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ijircce@gmail.com



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# IoT Based Saline Level Monitoring System

Dr. B. Raghavaiah<sup>1</sup>, M.Sai Deepika<sup>2</sup>, P.Sanhitha<sup>3</sup>, A.Anila<sup>4</sup>, S.N.V.S.V.Prasad<sup>5</sup>

Professor, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India<sup>1</sup>

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India<sup>2</sup>

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India<sup>3</sup>

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India<sup>4</sup>

U.G. Student, Department of ECE, Sri Vasavi Institute of Engineering & Technology, Nandamuru, A.P, India<sup>5</sup>

**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 to be 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 and SMS alert. In this work, implementing IOT Based Saline Level Monitoring system to detect the level of the Saline bottle and send the SMS alert to the nurse and doctors and also it make a buzzer sound.

**KEYWORDS:** IoT, Saline Bottle, Buzzer.

## I. INTRODUCTION

As the world population is increasing, the need of health prevention is also increasing day by day. Hence, it is mandatory for everyone in this world to take care of their health properly. The monitoring of the patient wirelessly is a major improvement in the medical domain. In recent years, there is a rapid progress in medical care due to the technological advancements in the various fields of sensors, raspberry pi and computers for assuring fast recovery of patients in the hospitals. The major and fundamental requirement of the hospitalized patients is that every patient should be provided with a better treatment and observation and should be supplied the correct quantity of vital nutrition at the correct time. Among the various treatments, the saline therapy is the most important treatment that many patients receive from the hospitals. In recent developments, the internet of things (IOT) creates an interconnected network for all things. The healthcare sector has improved with this technology. Health problems in cardiovascular failure, lung failure and cardiovascular diseases are increasing day by day. These problems require a lot of health monitoring from time to time. A modern concept of patient health oversees wireless devices. This is a big improvement in the field of medicine. A doctor can constantly monitor the patient health without physically interact. Health specialists and technocrats have developed a wonderful, with a low expensive healthcare monitoring system for whom is bearing with several diseases using popular technologies such as wearable devices, wireless channels, and other remote instruments. As per that, doctors can diagnose the patient's disease with the doctor's device screen about his / her health condition from the patient's device, thus eliminates the number of the patient's presence in the hospital, also it provides the time for better treatment. Therefore, doctors are able to save human lives by providing quicker services to them. IOT has become the best platform for various application services Internet of Things (IOT) is the network of physical objects comprising of all the devices, vehicles, buildings and the other items embedded with electronics, software and sensors which enables these objects to collect and exchange data amongst each other. The Internet of things has evolved due to convergence of multiple technologies, commodity sensors, and embedded systems.

## II. LITERATURE SURVEY

Ashika A. Dharmale, Revati R. Mehare, et.al., implemented saline level monitoring & automatic alert system, which providing the saline drop rate by monitoring the saline system remotely by using Internet of Things platform. A sensor is 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. This can be used efficiently in homes as well as hospitals [1].

Anusha Jagannathachari, Archana Rajan Nair, implemented saline level indicator. In this the IR sensor act as a level sensor for monitoring the critical level of the saline in the saline bottle. Whenever the level of saline reaches a pre-defined critical level, the RF based automatic device alert and notification are sent to the hospital staff [2]

## III. METHODOLOGY

The previous session describes the details of literature survey on monitoring the saline level of saline bottle of a patient using Raspberry Pi. This chapter describes the implementation of monitoring the saline level of saline bottle of a patient using Raspberry Pi.

### 3.1.Implementation of IOT Based Saline Level Monitoring System

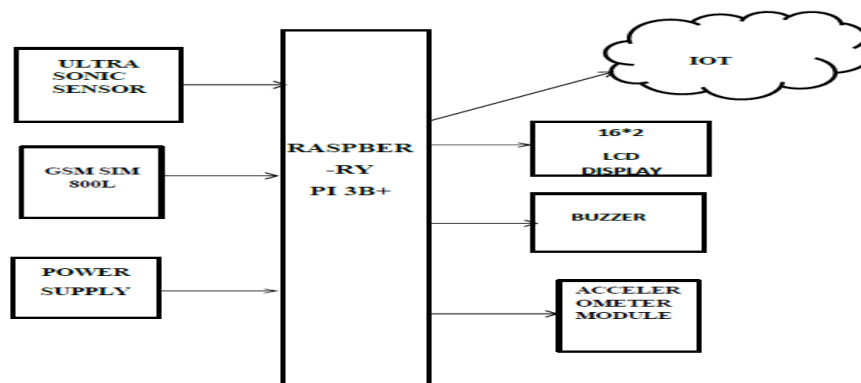


Fig.1.Block Diagram of proposed System

### 3.1.Raspberry PI 3B

Raspberry pi works well as a multi-processor. It has a graphics card, a volatile memory, RAM, device interfaces and other external wireless device interfaces. This raspberry Pi is consuming very less power, but it is still cheap and powerful. It requires a keyboard to provide commands, display unit and power supplies as a standard PC. Here, Raspberry Pi used the SD card as a hard disk. Raspberry Pi able to connect via a LAN / Ethernet or via a USB modem or via wireless. Raspberry Pi is supposed to support for various home and business applications. Raspberry Pi runs on a Linux-based OS and which operated by the Raspbian OS. It is capable of communicating with other external devices using wireless communication technologies, cellular networks, NFC, Zig Bee, Bluetooth etc. This was implemented on a fast network as 4G with the cellular network. Raspberry can be used for many applications and so, it has many opportunities in the future.

#### 3.1.1.Processor / SOC (System on Chip)

The Raspberry Pi has a Broadcom BCM2835 System on Chip module. It has an ARM1176JZF-S processor. The Broadcom SOC used in the Raspberry Pi is equivalent to a chip used in an old smartphone (Android or iPhone). While operating at 700 MHz by default, the Raspberry Pi provides a real world performance roughly equivalent to the 0.041 GFLOPS. On the CPU level the performance is similar to a 300 MHz Pentium II of 1997-1999, but the GPU, however,

provides 1 Gpixel/s, 1.5 Gtexel/s or 24 GFLOPS of general purpose compute and the graphics capabilities of the Raspberry Pi are roughly equivalent to the level of performance of the Xbox of 2001. The Raspberry Pi chip operating at 700 MHz by default, will not become hot enough to need a heat sink or special cooling.

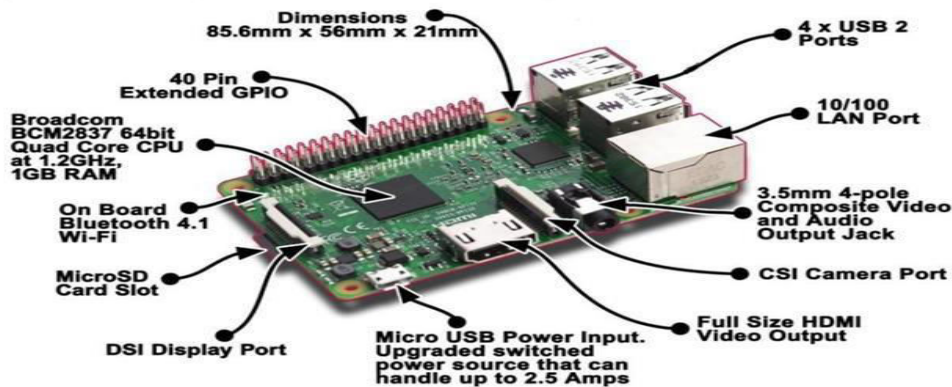


Figure .2: Block Diagram of Raspberry Pi 3B+

### 3.2.ADXL345 Accelerometer Module

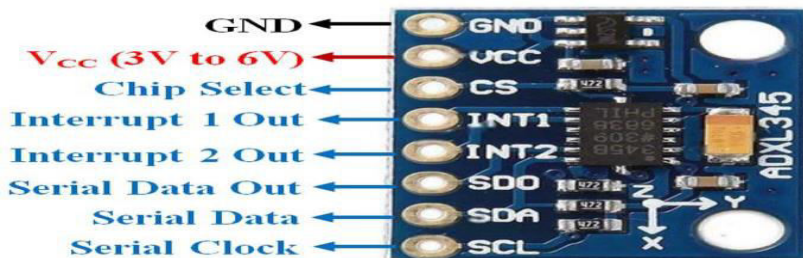


Figure .3. Accelerometer Module

The ADXL345 is a small, low power, complete 3 axis MEMS accelerometer modules with both I2C and SPI interfaces. The ADXL345 board feature on-board 3.3V voltage regulator and level shifter, which makes it simple to interface with 5V microcontrollers. This ADXL345 Accelerometer module consists of an ADXL345 Accelerometer IC, Voltage Regulator IC, Level Shifter IC, resistors, and capacitors in an integrated circuit. ADXL345 IC from Analog Devices is the brain of this module. The product measures acceleration with a minimum full-scale range of  $\pm 16g$ . ADXL345 Accelerometer module consists of 8 pins. Connect VCC and GND pins to 5V and GND pins of Microcontroller. The basic structure of the accelerometer consists of fixed plates and moving plates. When the acceleration is applied on an axis capacitance between fixed plates and moving plates is changed. This results in sensor output voltage amplitude, which is proportional to the acceleration.

### 3.3. GSM SIM 800L

A GSM module is a communication medium used for sending or receiving the data over the existing mobile architecture. It operates on a 5 V power supply. A sim card of any cellular operated should be inserted in it and the charges are levied on the user for availing the services provided by the cellular operator. It is operated on frequencies like 800/900/1800/1900 MHz It can be interfaced with the computer or Raspberry pi through attention commands. The data can be transmitted as SMS or MMS and voice messages. We can also avail internet access with the help of

GSM/GPRS module. It supports various software features such as FTP/HTTP, SSL, TCP/UDP protocol and jamming detection. SIM800L is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. The heart of the module is a SIM 800L GSM cellular chip from SimCom. The operating voltage of the chip is from 3.4V to 4.4V, which makes it an ideal candidate for direct LiPo battery supply.



Figure .4. GSM SIM 800L Module

### 3.4. HC-SR04 Ultrasonic Sensor

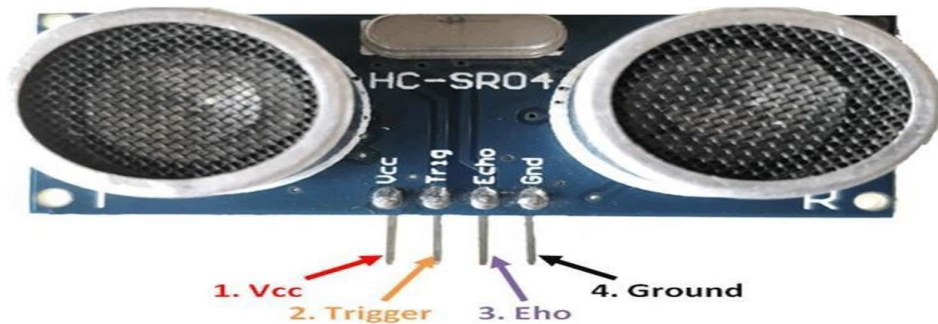


Figure 5. Ultra Sonic Sensor Pin Diagram



Figure 6. object detection

The HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used to measuring distance or sensing objects are required. The module has two eyes in the front which forms the ultrasonic transmitter and receiver. The sensor works with the simple formula that  $Distance = Speed \times Time$ . The ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the

ultrasonic receiver module as shown in figure 3.12. The universal speed of ultrasonic wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the ultrasonic wave to come back and turns on the echo pin high for that same particular amount of time.

### 3.5. Working Procedure

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 more number of patients, the nurse may forget to change the saline bottle as soon as it is totally consumed. Just after the saline finishes, blood rushes back to the saline bottle due to difference in blood pressure and pressure inside the empty saline bottle. This may cause reverse flow of blood to saline bottle from their vein. This result in the reduction of hemoglobin level of patients and may also lead to shortage of red blood cells (RBC's) in the patient's blood causing tiredness. Therefore, there is a need of developing a saline level monitoring system which will reduce the patient's dependency on the nurses or caretakers to some extent. In this work, IOT based automatic alerting and indicating device where ultrasonic sensor is used as a level sensor. Ultrasonic sensor output voltage level changes when intravenous fluid level is below certain limit. The comparator continuously compares the ultrasonic output with predefined threshold.

When the transceiver output is negative then the Raspberry PI will be displayed the visual warning on the LCD screen. When the threshold value is exceeded, GSM module, transmitter will send the sensed data from patient's bed to the GSM receiver at the doctor's cabin will receive the data and will be displayed on the LCD screen. Thus wireless transmission permits the examination of the physiological data of human under normal condition without any discomfort to a person under the investigation. This work consists of simple and low cost components which are capable of processing real time parameter like level detection of saline. When the saline drops down to a certain low level then an alarm or buzzer generated to alert the nurse that the saline fed to the patient is over.

## IV. EXPERIMENTAL RESULTS

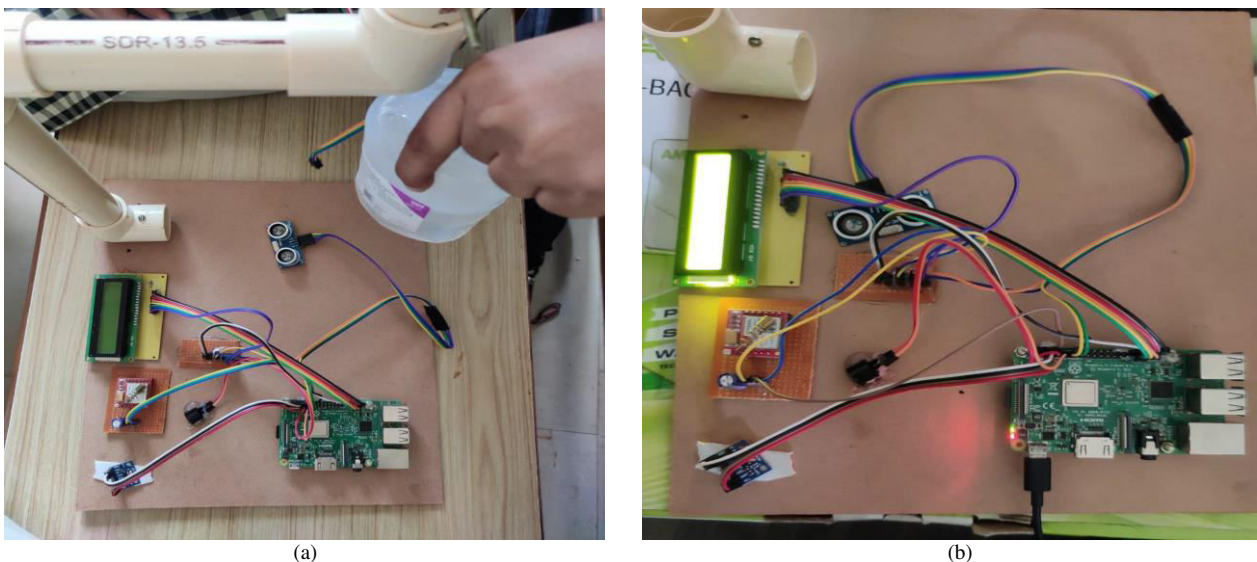


Fig.7.(a) Working Model without Power (b) Working Model With Power



(a)



(b)

Fig8.(a) Saline Level in Container (b) LCD Display Message For accelerometer sensor

The saline water reached minimum level the GSM activated and send the message to respective members



(a)



(b)

Fig.9 SMS From GSM800L

## V. CONCLUSION AND FUTURE SCOPE

In this work monitoring the saline level of saline bottle of a patient using implemented using raspberry Pi and is working adequately.

## REFERENCES

- [1].Ashika A. Dharmale, Revati R. Mehare, et.al. "IOT Based Saline Level Monitoring & Automatic Alert System" published in International Journal of Advanced Research in Computer and Communication Engineering.
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