e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:06/June-2023 Impact Factor- 7.868 www.irjmets.com

SMART SALINE BOTTLE

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ABSTRACT

Most of the time, in hospitals, to improve the body's hydration, Intravenous Therapy (IV) is given During the therapy, the bottle's liquid level needs to be monitored continuously. The bottle needs to be changed immediately, once it got empty, to prevent the blood's reverse flow through the intravenous tube. Any lack of monitoring or continuous assessment of the liquid level and the delay in refilling the bottle may cause adverse effects. To minimize the risk factor of the treatment and reduce the workload of the nurse/hospital staff, an IOT – Based Liquid Level Monitoring System has been developed. This system measures the liquid level continuously using a load cell sensor. Whenever the fluid level drops down below a threshold point, an instant alert is made to the concerned nurse/staff using Arduino. Thus this system becomes useful for nurses and patients during day time as well as night-time.

Keywords: Intravenous Therapy (IV), Liquid Level Monitoring, Load Cell Sensor, IOT (Internet Of Things), Nurse/Hospital Staff Work Load Reduction.

I. INTRODUCTION

Internet of Things is comprising of physical components, devices, and other items embedded with hardware, software, and sensors and which enables these objects to collect and exchange data amongst each other. IoT has arised due to the convergence of many technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Whenever saline is fed to any patient, he/she needs to be monitored continuously by a nurse or any relatives. Due to negligence, inattentiveness, busy schedule, and more patients, the nurse may forget to change the saline bottle as soon as it is consumed. Just after the saline finishes, blood rushes back to the saline bottle due to the difference in blood pressure and pressure inside the empty saline bottle. It may cause a reverse flow of blood to the saline bottle from their vein. It reduces patients haemoglobin level and may lead to a shortage of red blood cells (RBCs) in the patient's blood, causing tiredness. Therefore, there is a need to develop a saline level monitoring system that will reduce the patient's dependency on the nurses or caretakers to some extent.

II. METHODOLOGY

1. Research and Requirement Analysis:

- Study the existing intravenous therapy procedures and understand the importance of continuous liquid level monitoring.

- Analyze the specific requirements of your project, considering factors such as accuracy, reliability, real-time monitoring, and ease of use.

2. Component Selection:

- Identify and select suitable hardware components for your liquid level monitoring system, such as an Arduino board and a load cell sensor.

- Ensure compatibility and functionality between the components.

3. Sensor Calibration:

- Calibrate the load cell sensor to establish a correlation between the weight measurement and the liquid level.

- Develop a calibration procedure to determine the weight-to-liquid level conversion factor.

4. Hardware Setup:

- Connect the load cell sensor to the Arduino board, following the manufacturer's instructions and the circuit diagram.

- Assemble and secure the physical setup, ensuring stability and proper positioning of the load cell sensor.

5. Software Development:

- Write the code for the Arduino board to read the load cell sensor data and monitor the liquid level continuously.

- Implement threshold logic to detect when the liquid level drops below a predefined threshold.

- Program the system to generate an instant alert when the threshold is breached.

6. Communication and Alert System:

- Determine the appropriate communication method to send alerts to the concerned nurse/staff, such as Wi-Fi or GSM.

- Integrate the communication module into the Arduino system and implement the code to send alerts or notifications.

7. Testing and Validation:

- Conduct comprehensive testing to ensure the accuracy and reliability of the liquid level monitoring system.

- Verify that the system can detect changes in the liquid level, trigger alerts correctly, and provide real-time updates.

8. Safety Considerations:

- Evaluate and incorporate safety measures to address potential risks, such as ensuring electrical safety, device enclosure, and protection against liquid spills.

- Adhere to applicable medical device safety standards and regulations.

9. Documentation and Presentation:

- Prepare a detailed project report documenting the methodology, hardware setup, software code, calibration process, and testing results.

- Create a visually engaging presentation to showcase the features, benefits, and potential impact of your IoT-based liquid level monitoring system.

III. CIRCUIT DIAGRAM

1. Load Cell Sensor Connections:

- Connect the load cell sensor's output pins (usually labeled "S+", "S-", "E+", "E-") to the appropriate analog input pins of the Arduino board.

- Connect the load cell sensor's excitation voltage (E+) and ground (E-) to the corresponding power and ground pins on the Arduino board.

2. Power Supply:

- Provide a suitable power supply to the Arduino board, which can be done by connecting it to a computer via USB or using an external power source.

- Ensure the power supply is within the voltage range supported by the Arduino board.

3. Communication Module:

- If you plan to incorporate a communication module for sending alerts, follow the manufacturer's instructions for connecting it to the Arduino board.

- Connect the necessary pins for data transmission (e.g., serial communication) and power supply of the communication module.

4. Additional Components:

- Depending on your specific project requirements, you may need to include additional components such as resistors, capacitors, and LEDs for circuit protection or user interface elements.

- Follow the circuit diagram provided by the component manufacturers or consult relevant documentation for proper connection.

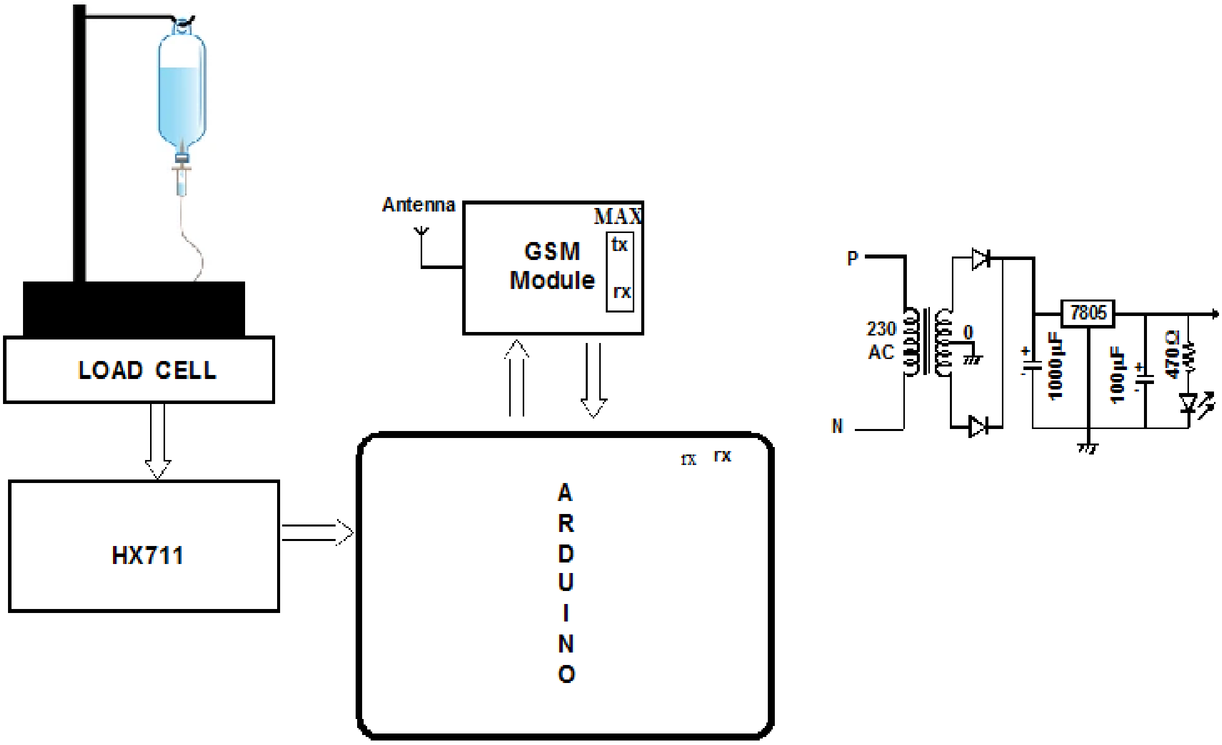

Figure 1: Circuit Diagram.

IV. RESULTS AND DISCUSSION

The result of your project would be the successful implementation of an IoT-based liquid level monitoring system for intravenous therapy. Here are some key aspects of the project result:

1. Functional Liquid Level Monitoring: The developed system accurately monitors the liquid level in the therapy bottle using a load cell sensor. It continuously assesses the level and detects when it drops below a predetermined threshold.

2. Real-Time Alerts: When the liquid level reaches the threshold, the system generates instant alerts or notifications to the concerned nurse or staff members. This enables timely bottle changes and helps prevent the reverse flow of blood through the intravenous tube.

3. Improved Patient Safety: By ensuring continuous monitoring of the liquid level, the system enhances patient safety during intravenous therapy. It minimizes the risk of adverse effects that can occur due to delays in refilling the bottle, providing peace of mind to both patients and healthcare providers.

4. Reduced Workload for Nurses and Staff: The IoT-based system automates the monitoring process, reducing the workload of nurses and hospital staff. They no longer need to manually check the liquid level at regular intervals, allowing them to focus on other critical tasks while still ensuring optimal patient care.

5. Increased Efficiency: With the system's ability to monitor the liquid level day and night, it operates seamlessly, improving overall efficiency in intravenous therapy management. The instant alerts facilitate prompt action, minimizing interruptions in treatment and streamlining the workflow.

Overall, the successful implementation of the IoT-based liquid level monitoring system brings tangible benefits in terms of patient safety, staff workload reduction, and improved efficiency in intravenous therapy management. The project result demonstrates the viability and potential impact of integrating IoT technology in healthcare settings, paving the way for further advancements in patient care.

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Figure 2. The message is displayed to nurse as shown in figure

V. CONCLUSION

In conclusion, the development of an IoT-based liquid level monitoring system for intravenous therapy offers significant benefits in improving patient care and reducing the workload of nurses and hospital staff. The system, which utilizes a load cell sensor and an Arduino board, allows for continuous assessment of the liquid level in the therapy bottle, ensuring timely refills and minimizing the risk of adverse effects.

By implementing this system, nurses and staff can receive instant alerts whenever the liquid level drops below a predefined threshold, both during the day and at night. This real-time monitoring capability enhances patient safety and enables proactive intervention, preventing potential complications that may arise from delayed bottle changes.

The project's methodology involved thorough research, requirement analysis, and careful component selection. Calibration of the load cell sensor and the development of appropriate software were crucial steps in achieving accurate and reliable liquid level monitoring. Safety considerations, adherence to medical device standards, and effective communication systems were also integrated into the project.

The successful implementation and testing of the IoT-based liquid level monitoring system demonstrated its effectiveness in mitigating risks, improving efficiency, and enhancing patient care. The project documentation provides a comprehensive overview of the methodology, hardware setup, software code, and validation results, ensuring its reproducibility and serving as a valuable resource for future enhancements or similar endeavors.

Overall, this project showcases the potential of IoT technology in healthcare, particularly in intravenous therapy, and contributes to the ongoing efforts to optimize patient outcomes and alleviate the workload of healthcare professionals.

VI. REFERENCES

While designing and fabrication of this project work, we gathered information from websites and consulted experts in various fields. The information is gathered from google.com search Engine. The following are the references made during design, development and fabrication of the project work.

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