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IoT BASED AUTOMATIC SALINE LEVEL MONITORING SYSTEM

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ABSTRACT

As the world's population is increasing,the need for health prevention is also increasing day by day. In these recent years, there is rapid progress in medical care due to the technological advancements in the various fields of sensors, micro-controllers, and computers for assuring fast recovery of patients in the hospitals. The major and fundamental requirement of hospitalized patients is that every patient should be provided with better treatment and observation and should be supplied with the correct amount of vital nutrition at the correct time. Among the various treatments, saline therapy is the most important treatment that many patients receive from the hospitals. The bottle of saline is fed to the patients to treat dehydration and thus improve their health. In the hospitals, whenever saline is fed to the patients, the patient needs to be continuously administered by a nurse or a caretaker. But unfortunately,some critical situations occur and due to the negligence towards the saline completion and busy schedules of the responsible doctors, nurses, or the caretakers, huge number of patients are being harmed. Hence, to prevent the patient's health and to provide maximum health safety during saline feeding hours, saline level monitoring and an automatic alert system have been developed. The proposed system facilitates a sophisticated method of controlling saline drop rate by monitoring the saline system remotely by using the IoT platform. This proposed system consists of a sensor used for monitoring the critical level of the saline liquid in the saline bottle and a mechanism that will stop the saline flow automatically after the saline bottle is completely empty.

Keywords: Intravenous, Internet of Things (IoT), Node MCU, Saline, Servomotor, Arduino Microcontroller.

I. INTRODUCTION

Whenever a saline is fed to any patient, he/she needs to be constantly monitored by a nurse or any relatives. Most often due to negligence, inattentiveness, busy schedule, and a greater number of patients, the nurse may forget to change the saline bottle as soon as it is totally consumed. Therefore, there is a need of developing a saline level monitoring system that will reduce the patient's dependency on the nurses or caretakers to some extent. In this system, an IOT-based automatic indicating device where a load sensor is used as a level sensor. The sensor's output voltage level changes when the intravenous fluid level is below a certain limit. When the saline drops down to a certain low level then an alert is sent to the nurses that the saline fed to the patient is over with all thedetails of the patient.

The difference in weight is used to sense the amount of saline present in the bottle and hence is used to send a notification to the attendant or the nurse room. If the nurse fails to attend to the patient immediately then a motor arrangement is done which suppresses and flattens the saline tube and immediately stops the flow of the electrolytic solution. This prevents the formation of air bubbles and does not cause blood clotting and thus provides maximum health safety to the patient.

500ml Saline Bottle

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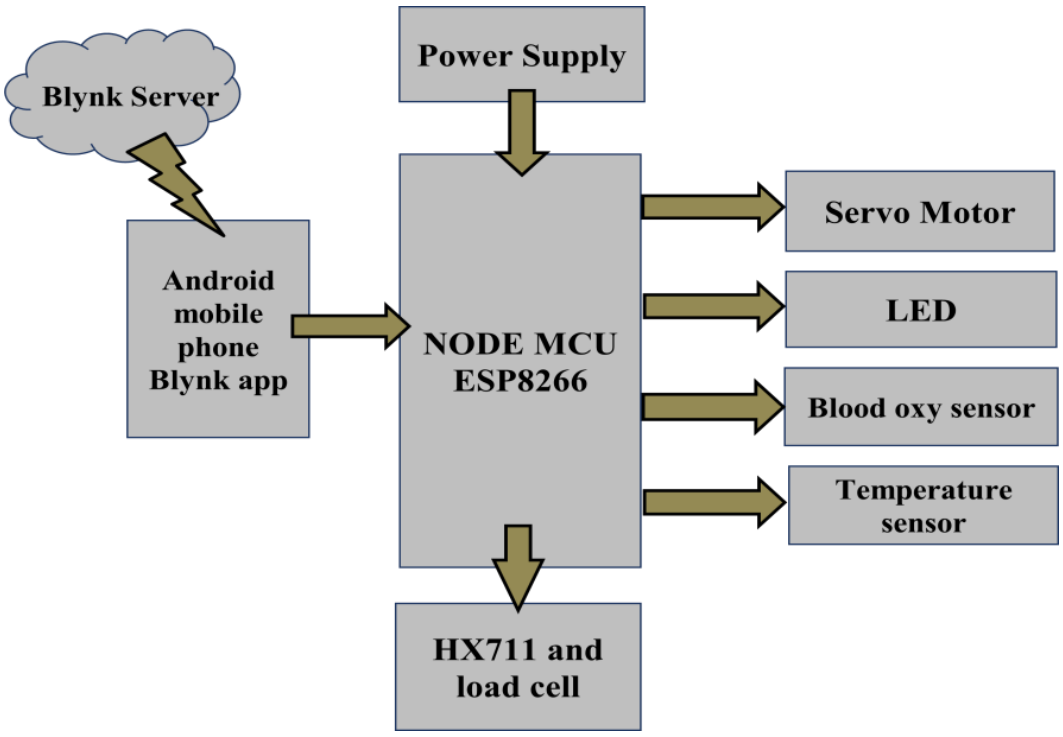
II. METHODOLOGY

Using our proposed system, the nurse can monitor the amount of saline even in the control room using an application i. e. Blynk app. We have used a load sensor to determine the status of liquid in the bottle whether it is normal or warning status. The output obtained from the sensor is processed to check whether the saline bottle is empty or not. When the level of saline dips below a certain level,a red LED will glow.

The HX711 sensor with load cell is used to measure the saline level. The content of saline in a normal saline bag is 500 ml. The saline bag is replaced by another when the saline falls below 50 to 100 ml. The

critical level of saline is set to 70 ml which is between 50 to 100 ml so the nurse can change the saline bagwhen the liquid reaches the critical point. The system proposed is electrolyte independent and can be used with all sizes of electrolyte bottles.

The system is electrically powered and a voltage of 9V is required to power the system. As soon as the electrolyte bottle is hung on the stand and attached to the sensor via a specially designed 3-d printed hook,an initial weight reading of the bottle is recorded in the database designed by the microcontroller. The loadsensor senses the weight at regular intervals. The same is updated in the database regularly. As soon as the read value of the load reaches 30% of its initial value recorded in the database, a notification is sent to the respective authorities nurses/control room admins with the details of the patient.



Block Diagram of the System

The sensor keeps reading the weight of the bottle and the red LED starts blinking as soon as the weight of the bottle further decreases to 30 percent of its initial weight. If further no one attends to the patient, and the electrolyte gets fully consumed without being disconnected or refilled manually, the microcontroller powers the DC motor. The motor actuates the screw-powered clamp,which disconnects the patient with the electrolyte bottle. Two more extra parameters added to this system are 1. Temperature Sensor which detects the temperature of the patient and 2. Blood-Oxy Sensor which detects the blood pressure and the oxygen level of the patient.

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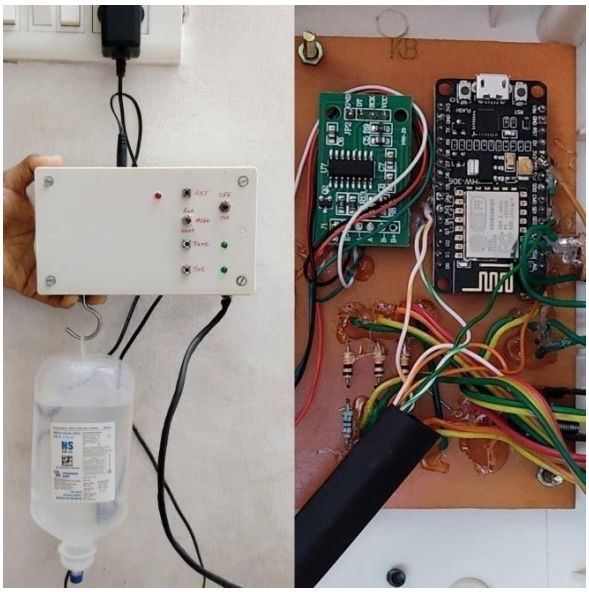
III. MODELING AND ANALYSIS

COMPONENTS	SPECIFICATIONS
NodeMCU ESP8266	Microcontroller : Tensilica 32-bit RISC CPU XtensaLX106 Operating voltage : 3. 3 VInput voltage e: 7-12 V
Load Cell	Capacity : 5kg / 11 lbs Maximum excitation voltage : 10V DCRated o/p : 1. 2 +/- o. 1mV/V
Temperature Sensor	Temperature range : -40 to 85 CTemparature accuracy : +/- 1 C
Hx711	Output sensitivity : 1. 0 +/- 0. 1 mV/ VMeasurement resolution : 24 bit.
Servomotor	Operating voltage : +5 VOperating speed : 0. 17 s

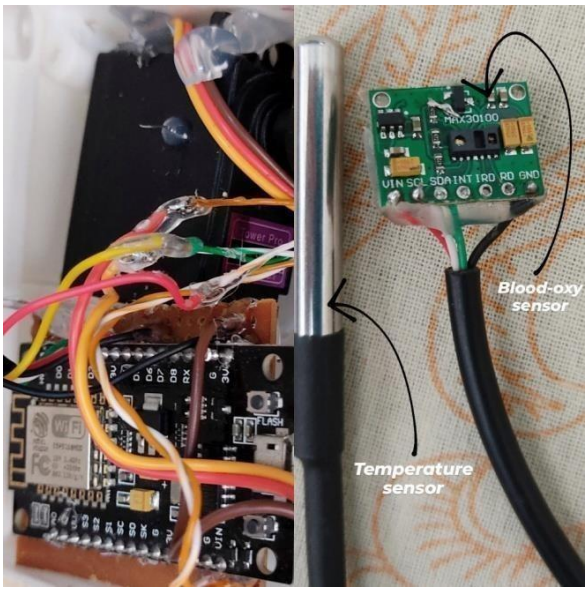
➢ **NODE MCU ESP8266:**

The NodeMCU(Node Micro Controller Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer : CPU , RAM , networking (Wi-Fi) ,and even a modern operating systemand SDK that makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

IV. RESULTS AND DISCUSSION



NODE MCU ESP8266 with Hx711 and load cell



NODE MCU ESP8366 with Temperature & Blood-Oxy sensor

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V. CONCLUSION

As the entire proposed system is automated, it requires very less human intervention. So, the manual effort on the part of the nurses is saved. It will be more advantageous at night as there will be no such

requirement for the nurses to visit the patient's bed every time to check the level of saline in the bottle since an alert notification will be sent to the nurses, doctors, and caretakers when saline reaches the critical level. Our system provides more flexibility to doctors, thereby the patient's care is enhanced.

Hence it saves lots of time for the nurse who is on duty. We can control the saline flow by using a servomotor. This system helps nurses to monitor the saline flow from a distance.

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