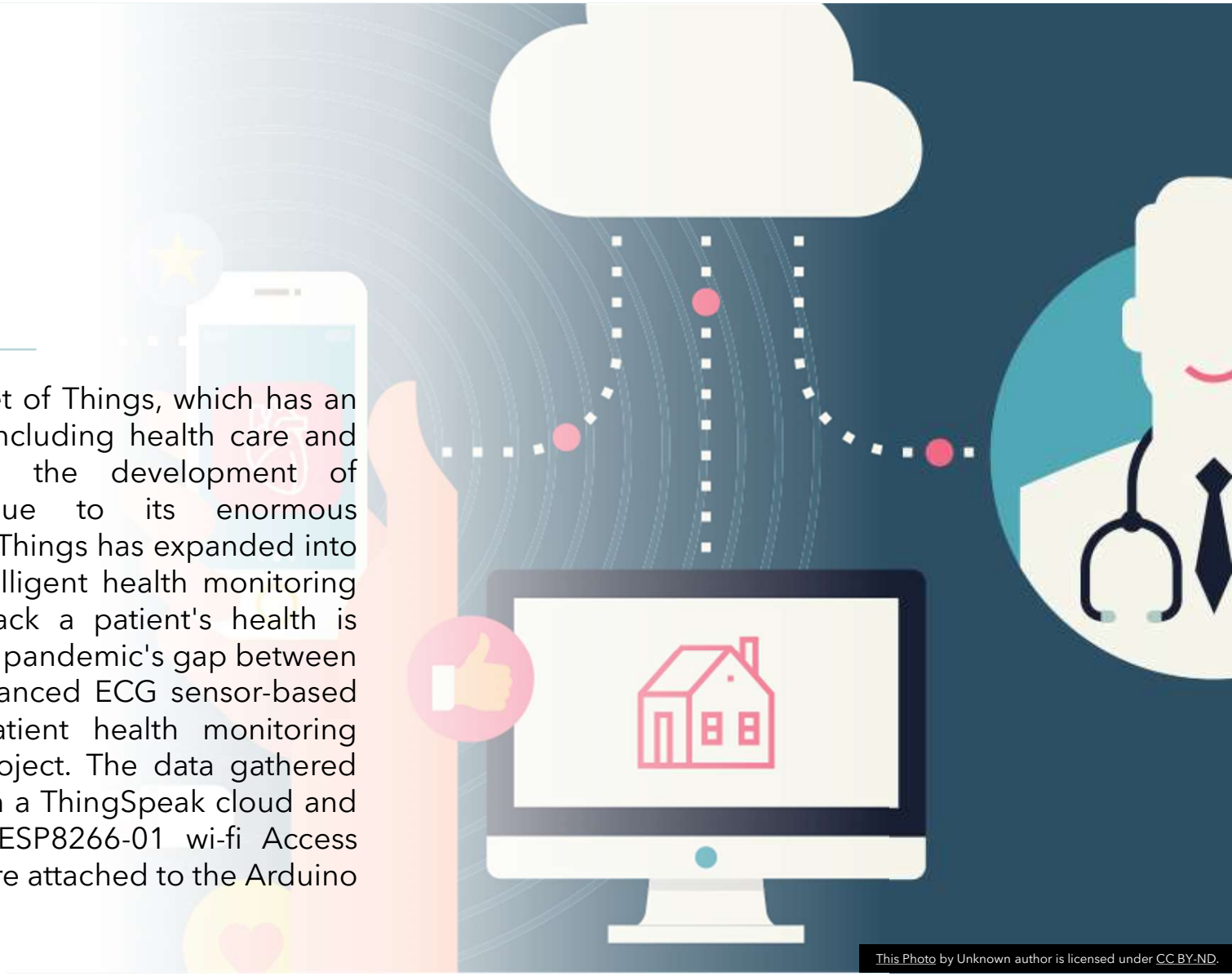
IOT based Patient health monitoring system

PARTICIPANTS

- SOHAN DAS (20BEE0330)

ABSTRACT

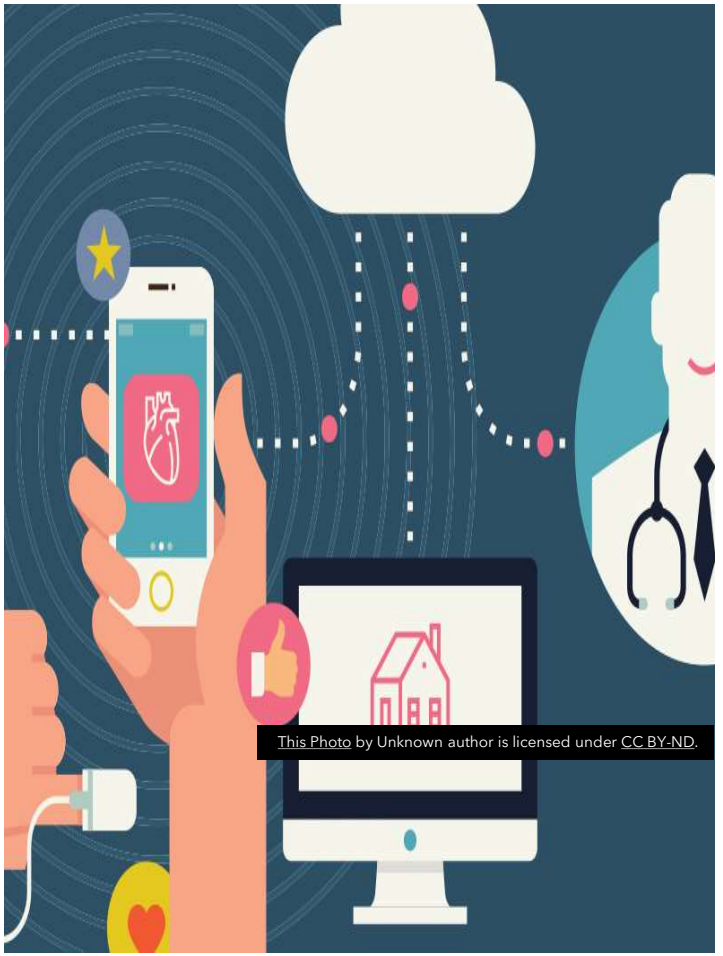
The emergence of the Internet of Things, which has an impact on numerous areas, including health care and health services, exemplifies the development of information technology. Due to its enormous characteristics, the Internet of Things has expanded into nearly every industry. An intelligent health monitoring system that can precisely track a patient's health is essential in light of the current pandemic's gap between doctors and patients. An enhanced ECG sensor-based Internet of Things-based patient health monitoring system is the goal of this project. The data gathered from these sensors is stored in a ThingSpeak cloud and communicated with by the ESP8266-01 wi-fi Access Module. These sensory units are attached to the Arduino Uno board.



INTRODUCTION

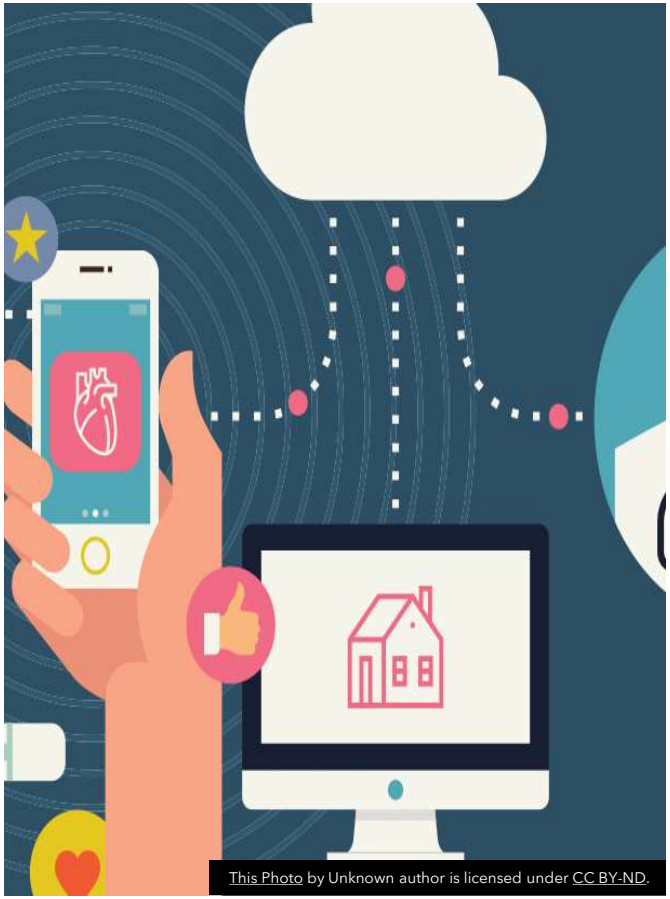
This system attempts to alleviate this issue by automatically monitoring some fundamental variables that govern a patient's health condition. Patients require continuous monitoring, which is difficult to perform at home or in hospitals. The ECG signal from a single-lead heart monitor and the temperature from a temperature sensor are the variables that this system monitors. The data is then saved to the cloud, where it can be viewed remotely by the doctor, nurses, or family members. The cloud makes it accessible from any location and on any device. In addition, a SMS notification is sent to a pre-defined emergency number if the values become critical. The WIFI module is used to create the interface between the hardware components and the cloud for this monitoring system.

The ECG and temperature sensors are connected to the Arduino Uno board, which is connected to the ESP8266 WIFI module. Data is sent to the cloud from the Arduino board to the WIFI module. The web interface where graphs are generated can only be accessed by users with a username and password.



BACKGROUND

The Internet and its applications are now an essential part of modern life. It is now a necessary tool in every way. By giving us the ability to track and manage important phenomena in our environment through devices that can sense, store, and wirelessly transfer information to remote storage, such as the cloud, for analysis and presentation in a human-readable form, IoT technology has completely altered society's narratives. Due to the immense demand and necessity, researchers went beyond connecting computers to the internet. The Internet of Things, a ground-breaking gadget, was created as a result of these studies. Although the Internet of Things (IoT) technologies were suggested years ago, commercial implementation is still in its infancy. The world is greatly affected by the growing prevalence of mobile technologies and smart devices in the healthcare industry. In order to eradicate illnesses and diseases, one must closely monitor their own health. Health professionals are gradually utilizing these innovations, resulting in a significant shift in health care. In a similar vein, a lot of people have access to the benefits of M-Health (Mobile Health) and E-Health (ICT-supported healthcare) applications to help them improve, support, and support their health.



LITERATURE SURVEY

AUTHOR	SENSORS	METHODOLOGY	CONTRIBUTION	LIMITATION
Yeri and Shubhangi (2020)	*temperature sensor, pulse sensor, and SpO2 sensor*	*Arduino, Wi-fi, web and mobile platform*	*The intervention time between doctor and patient is reduced in case of emergency*	*Proposed model doesn't include the blood pressure Monitoring system.*
Hasan and Ismaeel (2020)	ECG	*Arduino Uno, ESP8266 wi-fi module, and IoT Blynk application*	Low Cost	*Absence of cloud database and limited parameters*
Akshaya et al. (2019)	*pulse / heart beat sensor, Temperature sensor, Electrical sensor, blood Pressure sensor and Patient position sensor*	*Raspberry pi and wi-fi module*	*The proposed system was able to display data in real time*	*Data loss due to low signal gain*

AUTHOR	SENSORS	METHODOLOGY	CONTRIBUTION	LIMITATION
Warsi et al (2019)	*Blood pressure, heartbeat rate and ECG*	*Arduino and wi-fi module*	*The proposed system was able to upload the data to a cloud storage.*	*Just three sensors was used for the analysis.*
Majumder et al (2018)	*Blood pressure, heartbeat rate, and temperature*	*Arduino and Bluetooth.*	*Easily portable and cheaper*	*Need for additional sensory unit*
Raiz (2018)	*Heart beat*	*Microcontroller with wi-fi module*	*Low cost and high response rate.*	*Limited parameter was considered.*
Rahman et al (2019)	*ECG*	*Raspberry pi*	*The proposed system was able to monitor real time status of the patient irrespective of the presence of Doctor*	*Limited parameter was considered*
Sollu et al. (2018)	*Heartbeat and temperature*	*Raspberry pi*	Low Cost	*Data's are not Easily accessible*

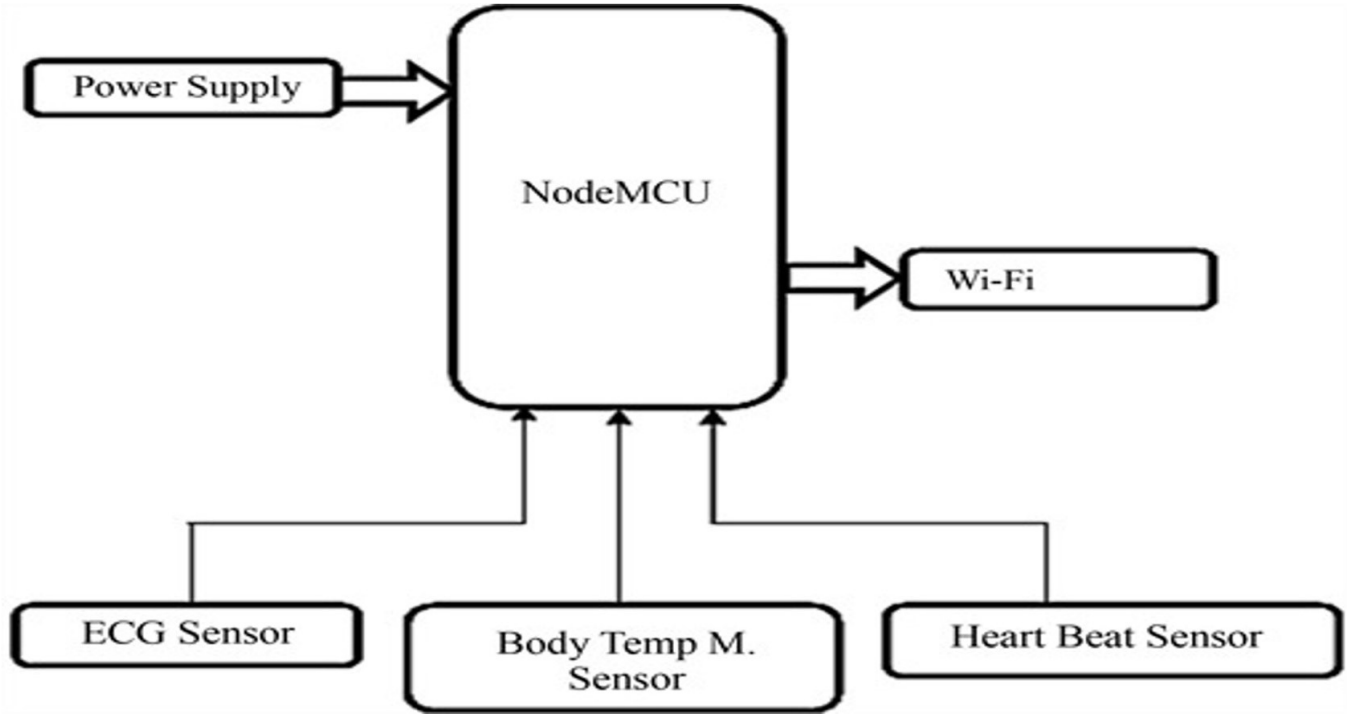
AUTHOR	SENSORS	METHODOLOGY	CONTRIBUTION	LIMITATION
Akhila et al (2017)	*Temperature and Heartbeat*	*Arduino and Wi-fi module*	*Low Cost*	*Limited Parameters*
Kumar and Rajasekaran (2016)	*Temperature sensor, Heartbeat sensor, Respiration sensor, and accelerometer sensor*	*Raspberry pi*	*Effective transmission of patients data.*	*Limited connectivity*
Tello et al. (2012)	*Temperature and ECG*	*Arduino and Bluetooth.*	*Portability, low cost, Connectivity easiness, and scalability*	*Delay in signals*
Bharadwaj et al. (2018)	*ECG and Temperature*	*Arduino, Wi-fi module and Thingspeak*	*Low Cost*	*Limited parameter was considered.*
Li and Pan (2017)	*Temperature, ECG, and pulse rate*	*Bluetooth and GPRS*	*Portable and did not need Extra communication network.*	*Limited connectivity*

AUTHOR	SENSORS	METHODOLOGY	CONTRIBUTION	LIMITATION
Rajkumar et al. (2017)	*Temperature, heartbeat rate*	*Raspberry pi*	*Low cost*	*Data's are not easily accessible*
Alvee Rahman	*ECG Sensor*	*Arduino Uno*	*Portability ,low cost, Scalability*	*Proposed model doesn't include the blood pressure Monitoring system*
A. Vishwanatham (2018)	*ECG sensor,Temperature sensor*	*Smart Wearable*	*Portability, Scalability,High response rate*	*Expensive*

Problem Statement

The patient cannot consult the doctors when they are absent, which increases the likelihood of an emergency occurring. Due to the rise in health issues in the modern world, it is considered very important for each individual to have their own health monitored. The public's health is suffering the most as a result of the increasingly stressful lifestyle. Doctor fees have skyrocketed in response to the growing number of patients and the ever-increasing lines at hospitals. This has a particularly negative impact on patients who are unable to pay or who do not have serious health issues but only learn of them after paying a hefty fee to the doctor.

BLOCK DIAGRAM



METHODOLOGY

- The system gets the input bio-metric signals from the human body using 3-lead electrodes. After processing all the three inputs, the ECG module produces a single analog output. The analog output is then given to the NodeMCU ESP8266 Microcontroller. NodeMCU is responsible for the remaining operations. It checks whether all the three inputs are received properly. If there is any error while getting the input, the Serial Monitor shows the error code. If not, the signal is sent to the microcontroller , from where it can be either seen on the Serial plotter or the cloud server. This is the working of the system.

WORK PLAN

- 1.The prototype will consist of both hardware(to measure electric impulses from heart - ECG) and software(Adafruit, Blynk). The system will be on a portable heart rate monitoring designed in a cost effective manner
- 2.Real-time data will be collected which will be analysed(R-R peak analysis and conditions such as Tachycardia/ bradycardia will be observed) and stored for future studies w.r.t heart condition of patient
- 3.The sensors can be adapted as a wrist band for early and timely detection of heart attack and to avail medical facilities asap.

OBJECTIVES

The objectives are to remotely access the ECG signal through a cloud. The ECG signal will then be processed using AI/ML to check for any abnormalities.

The approaches that can be used are:

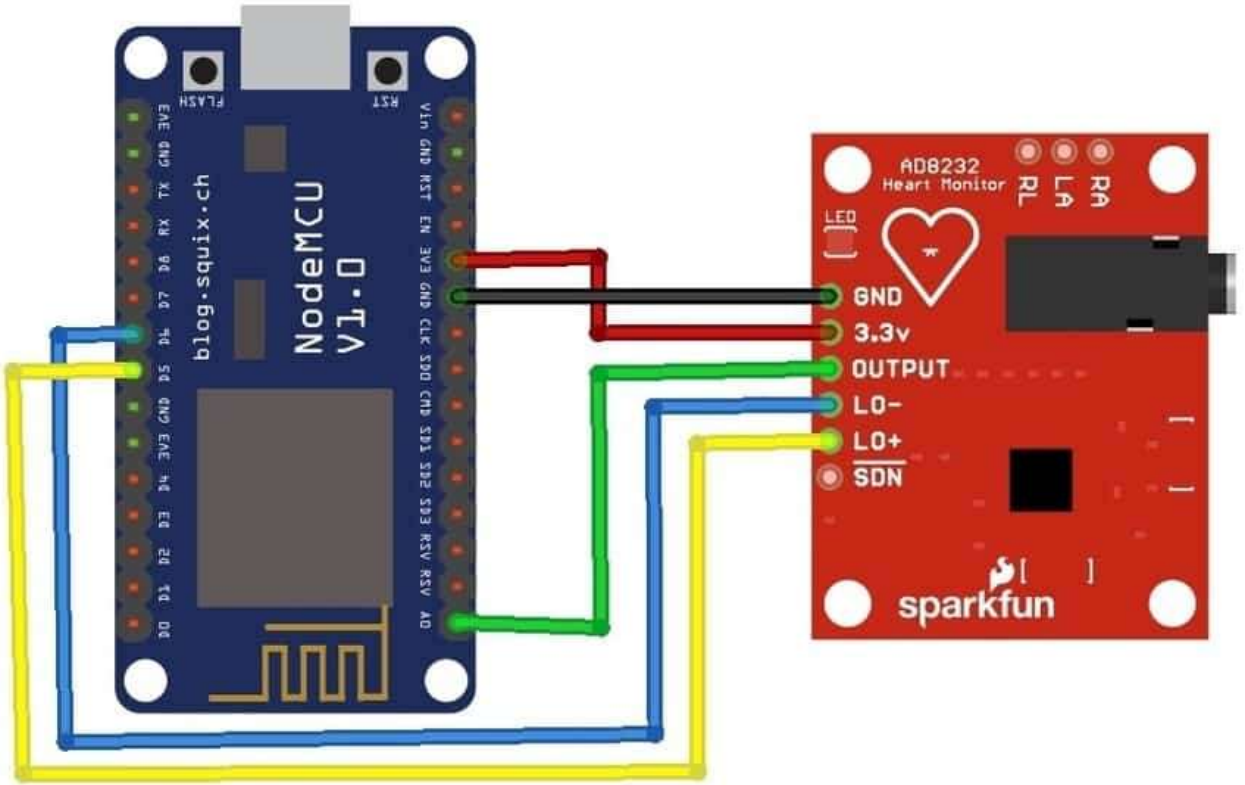
1)Using Thingspeak to transmit the data to MATLAB. Then the data can be processed using the signal processing and AI/ML features on MATLAB.The drawback is the time taken by Thingspeak to transmit the data from the microcontroller to the cloud.

2)Using TinyML/Tensorflow Lite. The drawback for this method is to find a reliable dataset for arrhythmia detection.

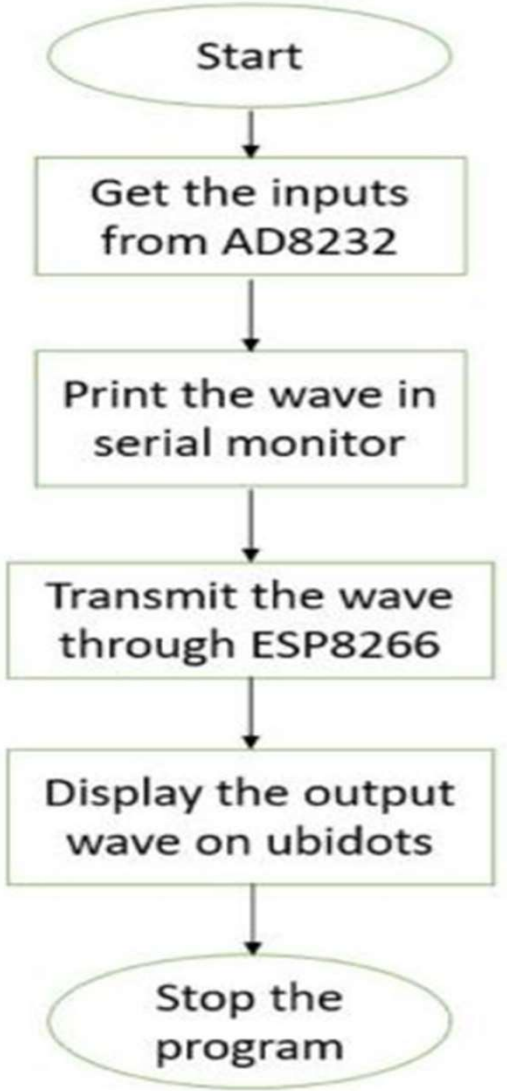
DESIGN

Here we have described briefly the hardware are an implementation of the system. The hardware part depicts briefly about the ECG monitoring circuit system parts such as Ag/Cl electrodes and ECG module. The figure depicts the circuit diagram of the interfacing between ECG module and ESP8266.

The ECG module is getting three inputs from the human body using 3-lead electrodes. The ECG module(AD8232) has Instrumentation Amplifier and High pass filter for the working purpose. After, processing the inputs, It produces the single output. This output is given to the NodeMCU ESP8266 Microcontroller with the help of the Analog pins.


NodeMCU
V1.0
blog.squix.ch
FLASH
RST
AD8232
Heart Monitor
RL
LA
RA
LED
GND
3.3v
OUTPUT
LO-
LO+
SDN
sparkfun

FLOW CHART


Start
Get the inputs from AD8232
Print the wave in serial monitor
Transmit the wave through ESP8266
Display the output wave on ubidots
Stop the program

CONCLUSION

Within the IoT environment, this project demonstrates the design and implementation of a health monitoring system. Patients in the intensive care unit (ICU) or bedridden at home will have access to continuous health monitoring facilities via this system from any location. The two sensors that have been utilized to enable real-time monitoring of the patient's temperature and ECG signal are the digital thermometer and ECG sensor.

In addition, the data are regularly and continuously uploaded to the cloud. This helps the patient's doctors, nurses, or family members keep an eye on the patient's health and take any necessary action when it's needed. If the temperature reading or the ECG signals go above or below the threshold value, the system also sends doctors or family members an automated text message. It will improve patient monitoring and treatment efficiency and assist doctors in numerous ways. To make the system even more effective, a pulse oximeter that measures a patient's blood oxygen saturation will be added in the future.

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