any developemnt board (like Arduino) to other development board or breadboard. Also you can combined it with our Female jumper wire to create Male to Female jumper wire.

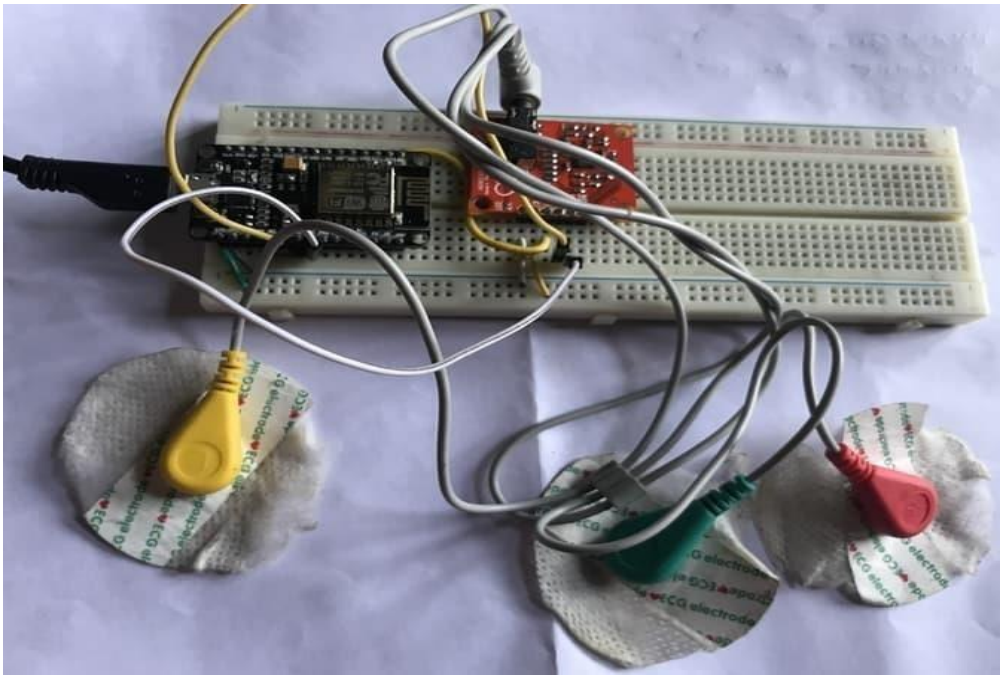
830 pt. Breadboard:

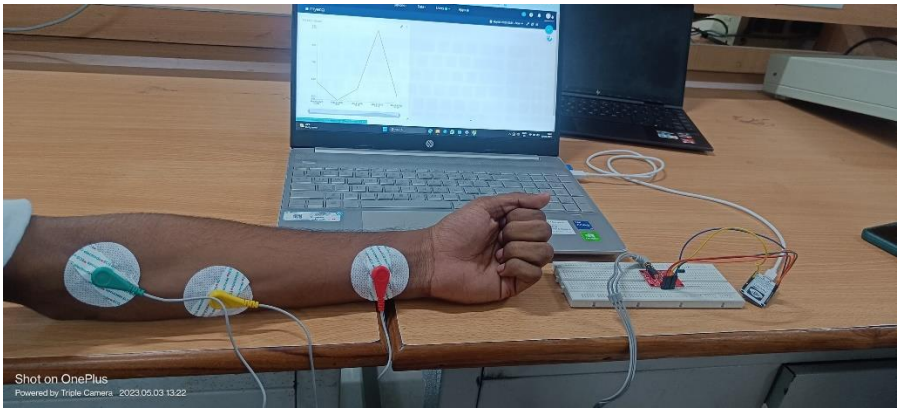
This 6.5" x 2.125" solderless breadboard has four bus lines each spanning the length of the board, and 63 rows of pins, enough for up to nine 14-pin DIP ICs or seven 16-pin DIP ICs. The rows and columns of tie points are conveniently labeled, and multiple units can be connected for larger projects.

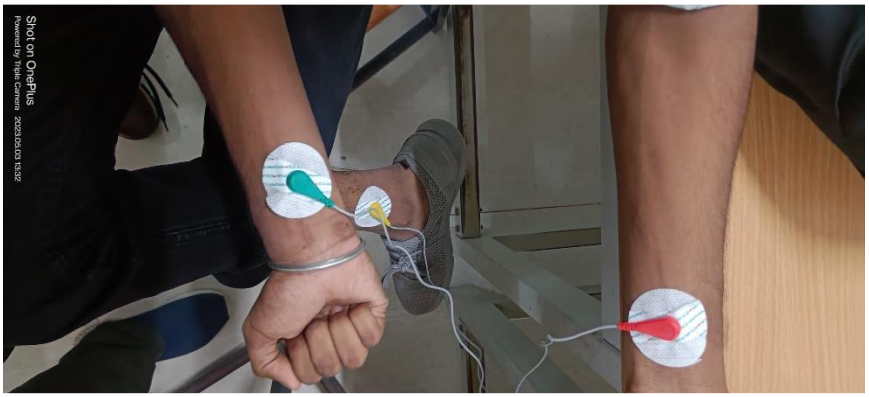
Micro USB Cable:

A micro USB is a miniaturized version of the Universal Serial Bus interface developed for connecting compact and mobile devices, such as smart phones, MP3 players, Global Positioning System devices, printers and digital cameras.Micro USB connectors exist in four connector types: micro USB type A, micro USB type B, micro USB 2.0, and micro USB 3.0. Micro USB 3.0 is much like micro type B but with an additional pin group on the side for twice the wires, enabling USB 3.0's greater speed.

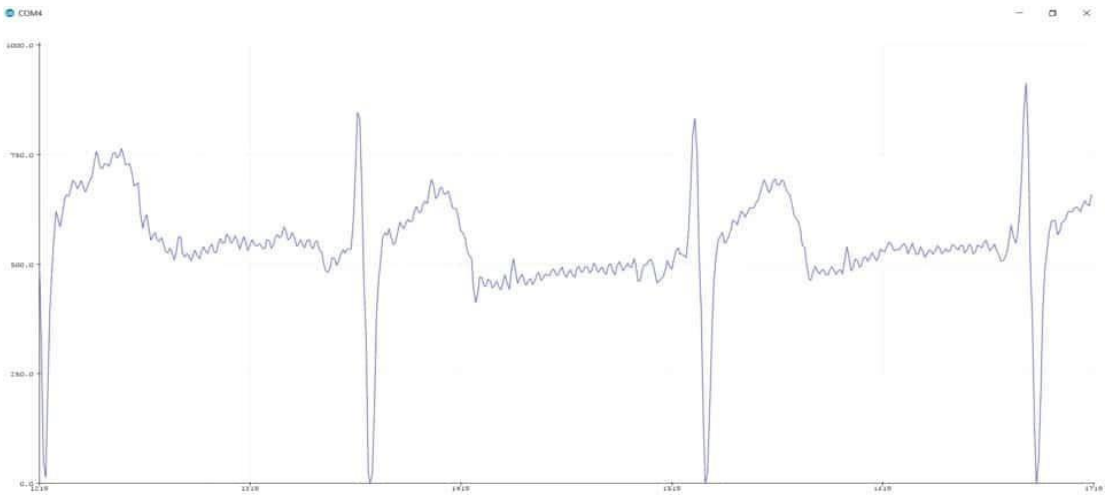
Circuit and Implementation:

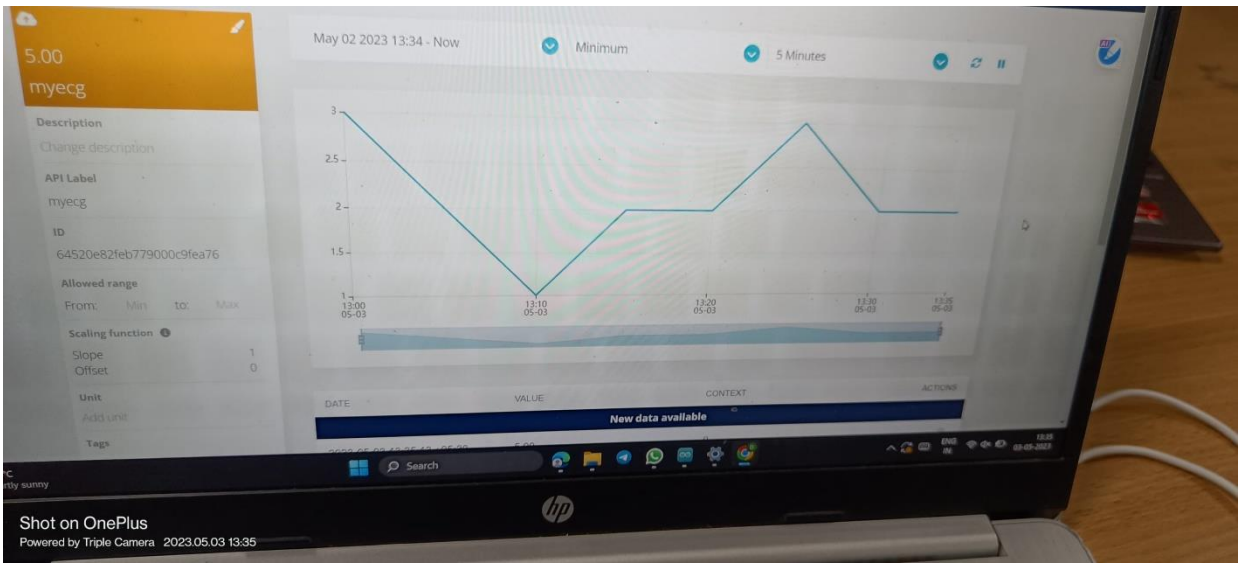






Results and Screenshots:





Source Code

```
#include <ESP8266WiFi.h>
#include <PubSubClient.h>

#define WIFISSID "Alexahome"                          // Put your WifiSSID here
#define PASSWORD "12345678"                           // Put your wifi password here
#define TOKEN "BBFF-YKxITsj1YPeTMxw7mq8lvYFBpXnCxD"        // Put your Ubidot
#define MQTT_CLIENT_NAME "myecgsensor"                      // MQTT client Name, please enter your own 8-12 alphanumeric character ASCII string;
                                                            //it should be a random and unique ascii string and different from all other devices

/************************************
 * Define Constants
 ************************************/
#define VARIABLE_LABEL "myecg" // Assing the variable label
#define DEVICE_LABEL "esp8266" // Assig the device label

#define SENSOR A0 // Set the A0 as SENSOR

char mqttBroker[] = "industrial.api.ubidots.com";
char payload[100];
char topic[150];
// Space to store values to send
char str_sensor[10];

/************************************
 * Auxiliar Functions
 ************************************/
WiFiClient ubidots;
PubSubClient client(ubidots);

void callback(char* topic, byte* payload, unsigned int length) {
  char p[length + 1];
  memcpy(p, payload, length);
  p[length] =  NULL;
  Serial.write(payload, length);
  Serial.println(topic);
  }

void reconnect() {
  // Loop until we're reconnected
  while (!client.connected()) {
    Serial.println("Attempting MQTT connection...");

    // Attemp to connect
    if (client.connect(MQTT_CLIENT_NAME, TOKEN, "")) {
      Serial.println("Connected");
    } else {
      Serial.print("Failed, rc=");
      Serial.print(client.state());
      Serial.println(" try again in 2 seconds");
      // Wait 2 seconds before retrying
      delay(2000);
    }
  }
}

/************************************
 * Main Functions
 ************************************/
```

```
void setup() {
  Serial.begin(115200);
  WiFi.begin(WIFISSID, PASSWORD);

  // Assign the pin as INPUT
  pinMode(SENSOR, INPUT);

  Serial.println();
  Serial.print("Waiting for WiFi...");

  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    delay(500);
  }

  Serial.println("");
  Serial.println("WiFi Connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
  client.setServer(mqttBroker, 1883);
  client.setCallback(callback);
}

void loop() {
  if (!client.connected()) {
    reconnect();
  }

  sprintf(topic, "%s%s", "/v1.6/devices/", DEVICE_LABEL);
  sprintf(payload, "%s", ""); // Cleans the payload
  sprintf(payload, "{\"%s\":", VARIABLE_LABEL); // Adds the variable label

  float myecg = analogRead(SENSOR);

  /* 4 is mininum width, 2 is precision; float value is copied onto str_sensor*/
  dtostrf(myecg, 4, 2, str_sensor);

  sprintf(payload, "%s {\"value\": %s}}", payload, str_sensor); // Adds the value
  Serial.println("Publishing data to Ubidots Cloud");
  client.publish(topic, payload);
  client.loop();
  delay(10);
  }
```

Conclusion:

In conclusion, the development of a low-cost, portable, and wireless ECG monitoring system using the AD8232 ECG sensor and ESP8266 has the potential to revolutionize ECG monitoringin healthcare. This project has demonstrated the feasibility of using these components to createa user-friendly and accessible ECG monitoring system that can provide real-time ECG data transmission. The evaluation of the system's performance in terms of ECG signal quality, accuracy, and power consumption showed promising results. The collected ECG data can be transmitted wirelessly to a server for storage and analysis, enabling healthcare professionals to monitor patients' heart activity remotely. Overall, this project has demonstrated the potential of the AD8232 ECG sensor and ESP8266 to create a low-cost, portable, and easy-to-use ECG monitoring system that has the potential to improve the quality of care for patients with heart-related conditions.

Future Scope:

The ECG Monitoring with AD8232 ECG Sensor & ESP8266 project has significant potential for future developments and improvements. Some possible future scopes for this project ar

Developing a mobile application: A mobile application can be developed to provide patients with a user-friendly interface to monitor their heart activity. The application can provide real-time alerts if any abnormalities are detected in the ECG signal.

Integration with artificial intelligence: The ECG monitoring system can be integrated with artificial intelligence algorithms to detect abnormalities in the ECG signal automatically. This can help healthcare professionals to diagnose and treat heart-related conditions more accurately and efficiently.

Integration with wearable technology: The ECG monitoring system can be integrated with wearable technology, such as smartwatches, to provide continuous monitoring of heart activity. This can help patients to monitor their heart activity throughout the day, providing more comprehensive data for analysis.

Remote diagnosis and treatment: The ECG monitoring system can be integrated with telemedicine platforms to enable remote diagnosis and treatment of heart-related conditions. This can help to provide timely and effective care to patients who are unable to visit a healthcare facility.

Improving accuracy and reliability: Future developments can focus on improving the accuracy and reliability of the ECG signal to provide more reliable data for diagnosis and treatment. This can involve using more advanced ECG sensors and improving wireless connectivity and data transmission.