IoT based saline level monitoring system

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Abstract. In the process of medication, it is a common practice to treat patients with saline for dehydration and other medical ailments to improve the health condition of the patients. When fed with saline continuous observation of nurses is mandatory in monitoring the level of the saline. There are many cases where patients are being harmed due to the staff inattentiveness, as their absence does not notice the completion of saline level in the container. This arise the problem of back flow of blood immediately after the completion of saline in container. Hence to protect the patient from getting harmed an IoT based saline level monitoring system has been developed. The proposed model incorporates a sensor which continuously detects the saline drops. Whenever the sensor does not detect the drops for a certain interval it alerts the staff of the hospital with the buzzer, helping to monitor the safety of the patients.

Keywords. Saline, IR Sensor, Servo Motor, Arduino Microcontroller

1. Introduction

Arduino microcontroller is a programmable circuit board; unlike other circuit boards the Arduino does not require separate hardware to upload a code and plays a major role in developing monitoring systems. In hospitals in the process of medication to patient when the patients are fed with saline they must be constantly monitored [1][2]. More often in the busy continuous schedule of the staff attending the large set of patients, the nurse may forget to monitor and change the saline bottle as soon as its completion. Thus the blood rushes back to saline bottle through the intravenous tube because of the imbalance created between the blood pressure and pressure within the empty saline bottle. This may cause the back flow of blood from their vein through cannula resulting in the reduction of patient haemoglobin levels and shortage of red blood cells (RBC's) [9][10][11].

Patients most frequently face this problem in the hospitals. This may even lead to patient's death. So to overcome this problem there is a necessity to develop saline level monitoring system which reduces the dependency of patients on nurses[13].

In this system, whenever the saline in the bottle completes, automatically the tube is compressed and additionally it also gives a buzzer alerting the staff about the completion of saline in the bottle. By this, we can avoid the patient's problems and even the hospital staff also feel ease. This system improves efficiency in the work giving greater results in the hospital maintenance. It is cost effective and even flexible for nurses[14].

2. Literature review

Saline, known as Saline solution, is a blend of sodium chloride (NaCl) in water (H2O) and has various utilizations in clinical field. By infusing it in to vein, treat lack of hydration and furthermore used to weaken different meds to be given by injection[8]. It is most usually utilized as a sterile 9g of salt per liter (0.9%) arrangement, known as expected saline. Higher and lower focuses may likewise at times be utilized. Saline has a PH of 5.5 (primarily because of broke down carbon dioxide) making it acidic.

Professional doctors or nurses are responsible for the patient taking intravenous solutions. When a patient is treated with the saline, as of now there exists no automated system which detects the completion of saline in saline bottle. This paper also concentrates in controlling the outflow flow of blood into the empty saline bottle and it is not just restricted in informing the nurses about its completion [4][5]

3. Existing approach

In the present health care systems nurses are responsible for taking care of patients. They are the one who monitors the saline level and uses roller clamp for controlling the flow of saline manually. When the clamp is rolled in upward direction it compresses the tube and stops or slows the saline rate [3][5]. If it is rolled in downward direction it releases the tube and increases the fluid rate. In the present world there exists no system which will reduce the dependency of nurses in monitoring the saline levels. Thus there is a need for development of automatic saline level monitoring system[12].

4. Proposed methodology

4.1. System requirements

4.1.1. IR Sensor

IR sensor is an electronic sensor which quantifies the infrared light transmitting from objects in its environmental factors. It is set at the trickle office of the saline bottle to observe the saline fruition status [4][6].

4.1.2. Arduino Microcontroller

Arduino microcontroller is an open source microcontroller utilized in building advanced gadgets and intuitive articles that controls and faculties objects in physical world. It is utilized as a handling and programming unit for sending guidelines to the servo engine, buzzer [3]

4.1.3. Servo Motor

Servo engine is an actuator which controls the angular or straight position, speed and increasing speed. It takes a shot at the PWM (Pulse Width Modulation) standard, which implies its point of turn is constrained by the term of heartbeat applied. It works as indicated by the orders given by the microcontroller and causes the developments in servo-R [4]

4.1.4. Buzzer

Buzzer is an audio signalling device. It alerts the nurses as soon as the bottle gets emptied.

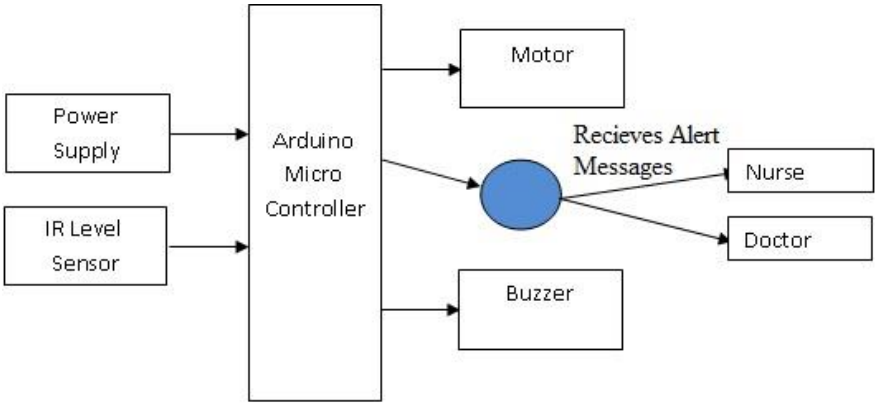

Figure 1. System architecture

In Figure 1, Arduino takes the power as the input through the USB cable and IR sensor is placed at the drip chamber of saline bottle. When the saline drop is not detected continuously for 30 sec then the IR sensor sends the signals to servo motor and buzzer. The servo arm rotates the tube by 90° preventing the reverse flow of blood and the buzzer gives the sound alerting doctors/nurses.

4.2. Working of system

The above proposed system functions in two different scenarios which are explained as follows

1. Giving a buzzer
2. Twisting the intravenous tube

In the first scenario the IR sensor detects the each saline drop and if it does not detect the drop for a specified time period it gives a buzzer, alerting the nurse about saline completion. In the second scenario the arm of the servo motor rotates about 90 degrees simultaneously with the buzzer by twisting the intravenous tube.

4.3. An algorithm of working of system

1. Acquire 5 voltage power Supply from battery
2. Input 5 Voltage to IR sensor.
3. If (signal ==HIGH)
   - 3.1 Ring buzzer for 5 minutes
   - 3.2 Sending the signal to the servo motor
   - 3.3 Rotation of servo arm to 90 degrees
   - 3.4 Twisting the intravenous tube
   - 3.5 Blocks the reverse flow of blood.

4.4. Mathematical expression

x = time (in sec)
y = servo_motor (0°)
sound →0 = off & 1 = on
if x > 30
    y = y + 90° && sound = 1

5. Conclusion

With automatic saline monitoring system the manual effort of continuously monitoring of patients injected with saline by the nurses will be reduced. As the whole proposed framework is automated it requires very less human intercession and endeavours in the centre[15-17]. It will be more invaluable at nights as there will be no such prerequisite for the nurses to check level of saline in saline container every now and again which is an apprehensive undertaking. It also saves the patients getting them harmed from the backflow of blood into the saline container which sometimes can have a deadliest impact. This will lessen the worry in persistent observing by the medical caretaker at a reasonable expense.

6. Future scope

In future, it can be implemented with more features using IoT, like

1. It can send the wireless messages to doctors and nurses about the saline droplet rate
2. It can also include the smart health system, which gives the information about body temperature, blood pressure, heart rate and also the pulse rate. This help in deciding whether the patient requires another saline bottle or not

7. References

[1] P Pearline Sheeba, N Anushree, and L Aishwarya 2016 Saline Infusion Level Detection and Heart Rate Monitoring System *International Journal for Research in Applied Science & Engineering Technology* **4(XI)** 637-641

[2] Shyama Yadav and Preet Jain 2016 Real time cost effective e-saline monitoring and control system *International Conference on Control, Computing, Communication and Materials(ICCCCM)*, Allahbad,India, pp. 1-4

[3] D Kothandaraman, M Sheshikala, K Seena Naik, Y Chanti and B Vijaykumar 2019 Design of an Optimized Multicast Routing Algorithm for Internet of Things *International Journal of Recent Technology and Engineering (IJRTE)* 8(2) 4048-4053

[4] Manoj Kumar Swain, Santosh Kumar Mallick and Rati Ranjan Sabat 2015 Smart Saline Level Indicatorcum Controller *International Journal of Application or Innovation in Engineering & Management (IJAIEM)* 4(3) 299-301

[5] C C Gavimath, Krishnamurthy Bhat, C L Chayalakshmi, R S Hooli and B E Ravishankera 2012 Design and development of versatile saline flow rate measuring device and GSM based remote monitoring device *International Journal of Pharmaceutical Applications(IJPA)* 3(1) 277-281

[6] P RamchandarRao, S Srinivas and E Ramesh 2019 A Report on Designing of Wireless Sensor Networks for IoT Applications *International Journal of Engineering and Advanced Technology (IJEAT)* 8(6S3) 2004-2009

[7] Mansi G Chidgopkar and Aruna P Phatale 2015 Automatic and low cost saline level monitoring system using wireless bluetooth module and CC2500 transreceiver *International Journal of Research in Engineering and Technology (IJRET)* 4(9) 274-276

[8] P Kalaivani, T Thamaraiselvi, P Sindhuja and G Vegha 2017 Real Time ECG and Saline Level Monitoring System Using Arduino UNO Processor *Asian Journal of Applied Science and Technology (AJAST)* 1(2) 160-164

[9] N Deepak, Ch Rajendra Prasad and S Sanjay Kumar 2018 Patient Health Monitoring using IoT *International Journal of Innovative Technology and Exploring Engineering (IJITEE)* 8(2S2) 454-457

[10] Pooja Kanase and Sneha Gaikwad 2016 Smart Hospitals Using Internet of Things(IoT) *International Research Journal of Engineering and Technology (IRJET)* 3(3) 1735-1737

[11] R Aravind and Syed Musthak Ahmed 2013 Design of Family Health Care Monitoring System Using Wireless Communication Technology *International Journal of Advanced Research in Computer and Communication Engineering* 2(9) 3666-3671

[12] Harshavardhan A, Suresh Babu Dr and Venugopal T Dr 2017 "Brain tumor segmentation

methods – A Survey " *Jour of Adv Research in Dynamical & Control Systems* **11** 240-245

[13] Harshavardhan A , Suresh Babu Dr and Venugopal T Dr 2016 **"**3D Surface Measurement through Easy-snap Phase Shift Fringe Projection"**,** *Springer conference International Conference on Advanced Computing and Intelligent Engineering Proceedings of ICACIE* **1** 179-186

[14] Rajasri I, Gupta AVSSKS and Rao YVD 2014 Symmetry and its Effects on Structures of Planetary Gear Trains *Journal of The Institution of Engineers (India): Series C* 95(1) 77-81 10.1007/s40032-014-0101-9

[15] Seena Naik K and Sudarshan E 2019 Smart healthcare monitoring system using raspberry Pi on IoT platform ARPN Journal of Engineering and Applied Sciences 14(4) 872-876.

[16] Harshavardhan A, Suresh Babu and Dr, Venugopal T Dr 2017 "An Improved Brain Tumor Segmentation Method from MRI Brain Images" *2017 2nd International Conference On Emerging Computation and Information Technologies (ICECIT)* IEEE 1–7. *DOI.org (Crossref)* doi:10.1109/ICECIT.2017.8453435.

[17] Mahender K, Kumar TA and Ramesh KS 2018 Analysis of multipath channel fading techniques in wireless communication systems *AIP Conference Proceedings* 1952() - 10.1063/1.5032012