IMPLEMENTATION OF IOT BASED SALINE/GLUCOSE LEVEL MONITORING SYSTEM IN HOSPITALS/CLINICS

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Abstract: **Nowadays, there are numerous advancements is carried out in medical care hospitals during surgery and treatments, however there is no automatic checking the Saline/glucose level and its intimation adopted in healthcare. In this paper, we developed an IoT based saline glucose level monitoring and alerting system. The proposed examination work uses some complex techniques for checking saline level. To enhance the present circumstances, the proposed IoT based Saline/ glucose level monitoring system screen the degree of electrolyte present in it. To process the level monitoring system, the information is fed into thingspeak cloud platform application. The doctor, nurse or healthcare worker can able to check the amount of saline level at whatever point and time they require. At the end point of time, when saline or glucose is going to finish, a buzzer sound is arises to make the staff attentive and alert. This gives advancement in medical hospitals and clinics to ensure the patient's health and provides careful monitoring towards the end of the saline flow treatment.**

Keywords: *Node Micro Controller Unit, IR Sensor, Ultrasonic Sensor, Thingspeak.*

I. INTRODUCTION

Due to illness, when the patient is being admitted in the hospitals, Saline/glucose is broadly utilized in present days to ensure first aid medication. Saline can be induced in many ways however in intravenous therapy (IV) it conveys liquids straight forwardly into people veins. In previous methods employed, the arrangements have to be done to inform the doctor or nurse at the end point of glucose level. The proposed work is started up with the monitoring of saline or glucose level in the container which can be read with locally accessible sensors. The sensors are connected to the cloud. Based on the saline level with respect to the time will be intimated to corresponding nurse or doctor an instructed to take care of the patients on priority basis. The objective of this proposed work is to design, develop and implement a saline monitoring system to facilitate medical doctors and nurses, as to inform them when the saline level is going to be empty or below the desired value. The proposed system also provides cost efficient and automatic saline level monitoring system which can be easily implemented in any hospital or clinics. Moreover this system avoids any harm caused to patient due to negligence in delay of stopping the saline valve.

II. IDEA BEHIND THIS PAPER

We have visited Government clinic centres and rural healthcare centres in and around the city. In the field visit's, based on the healthcare workers experience and our observations, we found that there was not any saline level indicators adopted in the clinics and hospitals. We communicated with the board and medical clinic staff about the possibilities of implementing the IoT based Saline level monitoring system. Later, we proposed to design a consistent checking framework so they can give appropriate medical care to patients.

The Saline Glucose level indicator can be implemented to aware about the status of patients who are injected with saline glucose for several hours. This can be monitored by the hospital nurses and staffs. This proposed paper describes the design of a cost effective reliable automatic saline level monitoring system, which could be easily implemented in any hospitals and clinics to prevent the patient from getting harmed during saline feeding period. In addition, when the saline volume is below the setting level, the buzzer alarm will be activated and the message will be notified by medical staffs through IoT application platform. This would further accommodate medical staffs for observing the saline level from their place and reduce the continuous on-site monitoring from time to time.

III. PROPOSED METHODOLOGY

The proposed framework consists of fluid level sensor (IR Sensor) which is interconnected to Node MCU. The data can be accessed by nurse or doctor end with the help of IoT platform. This system

can also enable us to know the condition of the patient. The data can be viewed on the Thingspeak cloud application. The nurse or doctor can observe the level of saline in the bottle through the specific values from time to time. Further, this system can be provided with the option of alarming in-case, the saline solution gets emptied. Node MCU consists of a Wi-Fi module that stores all the level of saline bottles and this can be displayed near the patient bed using LCD Display. At once if the saline bottle becomes empty the value will be displayed, then we should press the reset button to refresh the data and it will read the new value for another saline bottle. Tilt Sensor can be used to know the condition of the patient by knowing their body movements. In our proposed model we use the IR sensor used to measure the saline level. Usually, the saline bag measures about 1000 ml. The system intimate to change the saline bag when the saline falls below 50 to 100 ml. The critical level of saline is set to 50 ml. When the saline level dropped below 50ml, the system instructs the nurse to change the saline bag immediately.

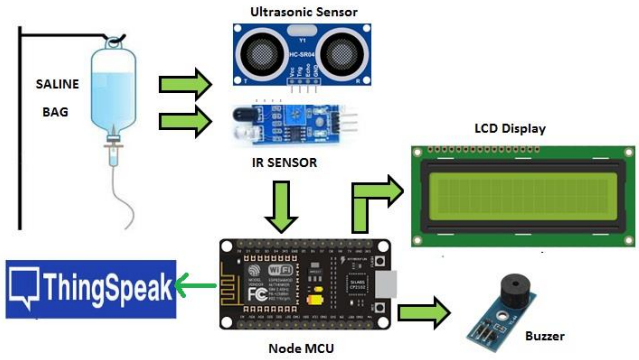

Fig-1: Process Involved in the Proposed Methodology

IV. FRAMEWORK

The proposed framework consists of the following components:

a. Node MCU
b. IR Sensor
c. Ultrasonic Sensor
d. LCD Display
e. Buzzer Module
f. Power Supply Unit

A. Node MCU

The Node MCU is a microcontroller device that is used to establish a connection and send data over the Wi-Fi protocol. It is in built with ESP8266. It is capable of retrieving and uploading data through the internet

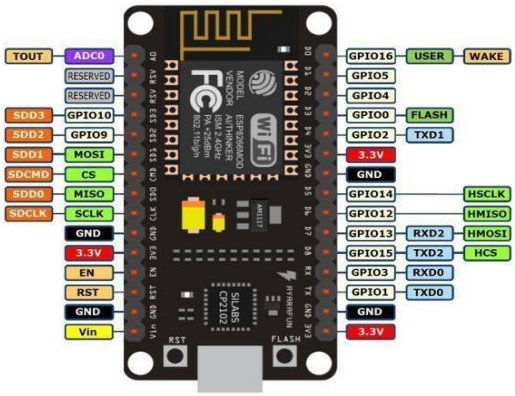

Fig-2: Node Micro Controller Unit

B. IR Sensor

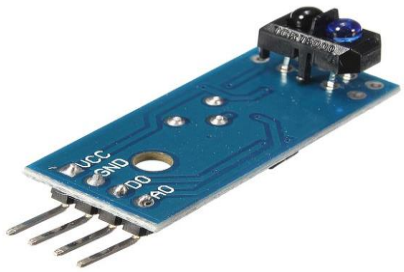

Fig-3: IR Sensor

An infrared sensor is an electronic device that emits lights in the surroundings. Here sensor out pin may be associated with the Node MCU analog pin A1. Once the saline reaches the critical level when fed to the patient, it is sensed by the IR sensor. The IR sensor has both transmitter and receiver. The critical value turns the voltage based on the distance travelled by the light from transmitter and the light gets reflected by the saline surface is received by the receiver sensor. This sensed output is sent to the node microcontroller unit which scans the database for retrieving the stored information and buzzer starts ringing for alerting the nurses and doctors in the hospitals.

C. Ultrasonic Sensor

An ultrasonic sensor is used to measure the liquid level of glucose, saline, water, and other substances. The ultrasonic sensor's primary function is to emit and reflect sound waves. It transmits signals through air but its operation is not affected by sunlight or black materials. Its key benefit is that it has high range accuracy and reliable readings, making it as a simple and ready to use package.

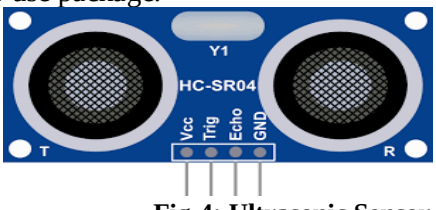

Fig-4: Ultrasonic Sensor

It will be used to accurately detect the saline level in the saline bottle/bag. In our project, we link the GND pin to the Node MCU's ground pin and the VCC pin to the 5V pin.

D. LCD Display

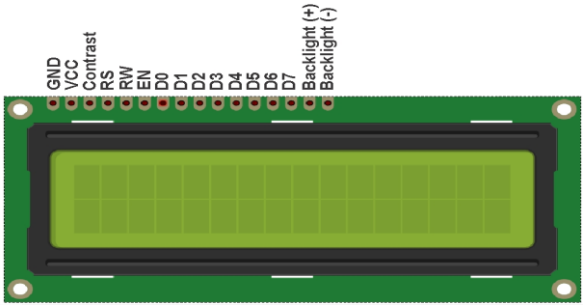

Fig-5: LCD Display

LCD is known for Liquid Crystal Display. The LCD display used in our project is 16x2 having parallel interface. This parallel interface enables the microcontroller to manipulate several interface pins to control the display at once. LCD is specialized for being used with node microcontroller unit, since they are not activated by standard IC circuit. They can be used for writing different messages on a miniature LCD. The message such as Relax, Alert, and Warning is displayed on the LCD.

E. Buzzer Module

Fig-6: Buzzer Module

The ringing buzzer can be set up with time limit. An alert message is sent to the concerned duty nurses or duty doctors associated with the patient through the use of the internet. If the nurse attends the patient, then she should stop the buzzer and reset the whole system.
If the nurse fails to attend the patient within the limited time, the buzzer will again start ringing louder to notify the nurse that the saline is totally consumed and there is a requirement for replacement of saline bottle.

F. Power Supply Unit

The power supply unit is the basic essential interface for regulating and supplying power to the connected components. The female jack connector placed on the power board acts as the input terminal and the terminal on the power supply board helps to connect the male pin to connect the components. The power supply unit provides 12 V input and the output varies from 12 V, 5 V or 3.3 V.

V. WORKING METHODOLOGY

When the saline is fed to the patient, the level of saline is measured for every one minute interval time. To compose and transmit to the Node microcontroller unit, the Arduino IDE is used. Also, keep in mind that the Thingspeak library for the Arduino IDE and programming interfaces is available. The information is then sent to the cloud with the help of node microcontroller unit. In fact, it is available as an open source application. The cloud, on the other hand, is being exploited in a variety of ways by bystanders. Its data is frequently retrieved from the cloud and displays the amount of saline present at any one time to spectators and duty nurses. Additionally, for alert system buzzer has been used. The buzzer is used to provide buzz alarm to the duty nurse when the saline bag is going to be getting empty. The proposed system works based on the following principle:

- Level of Saline is monitored on time interval basis. Here the time interval is set between 1 to 2 minutes.
- For every 10% drop in saline level, an indication will be recorded and data is noted in the patient data base which can be enabling to view in the monitor.
- Till the completion of 70% saline level, Relax message will be notified.
- When saline level reaches 80%, an alert message is sent to the nurse indicating to attend the patient.
- If the saline level reaches 90%, buzzer will activate and warning message will be sent to attend the patient and replace the saline bag immediately.

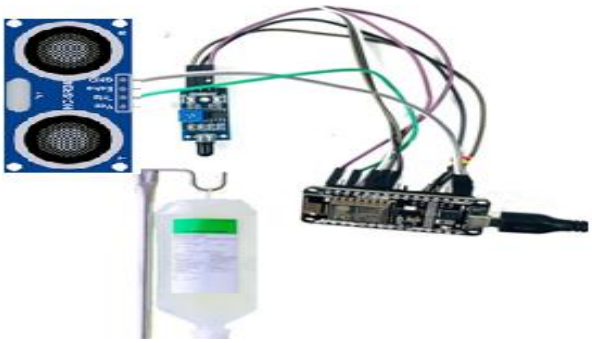

Fig-7: IoT Based Saline Monitoring System

The recorded output signals are of digital values and are calibrated to the précised measurement standards. Simulation of the source code is obtained by Arduino IDE software and results can be obtained through serial monitor and furthermore this data can be accessed through cloud platform using ThingSpeak and whenever the saline weight reaches the critical limit ThingSpeak sends the notification to the widget bar. Through which nurse or doctor can be alerted. SMS will be sent as alert to the nurse using GSM and even the results will be displayed on LCD.

VI RESULTS AND DISCUSSION

The following are the results obtained in our proposed model.

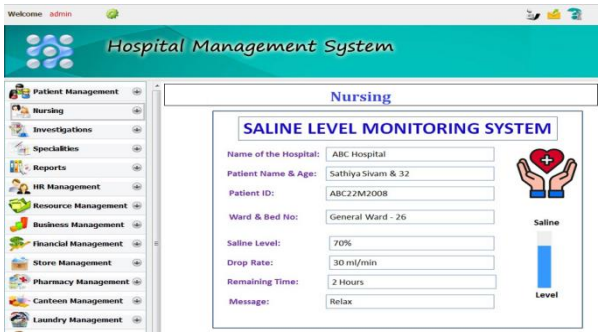

Fig-8: Patient Monitoring Database showing Relax Message when 70% Saline Solution available

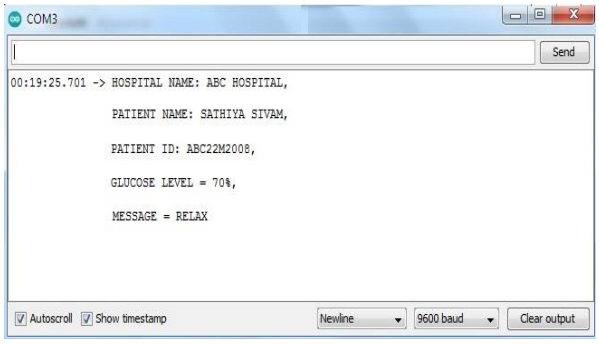

Fig-9: Serial Monitor Display Relax Message when 70% Saline Solution available

Fig-10: Patient Monitoring Database showing Alert Message when 80% Saline Solution gets over

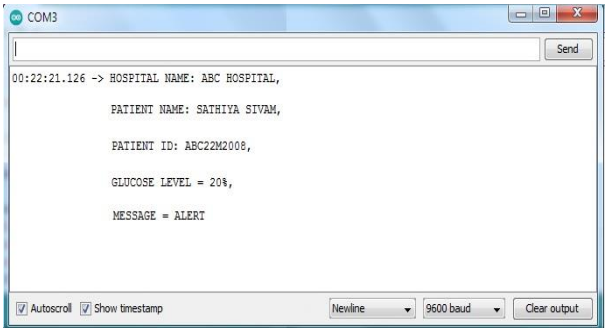

Fig-11: Serial Monitor Display Alert Message when 80% Saline Solution gets over

Fig-12: Patient Monitoring Database showing Warning Message and Alarm the Nurse to Replace the Saline Bag when 90% Saline Solution gets over

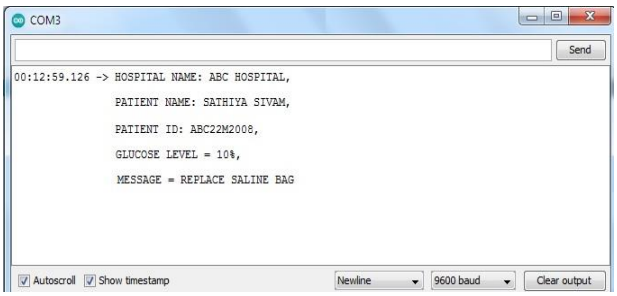

Fig-13: Serial Monitor Display Warning Message and Alarm the Nurse to Replace the Saline Bag when 90% Saline Solution gets over

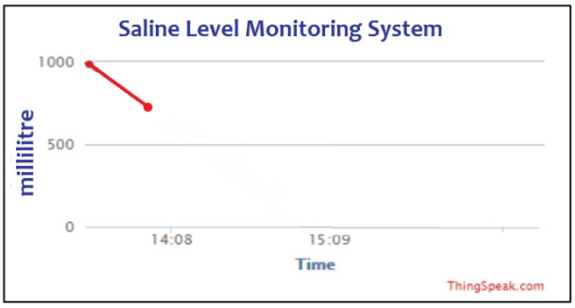

Fig-14: ThingSpeak Output When 80% Saline Solution is available

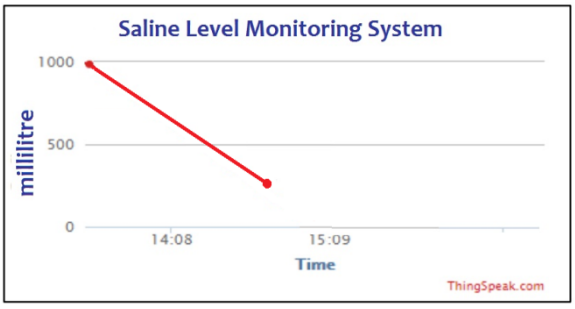

Fig-15: ThingSpeak Output When 20% Saline Solution is available

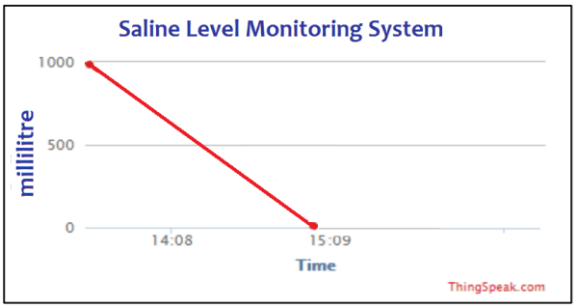

Fig-16: ThingSpeak Output When 20% Saline Solution is available

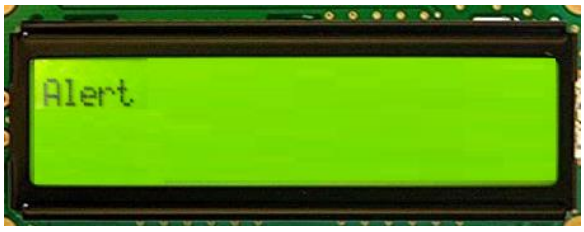

Fig-17: Alert Message in LCD When 20% Saline Solution is available

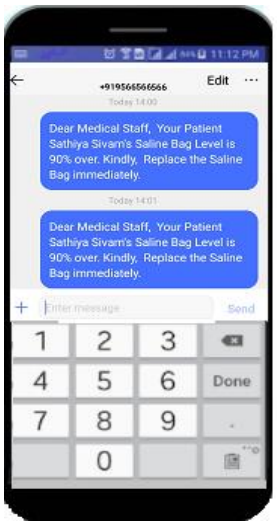

Fig-18: Message to Medical Staff Mobile

VI ADVANTAGES

The advantage of the proposed system is that it is not necessary to watch a patient every time who is fed with saline solution. Continuous monitoring of bottle is not required. As the messages are notified, it alerts the nurse about the status of the saline level. This enables the nurse to take care the patient with immediate effect. This system helps to avoid the backflow of blood in the saline tube since the nurse gets alert to replace the saline bag with immediate effect. Based on the doctor prescribed, nurse can replace or stop feed the saline to the patient. This proposed system provides reliable and cost effective implementation. There is no need of safety requirements since our system is purely software oriented.

VII CONCLUSION

The proposed project habitually gauges the amount of saline in saline container and the information is put away in thingspeak cloud. Utilizing this information spectator sees the amount of saline at whatever point he needs. At the point when the amount of saline is excessively low the buzzer cautions and rings an alert. The execution utilizing ultrasonic sensor is exceptionally simple contrasted with load sensor, as burden sensor requires a ton of gear, ultrasonic sensor gives better and precise outcomes contrasted with load sensor, on the grounds that ultrasonic sensor gives accuracy readings for short reach level estimating. With IoT based saline level checking framework, the manual exertion with respect to the medical care takers is saved.

As the whole proposed framework is mechanized, it requires extremely less human intercession and it will be worthwhile around evening time, as there will be no such prerequisite for the medical attendants to visit patient's bed each an ideal

opportunity to check the degree of glucose in the container since a ready warning will be shipped off the medical attendants, specialists, guardians when glucose arrives at the basic level.

VIII FUTURE SCOPE

In future, this framework can be stretched out to a developed dispersed remote organization framework. Moreover, with the improvement of inserted equipment, more mind-boggling installed coding should be possible. The sending and getting velocity of a security ready message will be high, so this can be utilized to give more sorts of utilizations later on. The framework is solid, savvy and helpful for medical attendants. It tends to be reused for the following jug. The framework assists attendants with observing the stream from a good way.

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