REVIEW PAPER ON IV BAG MONITORING USING IOT FOR HOSPITALS

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Abstract - 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. The proposed system alerts medical staff to continuous and timely changes of IV bottles, which can have positive effects on increasing the success of IV therapy, especially in oncology patients. The prescribed drip time of IV chemotherapy for the full effect of cytostatic should be imperative.
***Key Words*:** Intravenous Fluid Monitoring, IV bottle, Alert over IoT.

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.

2. LITERATURE REVIEW

In order to treat a variety of medical diseases, intravenous (IV) therapy, which delivers fluids and drugs straight into the bloodstream, is a crucial component of contemporary healthcare. Advanced technologies like body temperature monitoring and SOS buttons have been incorporated into IV bag systems due to the necessity for improved monitoring systems. This review of the literature looks at recent studies and advancements in the area, investigating how these integrated technologies affect patient outcomes, safety, and the entire healthcare delivery environment.

1. IV Bag Monitoring Systems:

The evolution of IV bag monitoring systems has been marked by a growing emphasis on patient safety and treatment efficacy. Early monitoring systems primarily focused on flow rates and volume measurements. Recent advancements have expanded the scope to include real-time tracking of additional parameters, providing a more comprehensive understanding of the patient's physiological status during IV therapy.

2. Body Temperature Monitoring in Healthcare:

Body temperature is a critical physiological parameter, often considered one of the vital signs. The integration of temperature sensors into IV bag monitoring systems enables continuous monitoring, offering insights into the patient's thermal status. Several studies highlight the significance of early detection of fever or hypothermia during IV therapy, as it can inform timely interventions and prevent complications.

3. SOS Button Technology in Healthcare:

The incorporation of SOS buttons into medical devices, including IV bag monitoring systems, aligns with the broader trend of patient-centric care. 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.

4. Integration Challenges and Solutions:

While the benefits of integrating body temperature monitoring and SOS buttons into IV bag systems are evident, researchers have addressed challenges related to device integration, data security, and user acceptance. Studies have proposed solutions such as standardized communication protocols, robust cybersecurity measures, and user-friendly interfaces to overcome these hurdles.

5. Clinical Outcomes and Future Implications:

Preliminary studies exploring the impact of integrated IV bag monitoring systems on clinical outcomes have shown promising results. Improved detection of adverse events, early intervention, and enhanced patient satisfaction are common themes in the literature. Further research is needed to establish the long-term effects and cost-effectiveness of these technologies in diverse healthcare settings.

3. METHODOLOGY

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. 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.

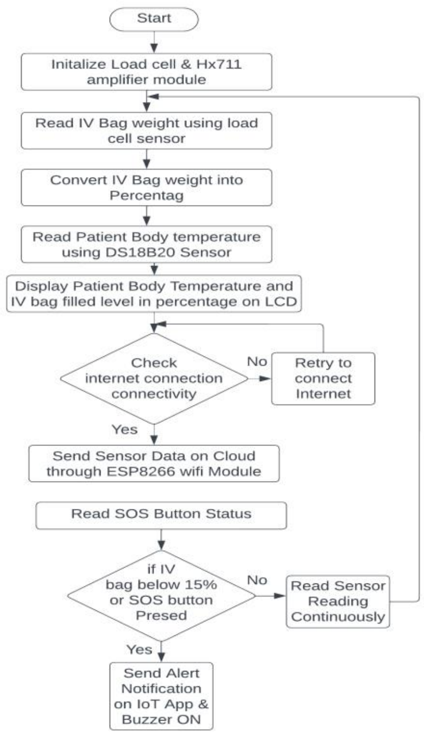

Fig -1: Flow Chart of IV Bag Monitoring

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.

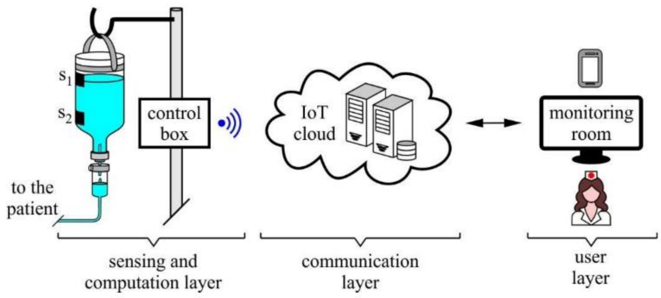

Fig -2: IV Bag Monitoring System Structure

4. COMPONENT DETAILS

NodeMCU ESP8266 Controller

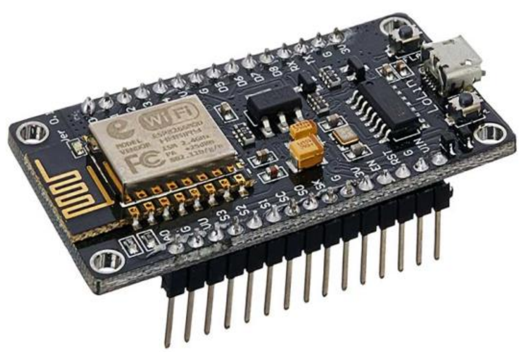

Fig -3: NodeMCU ESP8266 Controller

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

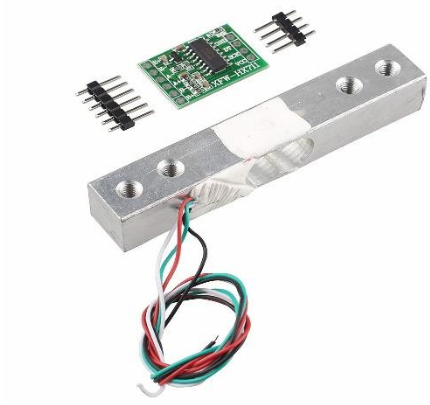

Fig -4: Load Cell Sensor

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 -5: 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

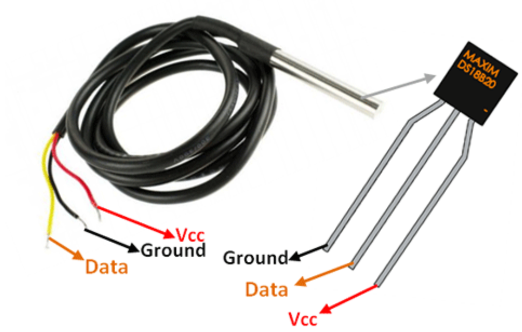

Fig -6: DS18B20 Temperature Sensor

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.

5. CONCLUSION

The integration of body temperature monitoring and SOS buttons into IV bag systems represents a significant advancement in patient care. These technologies contribute to early detection of physiological changes, timely interventions, and increased patient engagement. As research continues, the collective knowledge will guide the widespread implementation of these innovations, shaping the future of IV therapy and healthcare delivery. By providing healthcare professionals with real-time using IoT empowering patients to actively participate in their own well-being, these advancements hold the promise of transforming the landscape of intravenous therapy.

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