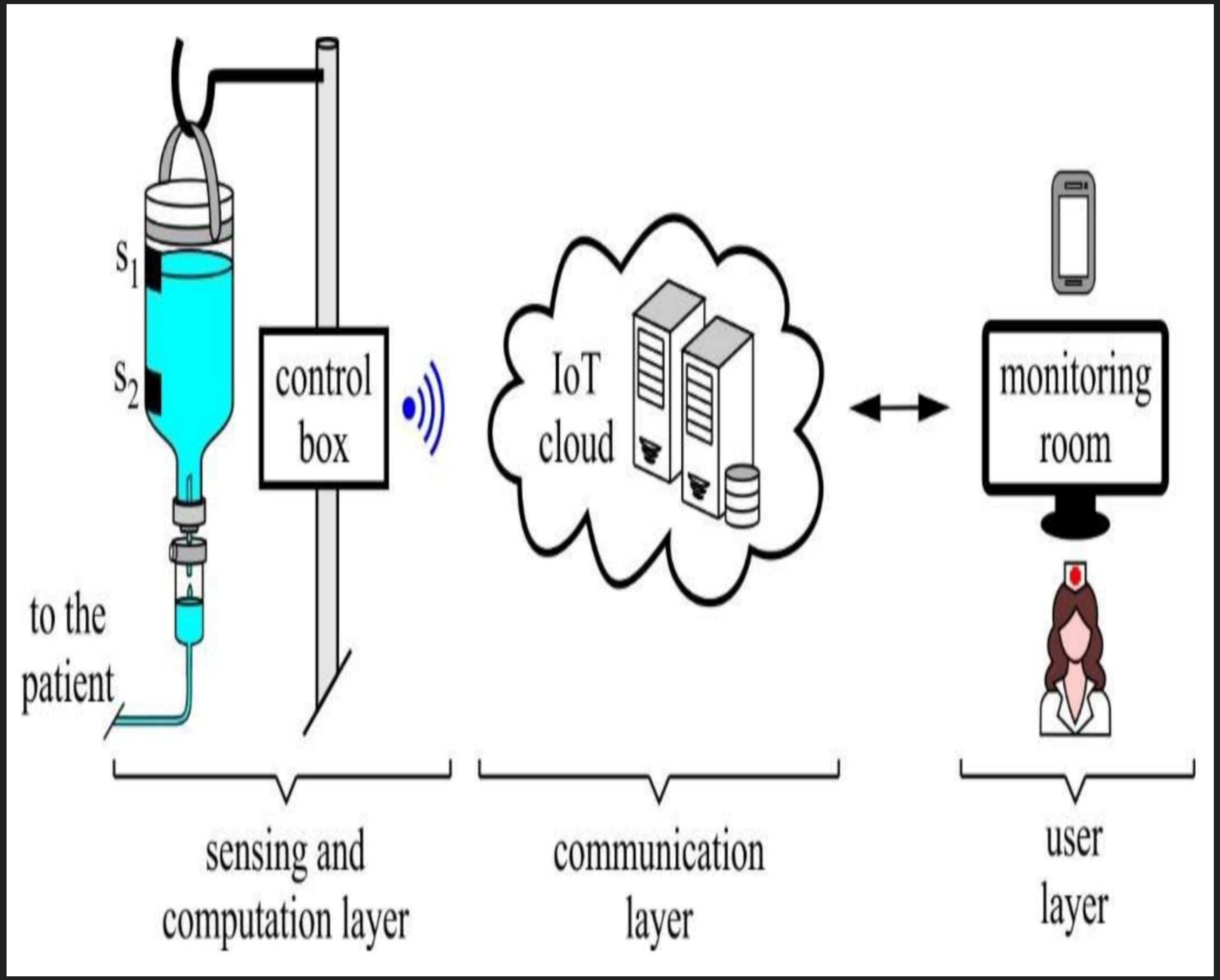
IOT BASED INTRAVENOUS DRIP SYSTEM



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PROBLEM STATEMENT

Healthcare settings face substantial issues with the manual administration of intravenous (IV) drip systems now in place. This calls for a paradigm change towards an Internet of Things (IoT)-based approach. In the current situation, hospitals have significant challenges in the efficient monitoring and management of IV drips, particularly during times of large patient influx like the COVID-19 pandemic. Healthcare personnel, especially nurses, often rely on manual oversight that is labor-intensive, prone to human error and oversights, and sometimes impeded by the heavy workloads on their schedules. The drawbacks of the current intravenous drip systems are addressed in this problem statement, which also emphasises the necessity for a creative and automated Internet of Things solution.

SOCIAL RELEVANCE PERSPECTIVE

CHALLENGES-

1-Human Error and Oversight : Human error can occur when manually monitoring IV drips, which can result in forgotten or postponed vital treatments like changing drip bottles. Patient safety may be jeopardised and negative health repercussions may arise from this.

2-Workforce limitations : Hospitals that are overcrowded and have a dearth of nurses may not give each patient's IV drip needs enough attention. The strain on medical staff members might cause them to neglect routine inspections and modifications, which would increase the risk to the well-being of patients.

3-Inefficient Resource Utilization: The current system's manual nature leads to an inefficient use of healthcare resources. Routine drip checks take up valuable nursing time that could be used for more involved patient care chores, hence raising the standard of care.

3-Real time monitoring challenges : It is a difficult effort to continuously monitor in real time the IV drips of several patients. This becomes particularly important in emergency situations or when a patient's health suddenly changes, as timely IV fluid adjustments are necessary for the best possible care.

4-Pandemic Preparedness : The COVID-19 pandemic has shown the susceptibility of healthcare systems to improper management of intravenous drips in emergency situations. In order to guarantee continuous treatment even in circumstances with excessive patient volumes, automated solutions are required.

OBJECTIVE

The goal is to create and put into use an IoT-based intravenous drip system that tackles the issues outlined above. In order to provide accurate control over the administration of IV fluids, this system should allow for automated monitoring, real-time data analysis, and intervention. Hospitals may improve the overall quality of healthcare delivery by utilising IoT technologies to improve patient safety, optimise resource utilisation, and strengthen their ability to respond effectively in both normal and emergency settings.

LITERATURE SURVEY

1-IoT in Healthcare: A Comprehensive Review:

- This comprehensive review provides an overview of the applications of IoT in healthcare, emphasizing the role of IoT in enhancing patient care and monitoring. The paper explores the potential of IoT in intravenous drip systems and highlights the need for automated solutions to improve accuracy and efficiency.

2-Challenges and Opportunities in Implementing IoT in Healthcare:

- Focusing on challenges and opportunities in IoT implementation in healthcare, this paper discusses the potential advantages and obstacles of applying IoT to intravenous drip systems. It addresses issues such as data security, interoperability, and scalability, providing insights into crucial considerations for successful implementation.

3-Automation of Intravenous Drip Monitoring Using IoT:

- This research paper delves into the technical aspects of automating intravenous drip monitoring through IoT. It discusses the architecture, sensor technologies, and communication protocols used in IoT-based systems. The study evaluates the effectiveness of automation in reducing human errors and improving patient outcomes.

4-Real-time Healthcare Monitoring System Using IoT:

- Focused on real-time healthcare monitoring, this paper explores how IoT technologies can be leveraged for continuous monitoring of patients receiving intravenous therapy. It discusses the integration of sensors, communication devices, and cloud computing to enable timely interventions and enhance overall healthcare quality.

5-Human-Centric IoT for Smart Healthcare: Opportunities and Challenges:

- Addressing the human-centric aspects of IoT in healthcare, this paper discusses the impact of IoT on healthcare professionals' workflow and patient care. It specifically explores the challenges and opportunities associated with implementing IoT in intravenous drip systems, emphasizing the need for user-friendly interfaces and seamless integration into existing healthcare practices.

6-Security and Privacy in IoT-Enabled Healthcare: A Comprehensive Survey

- Considering the critical nature of healthcare data, this survey paper examines security and privacy concerns in IoT-enabled healthcare systems. It provides insights into the measures and protocols required to ensure the confidentiality and integrity of patient information in IoT-based intravenous drip systems.

METHODOLOGY

To produce a fixed number of drops per unit time, the clinician adjusts the flow rate. Here, the driving pressure is the difference between the hydrostatic pressure generated by the column of liquid in the intravenous set and the venous pressure. The drop factor (also called the drip factor) of a drip set is the number of drops which make one ml of solution. It is drip set specific. It is relatively inexpensive, Best method if patient cannot tolerate drugs by oral or any other route, Immediate therapeutic effects is achieved due to rapid delivery of fluid to target sites. Risks involved in IV therapy: Medication error, Air embolism and Particulate contamination.

The proposed system makes use of Arduino Uno, HC SR-04 Ultrasonic Sensor, Light sensor, a light source and ESP8266-01 Wi-Fi module. The Arduino Uno will be connected to the ESP8266 modules and two sensors i.e., HC SR-04 and LDR. The Ultrasonic sensor will be attached to the top of the drip along with a small light source and LDR will be placed at the bottom of the infusion bottle. Arduino UNO is used to retrieve and calculate sensor data. The calculated sensor values will be conveyed to the ThingSpeak website via the ESP8266 module which will then be retrieved by the android application to notify the nurses about the fluid levels and formation of bubbles in the drip.

DELIVERABLES

System Architecture Design:

- Detailed documentation outlining the architecture of the IoT-based intravenous drip system, including the interaction between sensors, communication modules, cloud services, machine learning components, and user interfaces.

Prototype Development:

- A functional prototype of the IoT-based intravenous drip system, showcasing the integration of sensors, communication protocols, and the decision-making algorithm.

Algorithm Implementation:

- Codebase for the algorithms governing data acquisition, processing, decision-making, and automation within the intravenous drip system.

Data Security Measures:

- Documentation and implementation of robust security measures, including encryption protocols and access controls, to ensure the confidentiality and integrity of patient data.

User Interface Design:

- User interface designs for web or mobile applications, enabling healthcare providers to monitor IV drip status, receive alerts, and intervene when necessary.

Scalability Plan:

- A plan for scaling up the deployment of the system across multiple healthcare facilities, addressing considerations for scalability, interoperability, and integration with diverse infrastructure.

Training Materials:

- Training materials for healthcare professionals on the usage, monitoring, and intervention procedures related to the IoT-based intravenous drip system.

Maintenance and Support Plan:

- A detailed plan outlining maintenance procedures, support mechanisms, and contingency plans to ensure the ongoing functionality and reliability of the deployed system.

COMPONENTS

- Aurduino uno
- Ultrasonic sensor
- ESP 8266(Node MCU)
- Servo
- Clamp
- LDR
- Light source

ARCHITECTURE

Development of system

The proposed system makes use of Arduino Uno, HC SR-04 Ultrasonic Sensor, Light sensor, a light source and ESP8266-01 Wi-Fi module. The Arduino Uno will be connected to the ESP8266 modules and two sensors i.e., HC SR-04. The Ultrasonic sensor will be attached to the top of the drip along with a small light source will be placed at the bottom of the infusion bottle. Arduino UNO is used to retrieve and calculate sensor data. The calculated sensor values will be conveyed to the Arduino cloud website via the ESP8266 module which will then be retrieved by the android app dashboard notify the nurses about the fluid levels and formation of bubbles in the drip

Design and working

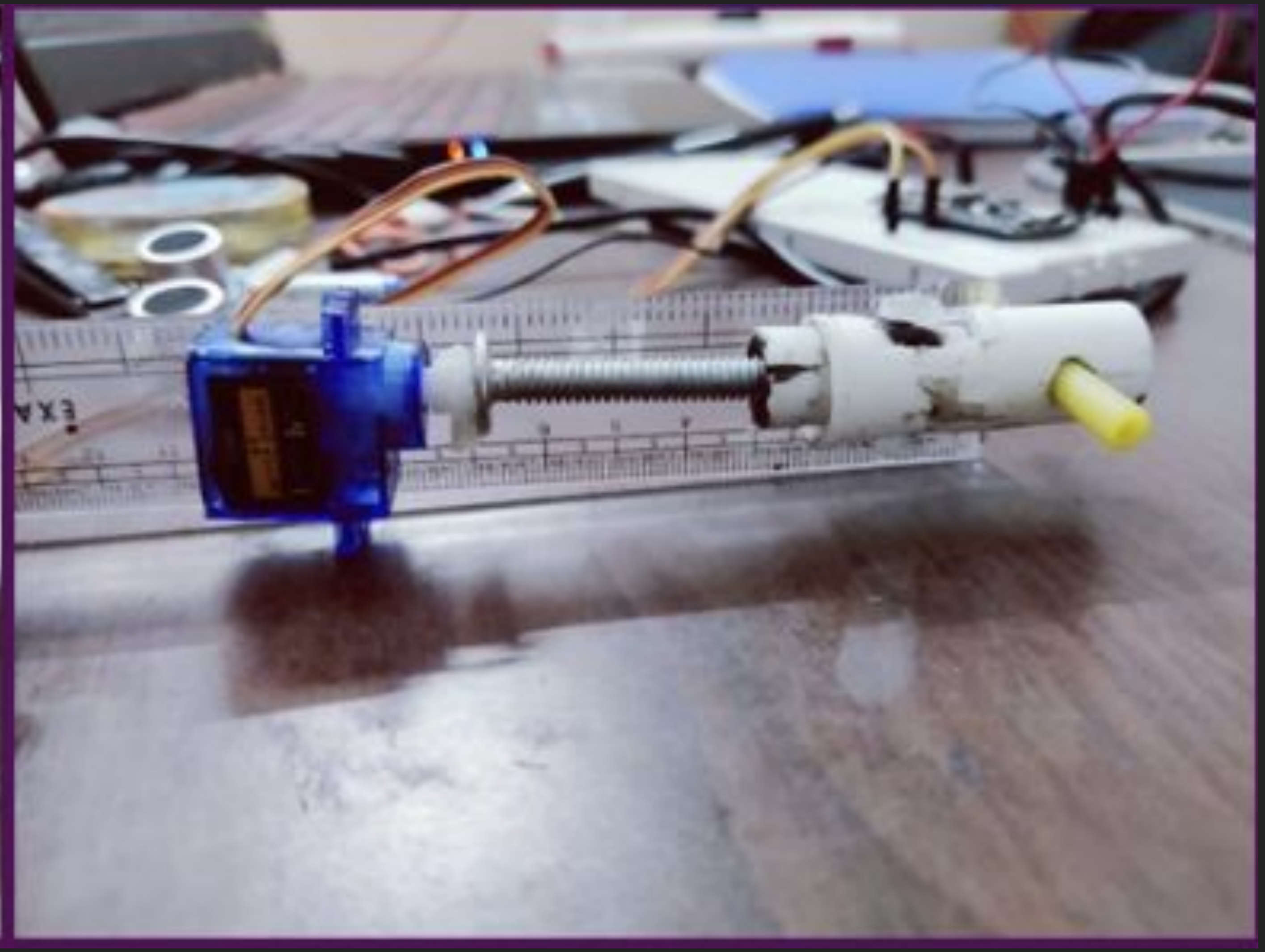
The objectives for the design of this system are:

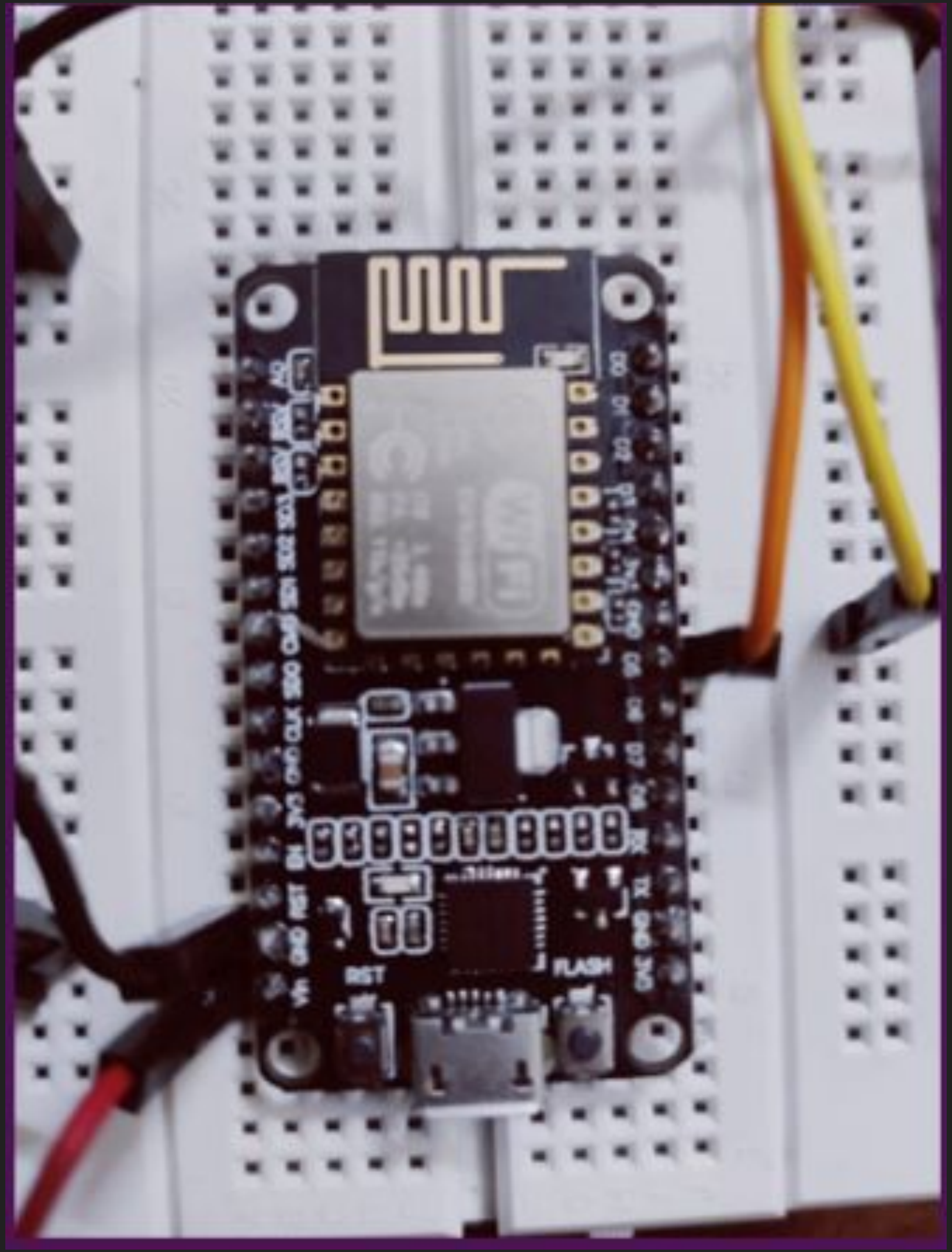
Measuring the level of the fluid in drip, The HC-SR04 ultrasonic sensor is attached to the top of the drip bottle which is used to measure the level of the fluid. The level of the fluid is measured by using a simple equation: 1 = height – d (1) where, 1 is the length of the fluid present in the bottle. height is the length of the bottle. d is the measured distance from the ultrasonic sensor the the surface of the fluid present in the bottle.

Clamp working

It will be a controlled clamp that would control the drip rate of IV a servo would be in place that would rotate and push a clamper to clamp the IV pipe that goes to the patient.It can take values from the nurse like the drip rate and then in a controlled way can clamp the IV and give the required drip rate

SCREENSHOTS






Vcc
Trig
Echo
Gnd
T
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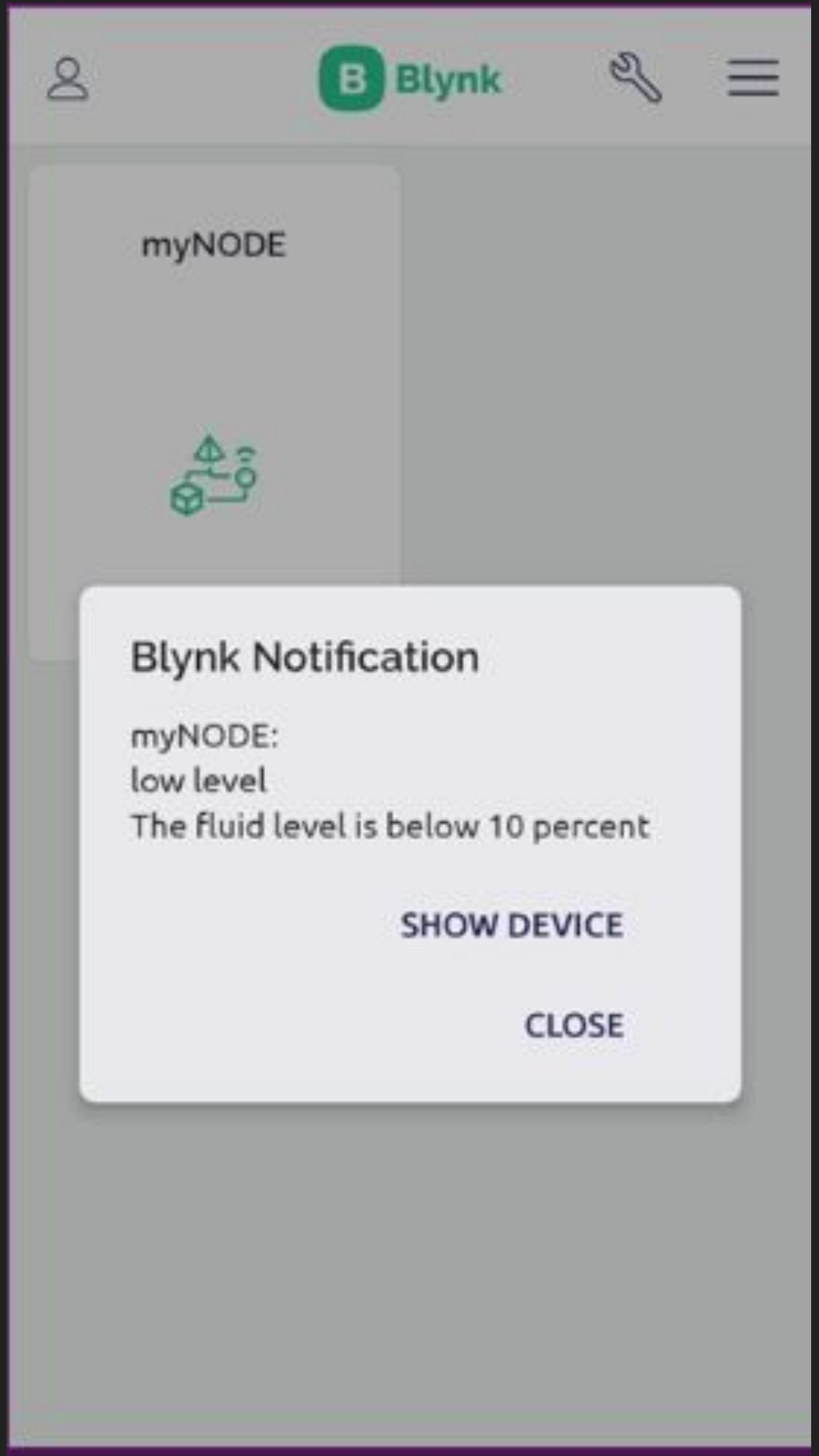
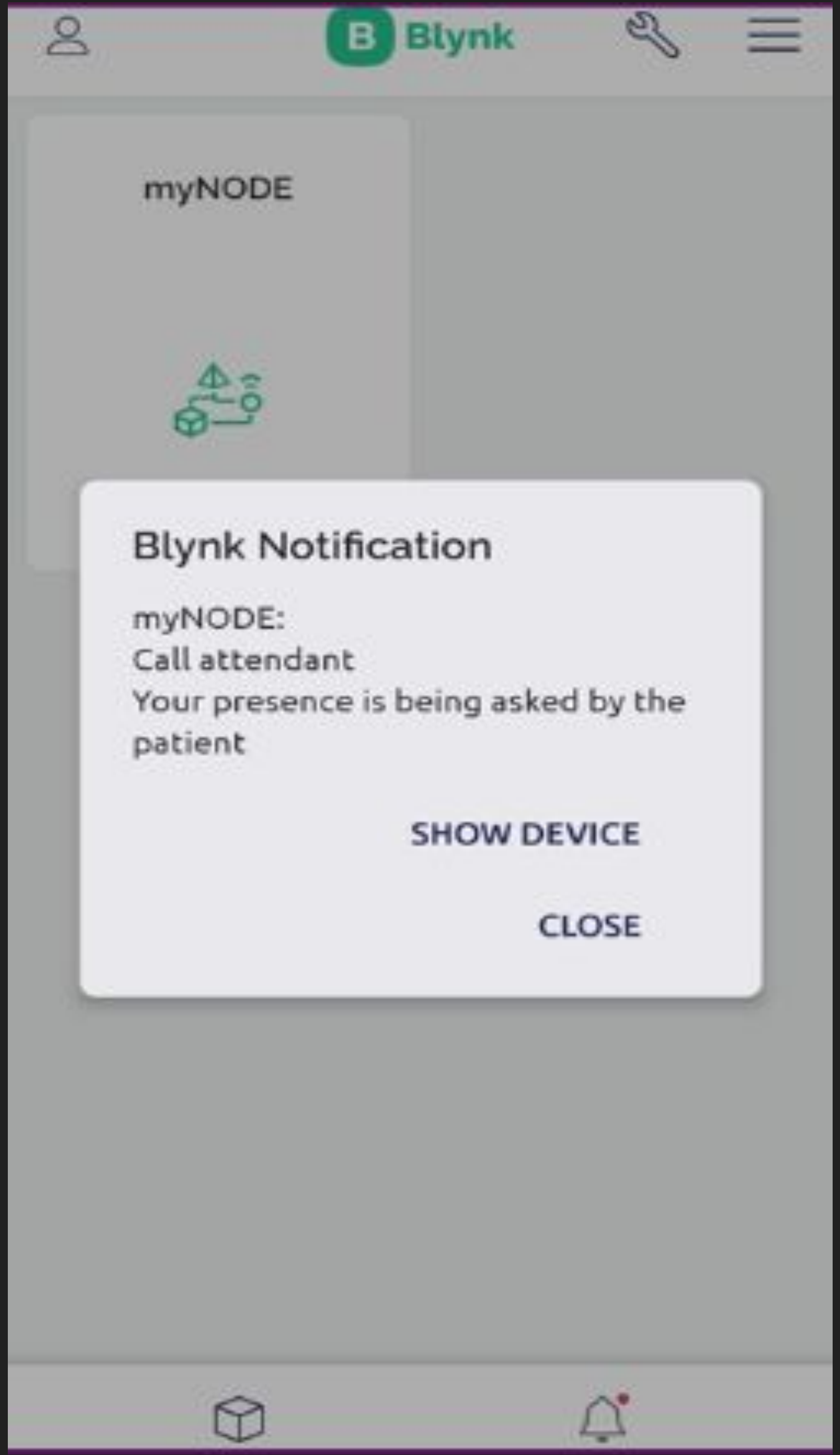

Blynk
myNODE
Blynk Notification
myNODE:
low level
The fluid level is below 10 percent
SHOW DEVICE
CLOSE


Blynk
myNODE
Blynk Notification
myNODE:
Call attendant
Your presence is being asked by the patient
SHOW DEVICE
CLOSE


CONCLUSION

In addition to being extremely important and necessary in the administration of pharmaceutical drugs, the use of intravenous (IV) drip also has serious consequences and adverse effects if it is not done correctly. Even though IV drip is undoubtedly a cost-efficient, safe, and useful instrument, using it may nonetheless present a number of problems. Therefore, it is important to administer the IV fluid with extreme care. We won't be able to give patients the care they need unless we address the| issues with IV drip usage, reduce its complications, and improve its accuracy. Therefore, it is necessary to design and develop a new type of IV drip set that can not only monitor but also regulate the drip rate as needed.