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IV BAG MONITORING FOR HOSPITAL WITH SOS BUTTON HEART RATE AND OXYGEN MONITORING FOR PATIENT CARE BY IOT MONITORING DASHBOARD

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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 like 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. Once the system detects that the bottle has gone empty, it sends an alert over IoT. Also this system have SOS button whenever patient have some emergency patient press that button. These buttons empower patients to communicate emergencies or distress directly to healthcare providers. Studies emphasize the positive impact of such technology on patient outcomes, reducing response times and enhancing overall patient satisfaction. This system also capable to monitor Heart rate and Oxygen level and share that that on IoT dashboard real time for patient health monitoring.

***Key Words*:** IV bag monitoring, Internet of Things (IoT), patient monitoring, IoT dashboard, heart rate monitoring, oxygen monitoring.

1. INTRODUCTION

In recent years, the field of healthcare has witnessed a paradigm shift towards integrating cutting-edge technologies to enhance patient care and safety. One such revolutionary development is the incorporation of advanced monitoring systems for Intravenous (IV) bags, ushering in a new era of precision and responsiveness in medical treatment. This review paper aims to explore and analyze the emerging trend of IV bag monitoring, specifically focusing on the integration of body temperature monitoring and the incorporation of SOS buttons. Intravenous therapy remains a cornerstone in medical practice, delivering essential fluids, medications, and nutrients directly into the bloodstream. Despite its widespread use, traditional IV administration has faced challenges related to monitoring and ensuring patient well-being. The integration of state-of-the-art monitoring technologies seeks to address these challenges by providing real-time insights into crucial parameters, thereby fostering a safer and more efficient healthcare environment.

Body temperature monitoring has long been recognized as a vital sign indicative of overall health and physiological stability. The incorporation of temperature sensors into IV bag monitoring systems offers a comprehensive approach to patient care. By continuously tracking body temperature during IV therapy, healthcare providers can detect early signs of fever, infections, or adverse reactions, allowing for prompt intervention and personalized adjustments to the treatment plan. The addition of an SOS button to IV bag monitoring systems introduces an extra layer of patient empowerment and safety. This feature enables patients to communicate distress or emergencies directly to healthcare providers, facilitating rapid response and intervention. The SOS button serves as a proactive measure, especially for patients with limited mobility or those undergoing self-administered therapies, ensuring that assistance is readily available in critical situations. As we delve into the advancements in IV bag monitoring with body temperature and SOS button integration, this review will explore the underlying technologies, their practical applications, and the potential impact on patient outcomes. Additionally, we will examine the challenges and ethical considerations associated with implementing such systems, shedding light on the balance between technological innovation and responsible healthcare practices.

IoT technology into hospital environments offers immense potential for improving patient care and safety. By combining IV bag monitoring with SoS functionality and continuous vital sign monitoring, the proposed system enhances the ability of healthcare providers to deliver timely interventions and personalized care. IoT-enabled monitoring dashboard architecture, highlighting its key functionalities and technical specifications. Emphasis is placed on the integration of the IV fluid level monitoring, Body temperature, SoS button, heart rate and oxygen level monitoring modules, along with their respective sensors and communication protocols.

3. METHODOLOGY

The system makes use of a Weight Sensor with an NodeMCU microcontroller with Wi-Fi 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. A small rod stretching from the top allows user to suspend the weight sensor hook on the stand. The weight sensor is used to measure the weight of empty IV bag at first. This is considered as empty weight. When the IV bag is suspended onto the sensor stand, it keeps on dripping until the fluid runs out.

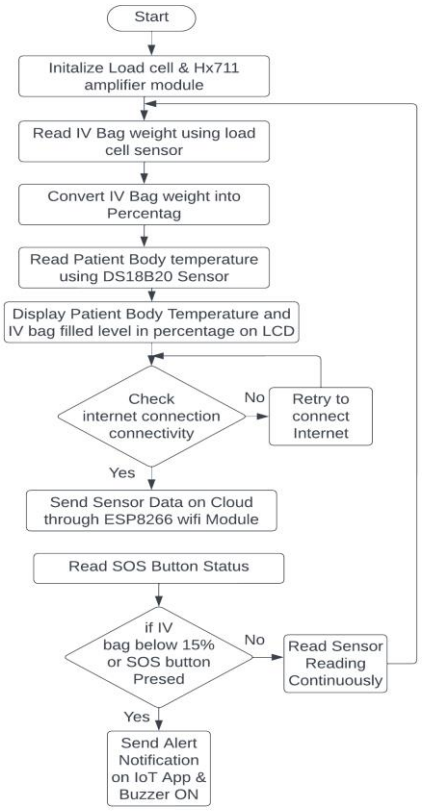

Fig -1: Flow Chart of IV Bag Monitoring

This system also measure patient body temperature using DS18B20 Temperature sensor and send this data to IoT cloud for monitoring purpose also have SOS button for emergency patient can pressed this button for call Nurse for any emergency.

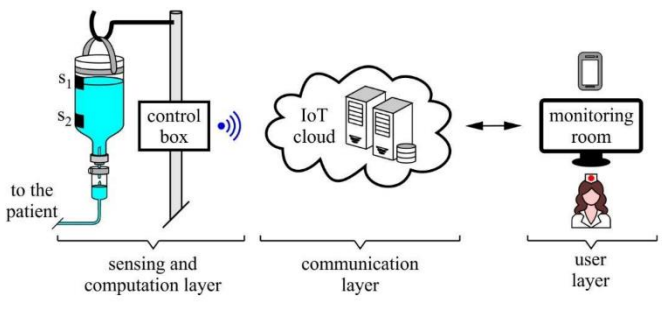

Fig -2: IV Bag Monitoring System Structure

The weight sensor value is constantly transmitted to NodeMCu microcontroller. The controller constantly processes this data and processes it. The current level of IV bag is parallelly displayed on an LCD display. Also this data is transmitted on IOT server via Wi-Fi Module. This level is displayed on IOT server online. As soon as the level falls below certain level its LCD display as well as Online dashboard displays as bag empty. This system also have SOS button which is used for any emergency with the help of this button patient can communicate with healthcare provider and this system monitor patient body temperature using DS18B20 sensor and heart rate and oxygen level using Max30102 and send all this data to IoT dashboard through NodeMcu ESP8266 controller whenever it connected to internet for real time monitoring of patient from anywhere. The proposed IoT monitoring system is complemented by a user-friendly dashboard interface, accessible to healthcare professionals through web or mobile applications. The dashboard provides comprehensive visualization of patient data, including IV fluid levels, Body temperature, and SoS alerts, Heart Rate and Oxygen level enabling efficient monitoring and decision-making.

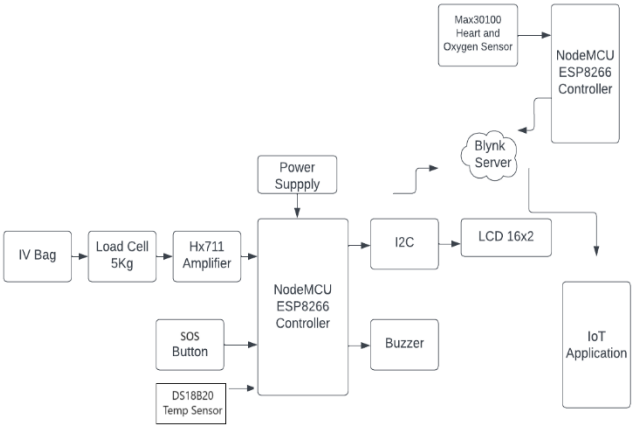

Fig -3: IV Bag Monitoring with Heart Rate and Oxygen Sensor

4. COMPONENT DETAILS

NodeMCU ESP8266 Controller

Fig -4: NodeMCU ESP8266 Controller

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was

added. NodeMCU is an open-source firmware and development kit that helps you to prototype your IoT (Internet of Things) projects. It uses the Lua scripting language and is based on the ESP8266 Wi-Fi module. The ESP8266 is a low-cost Wi-Fi module with full TCP/IP stack and microcontroller capability, making it suitable for a variety of IoT applications.

Load Cell

Fig -5: Load Cell Sensor

The load cell is a transducer that transforms force or pressure into electrical output. The magnitude of this electrical output is directly proportional to the force being applied. Load cells have a strain gauge, which deforms when pressure is applied to it. And then strain gauge generates an electrical signal on deformation as its effective resistance changes on deformation. A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. Load cell comes in various ranges like 5kg, 10kg, 100kg and more, here we have used Load cell, which can weigh up to 40kg.

LCD

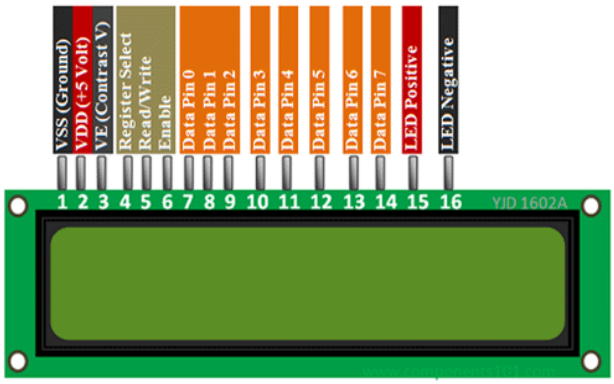

Fig -6: LCD 16x2

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data. The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

DS18B20 Temperature Sensor

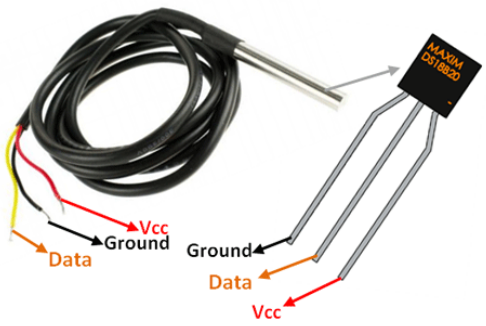

Fig -7: DS18B20 Temperature Sensor

The DS18B20 is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The constriction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from -55°C to +125° with a decent accuracy of ±5°C. Each sensor has a unique address and requires only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

MAX30102

Fig -8: MAX30102 Heart Rate and Oxygen Monitoring sensor

The MAX30102 is an integrated pulse oximetry and heart-rate monitor module. It includes internal LED, photodetectors, optical elements, and low-noise electronics with ambient light rejection. The MAX30102 provides a complete system solution to ease the design-in process for mobile and wearable devices. The MAX30102 operates on a single 1.8V power supply and a separate 3.3V power supply for the internal LEDs. Communication is through a standard I2C-compatible interface.

5. CONCLUSION

The integration of IoT technologies into hospital patient care represents a paradigm shift in healthcare delivery, offering unprecedented opportunities for enhancing patient safety, efficiency, and quality of care. Our proposed IoT monitoring dashboard presents a holistic approach to addressing the diverse monitoring needs of hospitalized patients, encompassing IV bag monitoring with an SOS button, Body temperature, as well as real-time tracking of heart rate and oxygen levels. By harnessing the power of interconnected devices and data analytics, our system empowers healthcare providers with actionable insights, enabling timely interventions and personalized care delivery. Moving forward, further research and implementation efforts are warranted to validate the effectiveness and scalability of our approach in diverse clinical settings, ultimately contributing to the advancement of patient-centered healthcare practices.

5. RESULT

Implementing IV bag monitoring with an SOS button, alongside heart rate and oxygen monitoring through an IoT dashboard, can significantly enhance patient care in hospitals. Here's how each component contributes to improved healthcare:

IV Bag Monitoring: IV bags are crucial for delivering medications, fluids, and nutrients to patients. By integrating monitoring sensors into the IV bags, hospitals can ensure that the right fluids are administered at the correct rate. This helps prevent under or over-administration, reducing the risk of complications or adverse reactions.

SOS Button: Placing an SOS button within reach of patients allows them to quickly alert healthcare providers in case of emergencies or urgent needs. This immediate communication enables rapid response times, enhancing patient safety and satisfaction.

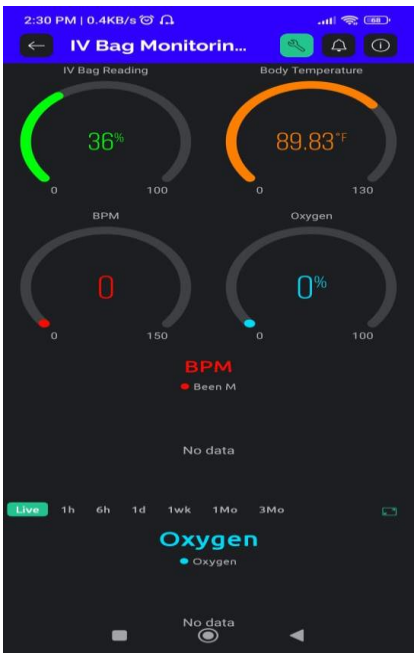

Fig -9: Mobile Application IoT Based Patient IV Bag Monitoring Dashboard

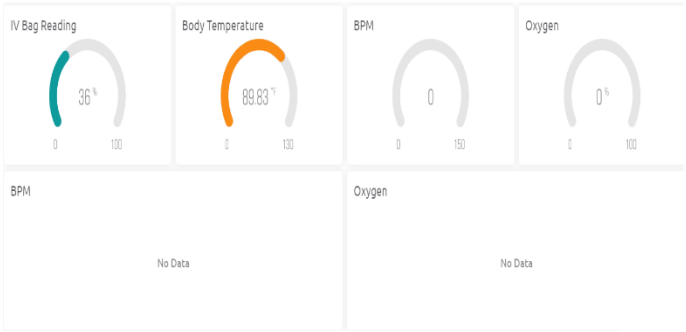

Fig -9: Web Application IoT Based Patient IV Bag Monitoring Dashboard

Heart Rate Monitoring: Continuous heart rate monitoring provides real-time data on a patient's cardiac activity. Sudden changes or irregularities in heart rate can indicate potential health issues such as arrhythmias or cardiac distress. Early detection through constant monitoring allows healthcare professionals to intervene promptly, potentially preventing adverse events.

Oxygen Monitoring: Monitoring oxygen levels in the blood is crucial, especially for patients with respiratory conditions or undergoing surgery. Low oxygen saturation (hypoxemia) can lead to tissue damage and organ failure if not addressed promptly. With IoT-enabled oxygen monitoring, healthcare providers can track oxygen levels remotely and receive alerts if they fall below safe thresholds, facilitating timely interventions.

IoT Monitoring Dashboard: Integrating all these functionalities into a centralized IoT monitoring dashboard provides healthcare professionals with a comprehensive view of patient status in real-time. The dashboard displays vital

signs, IV fluid levels, and SOS alerts, allowing for proactive management and timely decision-making. It can also store historical data for analysis and trend identification, aiding in long-term care planning and optimization of treatment protocols.

Overall, the integration of IV bag monitoring with SOS buttons, heart rate, and oxygen monitoring via an IoT dashboard offers a holistic approach to patient care, emphasizing proactive monitoring, rapid response, and data-driven interventions, ultimately improving patient outcomes and healthcare delivery efficiency.

REFERENCES

1. Shelishiyah, R.; Suma, S.; Reji, J.R.M. A system to prevent blood backflow in intravenous infusions. In Proceedings of the 2nd International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), Coimbatore, India, March 2022.
2. R. Su, Z. Cai, X. Wei, and W. Wang," Design of an Intelligent Intravenous Infusion Monitoring System Based on IoT," Journal of Sensors, vol. 2018, Article ID 3961016, 7 pages, 2020.https://doi.org/10.1155/2018/3961016.
3. Pratim, R.P.; Thapa, N. A systematic review on real-time automated measurement of IV fluid level: Status and challenges Measurement 2021.
4. Priyadharshini, R.; Mithuna, S.; Vasanth, K.U.; Kalpana, D.S.; Suthanthira, V.N. Automatic intravenous fluid level indication system for hospitals. Int. J. Res. Appl. Sci. Eng. Technol. 2021.
5. P. Kumar, P. Kumar, R. Gupta, and A. Mittal," Smart IV Drip Monitoring System Using IoT," International Journal of Engineering Technology, vol. 7, no. 2.26, pp. 33-37, 2021.
6. Pratim, R.P.; Thapa, N.; Dash, D.; De, D. Novel implementation of IoT based non-invasive sensor system for real-time monitoring of intravenous fluid level for assistive e-healthcare. Circuit World 2022.
7. Joseph, S.; Francis, N.; John, A.; Farha, B.; Baby, A. Intravenous drip monitoring system for smart hospital using IoT. In Proceedings of the 2nd International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICICT), Kannur, Kerala, India, 5–6 July 2021.
8. S. Tawade, M.S. Pendse, H.P. Chaudhari "Design and Development of Saline Flow Rate Monitoring System using Flow Sensor, Microcontroller and RF ZigBee Module" International Journal of Engineering Research and General Science(IJERGS) Volume 3, Issue 3, MayJune, 2020 Pg.no: 472-478.
9. K. Kumari and P. Kumar, "IoT Based IV Drip Monitoring and Alerting System," International Journal of Innovative Research in Science, Engineering and Technology, vol. 8, no. 1, pp. 143-146, 2022.