

# IoT BASED WIRELESS ECG MONITORING SYSTEM

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## ABSTRACT

Exact Diagnosis is still a problem in our country, after achieving advanced medical science, superb technology and a wide health network we are still not able to protect the patients who are suffering from cardiovascular and chronic disease throughout the globe.

Human is still the biggest challenge for ultra-modern medical science.

This project will address the challenges faced by cardiovascular patients as cardiovascular Diseases (CVDs) affect the blood vessels and the functioning of the heart. These activities involve heart failure, stroke, heart attack and many heart-related problems.

Every year more than one and a half Crore deaths happen due to CVDs throughout the world according to WHO and still, we are not taking it seriously.

To solve and reduce the cause of concern we made an ECG machine that is wireless and will detect the QRS complex at the ease of homes, offices or any remote place without doctors present in real-time. This model is being designed by using ESP32 and AD8232 followed by the UBI dots web platform which will detect the frequency of heart, bp, temperature, spo2 and many more.

The UBI dots platform sends the data to the cloud and the prescribed doctor having login id and password can check the conditions of patients at the same time through a different end.

## INTRODUCTION

Recent developments in electronics towards ultra-modern medical science showed a drastic change and helped mankind to achieve its goal to procure the patient's health using conventional and now smart methods. Conventionally the detection systems were only found in the health centre and were Signalize by huge and complex circuitry which required high power consumption

The ECG monitoring system will detect the QRS complex of patients by connecting sensor pads through the patient's body and checking it on laptop and mobile as it is connected with UBI dot platform a message will pop out in screen of prescribed doctors mobile and then he can log in through his login id and password and can check the status of patients from their end.

ECG Monitoring system boon for Telemedicine

As we know, with every advancement in technology the world is becoming a better and secure place to live in and similarly, the advancement in technology has paved its way to medical healthcare sectors and has brought drastically transformed way of treatment in the medical world. Earlier, it was not possible to detect heart diseases because of lack of medical help and absence of knowledge about the cardiovascular disease among humans but with the advancement, in the Era of science the humans have reached a place where they are not only detecting the diseases but the treatment is also possible. With having surged in cardiac conditions throughout the globe, it is very important to detect heart diseases and prevent deaths due to cardiovascular diseases. From the survey, we can clearly say that cardiovascular disease is the biggest cause of deaths across the globe. Since the time being, innovative methods and instruments have been designed to save the lives of patients dying due to heart diseases.

According to the estimation made in previous years, it can be stated that millions of people have died due to cardiovascular disease which represents quite a big percentage of global deaths. The evolvment of wireless monitoring systems because of care boosted the acceptance of homely treatment which resulted in propelling the development of the ECG monitoring system. Keeping in mind the ratio of doctors to patients is very much unbalanced and thus it is just not possible for every patient to get the treatment done on time.

The deaths occur only because there is no treatment possible on the spot and thus seeing the ratio of doctors to patients it is not possible for the doctors to reach every patient on time and for this reason invention of the Wireless ECG monitoring system is very much beneficial for the cardiac patients. This project is IoT based and being advance in technology it has many advantages which proves this wireless ECG monitoring system a boon for medical advancement and the patients of cardiovascular disease throughout the globe.

Being wireless, this monitoring system identifies the risky situation and alarms the physicians about the complications regarding patients health via e-mail and SMS services thus it is potent enough to reduce the requirement of hospitalization.

This system is used for monitoring post-operative patients in an environment which resembles the hospital zone using wireless sensor networks which are proposed for the enhancement of patient's care with the help of integrating smart sensors, wireless communication and network technology.

Our project is very cost-effective because it is presenting the outlook for monitoring the patient using the wireless sensor network in the homely environment without being disturbed in their daily activities and having an improved quality of life at a low cost. The reachability and affordability is the most important factor of this wireless monitoring system. With the help of this monitoring system, physicians and health care-takers can detect the risky situation through e-mail and messaging services.

Being technology affiliated, this system is quite secure and details of the patients are kept confidential so the database cannot be leaked. While making this project, the safety and security of everything have been kept into consideration. With this monitoring system, the real-time data of the patient can be shared with the physicians or healthcare professionals insecure way and thus making the doctors look after the patient without wasting time.

This wireless ECG monitoring system can design and implement, which will successfully help the patients get the treatment on the spot without delay because of the correct diagnosis at the right time and will be easier to get the doctor's suggestion for further treatment of the patients. This wireless system will be a better and modified version of the current monitoring system, also because it is wireless thus, it helps in avoiding problems for patient's caretakers or physicians to make the set-up for the diagnosis. The benefits of having such a version of monitoring are in a wide range as the

patient can continue their normal life along with being monitored at any place.

With this, we can surely say that this project, "IoT BASED WIRELESS ECG MONITORING SYSTEM" is a boon for the medical sector and every patient who is suffering from cardiovascular disease.

## IMPLEMENTATION OF ECG MONITORING SYSTEM

AD8232 ECG sensor is a cost-effective board use to measure the heart's electrical activity. The AD8232 is an integrated signal conditioning of cardiac biopotentials for heart rate monitoring. it contains a special instrumentation amplifier, an operational amplifier, a right leg drive amplifier, and a mid supply reference buffer. In addition, the AD8232 includes a lead-off detection circuit that brings back the signal shortly after leads are reconnected. This contains a specialized instrumentation amplifier that amplifies the ECG signal while rejecting the electrode half cell potential on the same stage. This is doable with an indirect current feedback architecture, which reduces size and power compared. This is operated from a single supply.

To simplify the design of single-supply applications, the AD8232 incorporates a reference cushion to make a virtual ground between the stockpile voltage and the framework ground The signs present at the yield of the instrumentation intensifier are referred to around this voltage.

The AD8232 has kept typically in a pod near the heart. The two sense electrodes have kept underneath the pectoral muscles, no driven electrode is used because the distance from the heart to the AD8232 is small, the heart signal is strong and there is less muscle artefact interference.

A more limited separation from the AD8232 to the heart makes this application less powerless against basic mode obstruction. An ECG waveform with minimal distortion, the AD8232 is configured with a 0.5 Hz high pass filter followed by a two-pole and 40 Hz low pass filter

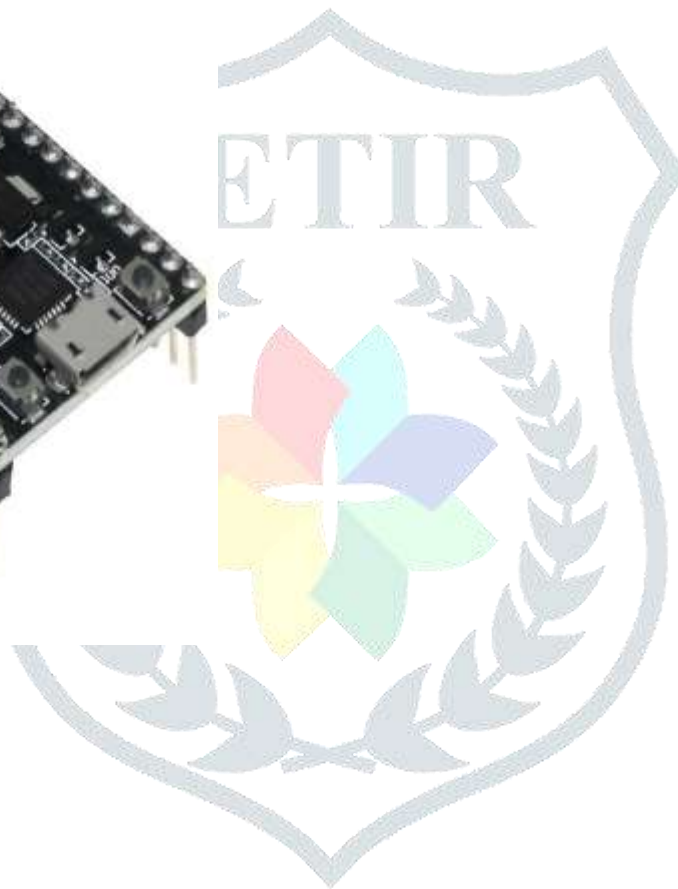
## ESP 32

ESP32 is an excessive integrated solution for Wi-Fi and Bluetooth IoT applications. This integrates an antenna switch, low noise receive amplifier, filters, power amplifier and power management modules. ESP32 uses CMOS to register single-chip

completely integrated radio and baseband. ESP32 is designed for mobile, Internet of things (IoT) and wearable electronics applications.

It features all the state of art characteristics of low power chips, including multiple power modes and dynamic power scaling. The operating voltage ranges from 2.3 V to 3.6 V for ESP32.

When using a single power supply, the recommended voltage of the power supply is 3.3V and its output current is 500 mA or more.



## Sensor Pads

Our planned ECG sensor is a two-lead framework comprising of two fundamental parts: three indistinguishable measured PCBs as anodes for signal obtaining and regular mode weakening, furthermore, one primary board for signal moulding transmission. Two of these cathodes are appended to the chest for signal procurement from the body, and one of them is connected a long way from the chest on the right hip as a source of the perspective terminal. The sign procured from the terminals then, at that point goes to the primary board to be enhanced, separated, digitized and sent. The ECG capacitively coupled sensor with signal conditioning and processing circuits is capable of providing useful vital signs information on the heart's functioning.



## Ubidot web platform

Ubidots gives chiefs the specific data required for basic choices continuously, paying little mind to where the clients are. Regardless of whether in the workplace, on the creation floor, at home, or out and about, Ubidots keeps the clients educated and engaged to reliably settle on information-driven choices for improving creation.

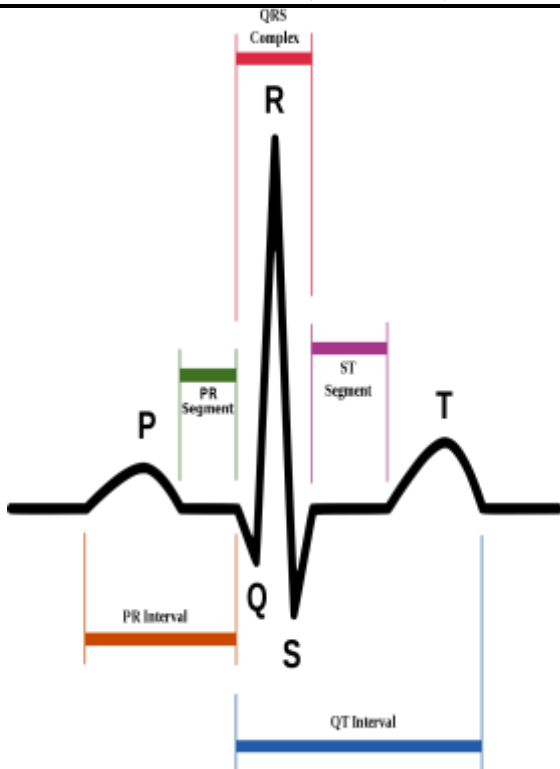
UBIDOTS, which provides both clouds storing services and basic information analyses on the measured variables in real-time. UBIDOTS presents this proposal based on a previous research project that developed an e-health monitoring system for a neonatal incubator prototype. UBIDOTS is a cloud service to store and analyze information from sensors in real-time. It allows creating applications using the Internet of Things without having much knowledge in web programming or databases.

The interface of UBIDOTS is user-friendly and enables fast visualization of the variables of interest. Through this platform, you can create alarms or warning messages, send them to a mobile device and configure the device to execute a control action. The system, mentioned above, sends warning messages to a cell phone via Wifi.

## QRS complex

QRS Complex is the most unmistakable component in the Electrocardiogram (ECG) sign and compares to the ventricular excitation. The significance of QRS identification results from the wide utilization of the circumstance data of this segment.

The QRS complex gives information about the Ventricular systole in Consequence of the inspiration propagation to the ventricles (Q wave), while the transmission to the entire tissue is brought about by the R and S wave. The QRS complex gives information about fibrillation and arrhythmias it tends to be useful to investigate coronary failures. The first stage is to find the point R by applying the difference equation operation to the ECG signal. The subsequent stage searches for the focuses Q and S as per the guide R toward discovering the QRS complex solid and right identification of QRS buildings, under different foundations, is vital in any calculation utilized for ECG investigation. The right exhibition of these situation relies upon a few significant factors, for example, the nature of the ECG signal, the applied recognition rule, the learning and utilized testing dataset.



Remote setting	<ol style="list-style-type: none"> <li>1. Telemonitoring</li> <li>2. Smart device-based ECG monitoring</li> <li>3. Compressed ECG sensing</li> </ol>
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**APPLICATION**

It is used in a wide range of applications for the usage of mankind hence some of the brief examples are shown in this table.



Content-aware ECG Monitoring System	Category
Home setting	<ol style="list-style-type: none"> <li>1. Telemonitoring</li> <li>2. Wearable</li> <li>3. continuous monitoring</li> <li>3. Elderly monitoring</li> </ol>
Hospital setting	<ol style="list-style-type: none"> <li>1. ICU, non-ICU Clinical setting</li> <li>2. Holter monitoring</li> </ol>
Ambulatory setting	<ol style="list-style-type: none"> <li>1. Ambulatory cardiac/telemetry monitoring,</li> <li>2. Wearable ECG monitoring</li> </ol>

**UPCOMING PLANS WITH ECG MONITORING SYSTEM**

This advanced monitoring system has a large scope in future along with multiple benefits which are IoT based being the modified version of the current system. This monitoring system shares the real-time data with the health care professionals via e-mails and messages with the safety and security of the database has been considering. This monitoring system has the potential to reduce the need for hospitalization. Thus the use of advanced technology is evident in the functioning of this monitoring system. Also, this wireless ECG monitoring system can control cardiac problems and provide timely aid to the patient present in any corner of the world. This device will thus be helpful for the patient to contact their respected doctors immediately and receive proper consultation after being instantly diagnosed. With this, we can see that there is a lot of scope for the success of this project in future to provide a correct diagnosis to the cardiac-related problems.

**CONCLUSION**

The above paper submitted presents the IoT based Wireless ECG monitoring system to acquire the real-time ECG signals of the patients and be the alarm for the care-takers or the health physicians, at any place as it is portable and easy to use. This

wireless ECG monitoring system can design and implement, which will successfully help the patients get the treatment on the spot without delay because of the correct diagnosis at the right time and will be easier to get the doctor's suggestion for further treatment of the patients.

This wireless system will be a better and modified version of the current monitoring system, also because it is wireless thus, it helps in avoiding problems for patient's caretakers or physicians to make the set-up for the diagnosis. The benefits of having such a version of monitoring are in a wide range as the patient can continue their normal life along with being monitored at any place. There are many more plus points of this system such as it helps avoid the risk of getting infected and also saves the expenses of the hospital charges and many more benefits are thus attached with this monitoring system.

With this, we can surely say that this project, "IoT BASED WIRELESS ECG MONITORING SYSTEM" has the potential of successful implementation and with the motive of human welfare along to decrease the death rate because of cardiovascular diseases.

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