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Smart Intensive Care Unit Using Embedded Systems

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Abstract: ***Even though technologies have been improved for the fast recovery of the patient, due to some carelessness in monitoring the patient condition may become critical. The most fundamental requirement in Hospital is good patient care, assessment and management of fluid. This project monitors the blood pressure, heart beat, temperature and flow of glucose and automatically refill when reduced to certain level. This system is implemented using embedded system, Arduino software, Proteus software****.*

Keywords: Embedded systems, Smart monitoring system, Wireless sensor network.

I. INTRODUCTION

Since the population growth has been increased, the purpose of health care also increased. Hence it is necessary to take care of the health properly. So, maintaining the patient safety is highest priority to be given. This project is to reduce the stress of nurse and doctor. The implementation such system brings a tremendous change in hospitals that measure the heartbeat, blood pressure, glucose flow level, temperature. It notifies the hospital staff about the glucose level which is injected into the vein of the patient. So, the manual need to monitor the glucose bottle is eliminated. The message is send through the GSM modem.
This paper is organized as follows: section II. Existing methods, section III proposed methods, followed by result and comparison in section IV and conclusion in section V

II. EXISTING PATIENT MONITORING SYSTEM

This part illustrates the present method of patient monitoring system.

A. GSM based Monitoring System

Almost in every hospital, it is an important criterion to check each and every patient. But due to the shortage of nurses it has been a difficult approach. In order to overcome this problem an advanced method called saline monitoring has been proposed. In this method a load sensor senses the saline flow rate and intimate to the nearby nurse through cell phones (GSM) in case of emergency. The same is displayed in a LCD display. The entire setup is achieved through AVR microcontroller.

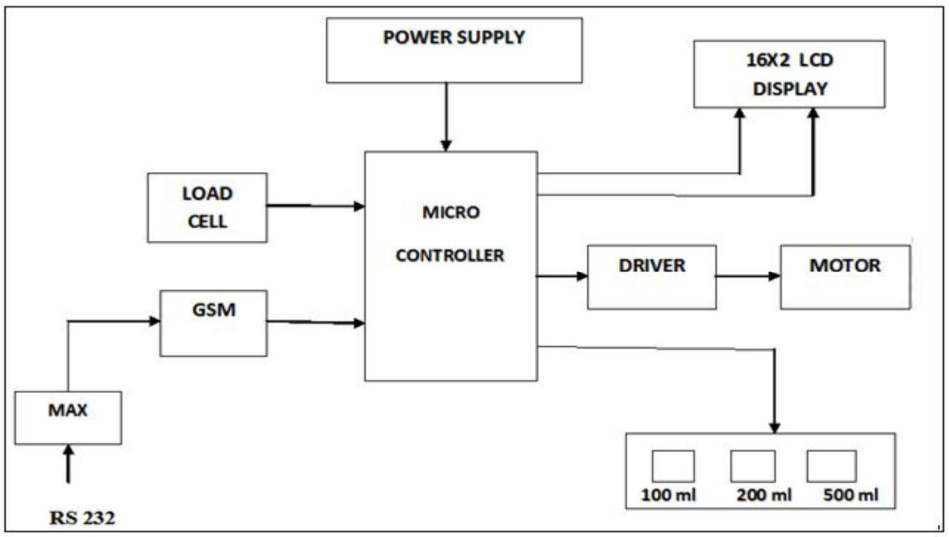

Fig 1 GSM based monitoring system.

B. Remote Monitoring the Glucose Bottle Level in Hospitals

This was proposed to intimate the nurse when glucose bottle reaches 50ml so that there is enough time for the nurse to reach the patients room and change the bottle. The second intimation will be a call alert indicating it is emergency to replace the bottle. In order to compare the message output with predefined threshold a comparator is used. Here the output voltage of the IR sensor changes when the intravenous fluid reaches below a certain level of value.

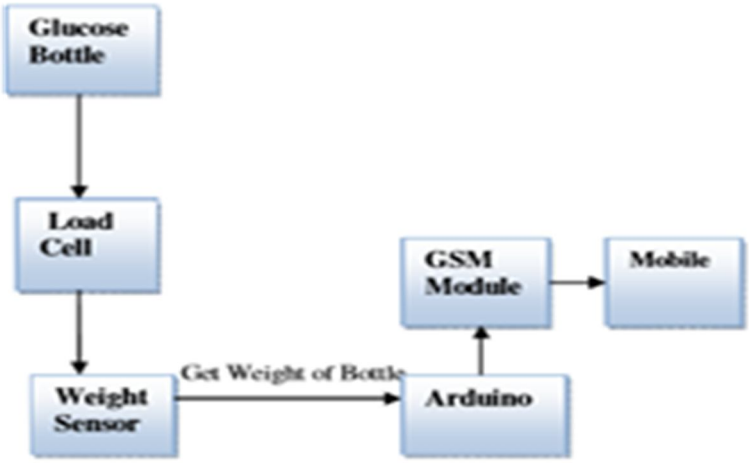

Fig 2 remote monitoring of glucose bottle level in hospital.

C. Patient Monitoring System

In this paper the data is collected and it is transferred using a micro controller, this facilitates the large number for monitoring patients quickly and effectively. The sensors are used which continuously monitor the critical parameter of the patient continuously. The physical parameters such as body temperature, percentage of oxygen in blood and heart beat rate are monitored using the sensors. Microcontroller converts analog signal into digital values by using ADC converter. When the critical values detected the message is send to the doctor via SMS using GSM module and the doctor's suggestion will be displayed in the screen.

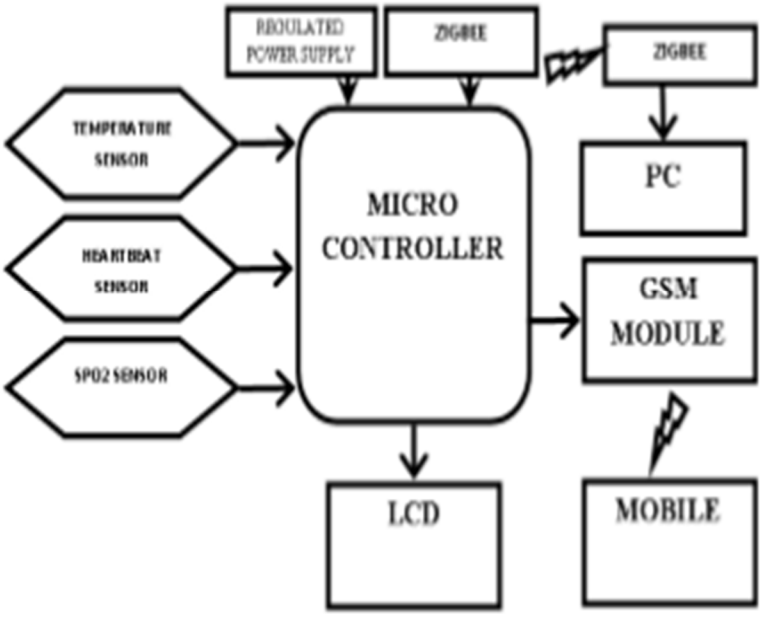

Fig 3 Patient monitoring system

III. PROPOSED METHOD WORKING METHODOLOGY

In the proposed system monitoring of patient and refilling of glucose is done. The monitoring is achieved through sensors like heart beat sensor, blood pressure sensor and temperature sensor. An ultrasonic sensor is used to sense the level of the saline quantity and send the information when the level goes below the standard value. The data is being processed by ATMeg328 microcontroller.

A. The heart beat sensor senses the heart rate when the finger is placed in it, a red led is used for indicating of pulse rate.
B. The temperature sensor senses, the body temperature and displays on the LCD. The blood pressure sensor detects the pressure level in the body,
C. The ultrasonic sensor senses the level of glucose in the bottle and intimation will be sent to the nurse through a GSM module.
D. A multimode pump is used to refill the glucose bottle in case if the nurse fails to change the bottle.
E. The LCD display is used for displaying normal condition.
F. The buzzer and the LED are used to indicate the abnormal and emergency condition

Fig shows the block diagram of the proposed system model.

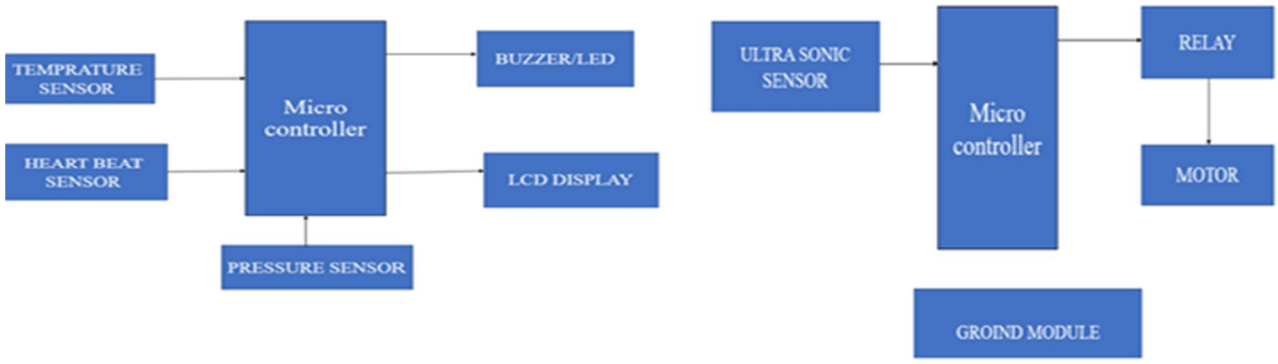

Fig 5 Block Diagram of the Proposed Method

IV. MATERIALS & METHODS

A. ATMega328 Microcontroller

The ATmega328 used here is a single-chip microcontroller from Atmel (mega AVR family). It is generally an 8-bit CMOS microcontroller. In that we have 14 digital input/output pins out of which there is 6 analog input pins,6 can be used as PWM output pins, a 16 Mega Hertz quartz crystal, a fixed USB connection, a power supply and a reset button to reset the entire operation. By executing instructions in a single clock cycle, the ATmega328 achieves throughputs reaching 1 MIPS/ MHz, allowing the system designated to optimize power consumption against processing speed.

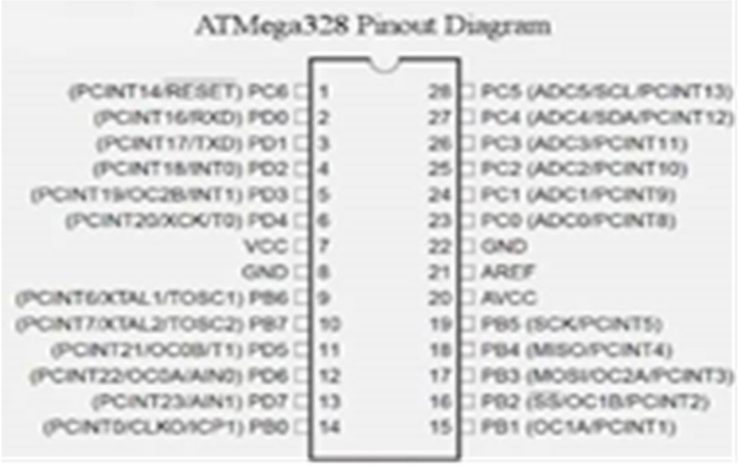

Fig 6 ATMega328Microcontroller

B. LM35 Temperature Sensor

The LM35 sensor which is otherwise called as LM35 series are very small integrated circuit temperature sensors, whose output varies linearly with the Celsius temperature as well as centigrade temperature. Here the prefix LM stands for linear monolithic which characterizes analog components integrated on a single chip of silicon. They were originated by National semiconductors. When there is an increase in voltage, simultaneously there will be a rise in temperature. This operation can be achieved using temperature sensor.

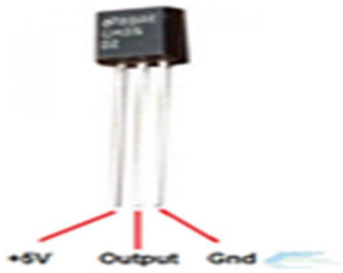

Fig 7 LM35 temperature sensor

C. Heart Beat Sensor

A normal human heartbeat is the sound of the opening and closure of the valves. When the sensor senses the heartbeat, the LED flashes in correspondence with the beat of the heart. The digitalized output can be given to the microcontroller to calculate the BPM rate. It works on the principle called light modulation.

Fig 8 Heart beat sensor

D. Blood Pressure Sensor

The blood pressure sensor is a non-invasive which is designed to measure human blood pressure. When there is an automatic cuff is detected, the sensor senses the return of the atrial blood flow. When the detected cuff is below the systolic pressure, a detectable vibration is setup, in the arterial valve whereas when it continuously flows, then it is diastolic pressure. the cuff is fully inflated to this pressure, no blood flow occurs through the artery.as the cuff is deflated below the systolic pressure, the reducing pressure exerted on the artery allows blood to flow through it and set up a detectable vibration in the arterial wall.

Fig 9 Blood pressue sensor

E. LCD Display

Liquid display is a very commonly used display module in almost all the fields for various applications. A 16*2 LCD display is the basic one among them. It simply means, it can display 16 characters in 2 lines

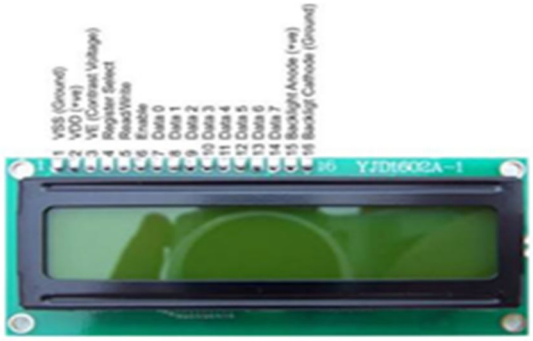

Fig 10 LCD display

F. Gsm

Global system for mobile communication is a digital telephony system GSM uses time division multiple access method.The main advantage of GSM is that two or more users can make use the similar frequency channel.this is possible due to the time slots that are divided.

Fig 11 GSM module

G. Multimode Pump

Multi-mode water Pump is a water pump that can change operation mode with the engine operating conditions and coolant temperature.

Multimode water Pump increases Fuel Economy and reduces Exhaust Gas of vehicle by minimizing water pump driving losses.

Fig 12 Multimode pump

H. Ultrasonic Sensor

The ultrasonic waves are the sound waves that can be heared by humans. Ultrasonic devices are used to sense the objects and measure the distance. It has two openings out of which one is for transmitting the ultrasonic waves and the other opening is for receiving them.

Fig 13 Ultrasonic sensor

IV. HARDWARE RESULT

In the proposed system monitoring of patient and refilling of glucose is done. The monitoring is achieved through sensors like heart beat sensor, blood pressure sensor and temperature sensor. An ultrasonic sensor is used to sense the level of the saline quantity and send the information when the level goes below the standard value. The data is being processed by ATMeg328 microcontroller. Hardware results showing patient monitoring system is shown below:

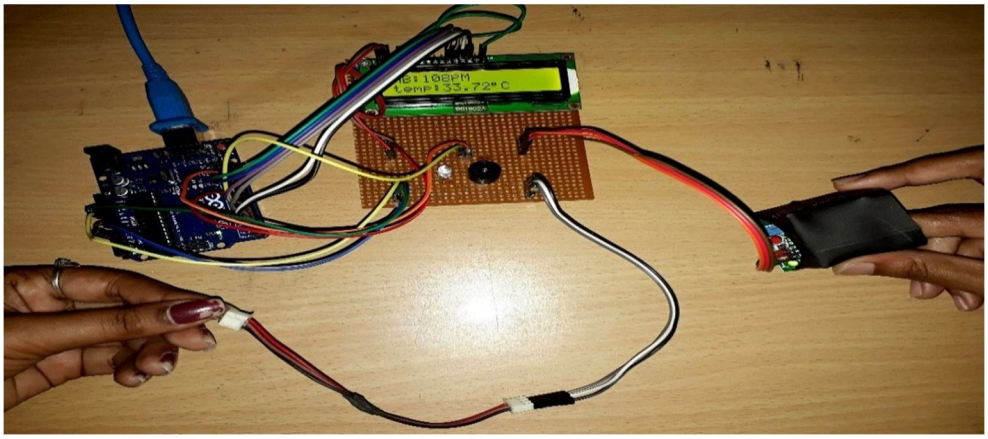

Fig 14 Hardware output

V. CONCLUSIONS & FUTURE ENHANCEMENTS

By sending glucose bottle alerts to hospital staff, the manually monitor the level of glucose method is avoided. This system also avoids the risk of air bubbles entering the patient's bloodstream which is a serious threat as air bubbles in blood can cause immediate death. Since it is a continuous monitoring system doctors could be able to give clear and best instruction with least time.

A. Reduces stress for nurse and doctor.
B. Many patients can be monitored.
C. Reduces death due to the careless of nurse.

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