

# Review Paper on Automatic Saline Water Level Monitoring & Controlling System Using IOT

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*Automatic Saline Level Monitoring & Controlling: Real-Time Saline Guard with IOT paradigm*

**Abstract -Advancements in healthcare technology have improved patient monitoring, addressing the rising demand due to global population growth. Intravenous saline is crucial, especially for COVID-19 patients, but manual administration poses risks like reverse blood flow and overinfusion. To enhance safety and reduce human error, a saline level monitoring and automatic alert system has been proposed particularly vital in pandemic scenarios, where the medical staff is under extreme pressure and consistent manual monitoring is often impractical.**

## LITERATURE REVIEW

Kriti Ojha et al. [1] introduced an IoT-enabled saline level monitoring system. Their design employs a level sensor to deliver precise measurements. When the saline level drops below a predefined threshold, it triggers a Bluetoothbased alert to notify healthcare personnel.

Sagnik Ghosh et al. [2] developed a smart saline bottle that integrates intelligent features. They utilized a linear regression algorithm to anticipate when the saline bottle needs replacement, thereby assisting medical staff in timely intervention.

Anusha Jagannath Achari et al. [3] created a saline monitoring system that tracks the saline flow and activates a DC motor mechanism along with a spring. This setup prevents blood backflow once the saline is depleted.

Karthik Maddala et al. [4] designed a system that displays both the saline level and flow on a 16×2 LCD screen. In case of depletion, it sends out alert messages to medical personnel.

Mustafa A. Al-Sheikh et al. [5] introduced a comprehensive monitoring system capable of tracking patient parameters such as temperature, heart rate, oxygen levels, and ECG. It uses an Android health monitoring app to relay all patient data for real-time tracking.

The IoT-based saline level monitoring system proposed by Kriti Ojha et al. as well as Development of intelligent and smart saline bottle proposed by Sagnik Ghosh et al. is an innovative solution, but it has some limitations that could be addressed for improved performance and scalability. There are drawbacks and potential ways to overcome them:

Threshold Point Adjustment: A fixed threshold point might not be ideal for all patients since saline infusion rates vary based on individual needs.

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## <sup>1</sup>. INTRODUCTION

The proposed project presents an IoT-based automatic saline level monitoring and control system designed to enhance patient safety and reduce human error in hospitals. Saline therapy is critical for treating dehydration and various ailments, especially in COVID-19 patients, where hypertonic saline helps reduce organ inflammation. However, manual monitoring of saline levels can lead to serious risks such as blood backflow or air embolism when the saline bag runs dry. To address this, the system employs sensors to detect the saline drop rate, triggering alerts via a buzzer when drops stop for a defined period. This ensures timely nurse intervention, even in busy or understaffed environments. The integration of IoT enables real-time data exchange and monitoring, making the system reliable and efficient for continuous patient care. This solution is

**Adaptive Threshold Settings:** Incorporate machine learning models to analyze patient-specific saline infusion rates and dynamically adjust threshold levels based on historical and real-time data.

**Connectivity Issues:** Bluetooth devices might face pairing and interference problems, especially in environments with multiple devices.

**Implement Cloud-Based Monitoring:** Use IoT cloud platforms to store and analyze real-time data, allowing notifications to be sent via SMS, emails, or mobile apps to nurses' devices anywhere in the hospital.

### BACKGROUND AND SIGNIFICANCE

An IoT-based system offers real-time, accurate monitoring, reduces risks, improves efficiency, and enables remote oversight, leading to better patient care and resource management.

In healthcare settings, the administration of intravenous (IV) fluids, particularly saline solutions, is a routine and critical procedure for patient hydration, medication delivery, and electrolyte balance. Traditionally, the monitoring and control of saline infusion relied heavily on manual observation by nurses and healthcare staff. This manual process is prone to several limitations, including:

**Human Error:** Nurses managing multiple patients can be subject to oversight, leading to delays in refilling empty saline bags or failing to detect critical low levels.

**Delayed Intervention:** The time lag between the saline level reaching a critical point and a nurse noticing can lead to complications like air embolism (if the bag runs dry) or backflow of blood into the IV line.

**Increased Workload:** Constant manual checks increase the workload on already burdened healthcare professionals, potentially diverting their attention from other critical tasks.

**Inaccurate Monitoring:** Visual estimation of saline levels can be subjective and inaccurate, potentially leading to suboptimal fluid administration.

**Lack of Real-time Data:** Manual methods do not provide continuous, realtime data on saline levels, making it difficult to track infusion rates and predict when a replacement bag will be needed.

The development of an automatic saline water level monitoring and controlling system using the Internet of Things (IoT) addresses these limitations and offers significant advantages for both patients and healthcare providers:

**Enhanced Patient Safety:** Continuous, automated monitoring significantly reduces the risk of complications associated with empty saline bags, such as air embolism and blood backflow. Timely alerts ensure prompt intervention.

**Improved Efficiency for Healthcare Professionals:** Automating the monitoring process frees up nurses and doctors from routine manual checks, allowing them to focus on more critical aspects of patient care. This can lead to better time management and reduced workload.

**Accurate and Real-time Monitoring:** IoT-based systems utilize sensors to provide precise and continuous data on saline levels. This real-time information can be accessed remotely, offering a comprehensive overview of the infusion process.

**Early Warning and Proactive Intervention:** The system can be programmed to trigger alerts at predefined low saline levels, allowing healthcare staff to proactively replace the bag before it runs completely dry.

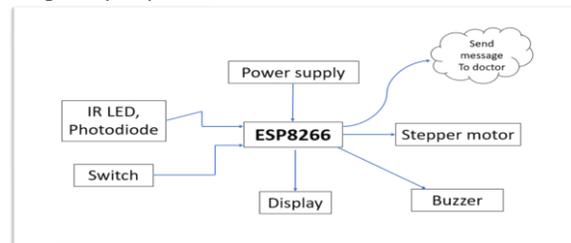


Fig1: Block Diagram

### INTERNET OF THINGS (IOT) TECHNOLOGY

IoT technology forms the core of the Automatic Saline Water Level Monitoring & Controlling System by enabling seamless data acquisition, processing, communication, and actuation. Sensors continuously monitor the saline level, feeding real-time data to the ESP8266 microcontroller. This "brain" analyzes the information, triggers local alerts via a buzzer and display, and can potentially control a stepper motor for automated flow. The crucial IoT aspect lies in the ESP8266's Wi-Fi connectivity, facilitating the

transmission of critical saline level data and alerts to remote healthcare professionals. This interconnectedness allows for continuous, remote monitoring and timely intervention, reducing reliance on manual checks and enhancing the safety and efficiency of saline administration in healthcare settings.

#### METHODOLOGY AND SYSTEM DESIGN

Methodology for Saline Level Monitoring System:

1. System Design: Architecture planning, hardware selection, and software design.
2. Hardware Development: Sensor calibration, microcontroller programming, and actuator Integration.
3. Software Development: Algorithm implementation, IoT platform integration, and Testing.
4. System Integration: Seamless hardware and software integration.
5. Testing and Validation: Thorough functional, performance, and usability testing.
6. Deployment and Maintenance: Efficient installation, training, and ongoing support.

By adopting this comprehensive methodology, our team ensures the development of a reliable, efficient, and innovative Automatic Saline Level Monitoring and Controlling System.

#### EXPERIMENTAL SETUP AND TESTING

Setup: Uses a saline container, IR sensor (for level), stepper motor (for control), ESP8266 (for processing & communication), display, buzzer, power supply, and simulated doctor's interface via Wi-Fi.

Testing: Evaluates sensor accuracy, low-level detection & alerts, automatic control, manual override, network connectivity, power consumption, longterm reliability, and user interface (display & buzzer).

Data: Collects sensor readings, alert timings, control performance, network stability, power use, and user feedback.

Outcome: Detailed report analysing system accuracy, reliability, and identifying areas for improvement.

#### CONCLUSION

The proposed system enables remote monitoring of saline levels, temperature, and blood oxygen via computer or smartphone, making it suitable for both hospitals and homes. It is especially useful at night, reducing the need for constant human supervision and lowering operational costs. The affordable, automated system minimizes human error, prevents reverse blood flow, and enhances patient safety through continuous real-time monitoring. This contributes to faster recovery and supports the development of a smart healthcare system.

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