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Using Internet of Things (IOT) in AD8232 Based Smart Healthcare System

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ABSTRACT

Through IoT-enabled platforms for continuous monitoring of healthcare data, it enables doctors to provide faster, smarter, and more efficient diagnostic methods. IoT, or Internet of Things, refers to the phenomenon of connecting people, computers, machines, etc. through the Internet for continuous process and data exchange, which can be detected by real sensors for a certain characteristic. time tracking, data tracking and management. IoT Healthcare can be used for critical patients who need constant monitoring. With IoT Healthcare applications, diseases can be detected early and the doctor can be notified immediately. Heart rate monitoring in IoT healthcare, It has a wide range of applications such as ECG monitoring, blood pressure monitoring and more. Here we will talk about ECG monitoring using IoT and its implementation methodology.

I. INTRODUCTION

IoT or Internet of Things refers to the phenomenon of connecting people, computers, machines, etc. through the Internet for continuous process and data exchange, which can be determined according to a certain characteristic using real sensors, time tracking, ma 'data tracking and management. Statistical analysis of real-time monitoring of patients and delivery of observed data to the Internet will be one of the great future tasks. Figure 1: Proposed IoT in ECG Healthcare Application Governments in many countries are investing a good amount of money in research to address medical negligence, which is one of the critical gaps in the healthcare

industry. . And so, this will be an important and much-needed change in the health sector that the world is looking for. Placement becomes an acute problem because the number of doctors across the country is limited relative to the population. So some highly qualified and efficient doctors have to travel across the country to see patients. In this case, it becomes very important for the doctor to closely monitor the patients and store their relevant data in the cloud, to know about the current condition of the patients and to take the next steps accordingly. For example, if a doctor performs an operation in Tashkent and therefore goes to Namangang It is important to constantly monitor the patient and store the monitored data in the cloud in order to inform the doctor about the details of the patient who operated in Tashkent on the same day if the nab has to go. The doctor can easily check the controlled data using the internet and give appropriate instructions. For elderly people with heart disease, online monitoring of data will be important for the doctor to make the correct diagnosis. If the monitored data does not fall below the normal value, the system can be programmed to alert the doctor. In order to inform the doctor about the details of the patient who underwent surgery in Tashkent, it is important to constantly monitor the patient and store the monitored data in the cloud. The doctor can easily check the controlled data using the internet and give appropriate instructions. For elderly people with heart disease, online monitoring of data will be important for the doctor to make the correct diagnosis. If the monitored data does not fall below the normal value, the system can be programmed to alert the doctor. In order to inform the doctor about the details of the patient who underwent surgery in Tashkent, it is important to constantly monitor the patient and store the monitored data in the cloud. The doctor can easily check the controlled data using the internet and give appropriate instructions. For elderly people with heart disease, online monitoring of data will be important for the doctor to make the correct diagnosis. If the monitored data does not fall below the normal value, the system can be programmed to alert the doctor. can easily check the data and give appropriate instructions. For elderly people with heart disease, online monitoring of data will be important for the doctor to make the correct diagnosis. If the monitored data does not fall below the normal value, the system can be programmed to alert the doctor. can easily check the data and give appropriate instructions. For elderly people with heart disease, online monitoring of data will be important for the doctor to make the correct diagnosis. If the monitored data does not fall below the normal value, the system can be programmed to alert the doctor.

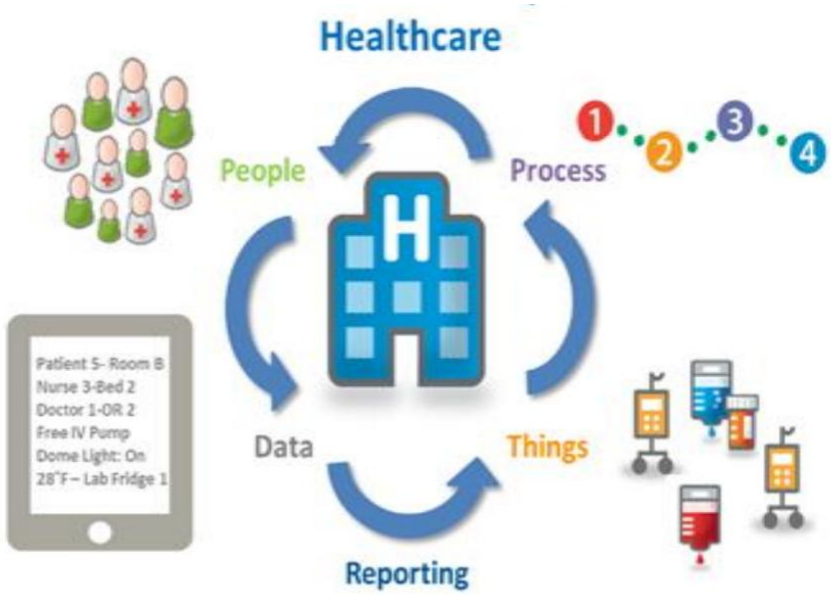

Figure 1: Overview of a smart healthcare system.Proposed IoT in ECG healthcare application.

The next IoT will play an important role in changing the world we live in now and will provide us with much simpler ways of life and get things done quickly and efficiently. There is intense government-funded research in IoT healthcare for smart data monitoring in many countries. This

not only helps us track data, but also gives each patient the attention they deserve to stay healthy. From the perspective of this article, as shown in Figure 1, we will monitor the data of AD8232 biometric heart rate sensor, and then send the data to the Internet for storage and processing. There are several techniques for uploading data to the Internet. We are using ESP8266 WiFi module to send the data to the internet because this process is simple but it has an efficient architecture and it is efficient and cost effective. The reason we are focusing on cost-effectiveness is that it leads to greater access to technology. ESP8266 is a low cost module with which we can give the microcontroller access to any WiFi network and upload the data later. The ESP8266 is an effective platform for communicating over the Internet. lib with which we can grant access to any WiFi network to the microcontroller and upload the data later. The ESP8266 is an effective platform for communicating over the Internet. lib with which we can grant access to any WiFi network to the microcontroller and upload the data later. The ESP8266 is an effective platform for communicating over the Internet.

II. SYSTEM ARCHITECTURE

Communication is an integral part of the IoT environment as it relates to synchronization between data, processing and user. Effective communication is critical to the patient's well-being and effective treatment by the physician and must therefore be managed with precision. In this paper, in addition to the analog data collection between our sensor and Arduino, the patient's mobility is monitored using a Wireless network. We use the internet to our advantage to inform the doctor about the information collected from the patient and therefore the communication over the internet is one of the most important parts of this proposed system as shown in figure 2.

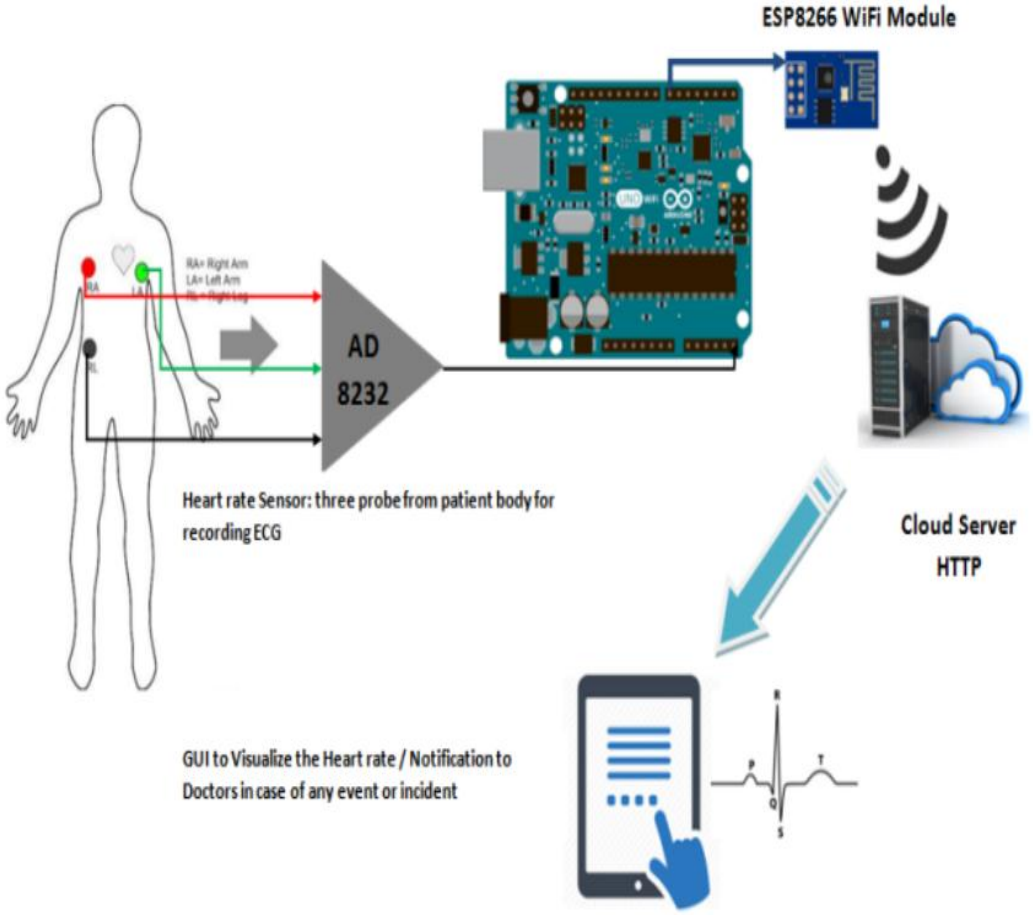

Figure 2: Proposed IoT in ECG healthcare application.

We take a bottom-up approach to handling communication procedures, starting with the raw data and ending on our website where the doctor can access the processed data. The process begins

with sensors (in our case, ECG sensors) that collect data from the patient and send it serially to the processor via a cable. It is sent as a stream of data, which is actually a voltage reading and is therefore easily read by our Arduino Nano microcontroller. In the next step, our Arduino transmits the data serially to the ESP8266 WiFi module. The ESP8266 acts as an important communication interface in our project, as it is the bridge between our raw data in the form of electrical signals and data over the internet. So, after this step, we have successfully sent our data to the internet and justified the theme of Internet of Things. The following steps are related to the software and data we send over the Internet. The data is first displayed on the web server sent by the ESP8266 and then stored and processed and then made available for analysis by the user (in our case, the doctor). This completes the process of notifying our physician, who then uses his expertise to provide the patient with the best option for wellness. in relation to the data and information we send over the Internet. The data is first displayed on the web server sent by the ESP8266 and then stored and processed and then made available for analysis by the user (in our case, the doctor). This completes the process of notifying our physician, who then uses his expertise to provide the patient with the best option for wellness. in relation to the data and information we send over the Internet. The data is first displayed on the web server sent by the ESP8266 and then stored and processed and then made available for analysis by the user (in our case, the doctor). This completes the process of notifying our physician, who then uses his expertise to provide the patient with the best option for wellness.

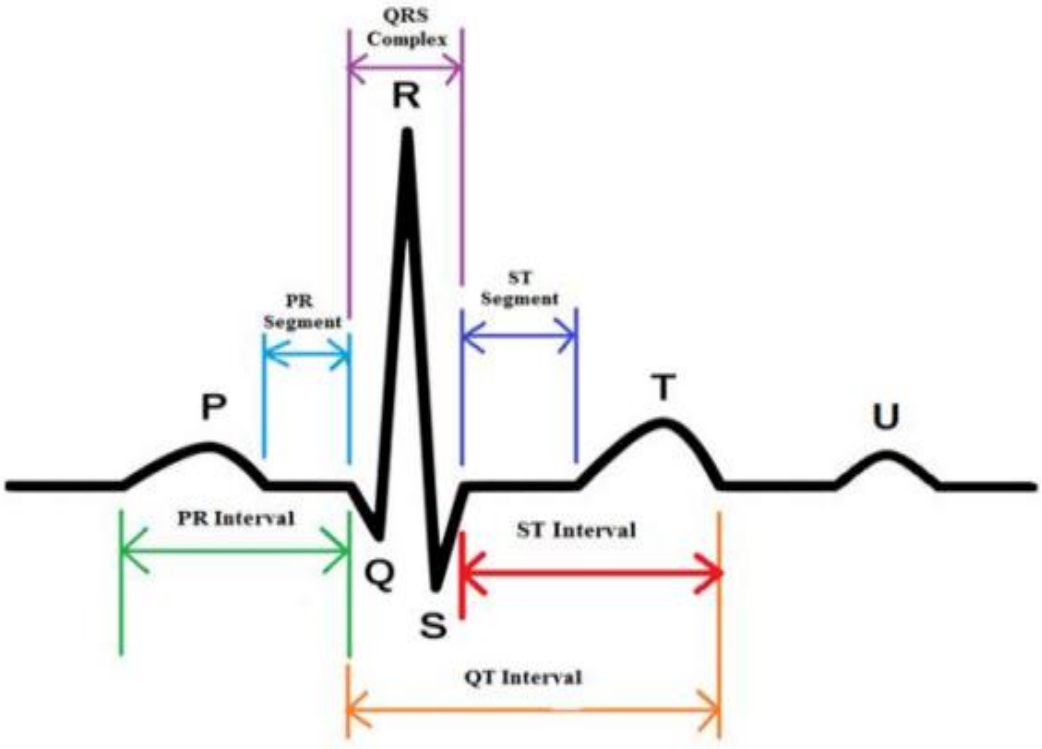

Figure 3: A typical ECG waveform.

A. ECG and its clinical significance

It is the typical QRS complex that is important for analyzing the patient's heart rate. The P-wave represents the activation of the upper chambers of the heart, and the T-wave represents the activation of the lower chambers of the heart along with the QRS complex. By analyzing the QRS complex, any problem with the functioning of the heart can be detected. Any abnormality in heart rate is indicated by lengthening, widening, or shortening of the QRS complex, as shown in Figure 3.

B. Recommended hardware model

The proposed hardware model was implemented by connecting different modules and sub-modules together and then connecting them to the power supply through a circuit. After complete connection, the hardware model will appear as shown in the picture.

Figure 4 shows a schematic diagram of the proposed AD8232-based heart rate monitoring system in the context of smart healthcare and IoT. As an IEEE 802.11 network adapter, the ESP8266 is used to send sensor data to the cloud via HTTP POST command via software serial AT on Arduino. Figure 4 shows the implementation of the proposed design, showing the probes to be connected to the RA, LA, and RL of a patient under real-time cardiac monitoring. Heart rate sensor data is sent to the cloud server over a TCP connection using an HTTP POST command.

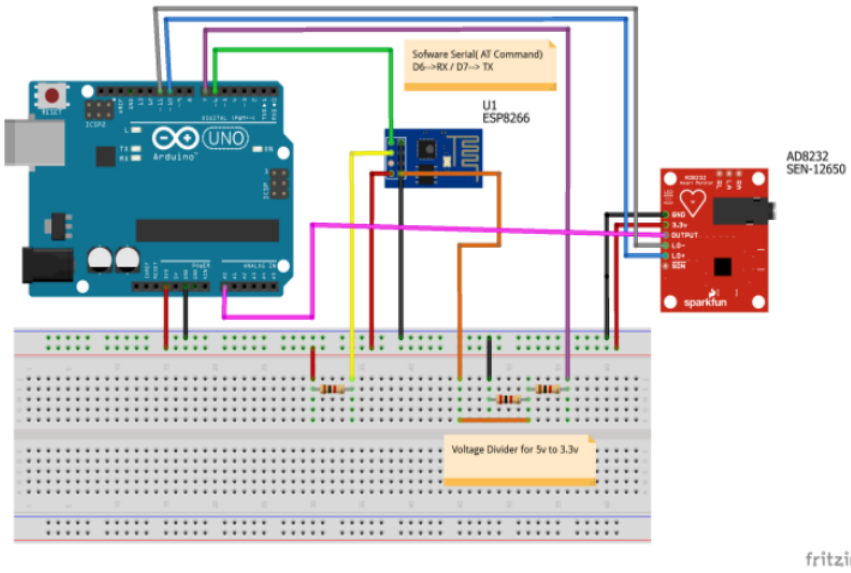

Figure 4: Schematic diagram of the proposed Smart Healthcare system developed at Fritzing.

C. Working with data

Data are mainly processed in three phases of our project. We can divide them into initial data collection stage, data transfer and interface stage and final data processing stage. In the initial phase, as the name suggests, we collect data from the patient using our sensor network. Processing at this stage is very important because accuracy in data collection ultimately determines the outcome and therefore requires the highest level of accuracy. In the second step, we transfer this data from the sensor network to our microcontroller and finally send it to the Internet via the Wi-Fi module. This stage has no data. while remaining may cause some noise in the circuit. However, the probability of error at this stage is lower and can be corrected by proper sampling depending on the overall data trend. Therefore, the first stage of data transmission has some effect on the data of this stage. The final stage mainly deals with data processing on our server and there is not much chance of error. However, this level determines the effectiveness of our final result to the greatest extent. Data handling at this stage is mainly concerned with graphing and processing our data. In conclusion, the data handling is the most important part of the project and cannot be neglected. Let's take a look at the devices that play the biggest role in working effectively with data:

D. AD8232 is a single lead heart rate monitor sensor

An ECG sensor attached to the patient (AD8232 shown in Figure 5) measures the electrical activity of the heart over a period of time.

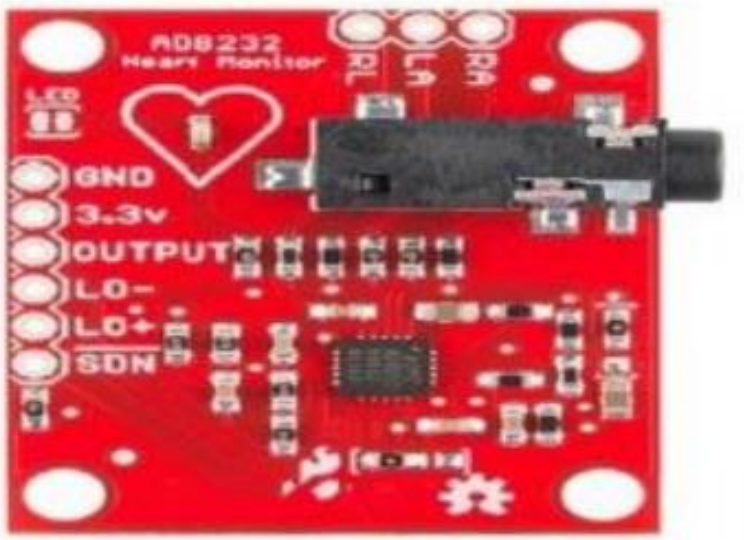

Figure 5: AD8232 heart rate sensor.

The sequence of sensor output data can be monitored using a monitor or sent directly to the cloud using a microcontroller. It collects data and sends it serially to Arduino for further actions. Table 1 shows the pinout for interfacing the AD8232 with the Arduino Nano.

Table 1: Pin level connection of AD8232 with Arduino

Board Label	Pin Function	Arduino Connection
GND	Ground	GND
3.3v	3.3v Power Supply	3.3v
OUTPUT	Output Signal	A0
LO-	Leads-off Detect -	11
LO+	Leads-off Detect +	10
SDN	Shutdown	Not used

E. Data processing

The data from the sensor network is processed using the Arduino Nano microcontroller (shown in Figure 6). The sensor network is connected to the Arduino board, which displays the data value or graphical value on the serial plotter. The Arduino also communicates with the ESP8266, which sends data to the internet via a series of IT commands.

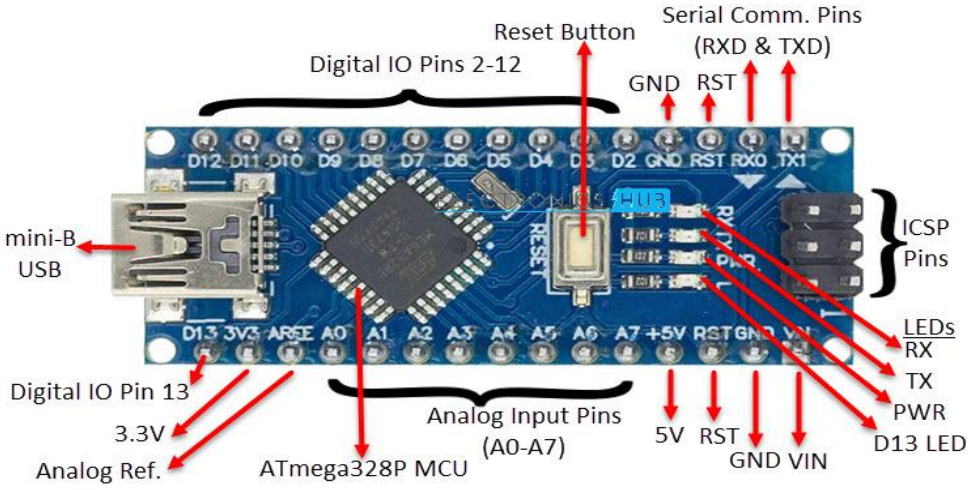

Figure 6: ATmega328 microcontroller: Arduino Nano.

F. ESP8266 WLAN module

Data collection is done using Arduino Nano and transmitted to the cloud via ESP 8266 MODULE. The ESP8266 module is pre-programmed with a firmware package and also knows AT commands, and so we can connect it directly to the Arduino and then transfer data. This stage of data processing causes small errors in the transmission from the shield to the Internet. However, this does not have a very detrimental effect on our results and can be adapted to use the correct technique in other steps.

AT buyruqlar to'plami: (HTTP orqali TCP ulanishi)

AT+CIPSTART="TCP","internetofthings.pe.hu",80
AT+CIPSEND=170

POST /sensorRead.php HTTP/1.1
Xost: internetofthings.pe.hu
Kontent turi: ilova/x-www-form-urlencoded
Kontent uzunligi: 23

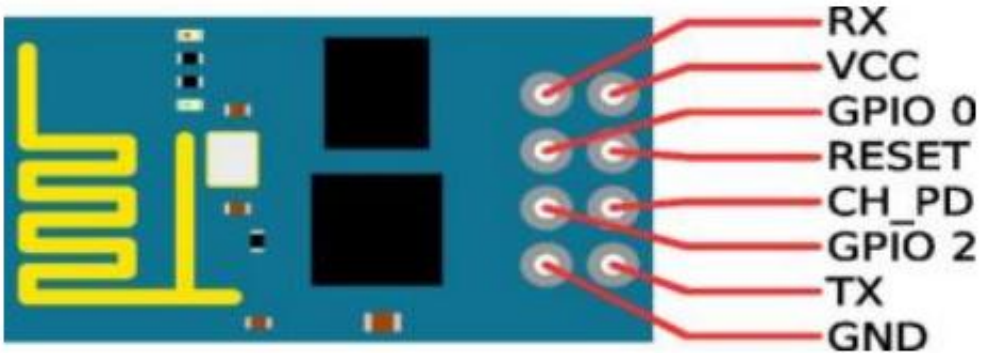

Figure 7: Pin-out diagram of the ESP-01 used to POST HTTP data, shown over a TCP server connection.

III. RESULTS

The circuit consisting of Arduino Nano, W-LAN module and ECG sensor is well connected. The ECG leads are then placed on the patient's body according to the color code. Now, with the circuit, the heart rate is continuously monitored and an EKG waveform is generated. Voltage values of the ECG are received by a serial monitor at certain time intervals. ECG waveform is generated on Arduino Nano series plotter and using ESP 8266 the data is sent via internet to a specific web page which can be accessed by the concerned doctor anywhere in the world. If there is any abnormality in the ECG waveform (that is, the QRS complex is not well defined, inversion of T waves, very low amplitude, etc.), the physician is immediately notified via SMTP that this patient has a problem. The doctor can then access the web page and view the EKG graph and take necessary steps to improve the patient's condition.

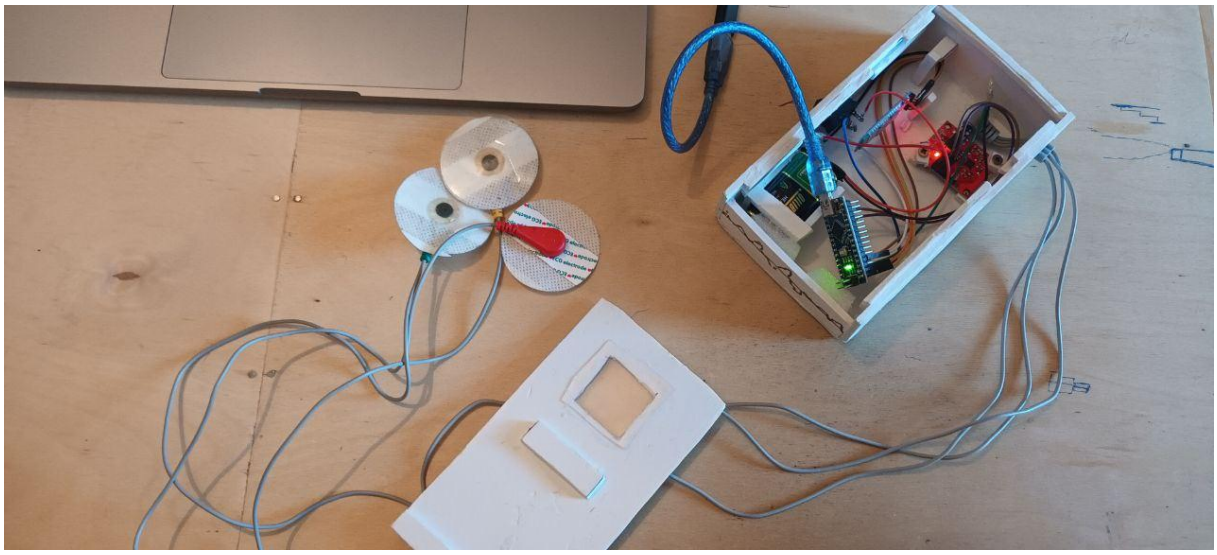

Figure 8: ECG sensor (AD8232).

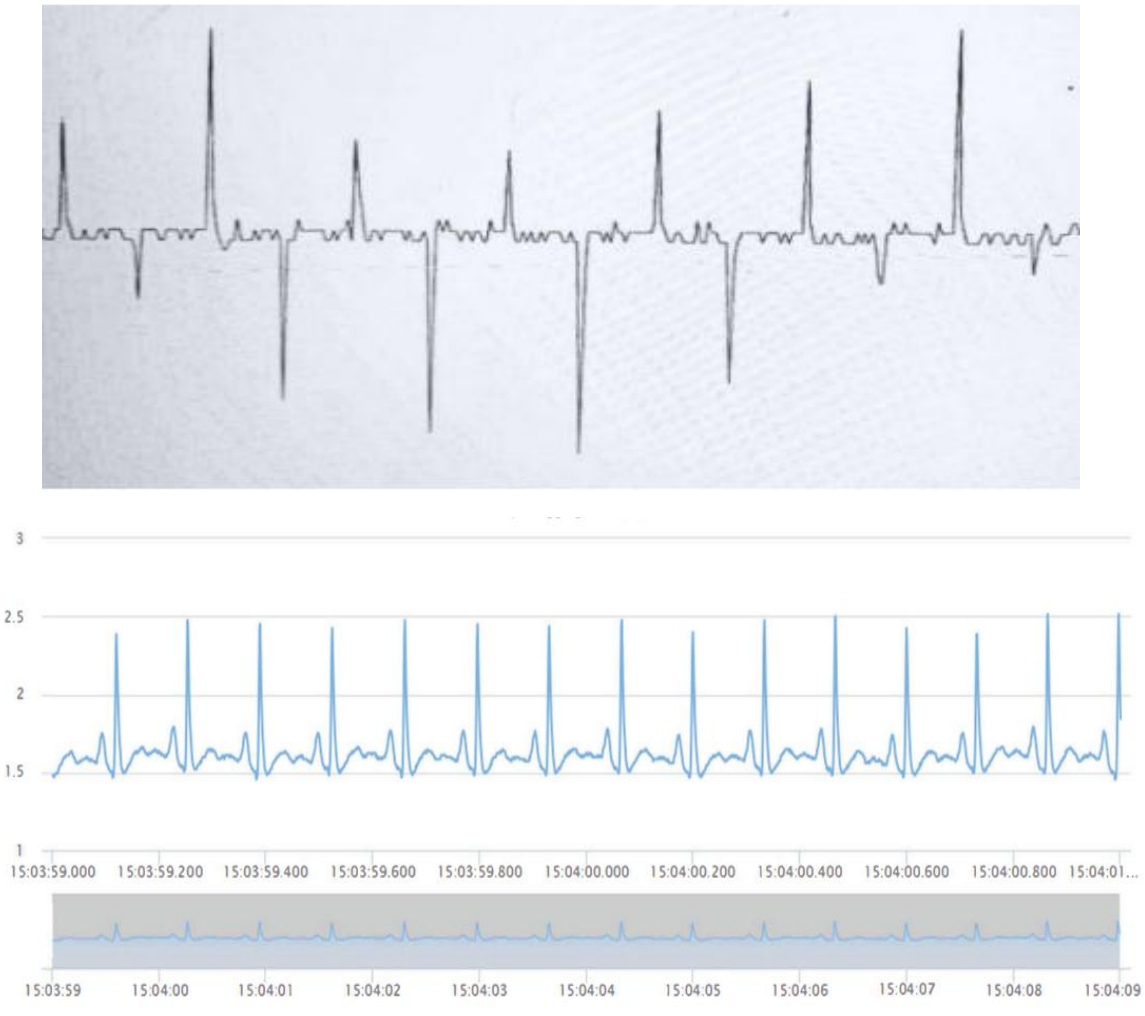

Figure 9: A typical ECG waveform recorded by the proposed apparatus.

IV. CONCLUSIONS

The integration of healthcare with IoT has opened up a vast field of development. It not only facilitates health care, but also identifies new disease prevention measures through data

processing and analysis of global trends. Also, the big future depends entirely on the automation of hospitals and treatment mechanisms, which will help doctors understand diseases through artificial intelligence and IoT. However, we need to take it one step at a time and not rush into this area because it deals with human health and safety and should be at the top of the agenda. On a large scale, it is also can lead to cheaper treatment and lower nursing costs for patients. If technology and health go hand in hand, we can achieve the goal of affordable, safe and effective disease prevention and treatment.

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