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IVigilance - Intravenous drip monitoring and controlling system

Vrunal Gharat[1], Mangesh Ram[2], Harshal Patil[3], Prof. Saniket Kudoo[4]

[1]*(Department of Computer Engineering, Mumbai University, MUMBAI)*
[2]*(Department of Computer Engineering, Mumbai University, MUMBAI)*
[3]*(Department of Computer Engineering, Mumbai University, MUMBAI)*
[4]*(Professor, Department of Computer Engineering, Mumbai University, MUMBAI)*

Abstract: *The " IVigilance -Intravenous Drip Monitoring and Controlling System for Hospital Using IoT" project presents an IoT-driven solution designed to modernize and enhance intravenous therapy management within healthcare organizations. Intravenous (IV) drips play a pivotal role in patient care, yet their manual oversight poses potential risks, including medication errors and inefficiencies. This project leverages IoT technology to create an automated system that continuously monitors and regulates IV drip operations. By incorporating IoT sensors and microcontrollers into the IV drip infrastructure, real-time data on flow rates and drip status is collected. This data not only ensures precise medication and fluid delivery but also enables remote control and adjustment by healthcare professionals. The system's benefits are twofold. First, it reduces the likelihood of human error, significantly improving patient safety. Second, it provides data-driven insights that empower healthcare institutions to optimize resource allocation and make informed clinical decisions. In summary, the "Intravenous Drip Monitoring and Controlling System for Hospital Using IoT" project offers a transformative approach to IV therapy management. It promises to enhance patient care, streamline hospital operations, and usher in a new era of healthcare technology, where IoT-driven automation ensures the accuracy and safety of intravenous therapies, benefiting both patients and healthcare providers.*

Keywords – *IoT-based system, IV drip therapy, Sensors, microcontrollers, and cloud computing, Remote adjustment and alerting, Real-time data.*

I. Introduction

Intravenous (IV) therapy is a critical part of healthcare, providing patients with essential fluids, suppositories, and nutrients. Ensuring the precise administration of IV drips is vital for patient safety and recovery. To meet this need, the Intravenous Drip Monitoring and Controlling System for Hospitals using IoT is a groundbreaking project that leverages the power of the Internet of Things (IoT) to enhance the accuracy, efficiency, and quality of IV therapy in healthcare settings. In the realm of modern healthcare, the traditional method of manually monitoring and adjusting IV drips is labor-intensive, error-prone, and often always relies on the accessibility of healthcare authorities. The IoT-based system we propose revolutionizes this process by seamlessly integrating smart sensors, connected devices, and cloud computing to create a robust, automated, and real-time solution. The core objectives of this project are twofold: first, to monitor the infusion rate of IV drips with unparalleled precision, and second, to provide healthcare practitioners with the ability to remotely control and adjust IV parameters in real-time, ensuring patients always receive the correct dosage of fluids or medications. The key components of the system include smart IV infusion pumps equipped with sensors, a secure IoT network infrastructure, and a user-friendly interface accessible to medical personnel through smartphones, tablets, or computers. The system continuously collects data on the flow rate, volume, and status of IV drips, transmitting this information to a centralized cloud platform. Here, sophisticated algorithms analyse the data, raising alerts for any anomalies or deviations from the prescribed treatment plan. By deploying this IoT-based solution, hospitals can achieve several significant benefits. These include reducing the risk of medication errors, minimizing the workload of healthcare professionals, enhancing patient comfort, and potentially decreasing healthcare costs associated with complications from incorrect IV therapy. Ultimately, our Intravenous Drip Monitoring and Controlling System represents a technological leap forward in patient care, combining the precision of IoT with the expertise of medical professionals to ensure safer and more effective IV therapy in hospitals.

II. REVIEW OF LITERATURE SURVEY

The following chapter is a literature survey of the previous research papers and research which gives the detailed information about the earlier system along with its pros and cons.

Ms. Sincy Joseph, Ms. Navya Francis Ms. Anju John, Ms. Binsi Farha, Mrs. Asha Baby [1], The paper titled "Intravenous Drip Monitoring System for Smart Hospitals Using IoT" presents an innovative healthcare solution that leverages Internet of Things (IoT) technology to enhance the efficiency and safety of intravenous (IV) drip administration in hospital settings. In traditional healthcare setups, IV drip monitoring often relies on manual observations by nursing staff, leading to potential human errors and delayed responses to critical situations. This paper introduces a smart hospital solution that utilizes IoT devices to continuously monitor and manage IV drips. If any irregularities are detected, such as an incorrect drip rate or nearing completion of the IV bag, automated alerts are generated to notify medical staff for prompt intervention. Furthermore, the paper discusses the benefits of this system, which include improving patient safety, reducing the workload on nursing staff, and optimizing resource utilization in hospitals. It also highlights the potential for data-driven insights and predictive analytics to further enhance patient care. Overall, the "Intravenous Drip Monitoring System for Smart Hospitals Using IoT" paper underscores the transformative impact of IoT technology in healthcare, emphasizing its potential to revolutionize IV drip management, enhance patient outcomes, and streamline hospital operations.

Shohag Hossain, Shraboni Sharmin, Tasnuva Faruk, and Md Kafiul Islam [2], The paper titled "Low-Cost Digitization of Infusion Pump for Real-time Automated Flow Rate Monitoring and Warning" presents a novel approach to enhance the safety and efficiency of infusion therapy in healthcare settings. In healthcare, infusion pumps are commonly used to administer fluids and medications to patients. However, manual monitoring of these pumps is prone to human error, potentially leading to adverse events. This research addresses this issue by proposing a cost-effective digitization solution for infusion pumps. The paper discusses the design, implementation, and testing of the digitization system, demonstrating its reliability and effectiveness in improving patient safety and reducing the risk of medication errors. This innovation has the potential to revolutionize the way infusion therapy is administered, making it more precise, automated, and secure, ultimately benefiting both healthcare benefactors and patients.

Shyama Yadav, Preet Jain [3], The authors introduce a remote drip infusion monitoring and control system designed to address the laborious and time-consuming nature of manual healthcare tasks, particularly in an era of increased population. The proposed system employs IR sensors, servo motors, and Wi-Fi communication to monitor and control drip infusion rates, detect remaining time, and alert when an infusion bag is nearly empty. This information is wirelessly transmitted to a central monitor in the nurse's control room, allowing nurses to remotely control infusion rates. The system eliminates the need for constant visual monitoring and enhances healthcare efficiency. The paper also discusses existing approaches and hardware components, showcasing its practicality and effectiveness in healthcare settings.

Preethi S, Akshaya A, Haripriya Seshadri, Vaishnavi Kumar, R. Santhiya Devi, Amirtharajan Rengarajan, K. Thenmozhi, and Padmapriya Praveenkumar [4], the authors research aims to leverage Internet of Things (IoT) technology to revolutionize healthcare by creating a wireless system for real-time patient monitoring, with a main focus on controlling and standardizing Intra Venous (IV) fluid flow. The system also monitors pulse rate and body temperature, eliminating the need for physical presence to oversee patients and stop IV infusion. Instead, it automatically stops infusion and notifies healthcare providers via an app. The project employs a cyber-physical system architecture based on ontology, enhancing patient care with fewer human interventions and reduced emergency risks. Hardware components like Node MCU and solenoid valves, along with software tools like Arduino IDE, Firebase, and MIT App Inventor, are used for implementation. The system proves effective for efficient, secure, and automated healthcare monitoring, potentially saving lives.

Debjani Ghosh, Ankit Agrawal, Navin Prakash, Pushkal Goyal [5], Saline, one of the most used intravenous (IV) therapies, is crucial in the treatment of critically ill patients. Monitoring the level of the saline bottle is crucial because blood can spill into it if the bottle is emptied but the needle is left in the vein. Monitoring the saline bottle level is the concern of the nurses or caretakers in hospitals. Most often, due to carelessness and any odd circumstance, the precise timing of withdrawing the needle from the patient's vein is disregarded, which results in major injury and may even result in death. Furthermore, in order to offer telehealth services, remote monitoring is necessary. They have offered a cost-effective smart saline level monitoring device that combines sensor and Internet of Things (IoT) technologies in order to diminish accidents brought on by careers' ignorance and to enable remote surveillance in telehealth services. The load sensor and the ESP32 Wi-Fi System on Chip (SoC) microcontroller were used to construct this structure. The bottle's weight is converted to a specified voltage by the load sensor. Based on the voltage the sensor's microprocessor, the ESP32, sends out, the microcontroller develops and publishes a certain message. We have used the MQTT-S publish/subscribe protocol, which runs over TCP, to circulate and distribute the messages to the devices (e.g., smartphone, tablet, laptop, etc.) of subscribers like doctors, nurses, or carers. The recommended monitoring system distributes messages to subscribers in a reliable manner, which is vital for the healthcare organizations.

Anagha R, Ashwini S, Keerthana G, Monica M, Prof. Vindhya [6], Electronic valve module includes a normally closed solenoid valve and a relay The load cell is used to continuously monitor the weightage of the saline bottle and it will be displayed on the LCD display, when it reaches the critical level, an automatic message will be sent to a hospital staff's Android app. The load sensor is fixed on a saline hook and bottle is hung on it. This sensor translates the changing weight of the bottle into different voltages. The pressure in the dripping IV solution is detected by a pressure sensor, connected to the motor. The valve assembles flow pulse signal from the Impeller Hall flow sensor through the Load sensor. Using this concept one doctor can monitor several patients' reports on the mobile app or computer screen so one doctor can monitor several patients.

Andrea Cataldo, Giuseppe Cannazza, Nicola Giaquinto, Amerigo Trotta and Gregorio Andria [7], The paper "Microwave TDR for Real-Time Control of Intravenous Drip Infusions" presents a novel application of microwave Time Domain Reflectometry (TDR) technology for enhancing the precision and safety of intravenous (IV) drip infusions. Traditional IV systems often rely on manual adjustments, leading to dosage errors and patient discomfort. In this study, the authors propose a real-time control system that utilizes microwave TDR to monitor the fluid flow within the IV tubing. By measuring the dielectric properties of the liquid in real-time, the system can accurately determine the flow rate and adjust it accordingly to maintain a consistent infusion rate. This technology offers several advantages, including the ability to detect air bubbles, occlusions, and variations in tubing diameter, thus reducing the risk of difficulties and refining patient care. The paper underscores the potential of microwave TDR as a valuable tool for enhancing the precision and safety of medical fluid delivery systems.

Dragana Oros, Marko Pencic, Jovan Sulc, Maja Cavi´c, Stevan Stankovski, Gordana Ostoji´c and Olivera Ivanov [8], The paper titled "Smart Intravenous Infusion Dosing System" presents a novel healthcare technology designed to improve the accuracy and safety of intravenous (IV) medication administration. The system integrates advanced sensor technology, data analysis algorithms, and real-time monitoring to optimize IV dosing for patients. It continuously assesses a patient's vital signs and adapts the infusion rate accordingly, reducing the risk of underdosing or overdosing. Key features of the system include automated adjustments in response to changes in patient condition, the ability to calculate precise dosages based on individual patient factors, and the capacity to provide alerts and notifications to healthcare providers in case of any anomalies or deviations from prescribed dosages. By enhancing the precision and responsiveness of IV medication delivery, the Smart Intravenous Infusion Dosing System has the potential to improve patient outcomes, minimize adverse events, and streamline healthcare workflows.

Muhammad Raimi Rosdi, Audrey Huong [9], This paper presents an intelligent infusion pump system planned to enhance the management and nursing of intravenous (IV) drips. The system employs an Arduino-based microcontroller for tasks such as drop counting, tube blockage detection, and monitoring drip bag emptying. It utilizes low-power laser diodes and optical sensors to achieve these functions. Data on flow rate and infusion intervals are wirelessly broadcasted to users' smartphones over the Blynk mobile app and computer-based applications. Notably, the study found no significant difference between manual and automatic drop counting interpretations. The system is also capable of notifying users of empty bottles and line blockages. Overall, the developed prototype holds promise for further enhancement and testing in real clinical settings, offering the potential for safer and more efficient IV fluid supervision with remote nursing abilities.

Mohammed Arfan, Srinivasan M, Adithya Gowda Baragur, Vaishnavi Naveen [10], This paper presents an IoT-based drip monitoring and control device designed to enhance the safety and efficiency of Intravenous (IV) infusion setups. The current practice of estimating drip rates and monitoring IV bottles is error-prone and relies on human judgment. This device aims to mitigate these issues by integrating an IR sensor for drop detection, a microcontroller with Wi-Fi capability for data transmission, and an actuator for drip rate regulation. The IoT platform allows doctors and nurses to remotely monitor and control IV therapy through a web dashboard or mobile app. It ensures accuracy, stability, and reliability in the IV setup. The device's data is delivered to an online server, deposited in a SQL database, and illustrated for easy readability. The paper discusses the device's design, testing, and battery capacity considerations. Additionally, the paper highlights the need for such technology in the context of the Internet of Medical Things (IoMT) and identifies existing IV monitoring devices that lack control features. Overall, this device represents a significant advancement in IV therapy management, offering both convenience and safety.

Pattarakamon Rangsee, Paweena Suebsombut, Phakphoom Boonyanant [11], This research suggests a saline droplet measuring system (SDMS) that is inexpensive. In rural public hospitals, the procedure can be used to monitor the saline droplets in each patient's bed in hospital. All patient beds will have the measurement modules installed. Each patient's saline droplet status will be displayed by the system. So, Nurses can correctly monitor a patient's saline droplet standing. Saline droplet standings are presented on a computer with rate, time left, and drop rate. In rural public hospitals, nurses and patient relations monitor saline droplet status every hour, which is time-consuming and disrupts patient rest. Medical devices like infusion pumps and liquid droplets have been developed to check droplet status, but their prices are expensive. Liquid droplet devices use infrared sensors to detect and control medicine volume, while infusion pumps deliver fluids like pain relievers, chemotherapy drugs, hormones, insulin, and antibiotics. These devices are popular in hospitals but are only used in ICU rooms in Thailand. This paper offers a affordable saline droplet measurement system (SDMS) for common patient rooms in local public hospitals. The system provides a low-cost device and program that can be installed in the patient's room, allowing nurses to check saline droplet status without walking around the room in each hour.

Jayeeta Saha, Arnab Kumar Saha, Aiswarya Chatterjee, Suyash Agrawal, Ankita Saha, Avirup Kar, Himadri Nath Saha [12], The Internet of Things revolutionizes modern technology, making life easier and automated. It provides remote real-time health monitoring for patients, reducing human error and room occupied space. The combination of Raspberry Pi and IoT has solved the issue of patient anxiety by allowing remote monitoring of health conditions. Raspberry Pi offers a complete Linux environment at a low cost, allowing for interfacing services and actuators through general purpose I/O pins. This paper proposes an advanced IoT-based automated remote health monitoring system that offers alarm notifications, prescribed medicine names, and dose displays. This system reduces human error and allows patients to monitor their health from home, allowing for necessary action during minor ailments. Sensors are used for data measurement, and the system also provides automatic appliance control. Future improvements include a mobile app for managing data and strict security protocols. Phone or video call services can also be included for patient communication.

Nicola Giaquinto,Marco Scarpetta,Mattia Alessandro Ragolia [13], For patients who are hospitalized, intravenous (IV) infusion is one of the most popular treatments. Given that both over- and under-infusion can result in major health issues, it is crucial to monitor the fluid flow rate that is being given to the patient in order to ensure his safety. This paper presents a unique approach based on deep learning computer vision techniques for monitoring the IV injection flow rate. In essence, a camera records the drip chamber, and object detection is utilised to count the drips. As a result, compared to other techniques created for this goal, the suggested one is less invasive. It can generate an accurate real-time assessment of the drip's instantaneous flow rate, according to experimental data. t can generate an accurate real-time assessment of the drip's instantaneous flow rate,

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according to experimental data. These factors make the suggested approach suitable for implementing health facility monitoring and control systems. A smart system that uses deep learning and computer vision to monitor IV drips was developed. It was discovered that this method offered good accuracy performance without requiring direct interaction with the infusion kit, making it less intrusive than alternative solutions. Additional benefits of the system include its adaptability to various operating circumstances and modular design. It is in fact capable of receiving and analysing video signals from both nearby and far-off places. The estimating approach becomes more versatile and resilient to changing environmental variables with the use of deep learning algorithms.

Natapol Phetsuk, Sumet Umchid [14], The paper titled "Design, Development, and Fabrication of an Intravenous Infusion Monitoring Device" discovers the conception of an innovative medical device aimed at improving the precision and safety of intravenous (IV) therapy. The device is designed to monitor and regulate IV infusion in real-time, offering numerous advantages in the healthcare setting. The primary focus of the paper is on the device's design and development, highlighting its capacity to provide accurate monitoring of IV infusion rates, ensuring that patients receive the prescribed fluids and medications. It also discusses the fabrication process, emphasizing the technical aspects and components of the device. The advantages of this device include enhanced patient safety through real-time monitoring, the ability to detect anomalies or deviations, and the capacity to provide immediate alerts to healthcare providers. Furthermore, the paper mentions the device's potential for integration with the Internet of Things (IoT), which could enable remote monitoring and control of IV therapy. In conclusion, the paper underscores the potential of the Intravenous Infusion Monitoring Device to significantly improve the quality and safety of IV therapy in healthcare settings. It represents a significant technological advancement with promising applications in patient care, remote monitoring, and research within the healthcare industry.

Kothapally Aditya Reddy, Suggu Pavan [15], The paper presents a comprehensive solution for advanced patient monitoring in the Intensive Care Unit (ICU) by integrating multiple sensors for intravenous (IV) detection and employing Canny edge detection technology, alongside real-time Electrocardiogram (ECG) monitoring with a live feed. This innovative system enhances patient care by providing a holistic view of critical patient data. The integration of sensors for IV detection ensures accurate and timely monitoring of IV therapy, enabling healthcare professionals to track fluid administration and promptly detect any anomalies. The incorporation of Canny edge detection facilitates the recognition of subtle image details, allowing for more precise identification of critical patterns or objects. The real-time ECG monitoring with live feed offers continuous cardiac monitoring, enabling healthcare providers to closely monitor the patient's heart health and detect irregularities promptly.

III. ANALYSIS

Analysis table summarizes the research papers on the IV-Drip Monitoring and Controlling. Below is a detailed description of various algorithms used in research papers.

Table 1: Analysis Table

Title	Summary	Advantages	TechStack
Intravenous Drip Monitoring System for Smart Hospital Using IoT [1]	It presents an innovative healthcare solution that leverages Internet of Things (IoT) technology to enhance the efficiency and safety of intravenous (IV) drip administration in hospital settings.	1. Enhanced Patient Safety: Real-time monitoring and alerts minimize human errors in IV drip administration, ensuring patient well-being. 2. Operational Efficiency: Reduced workload for nursing	IoT Sensors, Cloud-based Platform, Data Analytics and Machine Learning, Mobile App or Web Interface.

		staff and optimized resource allocation lead to more efficient hospital operations.	
Low-Cost Digitization of Infusion Pump for Realtime Automated Flow Rate Monitoring and Warning [2]	This represents a innovative approach to enhance the safety and efficiency of infusion therapy in healthcare settings.	Enhanced patient safety through real-time infusion monitoring; cost-effective solution for existing healthcare setups.	Microcontrollers, sensors, data processing algorithms, and alert notification systems.
Real-Time Cost-Effective E-Saline Monitoring and Control System [3]	This paper presents a cost-effective electronic saline monitoring system with IR sensors and servo motors for remote control. The system detects drops, calculates infusion parameters, and alerts for low fluid levels. The proposed solution offers convenience, reliability, and cost-effectiveness for hospitals.	1. Efficient Patient Care. 2. Real-time Monitoring. 3. Reduced Human Error.	STM32F103C8T6 Cortex-M3 ARM microcontroller, Infrared (IR) sensors, such as the TSOP1740.
IoT based Healthcare Monitoring and Intravenous Flow Control [4]	This research explores the integration of IoT technology into healthcare, focusing on real-time patient monitoring and IV fluid control. The system automates tasks, enhances data accuracy, and reduces the need for constant human intervention, improving patient care.	Automation, Remote Monitoring, Efficiency, Reduced Human Intervention, Enhanced Patient Safety.	IoT, Intra Venous (IV) fluid control, Cyber-physical system, Arduino, Firebase, MIT App Inventor.
Smart Saline Level Monitoring System Using ESP32 And MQTT-S [5]	A smart saline level monitoring device has been established to diminish accidents and allow remote surveillance in telehealth services. The device uses a load sensor and ESP32 Wi-Fi System on Chip microcontroller to convert the bottle's weight to a voltage, which is then sent to the microprocessor.	1.Improved Patient Safety. 2.Real-time Monitoring.	MQTT-S publish/subscribe protocol.

Research on a library seat management system. [6]	The system integrates information reading, lock/unlock, and data transmission for collecting and sharing seat occupancy data. Real-time seat management for administrators is enabled by consolidating and transmitting the information to the upper computer.	The system offers real-time seat occupancy data, enhancing the efficient allocation of library seats. And The system demonstrates stable performance, ensuring consistent and reliable management of seat occupancy within the library.	Arduino, RFID-RC522, Infrared Sensor, ESP8266. LabVIEW is adopted as the upper computer to analyse data in real time and create a display interface.
Automatic Water level monitoring and Seat availability details in train using Wireless Sensor Network.[7]	It presents a novel application of microwave Time Domain Reflectometry (TDR) technology for enhancing the precision and safety of intravenous (IV) drip infusions.	1. Enhanced IV infusion precision and safety through real-time monitoring. 2. Detection of air bubbles, occlusions, and tubing variations for improved patient care.	Microwave Time Domain Reflectometry (TDR) technology, Real-time monitoring and control system for IV drip infusions.
Smart Intravenous Infusion Dosing System [8]	The system integrates advanced sensor technology, data analysis algorithms, and real-time monitoring to optimize IV dosing for patients.	1. Enhanced patient safety through real-time dosage adjustments. 2. Improved treatment accuracy and reduced human error in IV medication administration.	The system likely utilizes a combination of IoT sensors, machine learning algorithms, and healthcare software platforms for data analysis and decision-making.
A Smart Infusion Pump System for Remote Management and Monitoring of Intravenous (IV) Drips [9]	This study addresses the lack of remote monitoring in IV fluid administration systems by developing an intelligent infusion pump system. The system effectively detects and notifies users of issues like empty bottles and line blockages.	Remote Monitoring: The system enables remote monitoring and control of IV drips, enhancing patient care and reducing the need for constant on-site supervision.	Arduino-based Microcontroller: Used for monitoring the drop counter, sensing tube blockage, and monitoring the draining of the drip bag. Smartphone Application (Blynk): Provides a user interface for monitoring and controlling the system.
Design and Development of IOT enabled IV infusion rate monitoring and control device for precision care and portability [10]	This paper proposes an IoT-based drip monitoring and control device for IV infusion setups, reducing human error and allowing remote monitoring and regulation.	This IoT-based IV infusion monitoring and control device reduces human error, enhances accuracy, and allows for remote monitoring and control, improving patient safety.	ESP32 microcontroller, IR sensors for drop detection, a 2.4GHz Wi-Fi module, and a custom actuator for IV regulation.

Low-Cost Saline Droplet Measurement System using for Common Patient Room in Rural Public Hospital [11]	This paper recommends a saline droplet measuring system (SDMS) that is low-cost. In rural public hospitals, the procedure can be used to monitor the saline droplets in each patient's bed in hospital. All patient beds will have the measurement modules installed. Each patient's saline droplet status will be displayed by the system.	A user-friendly interface is a software interface where the user can easily understand and navigate through the application in an efficient way.	Wireless technology
Advanced IOT Based Combined Remote Health Monitoring, Home Automation and Alarm System [12]	The Internet of Things transfigures modern technology, making life easier and automated. It provides remote real-time health monitoring for patients, reducing human error and room occupied space.	Analyses data, tracks performance, and helps with troubleshooting.	Cloud platform, Accelerometer sensor MMA7260QT, Raspberry Pi 3 Model B.
Real-time drip infusion monitoring through a computer vision system [13]	This paper presents a unique approach based on deep learning computer vision techniques for monitoring the IV injection flow rate.	1. Improved Accuracy. 2. Reliable results	Deep learning computer vision.
Design, Development, and Fabrication of an Intravenous Infusion Monitoring Device [14]	The paper presents the design, development, and fabrication of an Intravenous Infusion Monitoring Device, focusing on real-time IV therapy supervision. This device offers enhanced patient safety, alerts for deviations, and the potential for IoT integration, showing promise for improving healthcare and research in the field.	Enhanced patient safety through real-time monitoring, reduced medication errors.	Embedded systems, microcontrollers, sensors, and possibly wireless communication protocols for real-time monitoring and control.
Advanced ICU Patient Monitoring with Sensor Integration, IV Detection WITH Canny Edge Detection, and ECG Monitoring with Live Feed [15]	The paper introduces an advanced ICU patient monitoring system that integrates sensors for vital sign monitoring, utilizes Canny Edge Detection for precise IV	1. Enhanced patient safety through accurate IV therapy monitoring. 2. Improved critical event detection with Canny edge technology.	Python for image processing, sensor integration, and Canny edge detection, ECG monitoring hardware and software for real-time cardiac monitoring, and

	tracking, and offers real-time ECG monitoring. This innovative approach enhances patient safety, minimizes healthcare professional workload, and holds potential for future remote monitoring and medical research.	3. Real-time ECG monitoring offers swift intervention in cardiac issues.	a user interface developed with web technologies for data visualization and live feed display.

IV. Conclusion

In conclusion, the IV monitoring system will be able to detect and signal the liquid level in an IV bottle. Additionally, it will permit real-time monitoring and viewing of the IV infusion process from distant locations, such as a nurse room. It will also enable automatic management and cessation of IV tubing-based infusion flow. The suggested method will be totally automated, with very little human input. As a result, the nurses won't need to perform as much physical labor. It will be helpful at night since it will alert nurses, doctors, and caregivers when saline levels are low, eliminating the need for nurses to routinely check the patient's bed to see how much saline is in the bottle.

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