IOT BASED INTRAVENOUS THERAPY MONITORING AND ALERT SYSTEM

[1]G. S. Suresh Kumar, [2] Mr. I. Hemanth Kumar, [3]Priyanka Lankalapalli, [4] Anusha Nandavarapu, [5] Bhagyasri Mandava

[1,2]Assistant Professor, [3,4,5]UG Scholar, [1,2,3,4,5]Department of Electronics and Communication Engineering, Vignan's Institute of Engineering for Women, Kapujaggarajupeta, Andhra Pradesh, India

ABSTRACT

This project This project introduces Intravenous (IV) infusion therapy, a conventional medical procedure utilized across various medical disciplines. It involves administering fluids directly into a patient's vein via a needle/cannula for medication delivery or blood transfusions. The proposed smart IV infusion dosing system aims to detect, signal, and monitor liquid levels in IV bottles remotely.

It comprises:

(i) **Sensing and computation layer:** Detects and signals fluid levels in IV bottles and regulates infusion flow.

(ii) **Communication layer:** Facilitates wireless exchange of information between system hardware and the client.

(iii) **User layer:** Allows real-time monitoring and visualization of IV therapy reception at a remote location. This system alerts medical staff to timely changes in IV bottles, potentially enhancing the success of IV therapy.

Keywords: Smart IV infusion dosing system, IV therapy, IV bottle, IV chemotherapy, nurse response time, Internet of Things (IoT), wireless intravenous system, remote infusion monitoring system.

INTRODUCTION

Intravenous (IV) therapy involves delivering fluids, medication, nutrients, or blood directly into the bloodstream via a vein using a small cannula and connecting tubing. This combination is commonly referred to as an "IV". The IV solution typically contains water, glucose and electrolytes such as potassium, sodium and chloride. It allows multiple fluids to be administered simultaneously and at the same site. Traditionally, the manual administration and monitoring of IV therapy from patient to patient can be time-consuming. Introducing IoT to manual IV therapy improves efficiency by reducing the likelihood of human error.

LITERATURE SURVEY

[1] Tanios Tawk, Antonio El Sarrouh, Roy Abi Zeid Daou Design of an IOT Intra-Venious System for Patient Monitoring, 979-8-3503-2585-0/23/ 2023 IEEE. The Internet of Things (IoT) Intra-Venious (IV) and patient monitoring system aims to create a cost-effective, scalable remote monitoring system for patients and IV therapy using IoT technology. It comprises an IV monitoring module and a patient monitoring module that tracks vital signs and IV therapy progress. Therefore, healthcare providers can remotely monitor patients, receiving alerts. An alert system notifies staff of IV bag replacement needs, reducing human error risk.

Summary: Apart from alerting the medical staff to change the IV fluid bags, we have created a Public Server which continuously displays the fluid levels to monitor.

[2] Uzma Salamz , M.A.H Ahsan , Tarikul Islam High-Precision Capacitive Sensors for Intravenous Fluid Monitoring in Hospitals, 2021 IEEE. This article carried out IV fluid monitoring using capacitive sensors

i.e, investigating three types of capacitive sensors, such as a cross capacitive, a semicylindrical, and a planar parallel plate to detect the presence of IV droplets in the fluid pipe nondestructively. The sensors are specially designed to fulfill the application needs, and simulated and fabricated with inexpensive double-sided copper-cladded flexible PCB substrates.

Summary: There is an instantaneous change in the value of capacitance due to a sudden change in the dielectric constant of a partially filled air medium. Hence the accuracy of the output decreases.

[3] Monisha K.Bhavasaar, M.Nithya, R.Praveena, N.S.Bhuvaneshwari, T. Kalaiselvi Automated Intravenous Fluid Monitoring System , 2016 IEEE. This paper emphasizes Intravenous fluid monitoring (IV) using load cell and heart beat sensors. Intravenous therapy is a typical method of treatment which may be used for better modification of electrolyte imbalances in the body, to deliver medications, for transfusion of blood or fluid injection. The proposed method lowers the chance of heart attack due to air embolism and reduces difficulties involved in IV therapy.

Summary: This system is efficiently designed for heart patients with load cell and heart beat sensor which might not be necessary for a normal patient using IV therapy.

[4] K Ramisha Rani, N Shabana, P Tanmayee, S Loganathan, G Velmathi. Smart Drip Infusion Monitoring System for Instant Alert Through NRF-24L01, 2017 IEEE. This project work involves trickle implantation observing framework for use in hospitals. The framework comprises of a drip infusion, sugar level observing gadgets and a monitoring screen. The mixture observing gadget utilizing a pressure sensor (MPX10GP) technology module can identify the trickle implantation rate and a vacant imbuement arrangement sack, and after that, this information is sent to the monitoring screen put at the medical caretaker's station by means of the radio frequency (nrf24L01). The monitoring screen gets the information from trickle implantation observing gadgets and after that shows graphically them.

Summary: Output can be given in a simplified form so that general people without medical expertise can understand them along with the medical staff.

EXISTING METHOD

This study proposes a pioneering approach by employing IoT technology to monitor alarm and IV bag systems. The application of IoT in IV bags is still emerging, presenting an opportunity to revolutionize medication distribution and benefit both patients and healthcare providers. The research envisions a comprehensive system that amalgamates technologies like load cells, machine learning algorithms, cloud-based systems, and user-friendly web dashboards. This integration aims to enhance the accuracy of IV bag monitoring while simultaneously reducing the workload of medical professionals. Moreover, the study introduces an innovative alarm system linked to a cloud-based platform, capable of automatically alerting healthcare staff when IV bag fluid levels are low. This advancement has the potential to minimize medication errors and heighten patient safety. The incorporation of such a remote alarm system could significantly improve the efficiency of IV bag monitoring, enabling timely responses to emerging concerns. The research also prioritizes the development of user-friendly web interfaces, ensuring easy access and comprehension for medical practitioners. IV weight detection is done by using a Weight Sensor. Load cells are transducers used in weighing scales and industrial applications for measuring force or weight. The HX711 load cell amplifier module provides high-precision readings using a two-wire serial interface. To use the module, connect it to the load cell, configure it with commands to adjust gain and tare, and send the module to convert the analog signal into a digital value. ESP-01 is a Wi-Fi module with built-in TCP/IP stack, allowing remote project control and data collection. ESP-01 can be used with Arduino to add wireless communication capabilities. In this project, two Wi-Fi modules were used, the first one to send data from the microcontroller to the Web and the other to send the data from the Web to the microcontroller. Connecting an LCD to a microcontroller using an I2C module requires fewer connections than a parallel This LCD shows actual level of the IV fluid in the bag. Arduino Uno uses a piezoelectric

buzzer, which emits sound. when a voltage is applied.

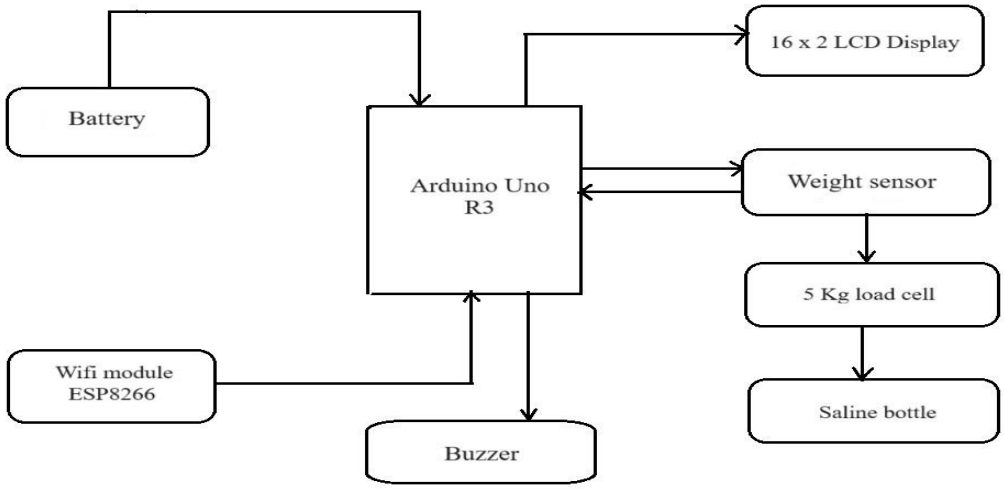


Figure.1. Block diagram for existing model

PROPOSED METHOD

In the realm of medical care, IV monitoring and alerting systems represent a critical component for ensuring patient safety and effective treatment delivery. Leveraging IoT technology, these systems offer a sophisticated approach to monitoring IV fluid levels in real-time, enhancing the quality of care provided to patients. At the heart of this system lies a microcontroller Arduino Uno connected to the WiFi module, GSM, LCD, Buzzer and a load cell with Hx711 weight sensor to measure the weight of IV fluid. The wifi module js connected to a ThingSpeak public server channel. This setup enables healthcare providers to remotely access and monitor the status of IV fluid levels from anywhere with internet connectivity. The ThingSpeak platform offers a user-friendly interface, allowing for seamless visualization and analysis of the data collected. Complementing the WiFi connectivity is the integration of a GSM module, which adds an extra layer of reliability and accessibility to the system. When the IV fluid level descends to a critical threshold, such as 25%, the system triggers an alert mechanism. Through the GSM module, the system sends SMS alerts to registered healthcare providers, ensuring prompt notification of the situation even if they are not actively monitoring the ThingSpeak channel. Furthermore, the system incorporates an Arduino Uno microcontroller connected to an LCD display. This display provides local visibility of the IV fluid level percentage, offering an additional means of monitoring for healthcare professionals directly onsite. Moreover, when the fluid level reaches the predefined threshold, a buzzer is activated, providing an audible alert to draw immediate attention to the situation. By combining IoT technology with robust alerting mechanisms, such as the public server channel and GSM module, this IV monitoring system offers a comprehensive solution for healthcare facilities. It empowers healthcare providers with real-time insights into IV fluid levels, facilitating proactive intervention and enhancing patient safety and care delivery.

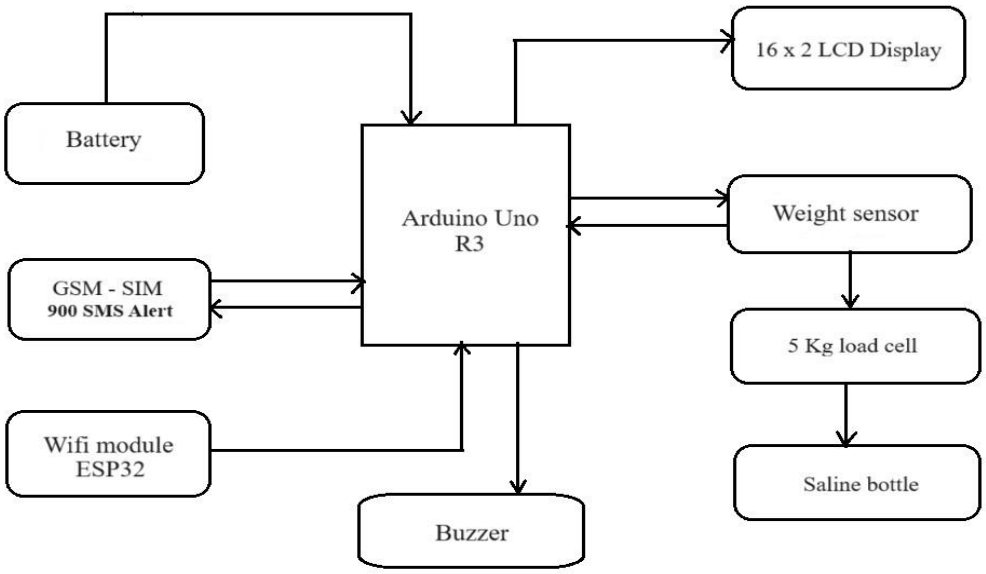
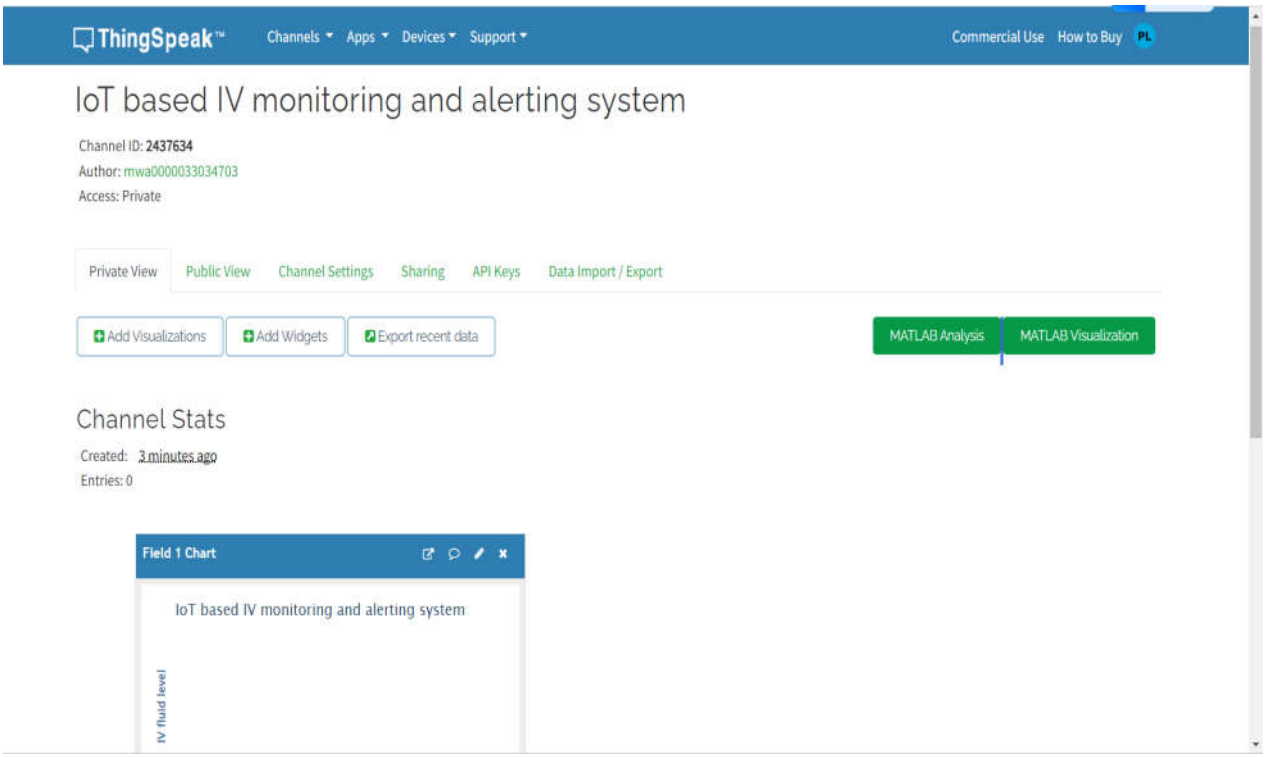
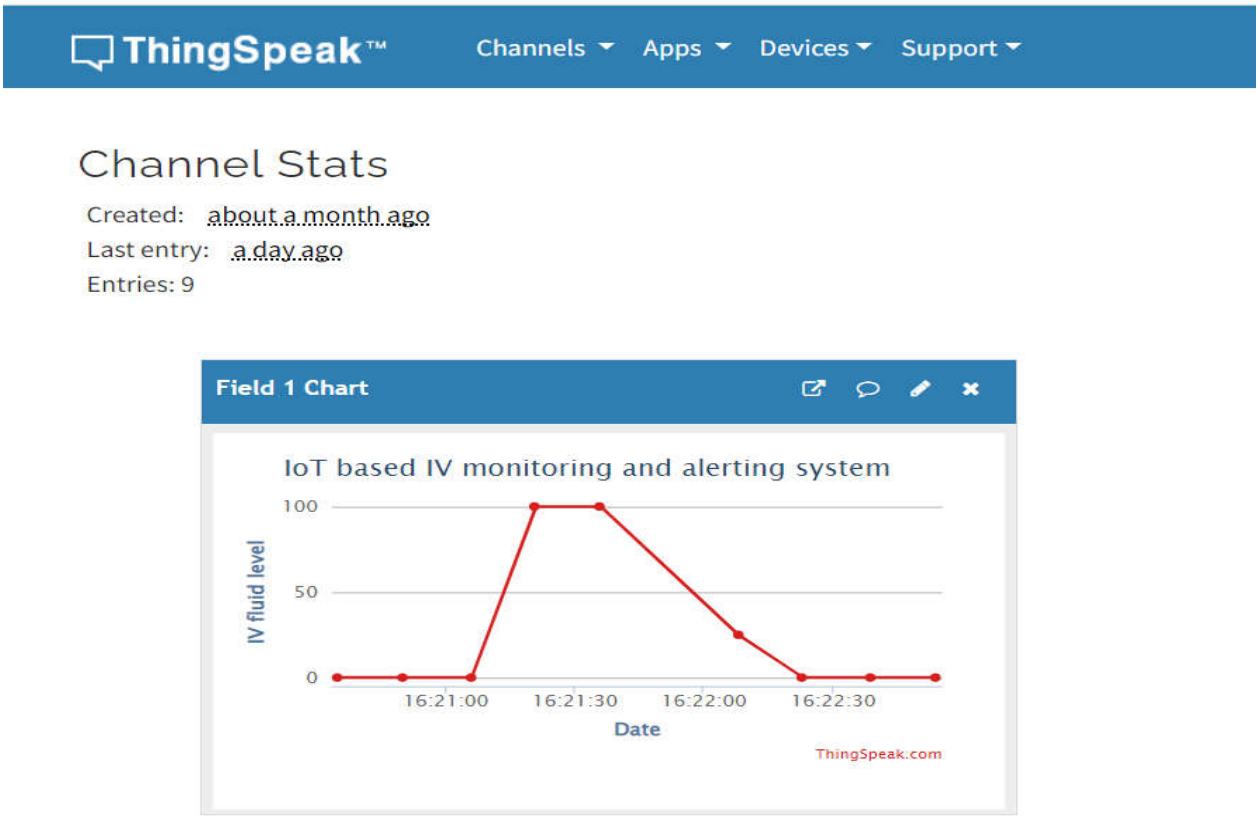


Figure.2. Block diagram for proposed model

RESULT ANALYSIS





From the above figures, we can monitor the fluid level in the IV bag through the ThingSpeak server and It also gives us the alert message to the registered numbers when the fluid in IV bag reached to the minimum level.

Fig. Outputs in LCD

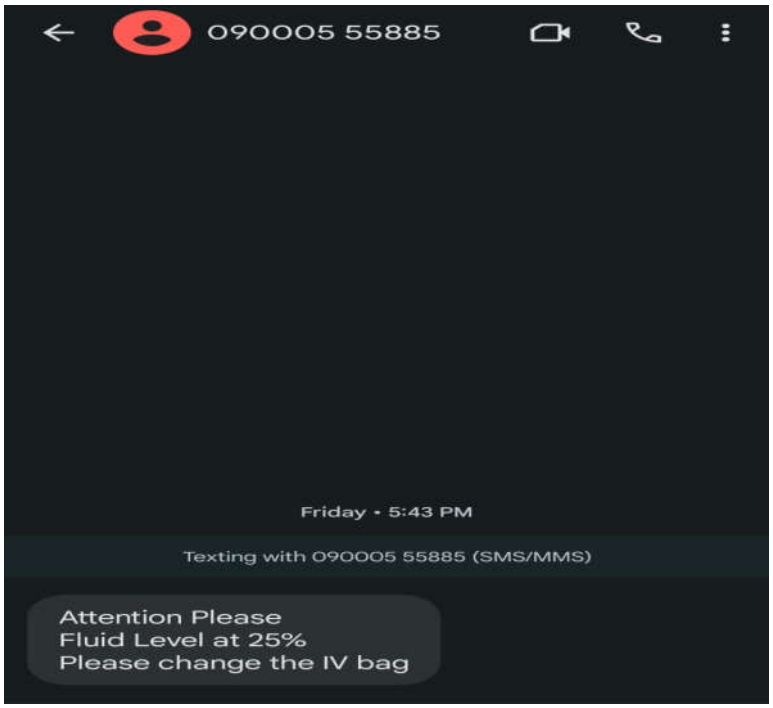


Fig. Alert message received to the registered number through the GSM module.

CONCLUSION

In conclusion, the development of an IV monitoring and alerting system utilizing the Internet of Things (IoT) heralds a transformative step forward in healthcare. By leveraging advanced technology, such as sensors, wireless communication, and real-time data analysis, this system offers unparalleled benefits in patient care and safety. The implementation of such a system facilitates remote monitoring of IV therapy, allowing healthcare providers to track fluid levels, regulate infusion rates, and respond promptly to any anomalies or changes. This not only enhances the efficiency of medical staff but also significantly reduces the risk of errors and complications associated with manual monitoring. Furthermore, the IoT-based IV monitoring and alerting system empower healthcare professionals with actionable insights and timely notifications, enabling proactive intervention and adjustment of treatment plans as needed. This proactive approach can lead to improved patient outcomes, reduced hospital stays, and overall cost savings for healthcare facilities. Moreover, by integrating seamlessly into existing healthcare infrastructures, this system offers scalability and adaptability to diverse clinical settings, ranging from hospitals to remote care facilities. It represents a paradigm shift towards personalized, data-driven healthcare delivery, where patients receive tailored treatments in accordance with their individual needs and conditions. In essence, the IV monitoring and alerting system utilizing IoT technology embodies the convergence of innovation and patient-centric care. Its implementation promises to revolutionize the practice of intravenous therapy, ushering in a new era of efficiency, safety, and quality in healthcare delivery.

REFERENCES

1. Tanios Tawk, Antonio El Sarrouh, Roy Abi Zeid Daou Design of an IOT Intra-Venious System for Patient Monitoring, 979-8-3503-2585-0/23/ ©2023 IEEE | DOI: 10.1109/ICABME59496.2023.10293091.
2. Uzma Salmaz, M.A.H Ahsan, Tarikul Islam, High-Precision Capacitive Sensors for Intravenous Fluid Monitoring in Hospitals. In In Proceedings of the IEEE Technological Innovations, Journal 70, 05 August, 2021.
3. Millam, D.A. Managing complications of iv therapy (continuing education credit). Nursing 1988, 18, 34–43. [CrossRef]
4. Bhavasaar, M.K.; Nithya, M.; Praveena, R.; Bhuvaneswari, N.S.; Kalaiselvi, T. Automated intravenous fluid monitoring and alerting system. In Proceedings of the IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR), Chennai, India, 15–16 July 2016; pp. 77–80.
5. Ramisha, R.K.; Shabana, N.; Tanmayee, P.; Loganathan, S.; Velmathi, G. Smart drip infusion monitoring system for instant alert-through nRF24L01. In Proceedings of the International Conference on Nextgen Electronic Technologies: Silicon to Software (ICNETS2), Chennai, India, 23–25 March 2017; pp. 452–455.
6. 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. 2015, 3, 427–432.
7. Makobore, P.N.; Mulerwa, M. An electronically controlled gravity feed infusion set for intravenous fluids. In Biomedical Engineering for Africa; Douglas, T.S., Ed.; University of Cape Town Libraries: Cape Town, South Africa, 2019; pp. 125–138.
8. Ajibola, O.O.E.; Sunday, O.O.; Eyehorua, D.O. Development of automated intravenous blood infusion monitoring system using load cell sensor. J. Appl. Sci. Environ. Manag. 2018, 22, 1557–1561.