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A LOW COST AUTOMATED FLUID CONTROL SYSTEM FOR MEDICAL APPLICATION

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ABSTRACT: *The technological advancement in the medical system is necessary due to the increase in the population. Current health care system requires manual care takers and their heavy duties which is very time consuming job. Advanced health monitoring systems are required with less human intervention which will be available at low cost in rural as well as urban areas. In almost all hospital a nurse is required for monitoring the fluid level and health condition. But the care taker/nurse may forget to change the fluid and inform the doctor about the health condition on time. This will be the major problem in the health condition of the patient. To overcome this problem a low cost automated fluid control device is implemented, which uses flow sensor, PIC microcontroller and other sensors to monitor the health condition of the patient, also control the flow control of the fluid using the microcontroller and flow sensor. This reduces the more intervention of the human and also requires low investment.*

Keywords: *PIC Microcontroller, Temperature Sensor, Oxygen Sensor, Heart Beat Sensor, Buzzer, LCD etc.*

I. INTRODUCTION

In the ever increasing in the population the maintenance of the health is the main issue. It is mandatory to everyone to take care of their health properly. In this scenario, maintaining patient's safety is the top most priority to be given in all hospitals. Due to evolution in science and development of the technology, the growth in the medical field is rapid. This is due to the combine of the engineering and medical field. Now days, many automatic health monitoring devices are developed to ensure patients safety and to reduce the stress of the doctors. The invention of such devices introduces a drastic change in medical field for monitoring the parameters like heart beat rate, temperature, pulse rate etc. Generally, in hospitals saline level is monitored by nurses and patients relatives. There is always a need to check the saline level after certain time. The existing system for saline level monitoring is very time consuming and inconvenient for nurses. An automated fluid control device consists of flow sensor and load cell which continuously monitor the rate of flow and level of the fluid in the bottle. The whole information will be updating to the caretaker and doctor through Bluetooth device and WI-FI module. If the rate of flow of the fluid is more it will be automatically controlled and if the fluid level is below the critical level it will send the emergency alert to the care taker and the doctor. Along with the fluid control this device will also monitor the health condition of the patient continuously, by using the temperature sensor, heart beat sensor, oxygen sensor etc, and will be sending the health status of the patient to the doctor continuously. If in the case of emergency it will alert the caretaker and the doctor with alarm and the emergency message. Bluetooth module and WI-FI module act as trans-receiver, due to which the notification can besent to the nurse on her mobile as well as computer.

The main objective of proposed system is to provide reliable, convenient, effortless and cost effective system for fluid level monitoring and also to record and monitor the patient health condition continuously. As the fluid goes below the critical level, it is necessary to change the saline bottle or in case of any emergency it is required to control the rate of flow of the fluid. This proposed health monitoring system will continuously monitoring the health condition of patient along with the fluid level, and keeps on updating about the health readings to caretakers and doctors. If any emergency is found it will immediately control the fluid level and alert the caretaker with alert message and buzzer. This system has many sensors which will be sensing the different parameters in the patient body, and will be updating the same to the caretaker and doctor via Wi-Fi device.

As it can control the fluid rate automatically based on the health condition, there is no need for the more human involvement and also consumes more time. Also this system can be installed in the ambulance, hence the patient

travelling in the ambulance can be treated with the preliminary treatment and his health condition can be monitored. The initial investment and maintenance, as it can control more than one patient at a time. It also reduces the human errors.

The current method for fluid levels tracking and health monitoring is certainly quite time intensive and annoying for medical workers. The primary goal of proposed technique is to offer dependable, hassle-free, simple and easy as well as a cost efficient method of saline level controlling.

This system monitors both the fluid control as well as the health condition of the patient automatically. Once it is installed there is no need of the continuous human intervention, since it is controlled automatically. It requires low investment and is easy to maintain. Hence it can be installed in the urban and rural areas. This will reduces the stress in continual monitoring by the doctor or nurse at an affordable cost. The primary goal of proposed technique is to offer dependable, hassle-free, simple and easy as well as a cost efficient method of saline level controlling.

II. LITERATURE SURVEY

R.Vasukiand et al., proposes "A portable monitoring device of measuring drips rate by using an intravenous (IV) set"**.** In this method the IV set is attached to the drips chamber. The flow sensor is used to detect each drops of IV set. For each drop, the beam of light is broken at each time and that is transmitted and received by IR sensor. This provides a change in sensor output and comparator gives a pulse output for each drop. The drip rate is indicated using the LCD with which the observer can identify the volume of fluid in IV set. If the device is not sensed for 45 seconds it will give an alarm.

C.C.Gavimathand et al., proposes a method of "Design and development of versatile saline flow rate measuring system and GSM based remote monitoring device". In this device an indigenously developed sensor is attached to the neck of the drips bottle. For every drop of the saline, the signal conducting circuit produces one pulse. The signal conditioning circuit consists of a multi vibrator, comparator and phototransistor. The 8051 microcontroller is used to count the pulse in unit time. This will resemble the flow rate. Through GSM technology the information about the flow rate is send to the observer's mobile. The cost of this device is high.

R.Aravindand et al., Proposed a paper, "Design of family health monitoring system using wireless communication". This is an ARM based embedded system through which the data of the patient is transmitted and received via RF transmitter and receiver. Then the information is stored as database and send to GSM. The database consists of all the details about the patient health conditions such as temperature, blood pressure and heartbeat by using visual basics. This makes the residential people to check their health by themselves but computer should need an IE. But it is not suitable for illiterate people for whom it is very difficult to operate and understand.

V.Ramyaand et al., proposes an "Embedded patient monitoring system". In this system the status of the patient is monitored continuously by using an embedded system. Here the PIC microcontroller and sensor are used to sense temperature and drip status. This status is given to the PC. If the temperature is greater than the set value it will send an alert to mobile phone and produces an alarm until the doctor response to that message.

III. METHODOLOGY

After examining a few paper based on the improvement of the automated saline monitoring system, it was seen that many complex circuit and modules were used which increase the cost of manufacturing. In all the previous system it was seen that there is no automatic control of flow rate. The proposed system of this paper is to detect and control the flow rate or fluid label accurately and give the signal to the doctor or nurse so that the amount of drop of saline can be controlled using a smart phone and manual control.

The block diagram of proposed system is shown in figure 1. The system will be able to control the flow rate automatically according to the command given to the device by the user. A flow sensor will be developed and employed to the drip chamber of the saline bottle to determine the circulation rate of the saline. Once command will be given to the device it will continuously check the flow rate and balance with the command given by the user. A fluid flow detector sensor will detect the water drop accurately. Error reading can be determined by signal conditioning circuit and will be removed by an isolator circuit.

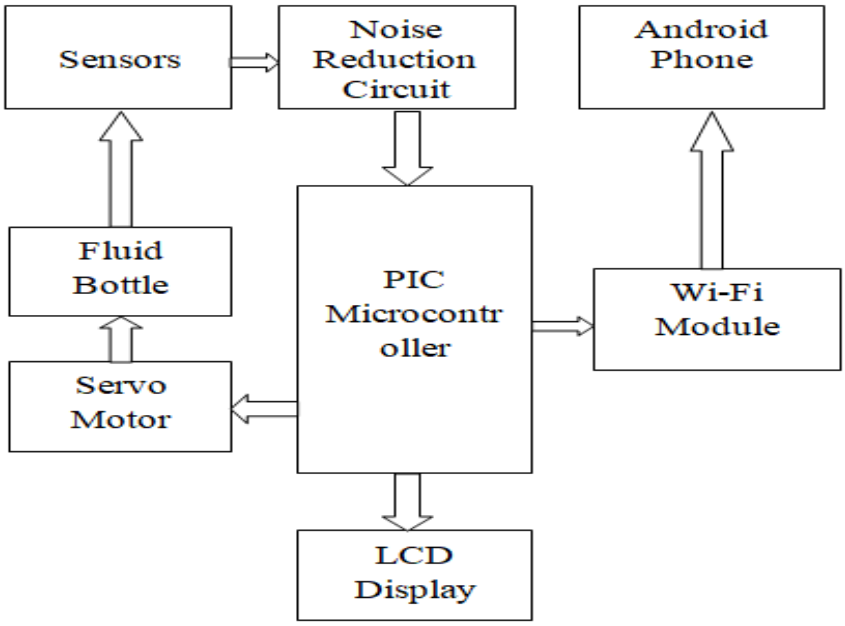

Figure 1: Block diagram of proposed automated fluid control device

This system is implemented using the PIC microcontroller, which is the controlling unit of the system along with the LCD display to display the status. The microcontroller will be stored with the standard health parameters and is connected to the patient through different sensors to sense the health parameters. The flow sensor will sense the rate of flow of the fluid and will be informing about the rate of flow of the fluid to the microcontroller. If the rate of flow is high then the microcontroller will slow down the rate of flow through the servo motor.

The microcontroller will be monitoring the health condition of the patient through the different sensors and will be notifying about the health condition to the caretaker and the doctor through the Bluetooth and the WI-FI module. Also it is provided with the buzzer which will rings during the emergency to alert the doctors and caretakers.

The proposed system of this paper is to detect and control the flow rate or fluid label accurately and also record the health parameters of the patient and give the signal to the doctor or nurse so that the amount of drop of saline can be controlled using a smart phone and manualcontrol based on the health condition. Also informs the doctor about the health condition of the patient. The proposed system uses several sensors for sensing the health parameters of the patient like heart beat, oxygen level, temperature etc. It uses PIC microcontroller as its control unit and some sensors, hence the cost of the system is less, so that it can be implemented in rural and urban area also. One system can control more than one patient at a time, hence the maintenance of this system is very easy. Hence the proposed is cost less and can easily maintained.

IV. WORKING

- All sensors, LCD display, Wi-Fi module, Gear motor, buzzer are connected to the microcontroller. The sensors are connected to the patient body and the fluid bottle. The sensors will be continuously sends the reading to the microcontroller.
- Flow sensor will sense the water level of the fluid, and the same readings will be displayed on the LCD display. The status of fluid level will be displaying on the LCD display.
- The standard readings are initially loaded to the microcontroller ant it will be comparing this reading with the sensors reading. If the fluid rate unstable it will be automatically controlled.
- All the other sensors will be sensing their respective parameters and updating the same to the controller. If any reading of any sensors is seen unstable then the fluid rate is controlled automatically.
- The health conditions of the patients will be updating to the caretaker and doctor using Wi-Fi module. If any emergency condition is found then an emergency message is sent to the doctor and caretaker.
- The emergency alert is also given through a buzzer to the caretaker and doctor. Also the buzzer will be connected to the microcontroller, which rings during the emergency case.

V. RESULT

The proposed system is tested and the resulted are verified practically. The automatic fluid control system based on the health parameters of a patient is verified practically. The health parameter and the fluid level information can be transmitted through Bluetooth. All the application of the system is practically verified.

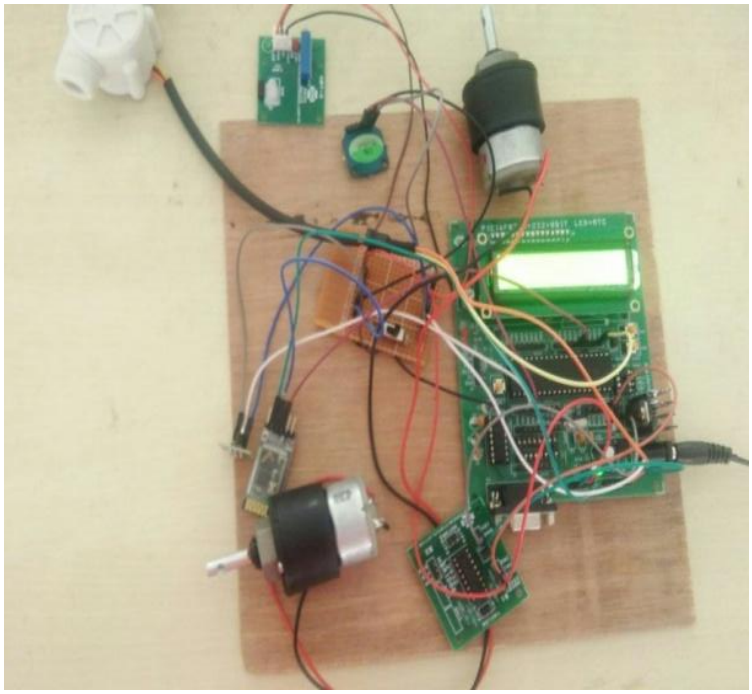

Figure 2: Model of the System

VI. ADVANTAGES

- The proposed system uses PIC microcontroller and some sensors, hence it is of low cost.
- This system can be installed in rural as well as in urban areas also.
- It consumes less human involvement and thus reduces the human involvement time.
- It upgrades the medical monitoring techniques.
- It can be easily maintained, no effects in caused by using this system.
- It can be installed in Ambulances to monitor the patient health condition and this can be tracked by using GPS.
- One system has an capacity of monitoring more than one patient at a time hence the initial investment for the system is less.

VII. CONCLUSION

This paper proposes the system which can automatically monitor the saline flow rate and health parameters by using microcontroller. It can wirelessly send the data to nurse's or doctor's computer and display the results in the form of number of droplets coming from saline bottle, and the health parameters, remaining time to empty the saline bottle with the help of serial port test software. The system is reliable, cost effective and convenient for nurses. It can be reused for the next saline bottle. It is beneficial for nurses as well as doctors at rural hospitals. Nurses can easily monitor the saline level from distance. It is mainly advantageous at night timing as there is no need for nurses to go to patient's bed to check the level of saline in the bottle.

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