IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# REAL-TIME ECG AND SALINE BOTTLE LEVEL MANAGEMENT SYSTEM USING NODE MCU

[1]Asha T, [2] Suraj S M, [3]Shreya K V, [4]Amritha J P

[1]Assistant Professor, [2] Student, [3] Student, [4] Student

[1]Electronics and Communication Engineering Department,

[1]GMIT, Davangere , India

*Abstract:* The real-time ECG (Electrocardiogram) and saline level monitoring system using Node MCU is an advanced technology that enables remote monitoring of a patient's ECG and saline level. This system is designed to provide real-time monitoring of a patient's health condition, making it possible to quickly detect any abnormalities and take appropriate action. The system is based on the Node MCU development board, which is an open-source platform that provides Wi-Fi connectivity and a microcontroller unit. The system consists of two main components: the ECG monitoring unit and the saline level monitoring unit. The ECG monitoring unit is designed to continuously monitor a patient's heart rate and ECG waveform using electrodes attached to the patient's body. The signal from the electrodes is transmitted to the Node MCU, which then sends the data to a remote server for analysis and storage. The saline level monitoring unit is designed to monitor the level of saline in a patient's IV bag. This is important because a low saline level can lead to dehydration, which can be life-threatening. The saline level monitoring unit uses a pressure sensor to measure the level of saline in the bag. The data is then transmitted to the Node MCU, which sends it to the remote server for analysis and storage. The system can be accessed remotely using a smartphone or computer, allowing doctors and nurses to monitor a patient's health condition from anywhere in the world. This makes it possible to provide timely care and treatment, even if the patient is located in a remote area.

***Index Terms*** - ESP8266, IR sensor, AD8232, NODE MCU.

## I. INTRODUCTION

Real-time ECG and saline level monitoring using the Node MCU project addresses the problem of the lack of effective tools to remotely monitor patients' health status, particularly in healthcare settings where patients require continuous monitoring of their ECG signals and saline levels. Traditional methods of monitoring patients' health status require healthcare professionals to be physically present with the patient, which can be costly and time-consuming. The project aims to address this problem by developing a real-time ECG and saline level monitoring system using Node MCU that can be used to remotely monitor patients. The system can be used in various medical applications, including hospitals, clinics, and home healthcare settings, providing healthcare professionals with an effective tool to monitor patients remotely and respond to any changes in the patient's ECG and saline levels quickly. The real- time ECG and saline level monitoring using the Node MCU project aims to improve patient care and revolutionize healthcare delivery by providing remote monitoring capabilities. By addressing the problem of the lack of effective tools to remotely monitor patients' health status, the project can have a significant impact on the healthcare industry.

Real-time ECG and saline level monitoring is a crucial aspect of patient monitoring in healthcare. With the advent of IoT (Internet of Things), it is now possible to remotely monitor a patient's ECG and saline levels in real-time using Node MCU, an open-source firmware development kit predicted on the ESP8266 Wi-Fi module. This project involves the use of an ECG sensor module and a saline level sensor connected to the Node MCU board to measure the patient's ECG signals and saline levels respectively. The collected data is then transmitted wirelessly over Wi-Fi to a remote server, where it can be monitored and analyzed by healthcare professionals in real time. This project has the potential to improve patient care and save lives by enabling healthcare professionals to detect and respond to any changes in the patient's ECG and saline levels quickly. This project will explore the steps involved in setting up a real-time ECG and saline level monitoring system using Node MCU.

## II. LITERATURE SURVEY

R. Vasuki et al., "A portable monitoring device of measuring drips rate by using an Intravenous (IV) set", International Journal of Biotechnology Trends and Technology, Vol. 1, Issue 3, No.4 2011. the authors proposed a portable device that measures the rate of drips delivered through an intravenous (IV) set. The device consists of a sensor module, a signal conditioning unit, a microcontroller, and a display unit. The sensor module is attached to the drip chamber of the IV set and measures the drops passing through it. The signal conditioning unit amplifies and filters the signal, which is then processed by the microcontroller. The device calculates the rate of drips and displays it on the LCD display unit. The device is small, portable, and low-cost, making it suitable for use in medical settings where IV therapy is required.

Aravind, Syed Mustak Ahmed, "Design of family health monitoring system using wireless communication", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 9, September 2013. discusses. The system aims to monitor the health status of family members remotely and send alerts to the caregiver in case of any health issues. The system consists of multiple sensor nodes, each connected to a microcontroller and a wireless communication module. The sensor nodes are placed in various locations in the home, including the bedroom, kitchen, and living room, to monitor different health parameters such as temperature, heart rate, and blood pressure. The collected data is transmitted wirelessly to a remote server using Wi-Fi or GSM/GPRS, where it is analyzed and displayed on a web-based interface. The paper discusses the various components of the system, including the sensor nodes, microcontroller, wireless communication module, and remote server. The authors also present the results of the experiments conducted to evaluate the performance of the system.

Prerana N Gawale, A.N. Cheeran, Nihi G Sharma, "Android Application for Ambulant ECG Monitoring", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 3, Issue 5, May 2014 In the literature review, the authors discuss several existing works related to ECG monitoring, including research on wireless ECG monitoring systems, smartphone-based ECG monitoring applications, and algorithms for ECG signal processing. The limitations of existing ECG monitoring systems, including their high cost, limited portabilityand lack of real-time monitoring capabilities. They argue that their Android application provides a low cost and highly portable solution that can overcome these limitations and enable more efficient and effective ECG monitoring for patients. Overall, the paper provides a detailed overview of the design and implementation of an Android-based ECG monitoring application and highlights its potential to improve the monitoring of cardiac patients in ambulatory settings to regenerate response.

C. Gavimath et al., The paper titled "Design and Development of versatile saline flow rate measuring system and GSM based remote monitoring Device", published in the International Journal of Pharmaceutical Applications, discusses the design and development of a versatile saline flow rate measuring system and GSM-based remote monitoring device. The system aims to monitor the saline flow rate of patients in hospitals and clinics and send alerts to healthcare professionals in case of any deviations from the normal range. The system consists of a saline flow sensor, a microcontroller, a GSM module, and a display unit. The paper discusses the various components of the system, including the design and implementation of the saline flow sensor, the microcontroller programming, and the GSM-based remote monitoring device. The authors also present the results of the experiments conducted to evaluate the performance of the system, including the accuracy and reliability of the saline flow sensor and the responsiveness of the GSM-based remote monitoring device.

## III. SYSTEM DESIGN

The figure 1 shows the block diagram of real-time ECG and Saline level monitoring system using node MCU.

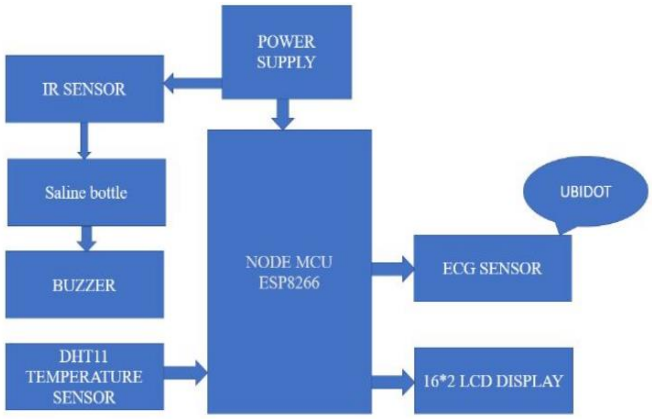


**Fig. 1: Block diagram of real-time ECG and Saline level monitoring system using node MCU**

Heart Beat and Body Temperature Monitoring using node MCU will detect the heartbeat using the Pulse Sensor and body temperature using the DHT11 sensor. Sensor will display the readings in BPM (Beat Per Minute) on the LCD (Liquid Crystal Display) connected to it. The body Temperature will be displayed on the serial monitor along with BPM readings. With the development of technology, in this system the temperature and heart rate using node MCU can be digitally sensed. Mainly node MCU is used because it can sense the environment by receiving input from a various sensors and can affect its ambience by controlling lights, motors and other actuators. Using the Arduino programming language the microcontroller on the board is programmed. DHT11 is used to sense the body temperature which is a basic parameter for monitoring and diagnosing human health. The heartbeat sensor is used to sense the heart rate. This device will allow one to compute their MAP (Mean Arterial Pressure) in about one minute and accurate body temperature will be displayed on the Android. The system can be used to compute anatomical parameters, such as heart rate (Systolic and Diastolic), Pulse rate.

## IV. SYSTEM IMPLEMENTATION

The system consists of the Node MCU, ECG Sensor, Saline Level Sensor, buzzer, Jumper Wires, Breadboard and Power Supply. Connect the ECG Sensor to Node MCU. The ECG Sensor has three Leads: RA, LA, and RL. Connect RA and LA to Node MCU Analog Input Pins, and Connect RL to Node MCU Ground Pin. Connect the Saline Level Sensor to Node MCU. The Saline Level Sensor has two Pins: VCC and GND. Connect VCC to Node MCU 3.3V Pin and GND to Node MCU Ground Pin. Connect the Output Pin of the Sensor to Node MCU Analog input pin. Write the code for Node MCU. Use the Node MCU to write the code. The code should read the ECG sensor and send them to a web server using Wi-Fi. The code should also display the values on Node MCU's serial monitor. Upload the code to Node MCU. Connect Node MCU to the computer using a USB cable. Select the Node MCU board from the Tools menu, and select the correct port. Click on the Upload button to upload the code to Node MCU. Connect Node MCU to a power supply, such as a USB charger or a battery. Test the system and check the values displayed on ubidots serial monitor. Saline level is monitored continuously in the patient's IV bag and then buzzer will give the alarm sound whenever the IV bag is empty.

Electrodes are placed on the patient's right wrist, left wrist, and right ankle. Then the sensors start to detect the patient's pulse continuously. Now the system had sensed the patient's ECG through 3 lead electrode systems sending them directly to the AD8232 which amplifies minor and small bio-signals to the node MCU which processes them and sends the processed data to the ubidots program.

### A. Interconnecting the AD8232 ECG Sensor With ESP8266

Supply the AD8232 with 3.3V from ESP32 and connect GND to GND in order to interface the AD8232ECG sensor with ESP8266 IoT chip. The output pin of AD8232 is an analog signal which is connected to the VP pin of ESP32.Similarly LO+ and L0- of AD8232 is connected to D2 & D3 of ESP8266. Remember, there are so many vendors who make ESP8266. All those ESP8266 have different pin mapping.

**B. Node MCU**

Node MCU (Node Microcontroller unit) is a freely available software and hardware development environment. It is assembled around an affordable SoC ( System-on-a-Chip ) called the ESP8266. The ESP8266, configured and manufactured by Express if System which contains the crucial components of a computer like CPU, RAM, networking (WiFi), and indeed a modern operating system and SDK. That makes it an outstanding choice for Internet of Things (IoT) systems of all kinds.

**C. DHT11 Sensor**

DHT11 Sensor operates with the voltage range between 3 to 5 volts and the maximum current used while measuring is 2.5 mA. The DHT11 is an elemental ultra-low-cost digital temperature and humidity sensor. It employs a capacitive humidity sensor and a thermistor to compute the surrounding air and asserts a digital signal on the data pin. Capacitive humidity sensing element and a thermistor are used for sensing the temperature in DHT11 sensor. The humidity sensing capacitor has bi-electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs whenever there is a change in humidity levels.

**D. IR Sensor**

The emitter and the receiver (transmitter & receiver) are the two components in IR sensor so this is combinedly called an opto-coupler or a photo-coupler. Here, IR LED projects like an emitter and IR photodiode as a receiver. The photodiode used in this is very perceptive to the infrared light emitted through an infrared LED. The resistance of the photodiode & output voltage can be varied in balance to the infrared light obtained. The type of incident that occurred is the direct otherwise indirect type where indirect type, the positioning of an infrared LED can be done ahead of a photodiode without barriers. In the indirect type, both diodes are ordered parallel through a solid object ahead of the sensor. The generated light from the infrared LED hits the solid surface and reverts back towards the photodiode.

**E. ECG Sensor**

ECG Sensor is an output device used for analog reading. A moderately cheap sensor board is utilized to measure the electrical activity of the heart. This electrical activity can be monitored using an electrocardiogram, or ECG, which generates an analogue printout. AD8232 single lead which monitors the heart rate by working as an op-amp which help in obtaining the clear signal from the pr and qt intervals. ECGs might include a lot of noise. The AD8232 module explodes nine connections from the IC. SDN, lo+, lo-, output, 3.3v, and GND provide essential pins for operating this monitor with an Arduino or other development board. RA (right arm), LA (left arm), and RL (right leg) pins are also supplied on this to attach and use custom sensors. Besides, there is a led indicator light that will pulsate to the rhythm of a heartbeat

## V. SOFTWARE REQUIREMENTS

A. **ARDUINO IDE SOFTWARE**

Arduino is a prototype platform (open-source) which is easy to-use hardware and software. It consists of a circuit board, which can be coded (referred to as a microcontroller), and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board.

**B. UBIDOTS**

UBIDOTS is an IoT Platform empowering innovators and industries to prototype and scale IoT projects to production. Use the UBIDOTS platform to broadcast data to the cloud from any Internet-enabled device. Then configure actions and alerts based on the real-time data and unlock the value of your data through visual tools. UBIDOTS offers a REST API that allows to read and write data to the resources available: data sources, variables, values, events, and insights. The API supports both HTTP and HTTPS and an API Key is required. The data will be protected with two more replication, encrypted storage, and optional TLS/SSL data support. Customize permission groups for each module of the platform, making sure the right information is shown to the right user is also possible. UBIDOTS (ubidots.com) is an IoT Application Development Platform that automates the process of IoT application creation for enterprises and individuals to deploy any IoT solution to scale and do so quickly.

## VI. RESULTS

The snapshots of different steps involved in designing and development real time ECG and saline level monitoring system is shown in the figure 2, 3 and 5. The figure 4 displays the serial monitor which continuously lists number of signals sensed from real-time pulse sensing. The sensed continuous ECG signal from the sensor has sent through the AD8232 for amplification and the amplified real-time signals are plotted through the feature of the node MCU processor called a serial plotter. The ubidots serial plotter function allows natively graphing serial data from node MCU to PC (Personal Computer) in real-time. The output is displayed on the LCD.

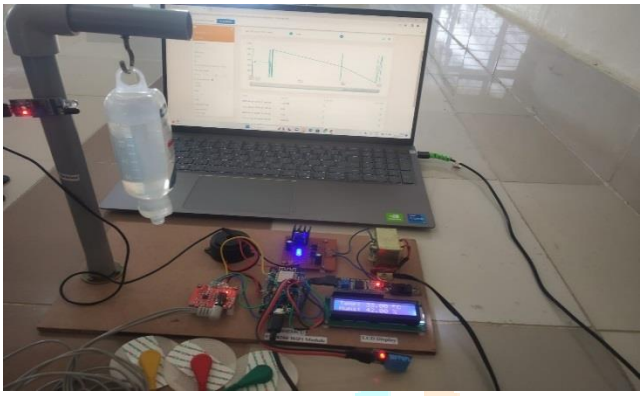

**Fig. 2: Snapshot of saline level monitoring using IR sensor**

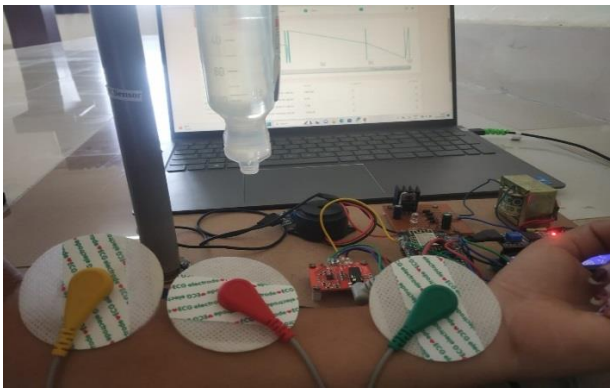

**Fig. 3: Snapshot of ECG level Monitoring Using AD8232**

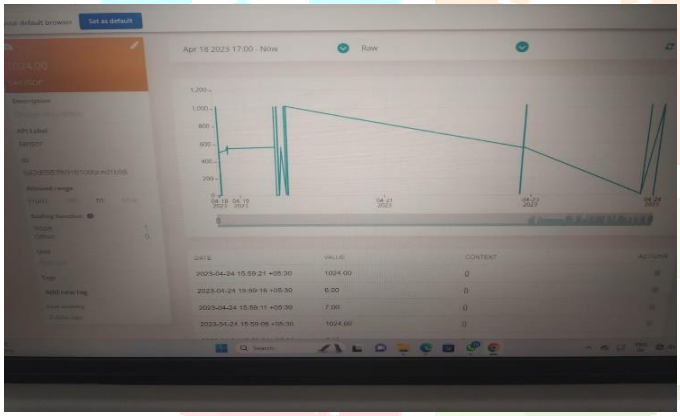

**Fig. 4: Snapshot of ECG Waveform as a visualization**

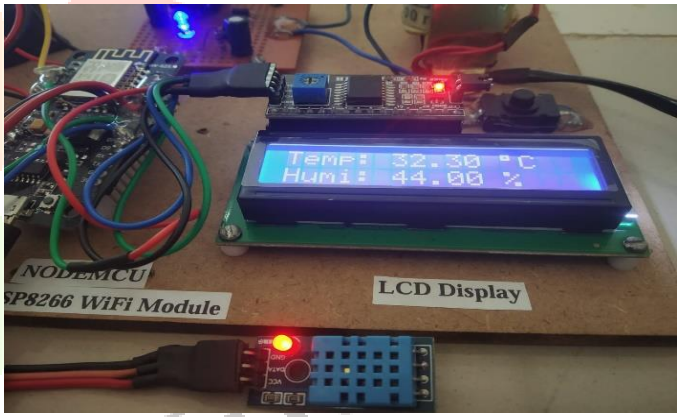


**Fig. 5: Snapshot of Temperature and Humidity using serial Monitor DHT11**

## VII. CONCLUSION

The goal of this project is to reduce deaths and to keep doctors and nurses on schedule. The data is shown via the display and the UBIDOTS application, and it is detected using sensors (heart rate, bodytemperature, and saline level).The anesthesiologist can watch multiple patients at the same time. A notification generated by the Android app alerts the doctor if there is an irregularity in the measured data. The microcontroller in this proposed system can automatically monitor the salt flow rate. The system is dependable, cost-effective,and easy to use.

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