AUTOMATED INTRA VENOUS FLUID LEVEL MONITORING SYSTEM FOR HOSPITALS

Theetchenya.S\textsuperscript{1}, Vidyabharathi.D\textsuperscript{2}, Vidhya.G\textsuperscript{3}, Marimuthu.M\textsuperscript{4}
\textsuperscript{1,2,3,4} Sona College of Technology, Department of Computer Science and Engineering, Salem, Tamil Nadu
\textsuperscript{1}theetchenya@gmail.com, \textsuperscript{2}dvbharathi77@gmail.com, \textsuperscript{3}gvidhyacse@gmail.com, \textsuperscript{4}mari.btech@gmail.com

ABSTRACT

In medical field, recently Automated Health care system is becoming more valuable for their accurate information and results. Also it reduces pressures on medical professionals and Patient observers on the absence of certain vital data. The main aim of this project is to relieve human effort by automatically controlling the dripping system of the patient in hospitals. The proposed system will send a message to the nurse about the status of the saline level of the patients for further actions. The system is designed such that if the Intravenous fluid reaches 75\% then a notification is send to the nurse and if it reaches a critical level 90\%, then it is sensed by the LED & LDR set up and an alarm is sounded at the nurses’ room indicating the room number. When this is done, the nurse can easily identify the room and go there directly to change the bottle rather than keep checking every room to notice if the fluid has reached the critical level. This requires the use of RF transmitters and receivers to transmit to distances.

Keywords: Arduino Controller, Buzzer, Intravenous fluid, LDR, LED, RF Transmitter, RF receiver

I. INTRODUCTION

IoT refers to the physical objects linked to the internet across the world that collectively store and share data. This is due to the advancement in computer chip technology and ubiquity of wireless networks. Everything is transformed to part of IoT, as small as pill to something as huge as an aircraft. Connecting and adding sensors to all of these various objects gives computers that might otherwise be dumb a level of artificial intelligence, enabling them to share data in real time without including a person. The Internet of Things is merging the real and artificial realms to make the world system around us smarter and more accessible. It is a multidisciplinary area in which various areas converge, such as cloud computing, embedded systems, and computer sciences. Building automation is one such IoT-based technology that has seen substantial investment from both the commercial and academic community in recent years. An IoT machine can be as lighthearted as a boy's toy or as extreme as a self-driving car. Some larger objects, such as a jet engine, can be fitted with many smaller IoT elements, such as thousands of sensors that collect and relay data back to ensure it operates efficiently.

Smart city programmes, on a broader scale, cover entire areas with devices that help us understand and track the environment. So IOT is very helpful in and pretty much the only way this project can be completed is that we can connect to all other technological devices using this domain and to the cloud itself, and it is easier because of its cost relative to other platforms where the project is more expensive. The Internet of Things encompasses traditional fields such as integrated technologies, wireless sensor networks, control systems, robotics, and so on. In the consumer industry, IoT technology is more closely associated with goods that fall under the "smart home" definition, which includes hardware and appliances that follow one or more common ecosystems and can be controlled by ecosystem-connected devices like smart phones and speakers.

Whenever a fluid is being fed to any patient, a nurse or any relatives must continuously monitor him / her. Most likely due to inattention, busy schedule and more patient numbers, the nurse can forget to change the saline bottle once it is fully consumed. Blood flows back to the saline bottle immediately after the saline finish because of the difference in blood pressure and pressure inside the empty saline bottle. This can cause blood to drain backwards from their veins into the saline tank. Also it causes a reduction in the patient's haemoglobin levels, as well as a
loss of red blood cells (RBCs) in the blood, resulting in fatigue. As a result, a structure must be created that reduces the patient's reliance on nurses or caregivers to some extent. This machine uses an IR sensor as a level sensor and uses an automatic alerting and signaling device based on IOT. The voltage output of an IR sensor varies when the volume of intravenous fluid is below certain thresholds. The comparator compares the IR output continuously with the predefined threshold. If the transceiver output is negative, the Arduino controller senses that the fluid volume is too low and alerts the observer with a buzzer. As the saline level decreases to a certain low level, a warning is activated to warn the nurse that the patient's saline is running out. The weight gap is used to determine how much saline is in the bottle, as well as to trigger an audible alarm in the attendant or nurse room indicator monitor. If the nurse fails to attend the patient immediately then there will be a motor system that will compress and flatten the saline hose. This prevents saline from flowing upwards from the veins to the bottle. The main intentions are.

- Overcoming disadvantages of manually operated saline system.
- To have greater accuracy than a manual regulation of the saline flow rate.
- To prevent harms caused by neglect against saline completion to patient wellbeing.
- To make the saline monitoring automated and to automatically remind the doctor/nurse about patient safety.
- Stop immediately flow after the saline bottle has been drained.

II. LITERATURE REVIEW

When the world's population expands, so does the need for health services. Health treatment has advanced rapidly in recent years as a result of advances in the fields of sensors, microcontrollers, and computers. It was decided to design and build a compact saline flow rate measurement device. The implementation of an automatic saline monitoring system using an indigenously designed low-cost sensor and GSM (Global Mobile Communication System) modem is described in this paper. This allows the on-call physician or nurse to keep an eye on the saline flow rate from a distance. To have coordination, the microcontroller 8051 is used. The flow rate of the liquid is measured using an infrared sensor on the neck of the saline container. The rate of saline drop can be detected with reasonable accuracy. An IR sensor is used at the bottom of the saline bottle to determine the flow rate of the liquid. The saline drop detection rate is fairly accurate. The sensor's output is analyzed to determine if the flow rate is slow, average, or high, and the same information is sent to a duty nurse or doctor’s mobile cell using GSM technology for future behavior. The smart drips [2] were developed by St. Thomas College of Engineering and Technology in Chengannur, India, using an Arduino microcontroller. Many advanced procedures have evolved in recent years as a result of technical advancements to ensure rapid recovery of hospital patients. The fluid level is constantly monitored by an assistant/nurse, particularly in hospitals. However, in government hospitals, due to a shortage of nurses, detecting this fluid is a major headache.

The Arduino microcontroller smart drip can resolve complications such as penetration, hematoma, air embolism, tubing blood backup, extra vascular injection, intra-arterial injection, etc. Using the Ultrasonic Sensor it can detect the emptying of the drip bag. To resolve this critical situation, we use Arduino to create a smart drip with automatic alerting and signalling system where Ultrasonic sensor is used as a level sensor. It will send a warning message to the nurse rooms if the fluid becomes low and nurses can also track the LIVE level graph in their screen. This technology eliminates the nurse’s work, rather than trying to search for an IV Fluid system. One of the strongest advantages of our project is the user-friendly interface that can be handled easily with a warning message.

Institute of Management Studies and Research [3] published the Saline Level Indicator in March 2013. The key goal of this paper is to use the Internet of Things (IOT) to advance the introduction of a saline level indicator in a saline container. It was presented by Mumbai University. The proposed device is made up of infrared sensors that are used to track and control various objects in the environment. The IR sensor can be used as a level sensor in the saline bottle to keep track of the saline's critical level. The automatic RF-based device sends an alert and alarm to hospital personnel when the saline level reaches a predefined critical level. The warning note will be sent over the internet to the nurses and doctors in charge of the patients. In addition, an alarm buzzer will begin to sound. The aim of this presentation is to show how a saline indicator is designed and implemented. This proposed method can be used in both homes and hospitals with success.
Many advanced procedures have evolved in recent years as a result of technical advancements to ensure rapid recovery of hospital patients. The most critical aspect of good health treatment in hospitals is the assessment and monitoring of patients' fluid and electrolyte needs. In all hospitals, an assist/nurse is in need of constantly checking the volume of IV fluid. Unfortunately, most observers will forget to adjust the saline bottle at the appropriate time due to their busy schedule. Patients can experience a variety of complications as a result of this, including blood backflow, blood loss, and so on. An automatic warning and signalling system based on low-cost RF is proposed to solve this crucial condition, with IR sensors serving as level sensors. It is based on the assumption that when the intravenous fluid level falls below such limits, the voltage level of the IR sensor output varies. A comparator compares the IR contribution to a predefined threshold on a continuous basis. When the transceiver output is negative, the Arduino controller senses that the fluid volume is too low and sounds a warning buzzer, while the LCD in the control room displays the patient's room number for fast recovery.

Another system is made up of four pieces that are attached to the drip chamber. The flow sensor is used to track four different sets of drops. The light beam is broken at some point with each drop, and the IR sensor transmits and receives it. This causes a change in the sensor's output, and the comparator outputs a pulse for each drop. An warning will be triggered if the device is not detected for 45 seconds. The other approach is to use GSM to develop and construct a modular framework for measuring saline flow rates and a remote monitoring unit. The drips bottleneck is attached to an indigenously built sensor in this device. On each drop of saline, the signal conduction circuit generates one pulse. A multivibrator, phototransistor, and comparator make up the signal conditioning circuit. The pulses are counted in units of time using an 8051 microcontroller. This will imitate the flow rate. The flow rate information is sent to the mobile observer using GSM technology. This machine is expensive. The disadvantage of this system is that it is expensive.

III. METHODOLOGY

Several automatic health monitoring systems have been created to ensure patient safety while reducing doctor workload. The nurse receives a notification/alert message from our device. Instead of constantly monitoring an IV fluid, the nurse's workload is reduced. We want to create a smart drips level measurement unit in which the drips level is determined using a load cell that is often used to determine the weight of a glucose container. Then the measured data is sent to NodeMCU where wifi connectivity is established then the data is sent to thingspeak where cloud analysis is done. when the saline level reaches certain point a message/notification is sent to the nurse who is taking care of the patient at the same time the nurse is busy/not in the ward .When the saline reaches certain point ie) critical condition. A buzzer is set to buzz to alert everyone in the ward so that someone free will take care of the patient. When threshold value reaches 75% ie) equal to 25 which defines the remaining saline level message is sent and when reaches 90% buzzer is set to buzz.

System specifications:

- NodeMCU
- Loadcell
- Amplifier
- Arduino IDE
- Thingspeak
- IFTTT

IoT Module

IoT Module includes a part of the hardware which includes LoadCell, Amplifier and NodeMCU. The LoadCell is used to gauge any object's weight. Four types of LoadCell are present. But LoadCell is used to single stage, where we can position the weight on top of the LoadCell. If anything is hanged, the weight is determined. Since the glucose bottle is hanging upside down it is very helpful in calculating the bottle’s weight. The measure weight will be sent via Amplifier to the NodeMCU where the data will be continuously read through the LoadCell and stored in a temporary memory, and then the data will be sent to Amplifier. For signal conditioning a LoadCell amplifier is used to amplify the signal and transform it into output energy. The calculated load cell data is sent to NodeMCU for further processing via amplifier. NodeMCU is a software and development kit open
source to help you create prototype or IoT devices. It includes software running on the wifi to the ESP8266. The data is sent to NodeMCU, which has a choice of built-in wifi connectivity. Rather than using the board of Arduino UNO and ESP8266, the node MCU ESP8266 is accessible at low cost. So the data can be sent to the cloud or any platform for analysing and visualising with the built-in wifi.

Cloud Module

NodeMCU is connected to wifi where the load cell sensed data is sent to the Thingspeak which is a cloud platform for visualising the data. Thingspeak is basically an IoT analytics software tool that enables you to integrate, visualise, and analyse live cloud data streams. Data can be sent from the input devices to ThingSpeak, instant data visualisation can be generated, and alerts can be sent via web services such as Twitter and Twilio. MATLAB code can be written and executed in ThingSpeak to perform preprocessing, visualisation, and review.

SMS Module

With the help of IFTTT, an SMS is sent to the nurse who handles a particular patient, and the data collected by LoadCell is sent to NodeMCU to establish wifi communication, after which the data is sent to Thingspeak and IFTTT. IFTTT is a web-based freeware service that creates applets, which are chains of short conditional statements. Other Web sites, such as Gmail, Facebook, Telegram, Instagram, and Pinterest, allow an applet to appear. IFTTT can simplify activities related to the mobile interface, such as posting the same content through various social media platforms. IFTTT can be used by marketing experts to monitor company mentions in RSS feeds. A threshold value is given to IFTTT with the help of the value, and when the saline amount reaches the value, a message or SMS is sent to the patient's nurse.

Critical condition

The critical situation is, when the saline level exceeds the threshold value and the alert is sent to the nurse, and yet the nurse is not in the position to care for the patient. In this case, a buzzer is set to alert nearby workers, guardians or doctors when the saline drains to 90%. That they may support the patient and take care of the patient. Most buzzers, in one box, include the oscillator circuit and piezoelectric part or speaker. When applying voltage to the buzzer as it gives irritating beeping or buzzing sound.

IV. ARCHITECTURE AND IMPLEMENTATION OF DRIPS LEVEL MONITORING SYSTEM

This could seem to be a coincidental occurrence at first. It does, however, have fatal effects. Blood rushes back to the saline reservoir after the saline is used due to the imbalance between blood supply and pressure in the empty tank. As a result, ground-breaking health surveillance devices have been installed with less human involvement and will be accessible at low cost in both rural and urban areas. The proposed device aims to efficiently solve the aforementioned issue. And in the control room, the nurse can keep track of the quantity of saline. Level sensors are used to measure the liquid state in the container, whether it is natural or alert, for automatic saline level control. The saline drop detection rate is fairly accurate. The sensor's data is analysed to ensure that the saline container is clean. When the saline level falls below a certain level, a warning will ring. The weight is determined by hanging the glucose bottle on the LoadCell. The weight is determined as the saline amount decreases, and the data is sent to NodeMCU. NodeMCU has a built in wifi module that is used to connect to the cloud. Thingspeak is the cloud platform used to view the data via monitor. If the saline level absorbs 75% (i.e.) the remaining 25%, a message will be sent to the patient's nurse. In a critical situation, as saline absorbs 90%, a buzzer is set up to alert the ward staff.
The IoT-based drip monitoring system serves as an aid for patient monitoring by nurses and doctors. This also reduces the number of IV-set status tests needed. It's fast, low-cost, high-precision, simple to use, completely automatic, and convenient for nurses. This device clearly demonstrates a positive shift in the medical field, especially in terms of monitoring with a lower initial expenditure. It can be used again for the next saline bottle. It is advantageous at rural hospitals for nurses and doctors alike. Nurses are able to track the saline level from afar quickly. It is mostly beneficial at night time, because nurses do not need to go to the bed of the patient to check the saline level in the container. Saline levels can be assessed and warning given to nurses even in the critical situation.

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