INTEGRATED INTELLIGENT SALINE STAND

A Project report submitted in partial fulfilment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

B. Bhargavi (319126512069) S. Kavya (319126512117)

SK. Ameena (319126512115) M. Tejas (319126512094)

Under the guidance of

Dr. SRINIVAS SABBAVARAPU

Associate Professor, M. Tech, Ph. D(IITH)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES

(UGC AUTONOMOUS)

(*Permanently Affiliated to AU, Approved by AICTE and Accredited by NBA & NAAC*)

Sangivalasa, Bheemili mandal, Visakhapatnam dist.(A.P)

2022-2023

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY AND SCIENCES

(UGC AUTONOMOUS)

(Permanently Affiliated to AU, Approved by AICTE and Accredited by NBA & NAAC)

Sangivalasa, Bheemili mandal, Visakhapatnam dist.(A.P)

ANITS

CERTIFICATE

This is to certify that the project report entitled **"INTEGRATED INTELLIGENT SALINE STAND"** submitted by **B. Bhargavi (319126512069), S. Kavya (319126512117), SK. Ameena(319126512115), M.Tejas(319126512094)** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Electronics & Communication Engineering** of Anil Neerukonda Institute of technology and Sciences(A), Visakhapatnam is a record of bonafide work carried out under my guidance and supervision.

Project Guide

Dr. SRINIVAS SABBAVARAPU
Associate Professor, M. Tech,Ph.D(IITH),
Department of E.C.E
ANITS

Associate Professor
Department of E.C.E.
Anil Neerukonda
Institute of Technology & Sciences
Sangivalasa, Visakhapatnam-531 162

Head of the Department

Dr. B. JAGADEESH
Professor&HOD
Department of E.C.E
ANITS

Head of the Department
Department of E C E
Anil Neerukonda Institute of Technology & Sciences
Sangivalasa - 531 162

ACKNOWLEDGEMENT

We would like to express our deep gratitude to our project guide **Dr. Srinivas Sabbavarapu**, M.Tech, Ph.D(IITH), Associate Professor Department of Electronics and Communication Engineering, ANITS, for his guidance with unsurpassed knowledge and immense encouragement. We are grateful to **Dr. B.Jagadeesh**, Head of the Department, Electronics and Communication Engineering, for providing us with the required facilities for the completion of the project work.

We are very much thankful to the **Principal and Management, ANITS, Sangivalasa,** for their encouragement and cooperation to carry out this work.

We express our thanks to all **teaching faculty** of Department of ECE, whose suggestions during reviews helped us in accomplishment of our project. We would like to thank **all non-teaching staff** of the Department of ECE, ANITS for providing great assistance in accomplishment of our project.

We would like to thank our parents, friends, and classmates for their encouragement throughout our project period. At last, but not the least, we thank everyone for supporting us directly or indirectly in completing this project successfully.

PROJECT STUDENTS

B. BHARGAVI (319126512069)
S. KAVYA (319126512117)
SK. AMEENA (319126512115)
M. TEJAS (319126512094)

ABSTRACT

The recent health care witnessing a massive technology invasion. Monitoring of health continuously, for a patient at remote place, becoming a daunting task for the health care professionals, especially in the kind of pandemics like Covid. To address the challenges associated with remote monitoring, IOT based health care systems proved the potential candidates. In remote monitoring of health status, it is essential to observe varied medical parameters, like body temperature, Heart rate, oxygen saturation levels, etc. Furthermore, active saline bottles need to be monitored and replaced timely. Hence, we implement an **INTEGRATED INTELLIGENT SALINE STAND (**IISS**)** using IoT technology, to monitor the Saline levels along with different biological parameters as mentioned above. In our work, the saline level of the injected bottle has been monitored, and when it reaches a predefined critical level, an alert to the doctor or the medical attender will be initiated. Furthermore, it can also monitor the Blood pressure, Temperature and Oxygen Saturation levels of a patient, thereby, reducing the number of personals required for monitoring multiple patients. This helps doctors to collect real time data effortlessly and assess patients remotely. Moreover, a timely response to emergencies can be automated using this IoT based remote health care system by simply integrating on to the proposed saline stand.

In this proposed work, we implemented an INTEGRATED INTELLIGENT SALINE STAND which Monitors the Saline level, vital parameters like Temperature, Heart Rate,Oxygen Saturation level and controlling the saline flow i.e., Clamping.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Introduction

The technology advancements, in recent past, the progress in medical field is rapid due to the interdisciplinary developments in medical and engineering disciplines. Automation is becoming an essential part of life in each aspect in current era. Human lives have become much more dependent on electronic devices. Today's world requires sophisticated control in its different electronic gadgets.

In present scenario, it is not possible and somewhat difficult to doctors, caretakers or nurses to stay besides the patients in the hospital all the time. In order to assists and monitor the patient's condition continuously and to help hospital staff about patient condition a biomedical application system has been developed that has saline level detection and monitoring unit along with body temperature, oxygen saturation levels and blood pressure measuring devices are designed and continuous developed. Traditional systems for saline monitoring are to involve a nurse or a caretaker to monitor the glucose status of patient. Also, it is not possible to the nurse to note down information of each patient and their status i.e., increases and decreases of body temperature and heart rate, also saline bottle at critical condition or emptying of saline bottle. Hence, to countermeasure, the above problems a saline monitoring with heart rate and body temperature monitoring system is being developed which could help patients, doctors, and nurses in the hospital.

1.1.1 Importance of Health Monitoring

Health monitoring is the process of regularly assessing and tracking an individual's health status over time. This is important for many reasons, including:

Early detection of health problems: Regular health monitoring can help identify health problems early before they become more serious or even life-threatening. This can help prevent the need for more invasive or costly treatments.

Better management of chronic conditions: Health monitoring is essential for individuals with chronic conditions such as diabetes, heart disease, or asthma. Regular monitoring can help

individuals and healthcare providers better manage these conditions by tracking symptoms, measuring progress, and adjusting treatment plans as needed.

Prevention of future health problems: Health monitoring can also help identify risk factors for future health problems, allowing individuals and healthcare providers to take steps to prevent these problems from developing.

Better overall health: Regular health monitoring can help individuals make informed decisions about their health and well-being, leading to better overall health and quality of life.

Improved healthcare outcomes: Health monitoring can also improve healthcare outcomes by providing healthcare providers with important data to help inform treatment decisions and assess the effectiveness of treatments.

Overall, health monitoring is an important aspect of maintaining and improving health, and it can lead to better health outcomes, better quality of life, and lower healthcare costs**.**

1.1.2 Importance of Remote Health Monitoring

Remote health monitoring, also known as Tele-health or tele medicine, refers to the use of technology to monitor a patient's health remotely. This approach has become increasingly important in recent years due to advancements in technology, as well as the need to provide access to healthcare services to people who live in remote or undeserved areas.

The concept of RPM is made possible with the widespread availability of wearable devices that provide physiological measurements to the doctors and the medical staff even from a remote location. This enables the patient's condition assessment without requiring patient proximity. Connected health devices run the gamut from wearable heart monitors to Bluetooth-enabled scales, to Fit bits. They provide health measures of patients and transmit them back to providers or in some cases are reported back to providers -to facilitate healthcare decisions from afar. Remote patient monitoring technologies are akin to tele-medicine technologies, since they automatically observe and report on patients, often with chronic illnesses, so caregivers can remotely keep tabs on patients. In the middle of the COVID-19 pandemic, connected health and RPM are more important than ever, because they enable physicians to monitor patients without having to meet them, thus preventing the spread of the novel corona virus. They also keep patients with less severe cases out of hospitals, so preserving precious bed space for patients with severe cases. Hospitals across the nation are using connected health and RPM to great effect during the pandemic.

Independent and convenient, healthy living is the aim of any human being no matter their age, gender, location, or health status. However, there are limitations due to age, illness, medication, hospitalization, epidemic, pandemic, and other circumstances. Health monitoring systems have evolved to assist convenient healthy living, more accessible communication between healthcare givers and patients for close monitoring, measurement of vital health parameters, routine consultation and overall healthy living. Moreover, with the recent advances in information and communication technologies (ICT) through the adoption of Internet of Things (lot) technology, smart health monitoring and support systems now have a higher edge of development and acceptability for enhanced healthy living.

Here are some of the key benefits and importance of remote health monitoring:

Improved access to healthcare: Remote health monitoring provides access to healthcare services to people who may not have access to traditional healthcare facilities due to distance, mobility issues, or other barriers.

Increased efficiency: Remote health monitoring allows healthcare providers to monitor patients' health in real-time, which can lead to earlier detection of health issues, quicker interventions, and more efficient use of healthcare resources.

Better patient outcomes: Remote health monitoring can lead to improved patient outcomes by providing more frequent monitoring and earlier intervention when health issues arise. This can result in better health outcomes and lower healthcare costs.

Cost savings: Remote health monitoring can reduce healthcare costs by preventing hospital read missions, reducing emergency room visits, and improving overall patient health.

Convenience: Remote health monitoring allows patients to receive healthcare services from the comfort of their own homes, without the need to travel to a healthcare facility.

Overall, remote health monitoring is becoming an increasingly important approach to delivering healthcare services. It has the potential to improve access to care, increase efficiency, and improve patient outcomes, while also reducing healthcare costs.

1.1.3 Use of vital signs in medical field

Vital signs are a group of measurements that are used to assess the basic functioning of the body. They include heart rate, blood pressure, respiratory rate, temperature, and sometimes oxygen saturation. Vital signs are important indicators of a person's overall health and can be

used in various medical settings for several purposes. Here are some common uses of vital signs in medical practice:

Assessment of general health: Vital signs are often used in routine physical exams to assess a person's general health status. The results of vital sign measurements can be used to track changes in health over time, identify any underlying health problems, and determine the need for further diagnostic testing or treatment.

Monitoring of critically ill patients: In hospital settings, vital signs are monitored regularly in intervention. For example, changes in heart rate or blood pressure can indicate a serious medical emergency that requires urgent treatment.

Evaluation of treatment effectiveness: Vital signs can be used to evaluate the effectiveness of treatments for various medical conditions. For example, changes in blood pressure can indicate whether medications for hypertension are working as intended.

Diagnosis of medical conditions: Abnormal vital sign measurements can be a sign of an underlying medical condition. For example, a fever can be a sign of infection, and low oxygen saturation can indicate respiratory distress.

Management of chronic conditions: Vital signs can be used to monitor and manage chronic conditions such as diabetes, hypertension, and heart disease. Regular monitoring of vital signs can help identify changes in health status that may require adjustments to treatment plans.

Overall, vital signs play a critical role in medical practice, providing important information about a person's health status that can be used for diagnosis, treatment, and ongoing management of medical conditions.

CHAPTER 2

RELATED WORK AND MOTIVATION

2.1 Related work

“IOT BASED SALINE LEVEL MONITORING SYSTEM IN HEALTHCARE” describes that a load sensor is used to determine whether the liquid in the bottle is in a normal or warning status [1], and the patient's data can be viewed on any website or in the Thing Speak app or any website. “Smart Health Monitoring System for Temperature, Blood Oxygen Saturation, and Heart Rate Sensing with Embedded Processing and Transmission Using IoT Platform.” describes for every three seconds, the LCD shows the temperature values [2], and every fifteen seconds, it shows the heart rate and blood oxygen saturation values. The buzzer and LED start to alert the caregiver in the event of an abnormal change in any of the body parameters. “AUTOMATIC AND LOW COST SALINE LEVEL MONITORING SYSTEM USING WIRELESS BLUETOOTH MODULE AND CC2500 TRANSRECEIVER” proposed that a saline bottle 500ml of the solution[3] are in the saline bottle. The data can be viewed in a smartphone or laptop with the aid of Bluetooth terminal software when the saline solution is above 70 ml. When the saline solution is below 70 ml or the critical level, red led starts blinking and buzzer starts ringing. “IoT-Based Health Monitoring System Development and Analysis” outline the measurements of the body temperature, SpO2, and pulse rate are displayed on the LCD display [4] and serial monitor of the Arduino IDE, respectively. The data is also displayed in the mobile application with the aid of a Bluetooth module. “IoT Based Stress Detection and Health Monitoring System” It alerts the user by sending an SMS to their mobile device using the GSM module when the temperature, blood pressure [5], or heartbeat sensors' values reach predefined levels. These values are also continuously monitored in the Thing Speak server using the Wi-Fi module (Node MCU). “IoT based Smart Saline Bottle for Healthcare” It determined the status of the liquid in the saline bottle by an LED-photo diode-based sensor [6]. A message will be sent to the nurses and doctors when the saline reaches the predetermined condition, and an indicator will glow to alert the nurse station as well as clamp the saline bottle with a solenoid plunger. “AUTOMATIC SALINE LEVEL MONITORING SYSTEM USING IOT” Uses the HX711 module, attach the load cell to the Arduino. The HX711 module[7] is useful for identifying loads applied to the load cell. The hospital management receives alert

messages from the load cell when the weight of the saline bottle reaches the threshold level. It also has access to the bottle's current level. The system described in paper [8] is constructed using an RF Trans receiver platform and includes a sensor that will serve as a weight sensor for tracking the critical level of saline in the saline bottle. The buzzer will sound, and an indicator will glow to notify the nurses, caretakers, and doctors that it is time to replace the saline bottle when the level of the solution reaches the pre-determined critical level.

In paper [9], vital signs like temperature, EEG, and heart rate are measured using the appropriate sensors, and they can be seen on a computer's screen using an Arduino Uno connected to a cloud database system, as well as seen from anywhere in the world using internet source. "IoT basis Patient Health Monitoring System" describes the Temperature and heartbeat sensor [10] for tracking patient's health. Two sensors are related to the Arduino-Uno. The record from sensors is non-prevent to the IoT platform the use of a wireless network. In case of any fast changes in patient's coronary heart rate or body, a temperature alert is sent to caretakers. "IoT based Health Monitoring System" The temperature and heartbeat sensors are connected to the Arduino board. The sensed values [11] are compared with the threshold values to check for any abnormal condition. If any such condition prevails an SMS is sent to both doctor and ambulance using GSM and buzzer beeps. "IOT BASED SALINE LEVEL MONITORING SYSTEM" automatically monitor the saline flow rate by using microcontroller [12]. It can wirelessly send the data to nurses or doctors' computer and display the results in the form of saline droplet rate, number of droplets coming from saline bottle, saline solution given to the patient in ml and remaining time to empty the saline bottle with the help of serial port test software. "IoT based Patient Health Monitoring using "ESP8266" describes Arduino[13] with esp8266 to monitor patient vital signs and send data to cloud platform that is thing speak. And alerts the medical staff about the abnormal parameter.

"Health Monitoring system using IoT" senses data from temperature and pulse sensors [14], can be viewed in thing speak and if it reaches any abnormal conditions sends alert messages to caretaker.

2.1.1 Drawbacks of Existing systems

In the current system, the patient must be admitted to the hospital for ongoing care. Once he or she is released from the hospital, it is not possible. System usage is not permitted at home.

This INTEGRATED INTELLIGENT SALINE STAND helps to achieve the following goals by addressing the shortcomings of conventional systems:

- To provide a simple and affordable system for monitoring saline level.
- To record and keep track of the patient's SPO2 level, body temperature, and heart rate.
- To show results on while also sending the message.
- To close the saline valve, which prevents blood inversion.

2.2 Internet of Things

The Internet of Things is the concept of connecting any device to the internet and to other connected devices. The IoT is a giant network of connected things and people all of which collect and share data about the way they are used and about the environment around them .IoT is a system of Interrelated computing devices, mechanical and digital machines, Objects ,animals or people that are provided with unique Identifiers(UIDs)and the ability to transfer data over a network without requiring human-to-human or human -to-computer interaction.

Figure 2.1 Internet of Things

2.2.1 How does IoT work

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environment. IoT devices share the sensor data they collect by connecting to an IoT

gateway or other edge device where data is either sent to the cloud to be analysed or analysed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.

2.2.2 Why is IoT Important

The internet of things helps people live and work smarter, as well as gain complete control over their lives and also it reduces human effort for many activities, and provides tons of information. When people have data, they feel more in control of every aspect that surrounds them. These technologies have also become more popular because of product prototype development. IoT enables companies to automate processes and reduce labour costs.

2.2.3 Pros and cons of lot:

Some of the advantages of IoT include the following:

- ability to access information from anywhere at any time on any device.
- improved communication between connected electronic devices.
- transferring data packets over a connected network saving time and money; and
- automating tasks helping to improve the quality of a business's services.
- reducing the need for human intervention.

Some disadvantages of IoT include the following:

- As the number of connected devices increases and more information is shared between devices, the potential that a hacker could steal confidential information also increases.
- Enterprises may eventually have to deal with massive numbers - maybe even millions of lot devices, and collecting and managing the data from all those devices will be challenging.
- . If there's a bug in the system, it's likely that every connected device will become corrupted.
- . Since there's no international standard of compatibility for lot, it's difficult for devices from different manufacturers to communicate with each other.

2.2.4 IoT standards and frameworks:

There are several emerging IoT standards, including the following:

- IPv6 over Low-Power Wireless Personal Area Networks (6LoWPAN) is an open standard defined by the Internet Engineering Task Force (IETF). The 6LoWPAN standard enables any low-power radio to communicate to the internet, including 804.15.4, Bluetooth Low Energy (BLE) and Z-Wave (for home automation).
- ZigBee is a low-power, low-data rate wireless network used mainly in industrial settings. ZigBee is based on the Institute of Electrical and Electronics Engineers (IEEE) 802.15.4 standard. The ZigBee Alliance created Dot-dot, the universal language for loT that enables smart objects to work securely on any network and understand each other.
- LiteOS is a Unix-like operating system (OS) for wireless sensor networks. LiteOS supports smart phones, wearables, intelligent manufacturing applications, smart homes, and the internet of vehicles (loV). The OS also serves as a smart device development platform.
- OneM2M is a machine-to-machine service layer that can be embedded in software and hardware to connect devices. The global standardization body, OneM2M, was created to develop reusable standards to enable loT applications across different verticals to communicate.
- Data Distribution Service (DDS) was developed by the Object Management Group (OMG) and is an loT standard for real-time, scalable, and high- performance M2M communication.
- Advanced Message Queuing Protocol (AMQP) is an open source published standard for asynchronous messaging by wire. AMQP enables encrypted and interoperable messaging between organizations and applications. The protocol is used in client-server messaging and in IoT device management.
- Constrained Application Protocol (CoAP) is a protocol designed by the IETF that specifies how low-power, compute-constrained devices can operate in the internet of things.
- Long Range Wide Area Network (LoRaWAN) is a protocol for WANS designed to support huge networks, such as smart cities, with millions of low-power devices.

loT frameworks include the following:

- Amazon Web Services (AWS) loT is a cloud computing platform for loT released by Amazon. This framework is designed to enable smart devices to easily connect and securely interact with the AWS cloud and other connected devices.

- Arm Mbed loT is a platform to develop apps for loT based on Arm microcontrollers. The goal of the Arm Mbed IoT platform is to provide a scalable, connected, and secure environment for loT devices by integrating Mbed tools and services.
- . Microsoft's Azure IoT Suite is a platform that consists of a set of services that enables users to interact with and receive data from their loT devices, as well as perform various operations over data, such as multidimensional analysis, transformation and aggregation, and visualize those operations in a way that's suitable for business.
- Google's Brillo / Weave is a platform for the rapid implementation of IoT applications. The platform consists of two main backbones: Brillo, an Android- based OS for the development of embedded low-power devices, and Weave, an IoT-oriented communication protocol that serves as the communication language between the device and the cloud.
- Calvin is an open-source loT platform released by Ericsson designed for building and managing distributed applications that enable devices to talk to each other. Calvin includes a development framework for application developers, as well as a runtime environment for handling the running application.

2.2.5 loT security and privacy issues:

The internet of things connects billions of devices to the internet and involves the use of billions of data points, all of which need to be secured. Due to its expanded attack surface, IoT security and loT privacy are cited as major concerns.

In 2016, one of the most notorious recent loT attacks was Mirai, a botnet that infiltrated domain name server provider Dyn and took down many websites for an extended period of time in one of the biggest distributed denial-of-service (DDoS) attacks ever seen. Attackers gained access to the network by exploiting poorly secured IoT devices.

Because loT devices are closely connected, all a hacker must do is exploit one vulnerability to manipulate all the data, rendering it unusable. Manufacturers that don't update their devices regularly or at all leave them vulnerable to cybercriminals.

Additionally, connected devices often ask users to input their personal information, including names, ages, addresses, phone numbers and even social media accounts information that's invaluable to hackers.

Hackers aren't the only threat to the internet of things; privacy is another major concern for IoT users. For instance, companies that make and distribute consumer loT devices could use those devices to obtain and sell users' personal data.

Beyond leaking personal data, loT poses a risk to critical infrastructure, including electricity, transportation, and financial services.

2.2.6 Applications of Iot

1. Wearables

2. Health

3.Traffic monitoring

4.Agriculture

5.Hospitality

2.3 Embedded Processors:

An embedded processor is a type of microprocessor designed into a system to control electrical and mechanical functions. Embedded processors are usually simple in design, limited in computational power and I/O capabilities, and have minimal power requirements. At a basic level, embedded processors are a CPU chip placed in a system that it helps control. Embedded processors are often confused with microcontrollers. While they do perform similar functions, they integrate with their given system in different ways. The actual functions they perform can also be different as well.

Microcontrollers are the result of technological advances decreasing the size of controllers. Eventually, all of the components of a controller including I/O devices and memory evolved into a single chip, giving us the "micro" in microcontrollers. These chips are small, self-contained devices that have all of the features necessary to control the system they are embedded in. This control autonomy is the primary difference between microcontrollers and embedded processors. Embedded processors require other external components such as integrated memory and peripheral interfaces to perform their designated functions. The two devices are frequently referred to as one device because embedded processors are often components within a microcontroller.

An embedded system is a computer system, made from a combination of hardware and software that is used to perform a specific task. A lot of embedded systems are created with time constraints in mind. In some situations, crossing time limits might not amount to much, but in some, it may actually be a disaster. For example, if the embedded system in a car's braking system doesn't strictly adhere to time, it may result in a However, if a time limit is passed on something less severe, it may just result in reduced performance. The processors found in common personal computers (PC) are general-purpose or universal processors. They are complex in design because these processors provide a full scale of features and a wide spectrum of functionalities. They are designed to be suitable for a variety of applications. On the other hand, another class of embedded processors focuses on performance. These embedded processors are powerful and packed with advanced chip- design technologies, such as advanced pipeline and parallel processing architecture. These processors are designed to satisfy those applications with intensive computing requirements not achievable with general-purpose processors. Overall, system and application speeds are the main concerns. Data storage is the process of ensuring that research data is stored, archived or disposed of in a safe and secure manner during and after the conclusion of a research project. This includes the development of policies and procedures to manage data handled electronically as well as through non- electronic means. Proper planning for data handling can also result in efficient and economical storage, retrieval, and disposal of data. In the case of data handled electronically, data integrity is a primary concern to ensure that recorded data is not altered, erased, lost or accessed by unauthorized users. All the above survey insists the need of real time health monitoring system which helps in critical situations.

This chapter describes about the related work and motivation. Chapter 3 talks about the Methodology and Requirement Analysis required for the system. In chapter 4 explains about the Implementation and Experimental setup of the proposed System. Chapter 5 gives the details regarding Outputs. In chapter 6, Conclusion and future work has been Explained. In Chapter 6 References has been Explained.

CHAPTER 3

METHODOLOGY AND REQUIREMENTS

3.1 Proposed System

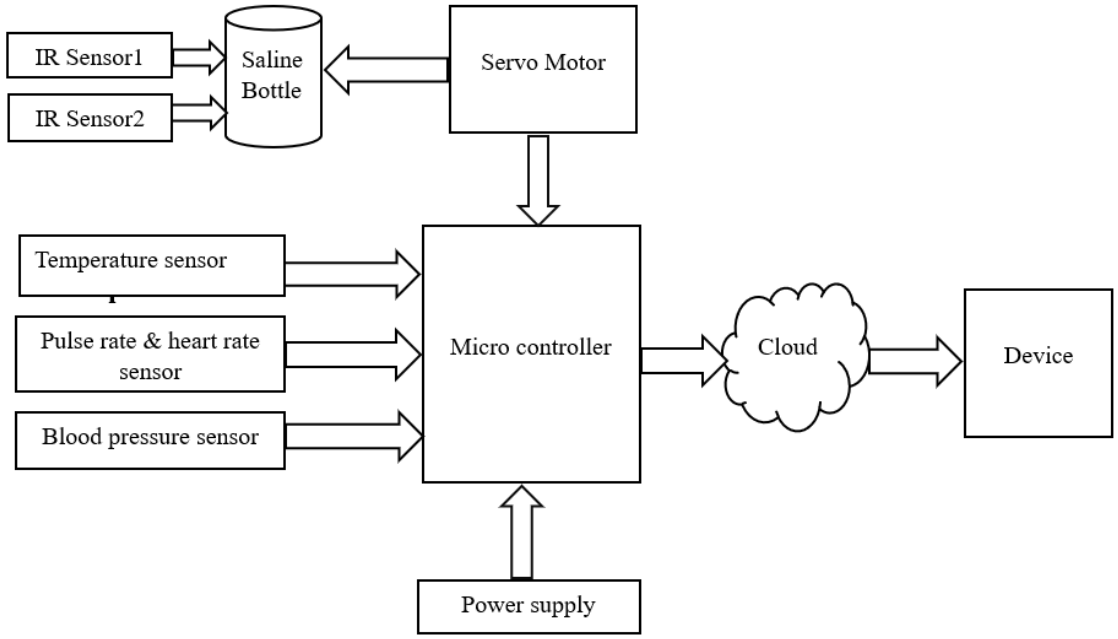


Figure 3.1 Block Diagram for Proposed System

In our project we are designing such type of device which is used for continuous monitoring of patients in hospital. We introduce "Integrated Intelligent Saline Stand “using Biomedical Sensors. In previous research we have seen that either the data is monitoring simple screen , but in our project the new thing is that we can continue monitor the Heart Rate, oxygen saturation level and human body Temperature which is integrated with monitoring of saline with clamping unit and we can further monitor blood pressure also and we can also analyse his/her health condition using Arduino software, which is used as the integrating platform for acquiring. processing and transmitting data and then the analysed data can send to doctor or

parents of patient by using a cloud platform. Overall, we are introducing a type of design which can monitor health condition and analyse the parameters and gives an alert if it finds any abnormalities in patient's health condition. The scope of our project is to reduce the human Intervention.

Our project is based on both software and hardware.

3.2 HARDWARE REQUIREMENTS

Node MCU esp8266

IR sensors

Servo motor

Temperature sensor

MAX30100 sensor

Breadboard

Power supply and connecting wires.

3.2.1 MICRO CONTROLLER (Node MCU ESP8266)

Definition

A micro controller is a small computer on a single integrated circuit that is designed to control specific devices and processes. It typically includes a central processing unit (CPU), memory, input/output interfaces, and other peripherals, all integrated into a single chip. Micro controllers are commonly used in embedded systems, such as home appliances, automobiles, and industrial control systems, where they provide control and monitoring functions in a compact and cost-effective manner**.**

Node MCU-ESP8266

Node MCU is an open-source development board that uses the ESP8266 Wi-Fi chip. It is based on the Lua programming language and provides a simple and easy-to-use platform for building Internet of Things (IoT) devices. The Node MCU board includes a micro controller, Wi-Fi connectivity, and a range of input/output interfaces, making it ideal for building projects that require remote monitoring and control. It can be programmed using Arduino IDE, and the coding structure remains similar to that of Arduino. But Arduino IDE does not come with pre-

installed ESP supported boards on it, so one needs to add/import the board attachments to the IDE before programming it. It is very simple to do. ESP series boards are not initially developed for Arduino IDE compatibility, therefore in Arduino IDE each pin on Node MCU corresponds to different GPIO pin for IDE.

Features

- It is based on the ESP8266 Wi-Fi chip, which provides Wi-Fi connectivity to the board.
- It has a built-in USB-to-serial converter that allows the board to be programmed and communicate with a computer.
- It is easy to program using the Lua scripting language or using the Arduino IDE with the ESP8266 core.
- It has a range of input/output interfaces, including digital and analog pins, PWM outputs, I2C and SPI interfaces, and a serial port.
- It supports firmware over-the-air (FOTA) updates, which allows the board to be updated wirelessly.
- It is compact and lightweight, making it ideal for projects that require a small form factor.
- It is relatively low cost, making it accessible to a wide range of makers and hobbyists.
- It is widely supported by the maker community, with a large number of libraries.

Specifications

- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz

Pin Diagram

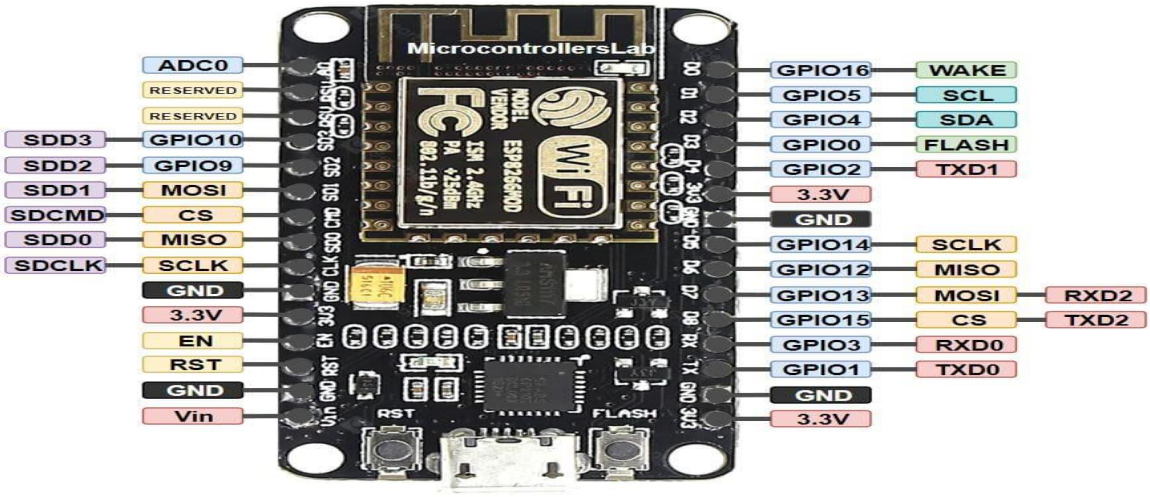


Figure 3.2 Pin Description of Node MCU

Description of ESP8266

Power pins

There are four power pins. **VIN** pin and three **3.3V** pins.

- **VIN** can be used to directly supply the Node MCU/ESP8266 and its peripherals. Power delivered on **VIN** is regulated through the onboard regulator on the Node MCU module – you can also supply 5V regulated to the **VIN** pin.
- **3.3V** pins are the output of the onboard voltage regulator and can be used to supply power to external components.

I2C Pins

I2C pins are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

GPIO Pins

GPIO Pins Node MCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each

digital enabled GPIO can be configured to internal pull-up or pull-down or set to high impedance. When configured as an input, it can also be set to edge-trigger or level-trigger to generate CPU interrupts.

ADC Channel

The Node MCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.

UART Pins

Node MCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485) and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) can be used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log.

SPI Pins

Node MCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:

- 4 timing modes of the SPI format transfer
- Up to 80 MHz and the divided clocks of 80 MHz
- Up to 64-Byte FIFO

SDIO Pins

Node MCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.

PWM Pins

The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 μs to 10000 μs (100 Hz and 1 kHz).

Control Pins

Control pins are used to control the Node MCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.

- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
- **RST:** RST pin is used to reset the ESP8266 chip.
- **WAKE:** Wake pin is used to wake the chip from deep sleep.

Architecture of ESP8266

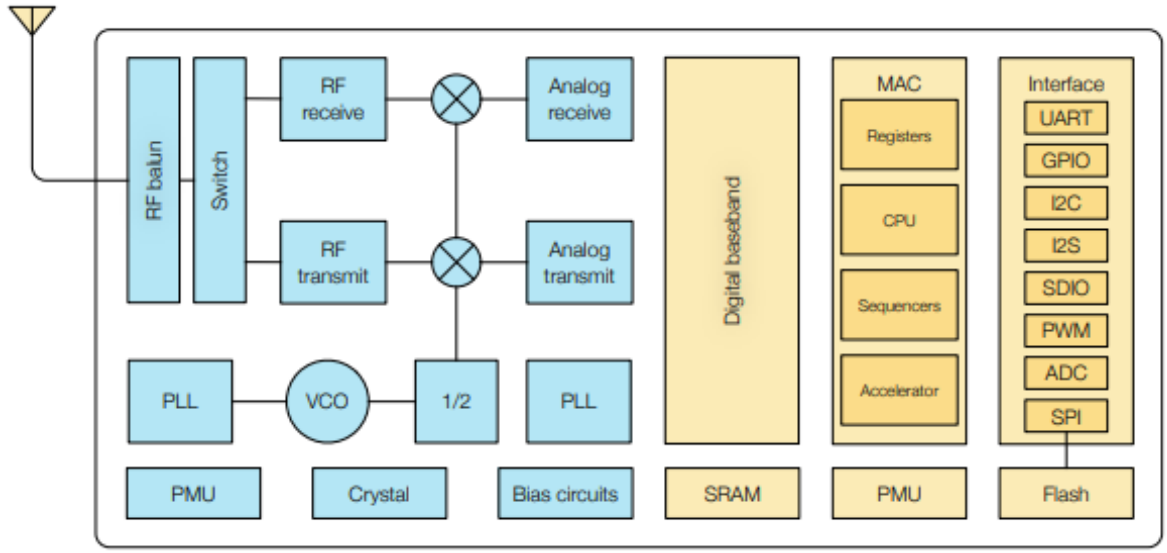


Figure 3.3 Architecture of ESP8266

It consists of CPU (central processing unit)and SRAM(Static Random Access Memory**).**The ESP8266 uses a 32bit processor with 16 bit instructions. It is Harvard architecture which mostly means that instruction memory and data memory are completely separate. The ESP8266 has on die program Read-Only Memory (ROM) which includes some library code and a first stage boot loader. All the rest of the code must be stored in external Serial flash memory (provides only serial access to the data - rather than addressing individual bytes, the user reads or writes large contiguous groups of bytes in the address space serially).Depending on your ESP8266, the amount of available flash memory can vary.

Power Requirement:

As the operating voltage range of ESP8266 is 3V to 3.6V, the board comes with a LDO voltage regulator to keep the voltage steady at 3.3V. It can reliably supply up to 600mA, which should be more than enough when ESP8266 pulls as much as 80mA during RF transmissions. The output of the regulator is also broken out to one of the sides of the board and labelled as 3V3. This pin can be used to supply power to external components.

Applications of Node MCU:

- Prototyping of IoT devices
- Network projects
- Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth functionalities.
- Smallest IoT Home Automation using ESP8266.
- Geo location using ESP8266.
- Wireless web server
- Air Pollution Meter
- Humidity and temperature monitoring

3.2.2 IR Sensor:

A sensor is a device that detects the change in the environment and responds to some output on the other system.

What is an IR Sensor?

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

Figure 3.4 IR Sensor Module

The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received. There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength used as infrared sources. The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibers. Optical components are used to focus the infrared radiation or to limit the spectral response.

IR Sensor Circuit

The application circuit of the IR sensor is an obstacle detecting circuit that is shown below. This circuit can be built with a photodiode, IR LED, an Op-Amp, LED & a potentiometer, The main function of an infrared LED is to emit IR light and the photodiode is used to sense the IR light. In this circuit, an operational amplifier is used as a voltage comparator and the output of the sensor can be adjusted by the potentiometer based on the requirement.

Once the light generated from the infrared LED can be dropped on the photodiode once striking an object, then the photodiode's resistance will be dropped.

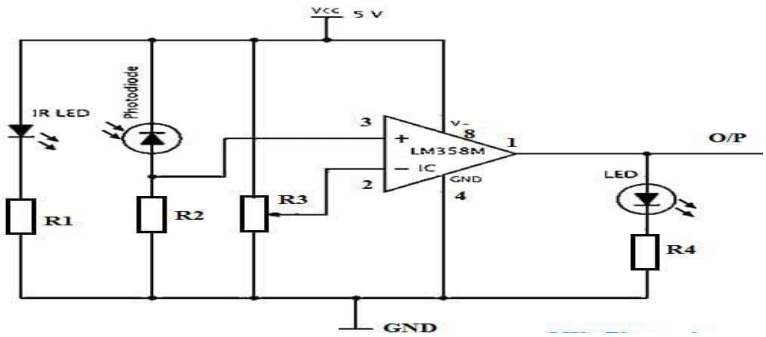


Figure 3.5 IR Sensor Circuit Diagram

Here, op-amp's one of the input at threshold value can be set through the potentiometer whereas other inputs can be set by using the series resistor of the photodiode. Once the radiation on the photodiode is more, then the voltage drop will be more across the series resistor. In the operational amplifier, both the voltages are evaluated.

If the series resistor's voltage is higher than the threshold voltage then the IC output is high. When the IC output is given to an LED then it will blink. So using a potentiometer, the threshold voltage can be adjusted based on the conditions of surroundings.

Types of IR Sensors:

There are two types of IR sensors are available and they are,

- Active Infrared Sensor
- assive Infrared Sensor

Active Infrared Sensor

Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include the LED or infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector.

Passive Infrared Sensor

Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detector. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat. Thermocouples, pyroelectric

detectors and bolometers are the common types of thermal infrared detectors. Quantum type infrared sensors offer higher detection performance. It is faster than thermal type infrared detectors. The photo sensitivity of quantum type detectors is wavelength dependent.

IR Sensor Working Principle

There are different types of infrared transmitters depending on their wavelengths, output power and response time. An IR sensor consists of an IR LED and an IR Photodiode, together they are called as Photocoupler or OptoCoupler.

IR Transmitter or IR LED

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations called as IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

The picture of an Infrared LED is shown below.

Figure 3.6 IR Transmitter

IR Receiver or Photodiode

Infrared receivers or infrared sensors detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. Below image shows the picture of an IR receiver or a photodiode.

Figure 3.7 IR Receiver

Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter. The emitter is an IR LED and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor.

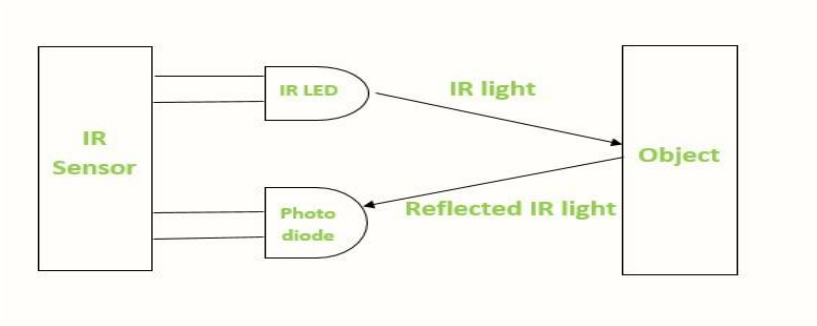


Figure 3.8 IR Sensor Working

When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor defines.

Applications of IR Sensor

IR sensors use in various projects and also in various electronic devices.

- Night Vision Devices
- Radiation Thermometers
- Infrared Tracking
- IR Imaging Devices
- Climatology
- Meteorology
- Photo biomodulation
- Flame Monitors
- Gas detectors
- Water analysis

3.2.3 Servo Motor

Servo motor is a rotatory actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with the servo motors. It is not a specific class of motor, although the term servomotor is often used to refer to a motor suitable for use in a closed loop control system.

Figure 3.9 Servo Motor

SG90 Servo Motor Pinouts	
Terminal Color	Brief Description
Red	VCC Connected to 3.5V to 5V
Brown	Ground
Orange/Yellow	Control Signal or PWM signal to be applied on this Terminal

Table 3.1 Servo Motor Pin Description

A servo motor is a motor with a built-in servomechanism. The servomechanism uses a sensor to monitor the motor shaft position and a controller to control the motor. It is fed a signal that indicates the position that the shaft should be set to. It then moves the motor into the required position. In the analog servo motors, we will be working with the control signal which is a PWM signal whose pulse width determines the angle the motor shaft is to be positioned at. The motor itself is a simple DC motor with a lot of gearing to slow down its speed and to increase its torque. In Order to function properly the servo motor needs a sensor that can accurately measure its shaft position. On some industrial and high-end hobby servos this is done using an optical interrupter disc, but in most standard hobby servo motors the sensor is a potentiometer. This works well as these servos typically travel 180 to 270 degrees, well within the range of a potentiometer.

3.2.4 Temperature Sensor:

Temperature is one of the most commonly measured parameters in the world. They are used in your daily household devices from Microwave, fridges, AC to all fields of engineering. Temperature sensor basically measures the heat/cold generated by an object to which it is connected. It then provides a proportional resistance, current or voltage output which is then measured or processed as per our application**.**

Temperature sensor are basically classified into two types:

- Non-Contact Temperature Sensors: These temperature sensors use convection & radiation to monitor temperature.
- Contact Temperature Sensors: Contact temperature sensors are then further sub divided into three types.

1. Electro-Mechanical (Thermocouples).

2. Resistance Temperature Detectors (RTD).

3. Semiconductor based. (LM35, DS18B20 etc**).**

The DS18B20 is a 1-Wire temperature sensor manufactured by Dallas Semiconductor (acquired by Maxim Integrated). Because it is a 1-wire device, it only needs one digital pin to communicate with the micro controller.

The sensor is typically available in two form factors. One comes in a TO-92 package, which resembles a simple transistor. The other comes in the form of a waterproof probe, which is more useful when measuring something far away, underwater, or beneath the ground.

To use the DS18B20 sensor, you need to connect it to a micro controller or other digital device that supports the 1-Wire protocol. You can also use a dedicated 1-Wire interface chip to communicate with the sensor. Once connected, you can use software libraries or code to read the temperature values from the sensor.

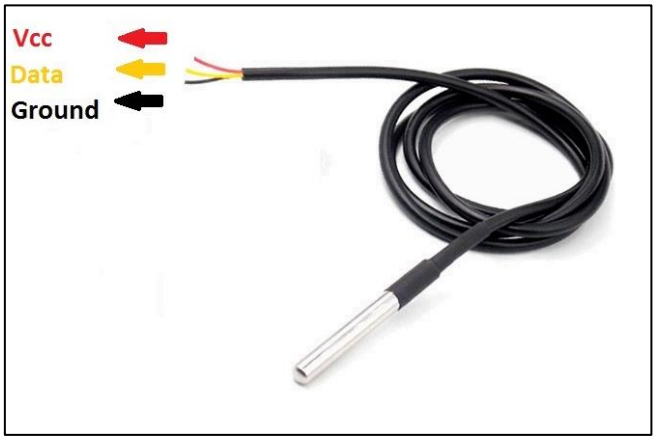


Figure 3.10 DS18B20 Temperature Sensor

GND: This pin or wire refers to the ground connection of the circuit parasite mode operation. The black wire of the DS18B20 represents the ground pin.

VCC: This pin refers to the positive power supply voltage of 3V to 5.5V to power up the sensor. The red wire of the DS18B20 represents the VCC pin.

DATA: This pin refers to the output pin that can generate the digital temperature value that can be read by using the 1-wire interface protocol. It is connected to the digital pin of an Arduino or microcontroller while interfacing. It provides power to the sensor when it is operated in the parasitic power mode. The yellow wire of DS18B20 represents the data pin.

Specifications and Features

- Programmable Digital Temperature Sensor
- Communicates using 1-Wire method.
- Operating voltage: 3V to 5V
- Temperature Range: -55°C to +125°C
- Accuracy: ±0.5°C
- Output Resolution: 9-bit to 12-bit (programmable)
- Unique 64-bit address enables multiplexing.
- Conversion time: 750ms at 12-bit
- Low Power Consumption
- Programmable alarm options
- Available as To-92, SOP and even as a waterproof sensor
- It is stainless steel with 6mm diameter and 35mm long.
- Diameter of the cable: 4mm or 0.16.
- Length of the sensor: 95cm or 37.4″.
- Probe: 7mm diameter, 26mm long, 6 feet overall length.

Applications of DS18B20

- This sensor is used to measure the liquid temperature.
- We can use it in the thermostat controls system.
- It can be used in industries as a temperature measuring device.
- This sensor is used as a thermometer.
- It can be used in devices like which are sensitive to thermal.
- These are used in HVAC systems.
- Applications where the temperature has to be measured at multiple points.

3.2.5 MAX30100 Sensor

MAX30100 sensor is a device that is used to monitor the heart rate and it is also used as the pulse oximeter. The device has two LEDs, one emitting a red light, another emitting infrared light. For pulse rate, only the infrared light is needed. Both the red light and infrared light is used to measure oxygen levels in the blood.

Figure 3.11 MAX30100 Sensor

When the heart pumps blood, there is an increase in oxygenated blood as a result of having more blood. As the heart relaxes, the volume of oxygenated blood also decreases. Ultimately, by knowing the time between the increase and decrease of oxygen-rich blood, the device calculates the pulse rate.

It turns out, oxygenated blood absorbs more infrared light and passes more red light while deoxygenated blood absorbs red light and passes more infrared light. This is the main function of the MAX30100: it reads the absorption levels for both light sources and stores them in a buffer that can be read via I2C communication protocol.

Pin Diagram

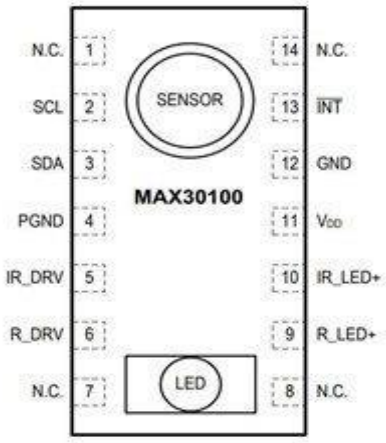


Figure 3.12 Pin Diagram of MAX30100 Sensor

Pin Description

PIN	NAME	FUNCTION
1,7,8,14	N.C.	No Connection. Connect to PCB Pad for Mechanical Stability
2	SCL	I^2C Clock Input
3	SDA	I^2C Clock Data, Bidirectional (Open-Drain)
4	PGND	Power Ground of the LED Driver Blocks
5	IR_DRV	IR LED Cathode and LED Driver Connection Point Leave floating in the circuit.
6	R_DRV	Red LED Cathode and LED Driver Connection Point leave floating in the circuit.
9	R_LED+	Power Supply (Anode Connection) for Red LED. Bypass to PGND for best performance Connected to IR LED+ internally
10	IR_LED+	Power Supply (Anode Connection) for IR LED. Bypass to PGND for best performance Connected to IR LED+ internally
11	VDD	Analog power supply input. Bypass to GND for best performance
12	GND	Analog Ground
13	INT	Active-Low interrupt(Open-Drain)

Table 3.2 Pin Description of MAX30100

Power Requirements

The MAX30100 chip requires two different supply voltages: 1.8V for the IC and 3.3V for the RED and IR LEDs. So, the module comes with 3.3V and 1.8V regulators. This allows you to connect the module to any microcontroller with 5V, 3.3V, even 1.8V level I/O.

One of the most important features of the MAX30100 is its low power consumption: the MAX30100 consumes less than 600µA during measurement. Also, it is possible to put the MAX30100 in standby mode, where it consumes only 0.7µA. This low power consumption allows implementation in battery powered devices such as handsets, wearables, or smart watches.

Specifications and features of MAX30100.

- Operating Voltage - 1.8V to 3.3V
- Input Current - 20mA
- Integrated Ambient Light Cancellation
- High Sample Rate Capability
- Fast Data Output Capability
- Current draw: ~600µA (during measurements)

- Red LED Wavelength: 660nm
- IR LED Wavelength: 880nm
- Temperature Range: -40˚C to +85˚C
- Temperature Accuracy: ±1˚C

Applications

- Medical Monitoring Devices.
- Fitness Assistant Devices.
- Wearable Devices.

3.2.6 Power Supply and Connecting Wires

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and, as a result, power supplies are sometimes referred to as electric power converters. Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads. Here, we use 5v dc power or sometimes power is given to the circuit directly from computer. A Wire is a single usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electric and telecommunication signals. Wire is formed by drawing the metal through a hole in a die or drawplate.

3.3 Software Requirement

Arduino IDE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any Arduino board. The Arduino development environment contains a text editor for writing code, a message area, a text console. a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Software written using Arduino are called sketches. These sketches are written in the text editor. Sketches are saved with the file extension ino, It has features for cutting pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino environment including

complete error messages and other information. The bottom right-hand corner of the window displays the current board and serial port. The toolbar buttons allow us to verify and upload programs. create, open, and save sketches, and open the serial monitor.

The source code for the IDE is released under the GNU General Public License. version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. By default, avrdude is used as the uploading tool to flash the user code onto official Arduino boards. Arduino IDE is a derivative of the Processing IDE, however as of version 2.0, the Processing IDE will be replaced with the Visual Studio Code-based Eclipse Their IDE framework. With the rising popularity of Arduino as a software platform, other vendors started to implement custom open source compilers and tools (cores) that can build and upload sketches to other micro controllers that are not supported by Arduino's official line of micro controllers.

Thing Speak

Thing Speak is an IoT analytic platform service that allows you to aggregate, visualize, and analyse live data streams in the cloud. You can send data to Thing Speak from your devices, create instant visualization of live data, and send alerts.

Collect:

Send sensor data privately to the cloud.

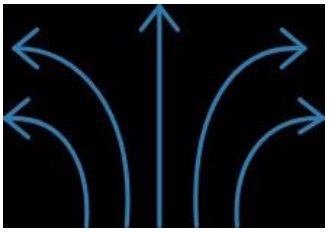


Figure 3.13 Send sensor data privately to the cloud.

There are sensors all around—in our homes, smart phones, automobiles, city infrastructure, and industrial equipment. Sensors detect and measure information on all sorts of things like temperature, humidity, and pressure. And they communicate that data in some form, such as a numerical value or electrical signal.

Analyse

Analyse and visualize your data.

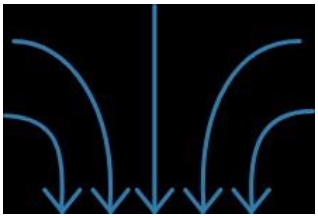


Figure 3.14 Analyse and visualize your data.

Storing data in the cloud provides easy access to your data. Using online analytical tools, you can explore and visualize data. You can discover relationships, patterns, and trends in data. You can calculate new data. And you can visualize it in plots, charts, and gauges**.**

Act

Trigger a reaction.

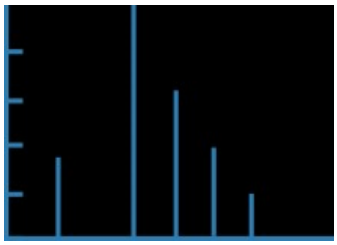


Figure 3.15 Trigger a reaction.

Acting on data could be something as simple receiving a tweet when the temperature you are measuring goes above 70° F. Or you could set up a more intricate action such as turning on a motor when the water level in your water tank drops below a specified limit. You can even remotely control devices, such as battery-operated door locks, using an app.

Features

- Collect data in private channels.
- Share data with public channels.
- RESTful and MQTT APIs
- MATLAB® analytics
- Event scheduling
- Alerts
- App integrations

IFTTT

IFTTT derives its name from the programming conditional statement “if this, then that.” What the company provides is a software platform that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services**.**

How IFTTT works

The automations are accomplished via applets — which are sort of like macros that connect multiple apps to run automated tasks. You can turn on or off an applet using IFTTT’s website or mobile apps (and/or the mobile apps’ IFTTT widgets). You can also create your own applets or make variations of existing ones via IFTTT’s user-friendly, straightforward interface.

IFTTT employs the following concepts:

- Services (formerly known as channels) are the basic building blocks of IFTTT. They mainly describe a series of data from a certain web service such as YouTube or eBay. Services can also describe actions controlled with certain APIs, like SMS. Sometimes, they can represent information in terms of weather or stocks. Each service has a particular set of triggers and actions.
- Triggers are the part of an applet represented as "This" in the "If This Then That" acronym. They are the items that trigger the action. For example, from an RSS feed, you can receive a notification based on a keyword or phrase.
- Actions are the "That" part of an applet. They are the output that results from the input of the trigger.

- Applets (formerly known as recipes) are the predicates made from triggers and actions. For example, a user would activate a trigger by liking a picture on Instagram and the applet would do an action, like sending the photo to their Dropbox account.
- "Ingredients" are basic data available from a trigger—from the email trigger, for example, subject, body, attachment, received date, and sender's address.

Blynk

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

There are three major components in the platform:

Blynk App: It allows you to create amazing interfaces for your projects using various widgets which are provided.

Blynk Server: It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries: It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands. The process that occurs when someone presses the Button in the Blynk application is that the data will move to Blynk Cloud, where data magically finds its way to the hardware that has been installed.

CHAPTER 4

IMPLEMENTATION AND EXPERMENTAL SETUP

4.1 Process Model

In this section we design structure of the system before implementation of circuit. we use advanced micro controller called Node MCU (esp8266). In this system we use IR sensors, temperature sensor DS18B20 and MAX30100 sensor, to detect saline level, temperature and heart rate sensor into appropriate voltage. This voltage is given to Node MCU, according to program it processes the analog signal into digital and send it to the concerned people as output through Thing speak and Blynk App.

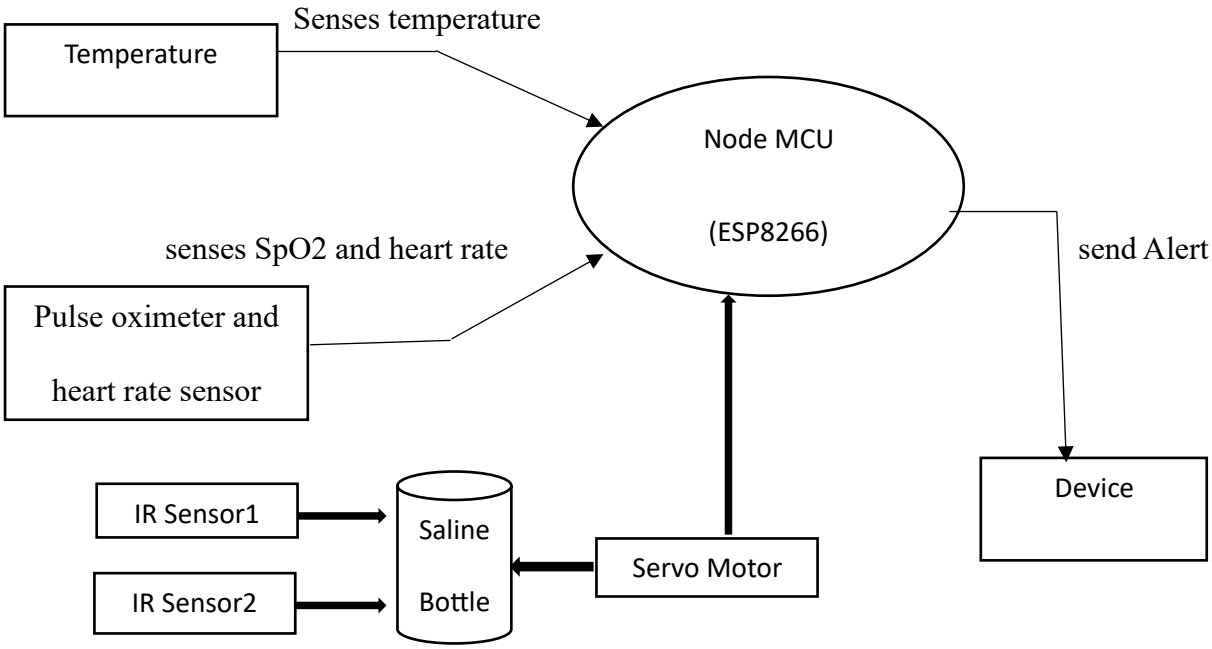


Figure 4.1 Data Flow Diagram

5.1 Hardware Implementation

The systems are divided into two sections. Saline is monitored in one part using a clamping circuit, and vital health indicators like body temperature, heart rate, and pulse rate are monitored in the other. IR sensors, a MAX30100 sensor for measuring heart rate and pulse rate, a DS18B20 temperature sensor, a Node MCU (esp8266), and a servo motor are the hardware elements used in this project. Therefore, mentioned three sensors are connected to Node MCU so that whenever a change in the patient's health is detected, alert messages can be sent to mobile devices via ifttt and the values can be seen on the thing speak website. A servo motor is attached to stop the flow of saline, preventing blood from the patient's body from flowing backward into the saline bottle or the air.

Saline monitoring:

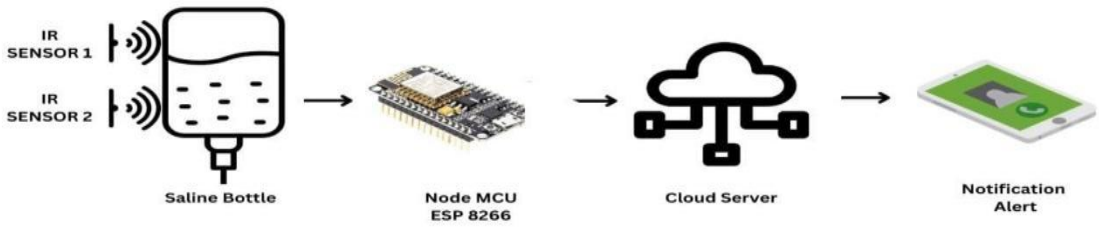


Figure 4.2 Block diagram of Saline Monitoring

The saline fluid level is predicted by using the IR sensors. These sensors are used to indicate whether the saline bottle has a high or low level. These sensors are connected to Node MCU. The Arduino software which an open source helps to read the sensors and the results can be seen via the serial monitor of the Node MCU and it will sends the alert by using IFTTT like

Saline is empty or saline is full and displays the values in thing speak platform. When the saline fluid gets finished, an alert message is sent to the patient's mobile device and a servo motor is fitted to the drip chamber which stops the reverse flow of blood from the patient's body by squeezing the saline tube.

Flow chat for Monitoring of Saline level:

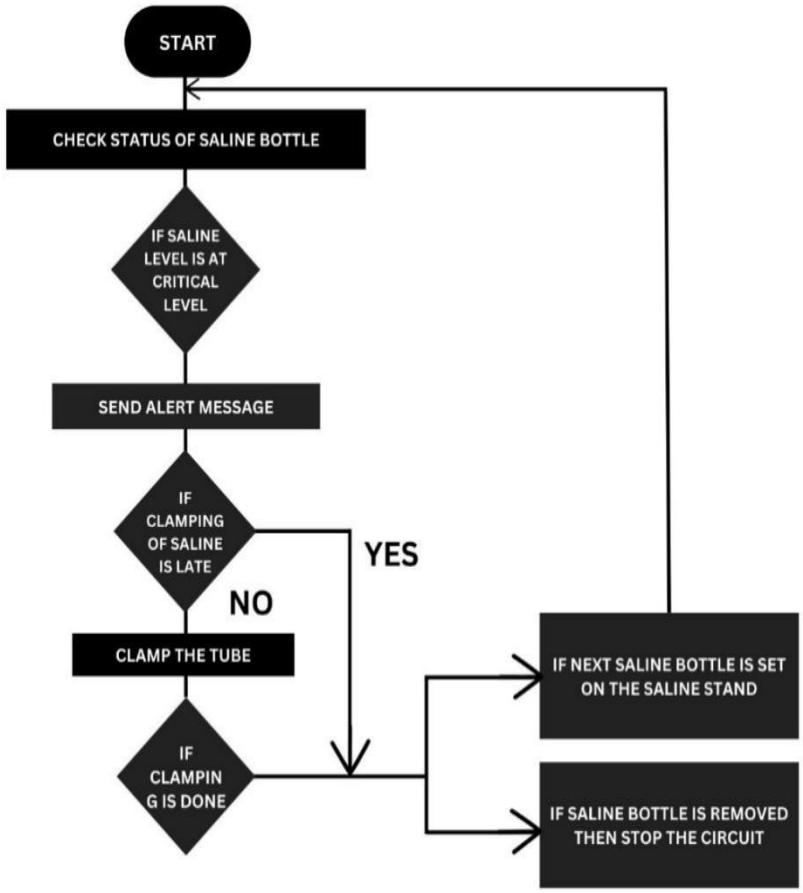


Figure 4.3 Flow Chart for Saline Monitoring

Health parameters monitoring unit.

To detect the temperature of the patient, DS18B20 is used. The core functionality of the DS18B20 is its direct-to- digital temperature sensor. The DS18b20 sensor is placed to the patient's hand to predict the body temperature whether it is normal or abnormal. To detect the heart rate of the patient, Pulse oximeter MAX30100 sensor is used. This sensor helps to monitor

the heart rate and the level of the oxygen in blood. This sensor is connected to Node MCU, and it can be easily clipped onto a fingertip/ earlobe of a patient. The pulse sensor is well designed heart rate sensor for Node MCU. A 24-inch colour Coded cable with header connectors. The front side of sensor that is heart logo make contact with a skin and a small round hole for LED glows from backside of sensor. If there is any changes observed in the heart beat the alert message will be sent to the nurse. If the oxygen level is between 95 and 99, then the patient has normal oxygen level otherwise the alert message will be sent to the nurse.

CHAPTER 5

RESULTS AND DISCUSSION

The result of our project work is measuring saline level using IR sensors and sending alert using IFTTT server and displaying data in thingspeak server. In our proposed system we are also measuring varied health parameters of human body like body temperature, heart rate and oxygen saturation level. If any physical or non-physical or mental changes occurring in human body allows a rapid changes in its values. By analyzing the data in thingspeak server. The alert is passed to caretaker via IFTTT. The main part of our project is to observe patient conditon and share information to caretakers through a mobile notification.The primary objective of our research work to reduce the cost, manpower and the time to send the information.

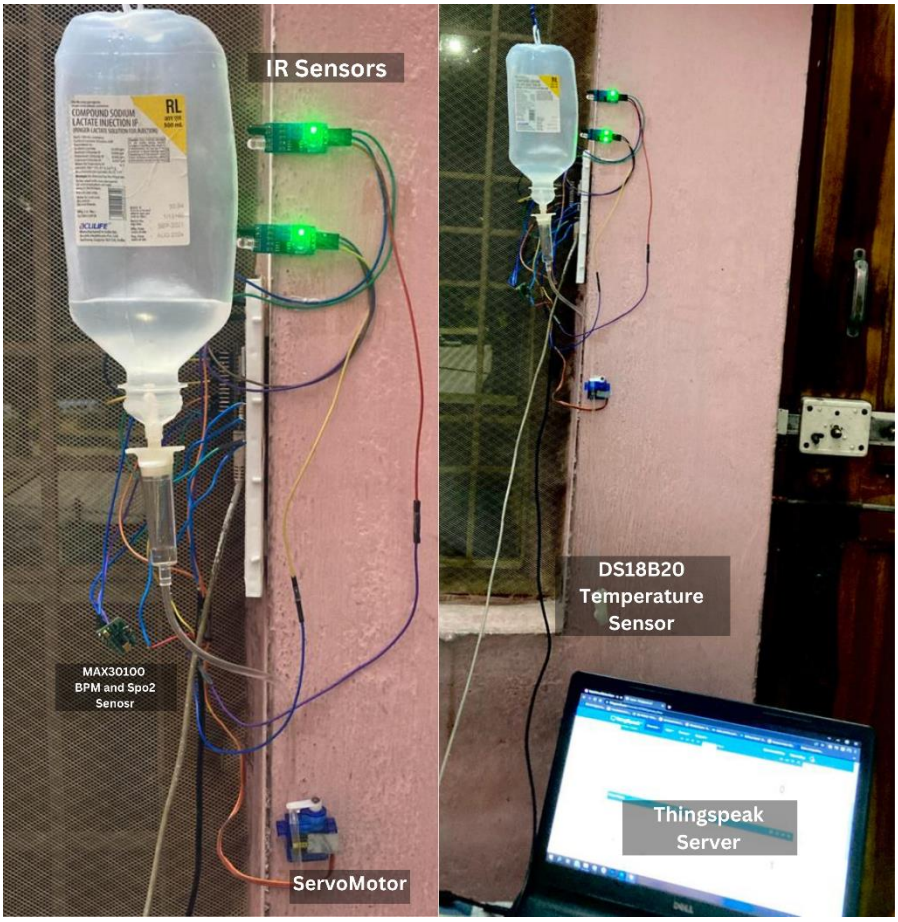
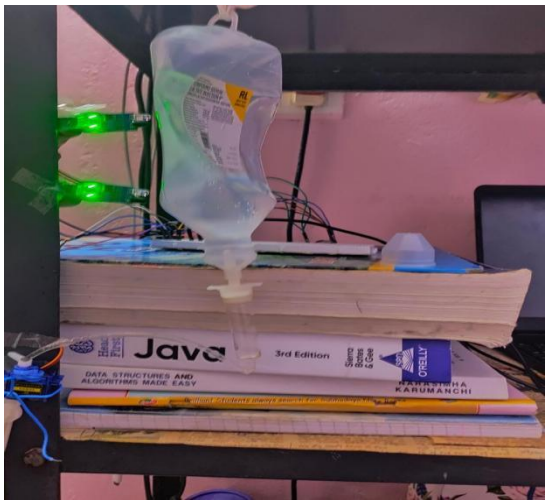
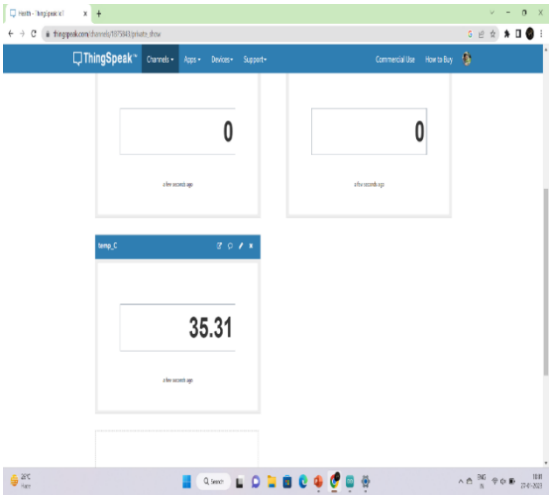


Figure 5.1 Work setup of the proposed system

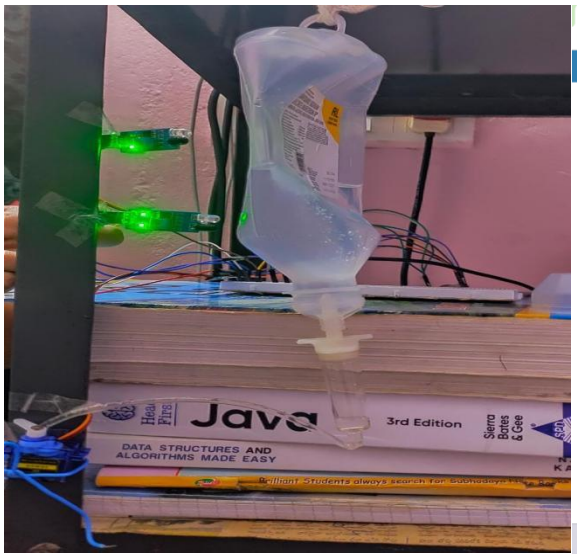
Data Displayed in web Application:

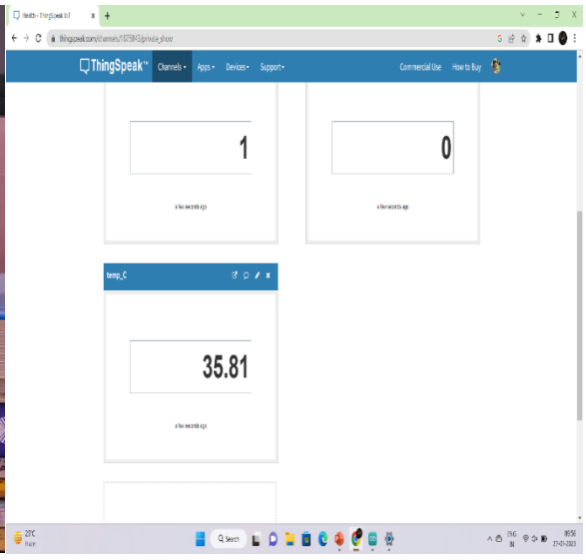
The day-to-day vital parameters such as, body temperature, heart rate and Oxygen saturation level can be displayed in the mobile phone and the same can be send to the doctor during emergency situations.



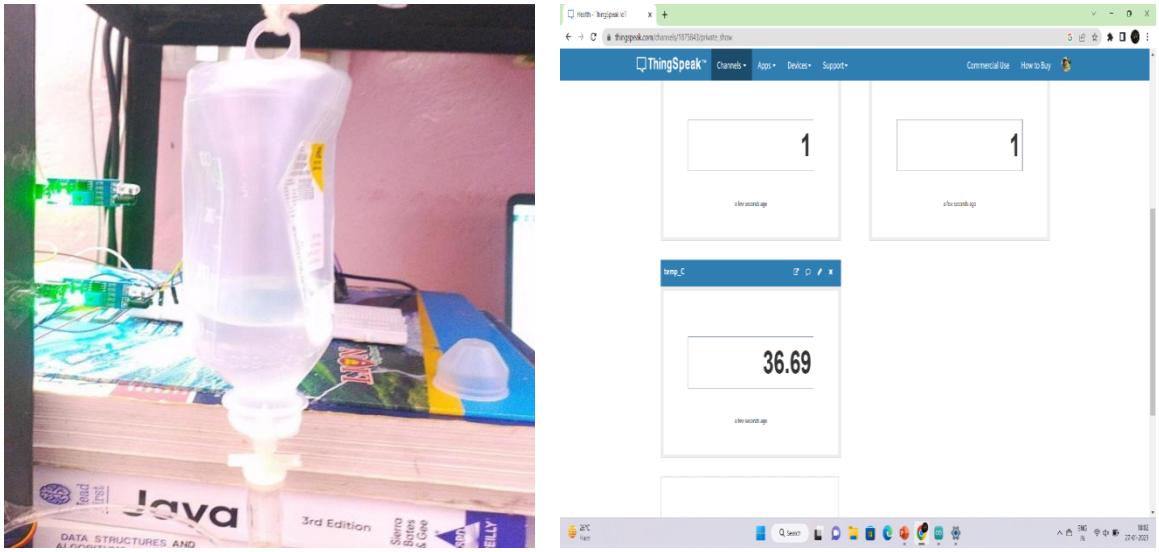


In the above figure, IR sensors indicates the value Zero displays in Thing speak as the saline level is full.

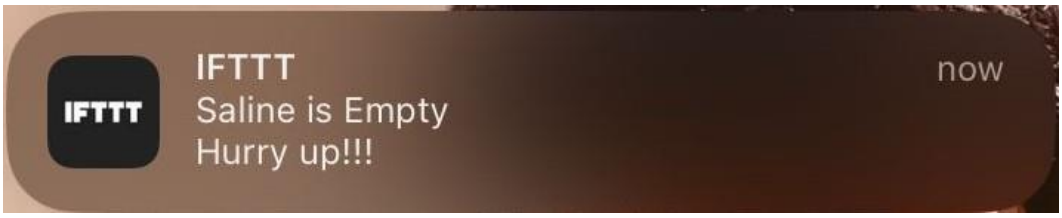




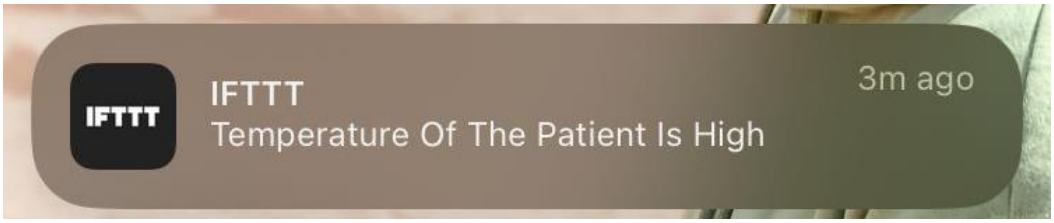
In the above figure, the saline level cross the IR sensor1 so, it indicate the value one and the other IR sensor indicates the value zero.



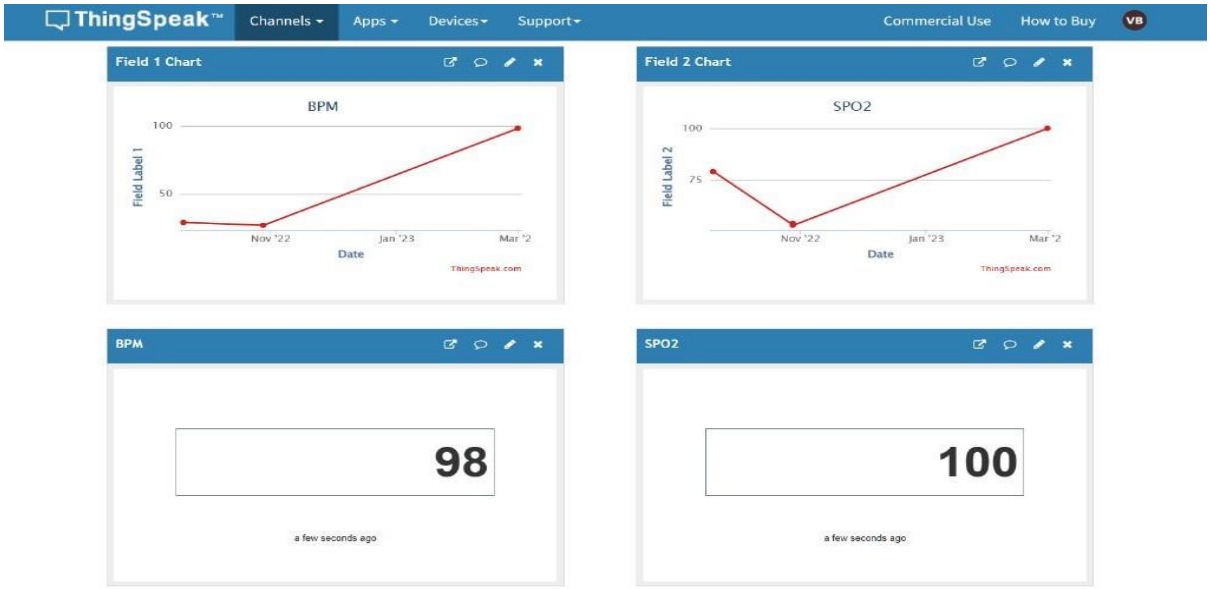
In the above figure, the saline level crossed both IR sensor 1 and IR sensor 2 so, it indicates the both values as one.



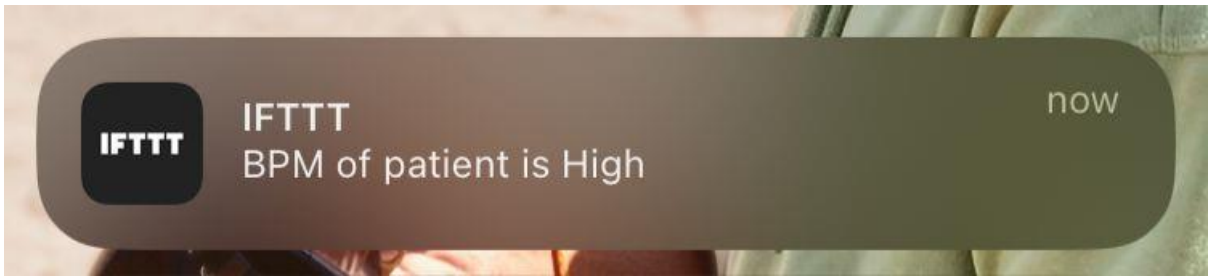
As the saline is approaching empty in the above image, the IR sensors indicate the value one in the thing speak, and an alert message is sent to the caretaker via IFTTT.



In above figures, patient's body temperature values are continuously tracked in thing speak, and if any abnormalities are noticed, an alert message is sent to the caretaker via IFTTT.



The above figure represents the value of Heart Rate and Oxygen Saturation Level.



In the above figure represents the notification give to a caretaker when the patient heart rate(BPM) is abnormal, Then notification sent to the care taker via IFTTT.

Figure 5.2 Outputs of the proposed system

CHAPTER 6

CONCLUSION AND FURTHER ENHANCEMENT

This system proposes the automated approach to monitoring the Saline Fluid in the bottle and furthermore to stop the flow of saline using servo motor. This system is suitable for use in hospitals via a computer or smartphone, doctors or nurses can screen the Saline level, temperature, oxygen level in the blood, and any patient's heart rate can be accessed at any time and from any place. This system could be improved and adjusted in a variety of ways in the future. The system can be turned into a complete health monitoring system by incorporating more sensors like blood pressure sensor, ECG sensor, respiration sensor, etc…. The ESP8266 micro controller can be replaced with a any micro controller and tweaked in a variety of ways. As the entire proposed framework is automated, it requires exceptionally less human intervention. It is particularly useful for the nurses especially at the hospitals where numerous patients are allotted to 2-3 nurses. Consequently, this system is user friendly and any naive user with a little training can easily utilize this system. It can be reused for the next saline bottle.

System can be updated with latest technologies and installed with user interface and including a digital display and make sure we display patient details. So, by including these components in saline stand, we can reduce equipment used in hospitals.

CHAPTER 7

REFERENCES

[1] Prasad Patil, Pritam Magdum, Prathamesh Gaikwad, Prof Mandar Kolap, “IOT BASED SALINE LEVEL MONITORING SYSTEM IN HEALTHCARE”, International Research Journal of Modernization in Engineering Technology and Science, volume 4, issue 7, July 2022.

[2] Samik Basu, Sinjoy Saha, Soumya Pandit and Soma Barman, “Smart Health Monitoring System for Temperature, Blood Oxygen Saturation, and Heart Rate Sensing with Embedded Processing and Transmission Using IoT Platform”, ResearchGate, January 2020.

[3] Mansi G. Chidgopkar, Aruna P. Phatale, “AUTOMATIC AND LOW COST SALINE LEVEL MONITORING SYSTEM USING WIRELESS BLUETOOTH MODULE AND CC2500”, International Journal of Research in Engineering and Technology, volume 4, issue 9,2015.

[4] Amey More, Darshan Bhor, Mihir Tila, Dr. Gajanan Nagare, “IoT based Smart Saline Bottle for Healthcare”, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY, volume 10, issue 6, 2021.

[5] Mr. Jayant Ingale, Ms. Sharvari Sahare, Ms. Pradhnya Kanchane, Mr. Nikhil Tonge, Mr. Akshay Shah, Prof. Amar Banmare, “AUTOMATIC SALINE LEVEL MONITORING SYSTEM USING IOT”, International Journal of Monitoring System Using IoT, volume 9, issue 5, 2021.

[6] Malathi M,Preethi D IOT BASED HEALTH MONITORING SYSTEM ,International journal of Engineering Research &Technology ,volume 7,issue 1,2019

[7] Yedukondalu Udara, Srinivasarao,Udara Harish H , Hadimani H C HEALTH MONITORING SYSTEM USING IOT, International Journal of Engineering and Manufacturing Science.ISSN 2249-3115 Volume 8, Number 1 (2018) pp.

[8] Akila M, Ashika S, Rubini S WIRELESS PATIENT HEALTH MONITORING USING IOT International Journal of Engineering and Manufacturing Science. ISSN 2249-3115 Vol.8, No.3, (2018)

[9] Ms. Prachi Patil, Mr. Swapnil Patil, Mr. Gaurav Parab, Ms. Mugdha Salvi , IoT based Patient Health Monitoring System , International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Special Issue – 2021

[10] C.Senthamilarasi, J.Jansi Rani, B.Vidhya , H.Aritha, A SMART PATIENT HEALTH MONITORING SYSTEM USING IOT, International Journal of Pure and Applied Mathematics,Volume 119

[11] Sakshi D. Ambadkar, Shobha S. Nikam "NRF Transceiver based Saline Level, Health Monitoring & Control", IJERT, Vol. 7, issue, 10, Oct 2020.

[12] Padmaja N Sathish Kumar B"IoT Based Stress Detection and Health Monitoring System",Helix(2020), Vol . 10 (2) March 2020.

[13] Ashika A. Dharmale, Revati R. Mehare, Ankita R. Bharti, Shweta R. Meshram, Prof. Swapnil V. Deshmukh5 "IOT Based Saline Level Monitoring & Automatic Alert System"

[14]https://how2electronics.com/iot-patient-health-monitoring-system-esp8266/ (IoT Based Patient Health Monitoring using ESP8266 & Arduino)

[15] Shivam Gupta,Mandar Kulkarni,Yashasvini Kulkarni "SMART SALINE MONITORING SYSTEM USING LOAD CELL AND RF SENSOR

[16] Dr.A.Sabanayagam, G.Anish Girija," DESIGN AND MODELING OF MOBILE HEALTH MONITORING SYSTEM", International Journal of Innovations in Scientific and Engineering Research (IJISER),vol4,no 2,pp.63-65,2017

[17] Vishal Dineshkumar Soni, "An IoT Based Patient Health Monitoring System ", International Journal of Integrated, vol 1, issue 1,December 2018.

[18] Anil Kadu, Mansi Gajare, Pritesh Chaudhari, Payal Deshmukh, Sameer Deshmukh, Manas Dani, "IOT BASED HEALTH MONITORING SYSTEM", Research Gate, January 2021.

[19] S. B. Akshaya, Gowri Anil, Raimy Paulson, Reya Jijy Abraham, P. Vandana. "IoT based Health Monitoring System", International Journal of Research in Engineering, Science and Management, Volume-2, Issue-6, June-2019.

[20] Geethalakshmi M N, K R Sumana, "IoT Based Patient Biomedical Signal Tracking System", International Research Journal of Engineering and Technology (IRJET), Volume: 09 Issue: 07 | July 2022

[21] Mohammad Monirujjaman Khan, Turki M. Alanazi, Amani Abdulrahman Albraikan, and Faris A. Almalki, “IoT-Based Health Monitoring System Development and Analysis”, 21 Apr 2022.

[22] Aditya Sharma, Anuj Kumar Singh, Khushi Saxena, Mr. Abhinav Bansal, “Smart Health Monitoring System using IoT”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 8 Issue V May 2020.

[23] Shruthi Nair , Nimmy Augustine , Leo Varghese, “Smart Health Monitoring System”, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT), Volume 9, Issue 1, 03-02-2020.

[24] Prajoona Valsalan, Tariq Ahmed Barham Baomar, Ali Hussain Omar Baabood, “IOT BASED HEALTH MONITORING SYSTEM”, Journal of critical reviews, Vol 7, Issue 4, 2020.

[25] Shubham Banka, Isha Madan and S.S. Saranya, “Smart Healthcare Monitoring using IoT”, International Journal of Applied Engineering Research , Volume 13, Number 15 (2018) .

[26] I. Khan, K. Zeb, A. Mahmood, W. Uddin, and M. A. Khan, “Healthcare monitoring system and transforming monitored data into real time clinical feedback based on IoT using Raspberry Pi”, ResearchGate, 2019.

[27] Richa, Anwesha Das, Ajeet Kumar Kushwaha, Prof. Mini Sreejeth, “An IoT based Health Monitoring System using Arduino Uno”, International Journal of Engineering Research & Technology (IJERT), Vol. 10 Issue 03, March-2021.

[28] Paul Stone Brown Macheso, Angel G Meela , “IoT Based Patient Health Monitoring using ESP8266 and Arduino”, International Journal of Computer Communication and Informatics, Vol. 3 Iss. 2 Year 2021.

[29] V.Akhila, Y.Vasavi, K.Nissie, P.Venkat Rao, “An IoT based Patient Health Monitoring Systemusing Arduino Uno”, International Journal of Research in Information Technology, Volume 1, Issue 1, November 2017.

[30] Amruta Unawane, Sneha Jadhav, Sujit Jagtap, “E PATIENT MONITORING SYSTEM USING ARDUINO”, International Research Journal of Modernization in Engineering Technology and Science, Volume:03,Issue:07,July-2021.

[31] Muhammad Sajjad, Shahryar Shafique Qureshi, Muhammad Afnan, “IOT BASED HEALTH MONITORING SYSTEM USING ARDUINO UNO, GSM SIM900D MODULE

ANDWIFI MODULE ESP8266", International Journal of Scientific & Engineering Research Volume 9, Issue 12, December-2018.

[32] Shivkumar Dharmoji, Akshata Anigolkar, Prof. Shraddha M, "IoT based Patient Health Monitoring using ESP8266", International Research Journal of Engineering and Technology (IRJET), Volume: 07,Issue: 03,Mar 2020.

[33] M. Chengathir Selvi, T. Bhuvaneswari, R. Naga Priyadarshini, R. Chitralekha, R. Ramya, "IoT based Saline Monitoring System", Journal of Pharmaceutical Negative Results, Volume 13, Special Issue 3, 2022.

[34] G.Sunil, Srinivas Aluvala, G. Ranadheer Reddy, Vedantham Sreeharika, Parupally Sindhu, and Sriramula Keerthana, "IoT based saline level monitoring system", ResearchGate, December 2020.

[35] G Hari Krishnan, I Kumaraswamy, G Umashankar, T Sudhakar, Joshini E , Kavitha S and Sandhya J, "IOT BASED AUTOMATED SALINE DRIP AND HAND MOVEMENT DETECTION SYSTEM FOR CRITICAL CARE PATIENTS", Biosciences Biotechnology Research Asia, Volume 19.

[36] Darshana Baviskar, Pooja Patil, Shivlila Bhatambre, Madhuri Hake, Prof. Sharad Adsure, "IOT BASED SALINE LEVEL MONITORING SYSTEM", Open Access International Journal of Science and Engineering, Volume 4, Issue 4, April 2019.