INTEGRATION OF PRECISION ELECTRONIC VALVE AND LOAD SENSOR FOR AUTOMATED CHEMICAL FLOW CONTROL IN MEDICAL APPLICATIONS

[1]Usha B S, [2]Chandana J K, [3]Chandana N R, [4]Chandana V C, [5]Chaya G K
[1]Professor, [2,3,4,5]Students
Department of CSE
East West Institute of Technology
Bengaluru, India

Abstract— The proposed system incorporates glucose monitoring sensors to track blood glucose levels, saline level sensors for intravenous therapy management, and a suite of health monitoring devices to capture vital signs. The collected data is seamlessly transmitted to a centralized IOT platform, where process and analyze the information. A user-friendly interface, accessible through mobile and web applications, allows both patients and healthcare providers to monitor and interpret the data effectively. An alert mechanism that notifies users and healthcare professionals in case of critical health parameter fluctuations. The integration of saline level monitoring enhances the system's utility, particularly for patients requiring fluid balance management. The robust security measures implemented ensure the confidentiality and integrity of sensitive health data.

Keywords— Saline Level Monitoring, ECG, SPO2, Heartrate Conditions, Human Body Temperature.

I.INTRODUCTION

To enable quantitative control in various fluid motion monitoring systems, an electronic valve with precision control has been developed. The valve collects flow pulse signal from the impeller Hall flow sensor. Micro controller chip is used to calculate the flow value and cumulate the total value. It`s also used to control relay in order to real-time control solenoid valve. Electronic valves play a pivotal role in both manufacturing and everyday activities. Presently, electronic valve technology is advancing in the directions of simplification, smart functionality, universality, and tailoring to specificneeds. Apart from their fundamental switching role, dedicated solenoid valves also cater to specific functions or are tailored for particular situations. Examples include gas, steam, oil, refrigeration, high-temperature, and explosion- proof solenoid valves. Within this project, a load sensor is connected to the Arduino microcontroller. This sensor is tasked with detecting the weight of chemicals and presenting this information on the LCD display.

In the next stage we are giving a flow input in ml/sec, in one second a particular quantity of chemical should go to the outlet this will controlled by a solenoid valve.

This can be employed for automated glucose flow regulation in hospital settings, for physical vapor deposition processes. The Drip bottle weight is measured using an electronic load cell and information about it will be sentto IOT server of the Hospital. But here for demonstration purpose we are sending the data to the basic android mobile App, through using the Wi-Fi module. When bottle gets a threshold level it intimates to the Wi-Fi module and sends the data to the Doctor and hospital staff. Doctors cancontrol the rate of fluid motion by sending commands from the phone.

SYSTEM LEVEL BLOCK DIAGRAM:

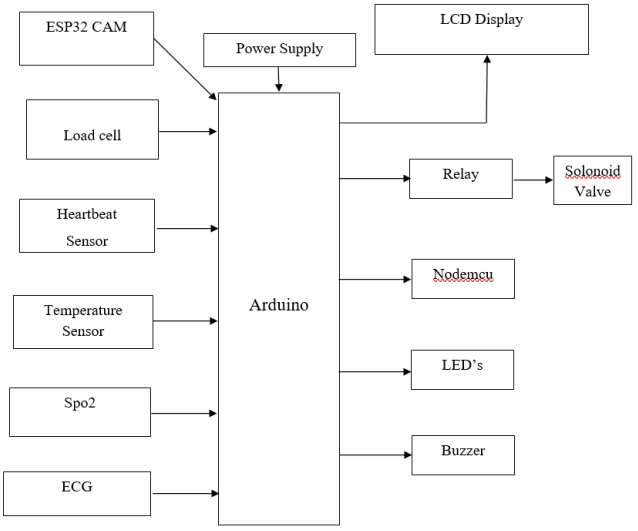

Fig 1: System level block diagram

System level block diagram is shown in fig.1. Saline Level Monitoring will monitor and regulate the rate of fluid motion of glucose drip accurately, when the drip is injected to the patient. Electrocardiography is a device employed for assessing different cardiac conditions in patients primarily captures the frequency of the heart rate and the regularity of its rhythm. Heart rate Conditions which are regarding the heart rate and blood pressure of the patient. Heart rate is controlled by two branches of autonomic nervous system. Human Body Temperature is about the patient body temperature which is in Celsius. The system must monitor the patient's body temperature using a temperature sensor.

II. **LITERATURE SURVEY**

A literature Survey involves reviewing existing scholarly work, research papers, articles and other source related to a specific topic. The table encompasses crucial details are vital net the study, author(s), publication year, research objectives, and key advantages and disadvantages identified in each work.

Title	Authors	Year	Objectives	Advantages	Disadvantages
"IoT Based Patient Monitoring System Using ECG Sensor"	Alvee Rahman, Jia Uddin	Jan 2019	1. Remote Monitoring: Enable healthcare professionals to remotely monitor patients' ECG signals in real-time, allowing for timely intervention and reducing the need for frequent hospital visits. 2. Early Detection of Abnormalities: Detect and alert healthcare providers to any abnormal heart activities or potential cardiac issues, enabling early diagnosis and treatment.	1. Early Intervention: Early detection of abnormal heart activities allows for prompt medical intervention, potentially preventing serious cardiac events. 2. Remote Access: Healthcare providers can monitor patients remotely, leading to more efficient use of resources and reduced healthcare costs.	1. Privacy and Security Concerns: Transmitting sensitive health data over the internet raises concerns about patient privacy and the security of the transmitted information. 2. Technical Challenges: Technical issues, such as sensor malfunctions or connectivity problems, may affect the reliability of the system.
"eSmart: An IoT based Intelligent Health Monitoring and Management System for M ankind"	Dr .T. Jagannadha Swamy and T. N. Murthy	2019	1. Early Detection of Health Issues: Implement algorithms and intelligent systems to analyse the collected health data for early detection of potential health issues or anomalies. 2. Personalized Health Insights: Provide personalized health insights to individuals, empowering them with information to make well considerd regarding their well-being.	1. Improved Patient Engagement: Engages individuals in their own health by providing them with continuous feedback and encouraging healthier lifestyle choices. 2. Data-Driven Healthcare: Harnesses the power of data analytics to derive meaningful insights, contributing to evidence-based healthcare practices.	1. Reliability and Accuracy: The accuracy and reliability of IoT devices for health monitoring may vary, leading to potential errors. 2. User Acceptance: Some individuals may be uncomfortable with continuous monitoring, leading to issues of user acceptance and complianc e.
"IOT Based Remote Patient Health Monitoring System"	Gulam Gaus Warsi, Kanchan Hans	2019	1. Enhanced Accessibility: Improve access to healthcare services, particularly for patients in remote or underserved areas. Patient Empowerment: 2. Empower patients to actively participate in their healthcare by providing them with access to their health data and encouraging self-care.	1. Timely Intervention: Enables healthcare professionals to intervene promptly in case of abnormalities, potentially preventing complications and reducing hospitalization rates. 2. Cost Efficiency: Reduces healthcare costs by minimizing the need for frequent hospital visits and preventing emergency situations through proactive monitoring.	1. Privacy and Security Concerns: Transmitting sensitive health data over the internet raises concerns about patient privacy and the security of the transmitted information. 2. Dependency on Technology: Over-reliance on technology might diminish the importance of human interaction in healthcare.

Title	Authors	Year	Objectives	Advantages	Disadvantages
"IOT based Patient Monitoring System which provides data on Patient's Respiration"	R. Kumar	Feb 2021	1. Patient-Centric Approach: Prioritize a patient-centric approach, empowering individuals to actively participate in their respiratory care through access to their own data. 2. Integration with Electronic Health Records (EHR): Ensure seamless integration with electronic health records, allowing for a comprehensive view of a patient's health history and facilitating informed decision-making.	1. Continuous Monitoring: Provides continuous and unobtrusive monitoring of respiratory parameters, allowing for a more comprehensive understanding of a patient's respiratory health. 2. Remote Accessibility: Enables healthcare professionals to remotely access and monitor respiratory data, improving healthcare delivery in diverse geographical locations.	1. Accuracy and Reliability: IoT devices measuring respiration might face challenges in accuracy and reliability, leading to potential errors or false readings. 2. Privacy and Security Concerns: Transmitting and storing sensitive health data related to respiration could pose privacy and security risks if not adequately protected.
"IOT based Real Time Patient Monitoring and Analysis using Raspberry Pi 3"	Neethu Anna Mathew and K M Abudeker	June 2018	1. Immediate Alerts and Notifications: Set up a mechanism to generate immediate alerts or notifications for healthcare professionals in case of critical health events or deviations from normal parameters. 2. Remote Accessibility: Enable healthcare providers to remotely access and monitor patient data, facilitating timely interventions and reducing response time.	1. Remote Accessibility: Enables healthcare professionals to remotely access and monitor patient data, improving healthcare delivery in diverse geographical locations. 2. Data-Driven Insights: Generates data-driven insights into patient health, contributing to evidence-based healthcare practices and personalized treatment plans.	1. Security Concerns: Securing patient health data transmitted and stored on Raspberry Pi 3 against potential cyber threats and breaches is essential but may pose challenges. 2. Integration Challenges: Integrating different sensors and ensuring their compatibility with Raspberry Pi 3 may present technical integration challenges.
"Design and Development of IOT Based Multiparameter Patient Monitoring System"	Athira. A, Devika. T. D, Varsha. K. R, Sree Sanjana Bose. S	Mar 2020	1. Multiparameter Monitoring: Develop a system capable of monitoring multiple health parameters, such as heart rate, blood pressure, respiratory rate, temperature, and more, simultaneously. 2. Real-time Data Transmission: Enable real-time transmission of patient data to healthcare providers or centralized monitoring stations, ensuring timely interventions in case of abnormalities.	1. Early Detection and Intervention: Facilitates early detection of health issues, allowing healthcare professionals to intervene promptly and potentially prevent complications. 2. Comprehensive Patient Monitoring: Provides a comprehensive view of a patient's health by monitoring multiple parameters simultaneously, enabling amore holistic approach to healthcare.	1. Ethical Considerations: Concerns about the ethical use of patient data and potential misuse of information gathered from continuous monitoring. 2. Training and Adoption: Healthcare professionals may require training to adapt to and effectively use the new technology, leading to initial resistance or learning curve challenges.

Title	Authors	Year	Objectives	Advantages	Disadvantages
"IoT-Based Glucose Drip Monitoring"	A. Patel, B. Sharma	2020	1. Immediate Alerts for Abnormalities: Set up a mechanism to generate immediate alerts or notifications to healthcare providers in case of abnormal glucose levels or deviations from the prescribed range. 2. Data Logging and Analysis: Log and analyse historical data to identify trends, patterns, and anomalies in glucose levels, aiding in treatment planning and optimization.	1. Precision in Medication Delivery: Enables precise control over the administration of glucose drips, minimizing the risk of under or over-administration of medication. 2. Real-time Alerts for Healthcare Providers: Provides real-time alerts to healthcare providers in case of abnormal glucose levels, allowing for immediate intervention and adjustments to the treatment plan.	1. Cost Consideration: Implementation and maintenance costs of the IoT infrastructure could be a limiting factor for healthcare facilities. . 2.Dependency on Technology: Healthcare providers and patients may become overly reliant on the technology, potentially neglecting other critical aspects of patient care.
"Smart Healthcare using Arduino"	C. Singh, D. Kumar	2018	1.Data Collection and Analysis: Design a platform that collects health data, such as vital signs, and analyses it to provide insights for healthcare professionals.	1. Ease of Prototyping: Arduino's open-source nature and simplicity make it a suitable platform for rapid prototyping of healthcare devices and systems	1.Security Concerns: Implementing robust security measures in Arduino-based healthcare systems may be challenging, raising concerns about the privacy and integrity of patient data.
"Arduino-Based Infusion Pump Control"	X. Chen, Y. Wang	2019	1.Accurate Medication Delivery: Design a system that ensures precise control over the administration of fluids or medications to patients through infusion pumps.	1.Open Source and Community Support: Arduino's open-source nature encourages collaboration and community support. Developers can leverage a wide range of libraries, tutorials, and resources available within the Arduino community.	1.Limited Connectivity: Arduino's connectivity options may be limited compared to more advanced platforms. This may pose challenges in integrating with larger hospital information systems or managing data transfer in real-time.
"Wireless Glucose Monitoring System"	M. Lee, N. Park	2021	1. Real-time Glucose Monitoring: Develop a system that enables continuous and real-time monitoring of glucose levels in individuals with diabetes. 2. Wireless Data Transmission: Implement wireless communication technologies to transmit glucose data from the monitoring device to a centralized system or mobile application.	1. Continuous Monitoring: Provides continuous monitoring of glucose levels, offering a more comprehensive understanding of a patient's glucose fluctuations compared totraditional intermittent measurements. 2. Real-time Alerts: Enables immediate detection of abnormal glucose levels, allowing individuals and healthcare providers to take prompt actions, such as adjusting insulin doses or making lifestyle changes.	1. User Training Requirements: Healthcare professionals and patients may require training to effectively use and interpret data from the wireless monitoring system. 2. Limited Coverage or Range: Some wireless systems may have limitations in terms of coverage range, affecting data transmission in certain environments.

III. COCLUSION

The proposed an IoT-driven healthcare monitoring system to enhance real-time tracking and management of patient health data for improved and efficient healthcare delivery. offers a promising and comprehensive approach to saline level management, holding immense potential to improve clinical outcomes, patient experience, and healthcare delivery for a healthier future. The comprehensive healthcare monitoring presents a transformative approach to healthcare management. The system's ability to empower patients, facilitate remote healthcare delivery, and contribute to early intervention positions it as a valuable tool in the ongoing efforts to enhance personalized and accessible healthcare.

REFERENCE

[1]. Alvee Rahman Department ,Tahsinur Rahman and Nawab Haider Ghani ,"Iot Based Patient Monitoring System using ECG Sensor" in 2019 International Conference on Robotic ,Electrical and Signal Processing Techniques(ICREST-2019).

[2]. Dr.T.J.Swamy and Mr.T.N.Murthy,"eSmart:An Iot based Intelligent Health Monitoring and Management System for Mankind" ,2019 International Conference on Computer Communication and Information (ICCCI-2019),Jan 23-25 ,Coimbatore,India.

[3]. Gulam Gaus Warsi,Kanchan Hans,Sunil Kumar Khatri from Amity Institute Of Information Technology ,in the 2019 International Conference on Machine Learning Big Data ,Cloud and Parallel Computing(Com -IT-Con),India,14th-16th Feb 2019.

[4]. Mohammed Sala Uddin Jannat Binata Alam and Suraiya Banu ,"Real Time Patient Monitoring System Based on Internet of Things" ,Proceedings of the 2017 4th International Conference on Advances in Electrical Engineering (ICAEE)28-30 September ,Dhaka, Bangladesh.

[5]. Neethu Mathew,K.M Abubeker "Iot Based Real Time Patient Monitoring and Analysis using Raspberry Pi",in International Conference on Energy,Communication,Data Analytics and Soft Computing (ICECDS-2017).

[6].Athira.A,Devika.T.D,Varsha K.R,Sree Sanjana Bose.S,"Design and Development of IOT Based Multi-Parameter Patient Monitoring System ",2020 6th International Conference on Computing & Communication Systems (ICACCS).

[7]. Hoe Tung Yew,Ming Fung Ng,Soh Zhi Ping,Seng Kheau Chung,Ali Chekima,Jamal A.Dargham="Iot Based Real-Time Remote Patient Monitoring System "-IEEE Conference Publication 2020.

[8]. C.-F. So et al., "Recent advances in noninvasive glucose monitoring," Medical Devices: Evidence Res.,no. 5, pp. 45–52, Jun. 2012.

[9]. S. K. Vashist, "Non-invasive glucose monitoring technology in diabetes management: A review," Analytica Chimica Acta, no. 750, pp. 16–27, Apr. 2012.

[10]. K. Song et al., "An impedance and multi-wavelength nearinfrared spectroscopy IC for non- Invasive blood glucose estimation," in Symp. VLSI Circuits Dig. Tech. Papers, 2014.