VISVESVARAYA TECHNOLOGICAL UNIVERSITY
"JNANA SANGAMA", BELAGAVI - 590 018

MINI PROJECT REPORT

on

"IoT Based Intravenous Bag Monitoring System"

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In partial fulfillment of the requirements for the V semester

BACHELOR OF ENGINEERING

in

INFORMATION SCIENCE & ENGINEERING

Under the Guidance of

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at

SAHYADRI

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MANGALURU

2023 - 24

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CERTIFICATE

This is to certify that the **Mini Project** entitled **"IoT Based Intravenous Bag Monitoring System"** has been carried out by **N P Aishwarya (4SF21IS050), Anand S B Patil (4SF22IS402), Karthik M S (4SF22IS404) and Pavitra Shankar Naik (4SF22IS407)**, the bonafide students of Sahyadri College of Engineering and Management in partial fulfillment of the requirements for the V semester of Bachelor of Engineering in Information Science and Engineering of Visvesvaraya Technological University, Belagavi during the year 2023 - 24. It is certified that all suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The mini project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said degree.

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1.	....
2.	....

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DECLARATION

We hereby declare that the entire work embodied in this Mini Project Report titled **"IoT Based Intravenous Bag Monitoring System"** has been carried out by us at Sahyadri College of Engineering and Management, Mangaluru under the supervision of **Dr. Rithesh Pakkala P**, in partial fulfillment of the requirements for the V semester of **Bachelor of Engineering** in **Information Science & Engineering**. This report has not been submitted to this or any other University for the award of any other degree.

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Abstract

The day-to-day monitoring of patients in a hospital is a challenging task under our existing medical care system. During Health Hazard times like Covid 19 physicians or nurses are too busy to keep track of every patient. This leads to numerous issues. Work relating to health should be completed correctly and accurately. Saline or intravenous (IV) fluid injections into patient veins are an example of this kind of activity in our hospitals. Inadequate drip system monitoring can result in issues like blood loss, fluid backflow, and other issues. We present a solution called the IoT Intravenous Bag Monitoring and Alert System in order to lessen the strain and resolve such a dire issue in the domain of an intravenous drip monitoring system. Healthcare workers found themselves overburdened at the height of the Covid-19 Epidemic due to the constant influx of new patients. Frontline staff members cannot directly monitor and care for every patient during such periods. A medical procedure called Intravenous treatment is used to inject nutrients, medicines, and fluids straight into a patient's vein. IV therapy is essential to aid a patient in recovering quickly because it is frequently used to rehydrate and supply nutrients. Nonetheless, IV drips require routine inspection and replacement. Depending on the patient and their condition, the fluid flow must also be measured. The Weight Sensor used by this IoT intravenous fluid monitoring system detects when the fluid level in the IV infusion bottle drops and broadcasts the information over IoT

Acknowledgement

It is with great satisfaction we are submitting the Mini Project Report on **"Intravenous Bag Monitoring System"**. We have completed it as a part of the curriculum of Visvesvaraya Technological University, Belagavi in partial fulfillment of the requirements for the V semester of Bachelor of Engineering in Information Science & Engineering.

We are profoundly indebted to our guide, **Dr. Rithesh Pakkala P**, Associate Professor, Department of Information Science & Engineering for timely advice, encouragement and we sincerely express our gratitude.

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Chapter 1

Introduction

Intravenous (IV) drip monitoring systems are used to monitor and regulate the delivery of fluids and medication to patients through an IV line. The purpose of IV drip monitoring systems is to ensure the safe and effective delivery of fluids and medications to patients in healthcare settings, including hospitals, clinics, and home healthcare. IV drip monitoring systems can help healthcare providers to: Monitor the rate of infusion: IV drip monitoring systems can measure the rate at which fluids and medications are delivered to a patient, helping to ensure that the right number of fluids or medication is administered at the right time. Monitor the volume infused: IV drip monitoring systems can keep track of the total volume of fluids or medication that has been infused into a patient, which can help to prevent overhydration or dehydration.

Potential Problems: IV drip monitoring systems can alert healthcare providers to potential problems such as air bubbles in the IV line or an occlusion (blockage) in the line, allowing for prompt intervention to prevent harm to the patient. Overall, IV drip monitoring systems help to ensure the safe and effective delivery of fluids and medications to patients, improving patient outcomes and reducing the risk of adverse events.

Considering the health industry, nothing is more precious than the patient's life. In such a scenario, it is not the number of patients or money turn over that counts but it is the quality of treatment that is important. Thus, the instruments used in administering any ailment should be self-sufficient and should be in a position to communicate to the hospital's dashboard in general and nursing staff in particular, so there is a need to develop the E-fluid monitoring in the present situation.

The setup detects the drop count, measures the fluid level and sends an alert signal to the attendant when the fluid reaches the threshold level. Pharmacology activities that are involved in the treatment of diseases include the medical administration by oral,intramuscular, subcutaneous,intra-arterial and intravenous.

IOT is a network of physical objects made up of all gadgets, cars, buildings and other things that include electronics, software and sensors that allow them to collect and share data with each other. Due to the convergence of many technologies real-time analytics, machine learning, cheap sensors and embedded systems, IOT has advanced. Whenever a patient is given saline, the patient is closely watched by a nurse or other family members. Mostly due to carelessness, lack of focus, busy schedule and increasing number of patients, nurses forget to replace the saline bottle as soon as it is completely consumed. Due to the pressure difference between the empty saline bottle and the blood, the blood returns to the saline bottle immediately after the saline is exhausted. This allows their veins to reverse blood flow to the saline vessel. This causes the patient's hemoglobin levels to drop, and can also cause a shortage of red blood cells (RBCs) in the patient's blood, causing them to feel tired. Therefore, a salt level monitoring system must be created to somewhat reduce the patient's dependence on nurses or other caregivers. This system uses an automatic warning and iot. When the intravenous fluid level falls below a specified threshold, the load cell's output voltage level changes. The nurse is notified by an alarm that the patient's saline supply has been exhausted as soon as the saline drops to a certain low level

Chapter 2

Literature Survey

The literature survey gives a brief overview of the various intravenous bag monitoring system models and methods implemented for road safety analysis. This helps in identifying the gaps in the already existing systems and helps in identifying the particular features of this application which will help bridge the gaps.

Gupta and Singh , proposed IV drip monitoring systems using different technologies, such as microcontrollers and sensors, to regulate infusion rates and ensure patient safety.IV therapy is essential to aid a patient in recovering quickly because it is frequently used to rehydrate and supply nutrients[1].

Drip bags are used in hospital environments to administerdrugs and nutrition to patients.Ensuring that they are usedcorrectly and are refilled in time are important for the safety of patients. This study examines the use of a ConvolutionalNeural Network (CNN) to monitor the fluid levels of drip bagsvia image recognition to potentially form the base of an earlywarning system, and assisting in making medical care moreefficient. Videos of drip bags were recorded as they wereemptying their contents in a controlled environment and from different angles[2].

Francis proposed medical care system, the monitoring of patients in a hospital throughout the day is a tiresome process. Sometimes Doctors or Nurses are too busy, so they can't monitor each patient. This causes many problems. The health related work should be properly done and that too with accurate manner. An example of such type of work in our hospital is injecting saline or Intravenous (IV) fluids in to the vein of patient. If the drip system is not monitored on time, it will causes problems like backflow of fluid, blood loss etc. In order to reduce the workload and overcome such critical situation in the area of an intravenous drip monitoring system, we proposed a system called Automated Intravenous Drip Monitoring System[3].

Mrs.B. Kiruthiga1 et al. proposed the term "The Internet of Things" refers to a network of physical objects including all appliances, cars, buildings and other structures that have been integrated with sensors, software or electronics enabling it to communicate and retrieve data from one another. The development of the Internet of things has been stimulated by a convergence of different technologies such as real time analytics, machine learning, commodity sensors and embedded systems. The nurse or members of the family should be closely monitoring patients every time they are injected with saline. Often, the nurse has forgotten to replace her saline container when it's entirely empty because of a busy schedule, inattention or an increased number of patients. Due to a difference in blood pressure and the pressure inside the empty saline container, blood returns to the saline bottle shortly after the saline has finished This would lead to the blood from their veins flowing backwards into a saline bottle. This may lead to decreased haemoglobin levels in the patients, and they can also experience a lack of blood Red Cells RBCCs which causes them to become tired. Therefore, in order to reduce the patient's reliance on caregivers or nursing staff, it is necessary to set up a saline level monitoring system[4].

Chapter 3

Problem Statement and Objectives

During the peak of the Covid-19 Pandemic, healthcare professionals found themselves spread thin among the ever-increasing wave of incoming patients. In such times, it is not possible for frontline workers to monitor and tend to each and every patient personally. Intravenous therapy is a medical technique used to deliver fluids, medications and nutrition directly into a person's vein. IV therapy is commonly used for rehydration and to provide nutrients and is crucial to help an individual with making a speedy recovery. However, IV drips need to be regularly monitored and replaced. The flow of the fluid also needs to be metered depending on the patient and their ailment. This IoT Intravenous Fluid Monitoring uses a weight sensor to detect as the fluid level in the IV Infusion bottle goes down and transmits the data over IoT. The system makes use of a Weight Sensor with an microcontroller and Wifi transmitter and LCD display to achieve this functionality. This allows for an automated and robust IV monitoring system. The Weight Sensor is attached to a small stand. The stand is fabricated with a cross section at bottom to balance it. When the IV bag is suspended onto the sensor stand, it keeps on dripping until the fluid runs out. The weight sensor value is constantly transmitted to microcontroller. The controller constantly processes this data and processes it.

Proposed solution:

We proposed prototype on IV drip monitoring system using IoT & blynk software.So that We can monitor the pateints in the hospital efficiently.

3.1 Objectives

- To develop prototype to implement Intravenous bag monitoring system
- To reduce the risk of medication errors, improve patient outcomes, and reduce healthcare costs.

Chapter 4

Methodology

Components used in our project are: 1. ESP 32. 2. Load Cell. 3. LCD Display. 4. Load Cell Amplifier. Consists of the following Hardware components: ESP 32, Load cell Driver,LCD Display, Software components used in this project is Aurdino IDE . First the ESP 32 is given power supply via 12v DC Power adapter and is connected to a PC/Laptop through a USB port.Once turned on the ESP Module is connected to a registered Wireless Network (Wi-Fi), on successful connection the ESP asks the user to place a weight on the Load cell which is displayed through the LCD Display connected to the ESP processor. After an object/bag is placed on the Load cell the weight of the object/bag is calibrated and is both displayed on the LCD and will be uploaded to the cloud which can be seen on the ThingSpeak Platform. Live Monitoring of the weight of the bag can be seen on the Blink Website. If the weight/liquid level of the bag is below a certain threshold level an alert message is sent to the user via the SMS and blink software app to Refill/Replace the bag.

4.1 Architecture Diagram

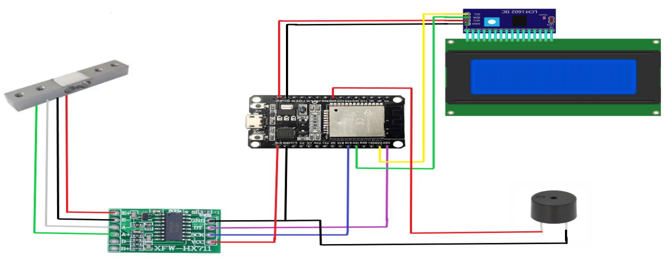

Figure 4.1: Architecture Design Of IV Bag Monitoring System

4.2 Components Requirements

- Load cell
- ESP32 Microcontrller
- LCD display
- Load controller
- Aurdino IDE
- Buzzer

4.2.1 Software Requirements

- Aurdino IDE
- ESP 32 Library
- HX711 load cell amplifier

4.2.2 Hardware Requirements

- Load cell
- Microcontroller
- LCD display
- 12C converter
- buzzer

4.3 System Design

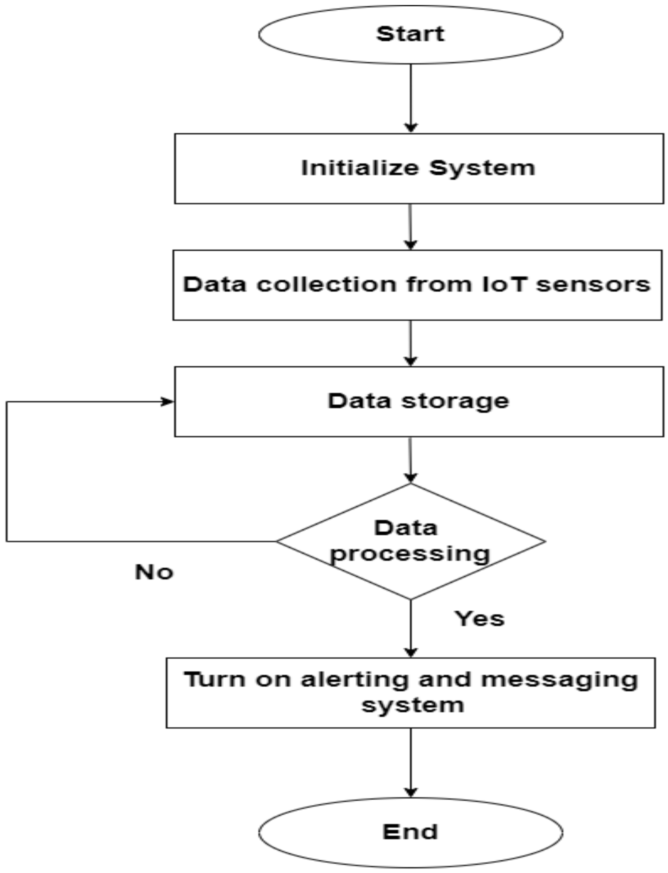

Figure 4.2: Flow Chart Of IV Bag Monitoring System

Start: The process begins when the system is activated or powered on.

Initialize System: The system initializes itself, performing any necessary startup routines such as checking hardware components, initializing software modules, and establishing communication channels

Read Sensor Data: The system reads sensor data from various sources. This could include sensors monitoring factors such as fluid level, temperature, flow rate, and possibly other parameters depending on the complexity of the system.

Data Processing: The raw sensor data is processed by the system to extract relevant information. This might involve filtering out noise, performing calculations (such as volume calculations based on flow rate and time), and converting raw sensor readings into meaningful values.

Check Thresholds: The processed data is compared against predefined thresholds or limits. These thresholds could indicate acceptable ranges for parameters like fluid level, temperature, or flow rate. If any thresholds are exceeded, it may indicate a problem with the IV bag or infusion process.

Generate Alerts: If any thresholds are exceeded or if other anomalies are detected in the sensor data, the system generates alerts to notify healthcare personnel. These alerts could take the form of visual indicators on a display, audible alarms, or notifications sent to remote monitoring stations or mobile devices.

Display Information: The system displays relevant information to healthcare personnel. This could include real-time sensor readings, alerts and alarms, status indicators, and possibly historical data or trend analysis to help identify patterns or issues over time.

User Interaction: Healthcare personnel may interact with the system to acknowledge alerts, adjust settings, or take other actions as needed. For example, they might replace an empty IV bag, adjust infusion settings, or troubleshoot equipment issues.

Monitor Continuously: The system continues to monitor sensor data and provide feedback to healthcare personnel in real-time, ensuring that IV infusion processes are safe and effective.

Stop: The process ends when the system is powered off or deactivated.

Code

```
#include<WiFi.h>
#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27, 20, 4);
include "HX711.h"
define DOUT 23
define CLK 19
define BUZZER 25
HX711 scale(DOUT, CLK);
define BLYNK_PRINT Serial
char auth[] = "*******";
char ssid[] = "*******";
char pass[] = "********";
int liter;
int val;
float weight;
float calibration_factor = 102500; // change this value for your Load cell
sensor
void setup()
// Set up serial monitor
Serial.begin(115200);
lcd.init();
lcd.backlight();
pinMode(BUZZER ,OUTPUT);
Serial.println("Remove all weight from scale");
scale.set_scale();
scale.tare(); //Reset the scale to 0
long zero_factor = scale.read_average(); //Getabaselinereading
Serial.print("Zero factor: "); //This can be used to remove the need to
tare the scale. Useful in permanent scale projects.
Serial.println(zero_factor);
```

Blynk.begin(auth, ssid, pass);

void loop()

Blynk.run();

measureweight();

void measureweight()

scale.set$_{s}cale(calibration_{f}actor);//Adjusttothiscalibrationfactor$

weight = scale.get$_{u}nits(5)$;

if(weight¡0)

weight=0.00;

liter = weight*1000;

val = liter;

val = map(val, 0, 505, 0, 100);

lcd.clear();

lcd.setCursor(1, 0);

lcd.print("IOT Based IV Bag");

lcd.setCursor(2, 1);

lcd.print("Monitering System");

Serial.print("Kilogram: ");

Serial.print(weight);

Serial.println(" Kg");

lcd.setCursor(1, 2);

lcd.print("IV Bottle = ");

lcd.print(liter);

lcd.print(" mL");

Serial.print("IV BOTTLE: ");

Serial.print(liter);

Serial.println("mL");

lcd.setCursor(1, 3);

lcd.print("IV Bag Percent=");

lcd.print(val);

lcd.print("

Serial.print("IV Bag Percent: ");

Serial.print(val);

Serial.println("

Serial.println();

delay(500);

if (val ¡= 50 && val ¿= 40)

Blynk.logEvent(”iv$_a lert”,”IVBottleis50$

digitalWrite(BUZZER, HIGH);

delay(50);

digitalWrite(BUZZER, LOW);

delay(50);

else if (val ¡= 20)

Blynk.logEvent(”iv$_a lert”,”IVBottleistooLOW”$);

digitalWrite(BUZZER, HIGH);

else

digitalWrite(BUZZER, LOW);

Blynk.virtualWrite(V0,liter);

Blynk.virtualWrite(V1,val);

Chapter 5

Results and Discussion

The Working of the system is divided into different steps of analysis and results to get a clear picture and understand the functioning of the project. In the following steps different operations and results are shown where the flow chart of the project is satisfied.

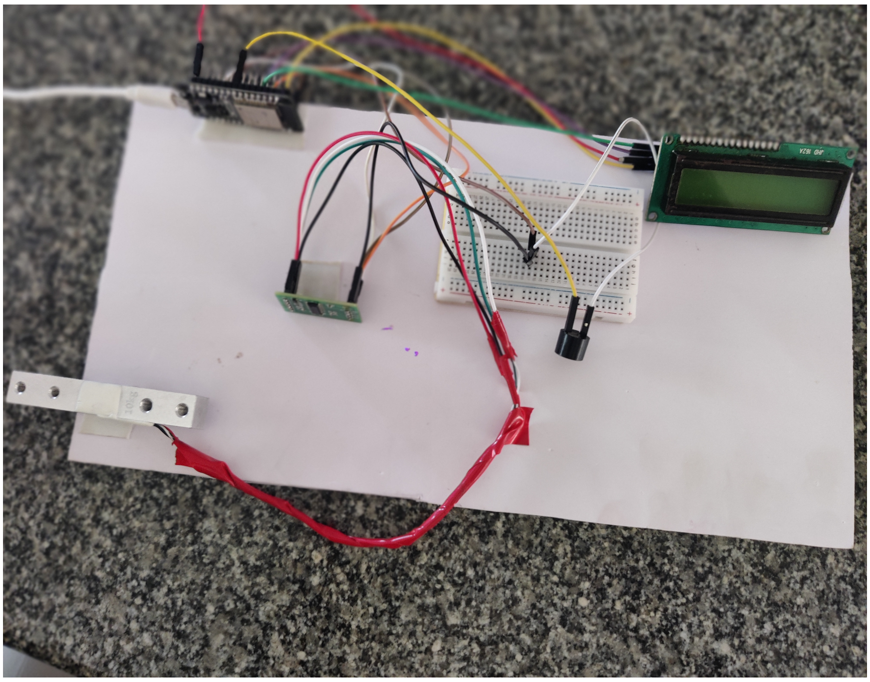

Figure 5.1: Prototype Of Model

As the system is turned on the Title of the Project is displayed on the LED Display.

As the weight is changed, the weight of the bag is simultaneously updated on the Blynk server which is shown in the below figure.

Figure 5.2: Alert On Blynk Application

Once the weight falls below the Threshold level the user is alerted through blynk S as well. An alert “Replace with New Bottle” is sent on Email.

This section would discuss the accuracy and reliability of the monitoring system in accurately measuring and tracking parameters such as fluid level, temperature, and flow rate. It would detail any validation or calibration procedures undertaken to ensure the system’s accuracy.Alerting and Alarm System: The effectiveness of the alerting and alarm system would be evaluated, including the system’s ability to detect anomalies in sensor data and promptly notify healthcare personnel. Discussions may include the types of alerts generated, their severity levels, and the responsiveness of healthcare staff to these alerts.Real-time Monitoring: This section would highlight the benefits of real-time monitoring provided by the system, such as the ability to quickly identify and address issues with IV infusion processes. It may discuss specific instances where real-time monitoring led to improved patient outcomes or prevented adverse events

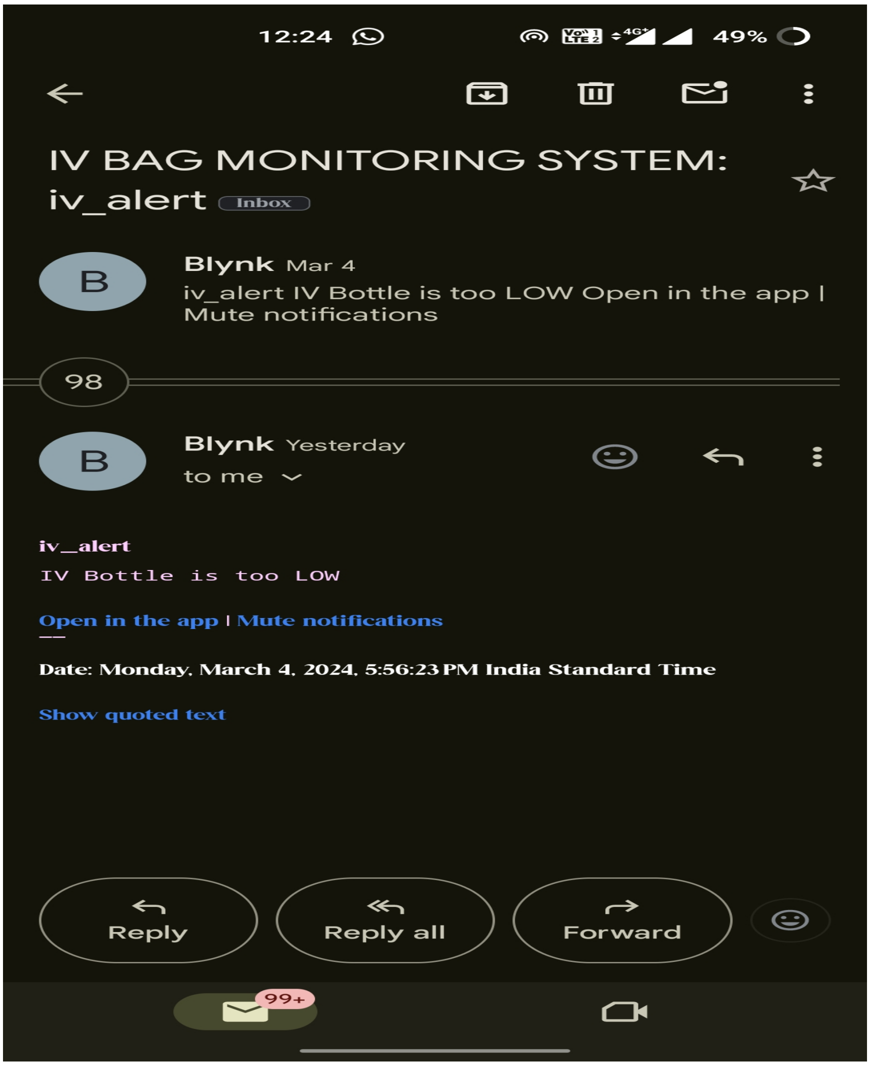

Figure 5.3: Alert Received On Email

Chapter 6

Outcome and Future Scope of Work

- The real-time monitoring of the intravenous drip infusion system is examined using an Internet of Things (IoT) embedded system.Intravenous (IV) drip monitoring systems play a critical role in ensuring the safety and efficacy of patient treatment. These systems can help healthcare professionals to accurately monitor the delivery medications and fluids, detect any deviations from prescribed dosages or flow rates, and quickly respond to any potential complications or adverse events.

- The use of an Intravenous Bag Monitoring system can help healthcare providers to monitor the status of intravenous therapy in real-time and take appropriate actions if any issues arise. Intravenous Bag Monitoring systems have several benefits for patients and healthcare providers. They can help reduce the risk of medication errors, improve patient outcomes, and reduce healthcare costs.

- By providing real-time monitoring of intravenous therapy, healthcare providers can quickly identify and respond to issues, such as changes in fluid levels, that could negatively impact patient care. In conclusion, IV drip monitoring systems are essential tools for modern healthcare settings, and their use can significantly improve patient outcomes and safety.

- As technology continues to advance, it is likely that these systems will become even more sophisticated and effective in the years to come, further enhancing the quality of care provided to patients receiving IV treatments.

Chapter 7

Conclusion

The study proposes an IOT-based monitoring and control platform for IV Set up inspiration. Suggested work reduces the amount of time and effort. Essential for monitoring infusion setups and allows for wireless monitoring. This system can be quickly installed on the stand where the drip bottle is hung, Makes a bottle replacement. It helps ensure that there is zero margin for error as improper administration. Drops can lead to many problems. It also improves clinical efficacy, safety and the patient experience in hospitals and home care is possible for many people patients and we additionally add medicine reminder which helps to the patients. The project's investigation's conclusions led to the conclusion that its users—nurses who work in hospitals with a high patient volume, in particular—will benefit immensely from it. Thanks to this clever technology, nurses will have more time to complete other tasks in addition to checking the patient's IV bag on a regular basis. Another benefit of this discovery is its suitability for night-time patient monitoring. This novel instrument is also considered to have considerable potential because of its low development cost and high commercialization potential.The real-time monitoring of the intravenous drip infusion system is examined using an Internet of Things (IoT) embedded system.It effectively combines non-contact type ultrasonic sensor with other electronic . A durable, affordable, and trustworthy system to monitor drip infusions in any situation is established by using a cloud

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