Patient Drip Monitoring System Using Arduino

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***Abstract*- The drips flow in the patient's body should be monitored carefully, and it is difficult for the nurse to monitor from all the wards, it reduces the risk and improves safety. Interfacing the load cell and flow sensor in Arduino, which process is done by alerts the level of the bottle to the main unit, so that the nurse can get to verify which patient needs to change the drips bottle. Each value is sent to the hospital through the web interface. Once the drip bottle reduces to 70% the intimation message is sent to the nurse and if the bottle drains 90% complete, the call will be alerted and the control valve will close automatically which flow of fluid stops immediately without any airflow in the patient's vein**

Keywords—infusion solution, Intravenous, wireless module, ESP8266

I.INTRODUCTION

Infusion therapy is often used in hospitals and care facilities, it should be managed. The drop counter is used to detect the infusion rate of the drip bottle. We have developed a smart drip infusion system, which consists of eminent monitoring systems with a central monitor computer at the nurse station. By considering standard parameters(pressure) caused by the dripping solution, the infusion rate, and information about the state of IV bag dripping, variation in flow, finished(solution bag empties) is sent to central monitor instantly, then these data are graphically stored in the central monitor of the nurse station. Therefore the developed system can effectively monitor the infusion status of many patients in a hospital and can be collected, saved in the nurse station, the message alert and call alert are placed automatically, which enhances retrieval facility too for later reference.

II. LITERATURE SURVEY

Hikaru Amano proposed a remote drip infusion monitoring system employing Bluetooth. The system consists of the infusion monitoring devices and the central monitoring system. The infusion monitoring device employs a Bluetooth module that can be used to detect the drip infusion rate and an empty infusion solution bag, and then these data are sent to the nurse station via Bluetooth module. The nurse station receives the data from several infusion monitoring devices and then displays graphically them. Therefore, the developed system can monitor intensively the drip infusion situation of several patients at the nurse station [1]

Xinling Wen proposed a Design of Medical Infusion Monitor and Protection System Based on Wireless Communication Technology. A medical infusion monitor and protection system design based on the technology of the

Modulation demodulation,single-chip microcontroller, photoelectric monitor and wireless communication, etc. infrared photoelectric conversion is collected by infusion

Signal. Monitor data to SCM AT89C51 processes and control area infusion speed and controls wireless transceiver nRF905 to constitute a wireless communication system to transmit data. Connected the main controller through the serial interface MAX487with each control node, the upper PC can monitor and control each node in real-time and renew control-schemes. This system has shown that the rate of infusion speed monitor error is less than 2 drops for every minute, and stability time is faster than others, it effectively completes the intelligent infusion system monitor and alarm [2].

Sosuke Tsukamoto has proposed that a new drip infusion solution monitoring system with a free-flow detection function. The intravenous therapy monitoring system has been developed for hospital and care facilities. The system detects the fall of each drip chamber drop of fluid and a free-flow situation. Three non-contacting copper coil electrodes are used. The electrodes are wrapped around the polyvinyl chloride (PVC) tube from the infusion PVC tube the drip chamber, and the solution bag. Drip infusion fluids have electrical conductivity, the infusion fluid and electrode are formed between the capacitor. A 30 kHz sine wave is applied to the electrode wrapped around the infusion supply PVC tube from the solution bag. Transducer output is the capacity-coupled signal on the drip chamber electrode. The output signal is changed when an infusion fluid drop is forming, its length and diameter, and therefore the drip chamber capacitance, are increased. The drip chamber electrode can detect the fall of each drip chamber of the fluid. When the infusion solution becomes free-flow, the infusion fluid flows continuously and an infusion fluid drop is not formed. Therefore, the output signal does not change the capacitance of the electrode around the drip chamber. On the other hand, the 30 kHz sine wave conducted by the infusion fluid detects the electrode wrapped around the infusion supply PCV tube under the drip chamber. The drip chamber electrodes and the infusion supply PVC tube under the drip chamber detect free-flow and each drop of fluid, respectively [3].

Priyadharshini.R proposed an automatic Intravenous Fluid Level Indication System. During recent years, the many sophisticated techniques, technological advancements, have been evolved for assuring fast recovery of the patients in hospitals. For good patient care in hospitals, assessment and management of patient's fluid and electrolyte need is the most fundamental thing required. All most in all hospitals and assist/nurse are responsible for monitoring the IV fluid level continuously. But unfortunately, most of the time, the observer may forget to change the saline bottle at the correct time due to their busy schedule. This may lead to several problems for the patients such as backflow of blood, blood loss, etc. To overcome this critical situation, a low-cost RF-based automatic alerting and indicating the device is proposed where the IR sensor is used as a level sensor. It is based on the principle that the IR sensor output voltage level changes when the intravenous fluid level is below a certain limit. A comparator is used to continuously compare the IR output with a predefined threshold. The Arduino controller identifies when the transceiver output is negative and the fluid level is too low and it alerts the observer by a buzzer and the room number of the patient indicates LCD at the control room for quick recovery [4].

Bailey Flynn proposed the Intravenous Dehydration Relief in Pediatrics. Dehydration is treated with IV therapy. The risk of IV therapy is over-hydration, which can lead to death and severe complications. In the developed world, infusion pumps are commonly used to regulate the delivery of IV therapy, but these technologies are too expensive and complex for many hospitals in the developing world. Pediatric wards in these hospitals lack sufficient electrical, and staff resources, financial, to monitor children undergoing IV therapy, often causing clinicians to undergo treatment entirely. They have developed IV DRIP, a simple, low-cost, mechanical automatic volume regulator to deliver intravenous fluid in low-resource settings. The device consists of two levers; an IV bag hangs on the upper level, while a counterweight hangs on the lower, notched lever. The position of this counterweight dictates the volume of fluid dispensed. When the target volume is delivered, stopping fluid flow the tip of the lever and kink the IV tubing and thus preventing overhydration. Tests have shown that IV DRIP can deliver fluid volumes from 50 mL to 800 mL increments with 97.5% accuracy. IV DRIP is an accurate tool to help save the lives of hundreds of thousands of children annually and affordable [5].

III.PROPOSED SYSTEM

The block diagram shown in Figure 1 illustrates the proposed system. The drip monitoring system using Arduino Uno R3, flow Sensor, solenoid valve, load cell, web interface. It can be more interactive in the hospital and it continuously monitors the drip level and updates the data to the more accurate cloud. There is a message alert and calling alert is based in our system to alert the nurse at the nurse station, it also placed based on the level of the drip. The specialty of the system is it always compares the flow result and load cell data and calculates the level of the drip which tends to be more accurate and the valve reaches 95% the auto call is placed and solenoid valve shuts down automatically

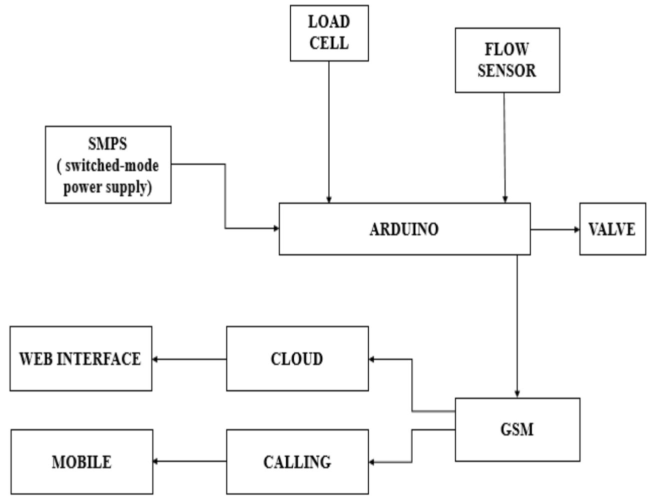

Figure 1- Block diagram for patient drip monitoring system

Load cell

A load cell is a transducer, specifically a force transducer. It converts a force such as, tension, pressure, or torque, compression into an electrical signal that can be measured. The load cell and the electrical signal are proportional to each other. Interfacing load cell to the Arduino using the HX711 Load cell amplifier module. The HX711 is a 24-bit ADC designed for weighing scales and industrial control applications to interface directly with a bridge sensor. The input multiplexer selects either Channel A or B they are called as differential input then changed into the low-noise programmable gain amplifier (PGA). Channel A1, A2, +5V and ground are present in the controller. The serial data, serial clock, +5v, ground are present in the HX711 load cell. The A2 is connected to the serial clock when the clock receives the pulse they will start the function even the ground, +5v are connected the serial data is connected to the A1 through the weight to read the A1

Flow sensor

The flow sensor consists of a plastic valve body, a rotor, and a hall-effect sensor. When liquid flows through the rotor, rotor rolls. Its speed changes with different rates of flow. The hall-effect sensor outputs represent the pulse signal. Working Voltage is 5 to 18V DC. The connections required for this flow rate sensor concerning the Arduino are very minimal. Only three wires are coming from the flow rate sensor. The signal/pulse (usually yellow) the GND (black wire), and 5V VCC (red wire) line. Connect the VCC and GND of the flow meter to the Arduino VCC and GND. The pulse line of the flow rate sensor is connected to the Arduino digital pin 2. The Arduino digital pin 2 serves as an external interrupt pin (interrupt pin 0).

1IV.RESULT AND DISCUSSION

In this system, it continuously monitors the patient's drip level and the data is sent to the cloud through the esp8211. The data are stored in the cloud for future reference

Drip level(%)	Alert mode and storage
0-80	Cloud
70	Cloud and message alert
90	Cloud and calling system

The table represents the function of the drip monitoring system. In these systems, the drip level reaches the 70% the automatic message will place, when they reach 90% call will be taken place, for the required number for alert them and when they reach 95% the solenoid valve will shut the flow automatically

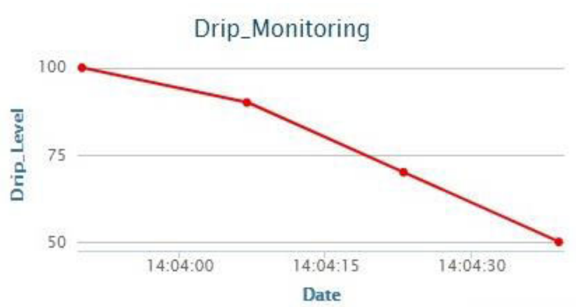

Figure 2-graphyical representation of drips flow

The fig 2 .shows that, the flow of drip level in nurse station. That varies according to comparison of load cell and flow sensor

IV.CONCLUSION AND FUTURE SCOPE

The automatic flow control in drip is realized as a small, compact and advanced technology in the medical field. Here the continuous flow of medicine through a drip to the patient is automatically controlled. This method can be done by measuring the level of the drip and is compared with the set point and also the flow of medicine is stopped when it reaches as the same. It is used for the overcoming of the careless mistakes done by the operators.

The above discussed systems ultimately aim at regulating the rate of infusion and alert in case of events like a drastic change in flow rate, no flow or blockage of the tube. The systems indeed ensure that the clinician takes a quick action in case of an emergency through mobile alerts, or alarms. However, these techniques have yet to be adopted in clinical settings owing to a variety of factors such as affordability, reliability, and ease of implementation. Another factor to take into consideration is the fact that while , these systems effectively regulate the flow rate and provide alerts in case situations like the backflow of blood occur, the clinician in charge has to come up to the patient to rectify the issue. However, despite these setbacks, monitoring systems facilitate better management of intravenous infusion both for the clinician and the patient and further development of these devices will no doubt exacerbate their benefits.

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