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Saline Infusion Level Detection and Heart Rate Monitoring System

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Abstract: Now days, it is not possible for an attendant to stay beside the patient all the time. This has increased the need for proper monitoring equipment. The project aims to modify an existing safety model employed in domestic field. The aim of this project is designing a microcontroller based patient monitoring unit. The heart rate, temperature and pressure of the patient are monitored by the doctor using IoT. When there is a change from the predefined nominal rate a buzzer goes off and the doctor from his cabinet makes sure that appropriate actions have been taken. This is done using the hyper terminal software. The advantage of this automated detection/alarm system is that it offers faster response time and accurate detection of an emergency in turn leading to faster diffusion of the situation, compared to manual methods. This is a very compelling reason that justifies designing such a safety system.
Keywords: Saline level, sensors, Global System for Mobile communication, Internet of Things, heart rate, temperature, blood pressure.

I. INTRODUCTION

In the present scenario, it is difficult for doctors to stay besides the patient in the hospital all the time. In order to assist and monitor the condition of the patient continuously and to help notify the attendant about the saline content level in the drips bottle, the saline infusion level detection and monitoring unit has been developed. In this paper, the saline infusion level detection and monitoring unit along with heart rate, temperature and blood pressure measuring devices are designed and developed. These devices are ergonomic, durable and cost effective.

The nominal range of temperature, heart rate and blood pressure is fixed initially. The condition of the patient is continuously monitored by the doctor using internet of things (IoT). Whenever there is deviation from these values, an emergency alert is sent to the attendant using global system for mobile communication. The content level in the saline bottle is monitored and displayed using an LCD. If the content level reduces below a certain level a buzzer is set on to notify the attendant immediately.

II. EXISTING SYSTEM

Dextrose is a key ingredient in many hospitals and clinics as part of an intravenous solution designed to deliver water and calories to sick patients. Professional nurses are responsible for managing and providing care to client receiving intravenous therapy. There is not a system currently for automated level detection of the drip bag.

Heart beat is detected and radio signal is transmitted, which the receiver uses to determine the current heart rate. This signal can be a simple radio pulse or a unique coded signal from the chest strap (such as Bluetooth, ANT, or other low-power radio link); the latter prevents one user's receiver from using signals from other nearby transmitters (known as cross-talk interference). Blood pressure is measured using an instrument called as sphygmomanometer.

III. PROPOSED SYSTEM:

In proposed system, temperature sensor LM35 is incorporated to detect the temperature of the patient. Heart rate is measured by a simple unit in the form of a finger clip containing light emitting diode and photo detector. The nominal temperature range for humans is 37^0C.

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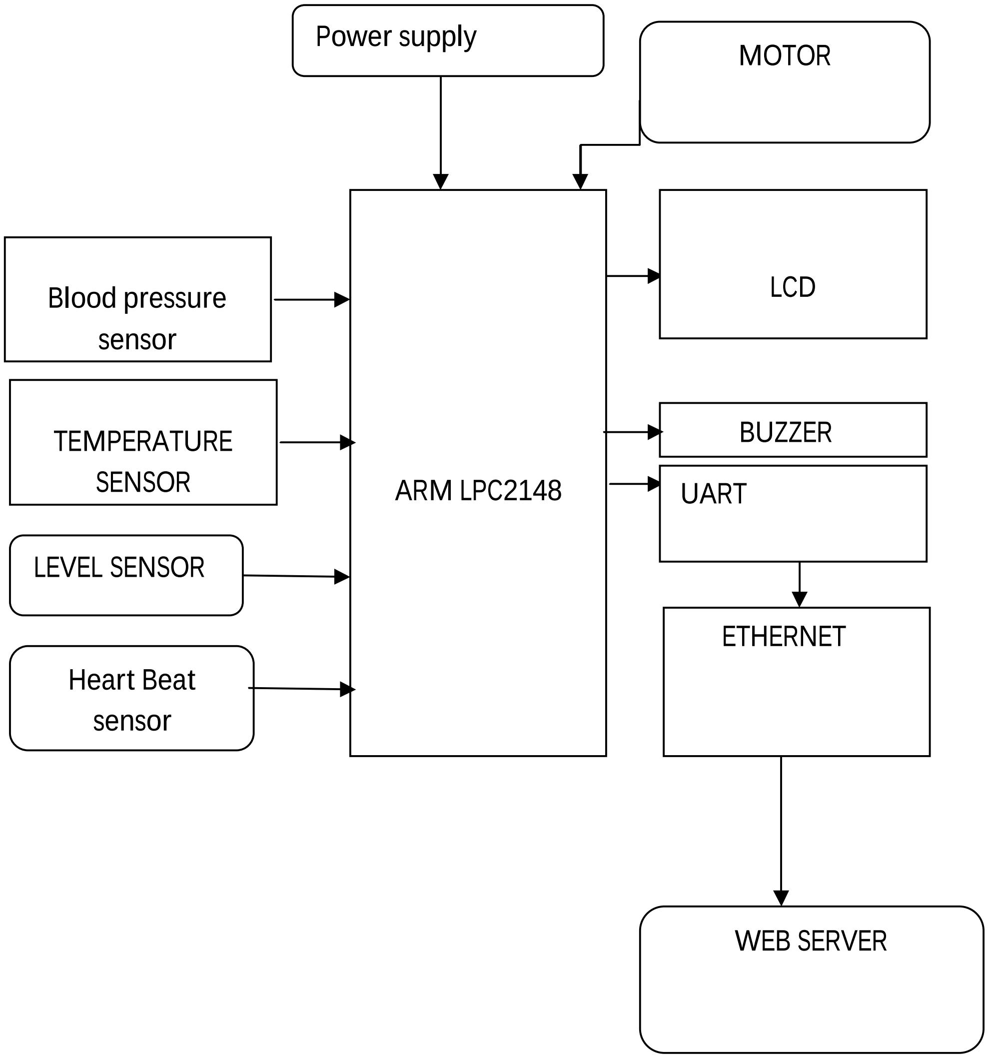

Fig 1: Block Diagram of the Proposed System

A. *Heart Rate Monitoring System*

Nominal blood pressure should be less than 120/80 mm Hg.The information of these parameters of the patient in a hospital are continuously delivered to the doctor's computer through IOT and when there is a change from the fixed nominal ranges an emergency alert is sent to the attendant via GSM. For a healthy person, heart rate should be 72 beats per minute.

CATEGORY	RANGE
Fetus	140bpm
Children	80-100bpm
Adults	60-100bpm

Table 1. Range for nominal heart rate

B. *Drip Annunciator*

A drip annunciator comprises a main body and a needle bottle capable of inserting into a drip bottle for outputting liquid. A buoyancy body is received in the needle bottle, which may move with the liquid level. It emits an alarm or lights up an alarm light so inform one to update the liquid there within. Meanwhile, a rolling ball will seal the liquid opening to prevent air to flow inwards so as to safeguard the life of a patient.

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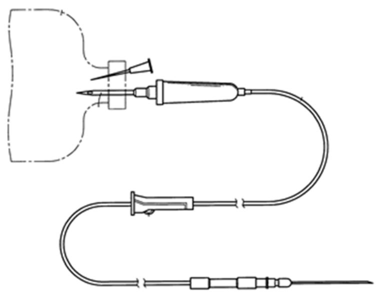

Fig 2. Drip Annunciator

C. Saline Infusion Level and Flow Detection

In order to monitor the level of liquid in the drips bottle, a level sensor is used. Whenever the saline level goes below the nominal rate, it is notified using an alarm and this information is passed to the hospital attendant, using GSM. Using a capacitive probe, the infusion rate is measured and the number of drops passing through the drip chamber per minute, i.e. drip rate is displayed.

Fig 3. Level Sensor

IV. OXYGEN RATE AND TEMPERATURE MEASUREMENT

A. Transmittance Method

In this method, light is transmitted through tissue using the LED and is detected on the other end using a photo-detector. It is more suited to the areas of body that lend themselves better to light transmittance through them, e.g. fingers or ear lobe. This configuration cannot be used in other areas of body when there are obstacles such as bones or muscles

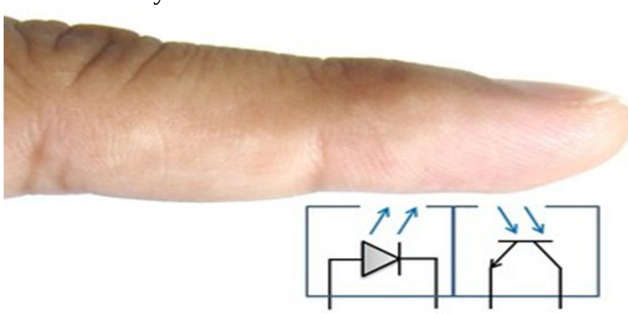

Fig 4.Reflectance method to measure heart rate

B. Reflectance Method

In reflectance pulse oximetry, it uses a photo detector on the same side as the LED to detect the light reflected by the tissue. This

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method is more useful where the vasculature is available close to the surface of skin e.g. forehead, wrist, forearm.Heart rate calculation: It is based on the beat to beat heart rate calculation process. In this process, number of pulses for a given period T is calculated and converted to bpm by multiplying with 60/T, that gives the instantaneous heart rate in bpm. So this can be expressed as: Heart rate= No of pulses for a given T/T bpm

C. *Temperature Measurement*

Temperature is measured using a temperature sensor LM35. This sensor is Calibrated directly in °Celsius (Centigrade), suitable for remote applications, low-cost due to wafer-level trimming, Operates from 4 to 30 volts.

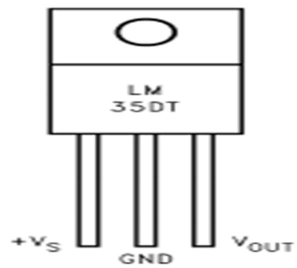

Fig 5. LM35 Temperature sensor

V. ARM PROCESSOR AND IoT

ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture. This approach reduces costs, heat and power use. A simpler design facilitates more efficient multi-core CPUs and higher core counts at lower cost, providing higher processing power and improved energy efficiency for servers and supercomputers. ARM 7 LPC2148 is used which is a 32-bit processor and requires 3.3V to operate. This processor requires only one clock pulse and comparatively faster than the other processors. There are 64 pins in this processor which are classified for general processing input output, analog to digital convertor, pulse wave modulation and interrupt.

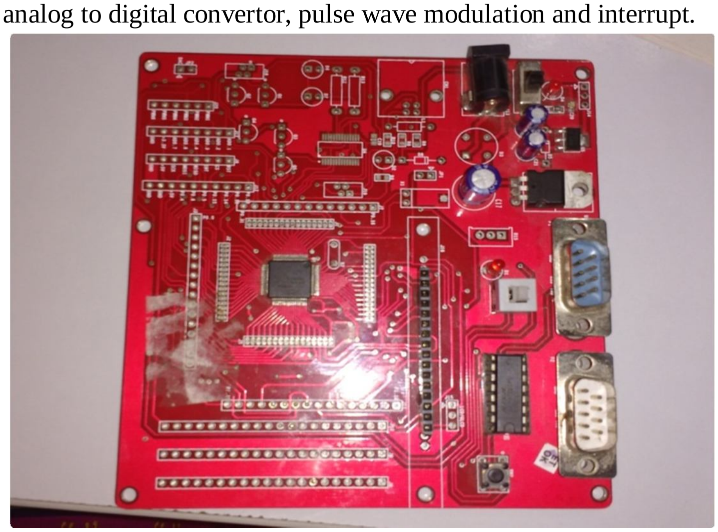
Fig 6.ARM Processor

A. *Internet of Things (IoT)*

The Internet of Things (IoT) is the network of physical objects—devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity that enable these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit; when IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the

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existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

VI. EXPERIMENTAL RESULTS

A 2*16 liquid crystal displays is used to display the heart rate, temperature and pressure of the patient. A level sensor is used to detect the level of saline content in the drips bottle and a buzzer (HXD6) is used to notify the attendant in case of an emergency. A Wi-Fi module is used to interface with doctor's pc via internet of things.

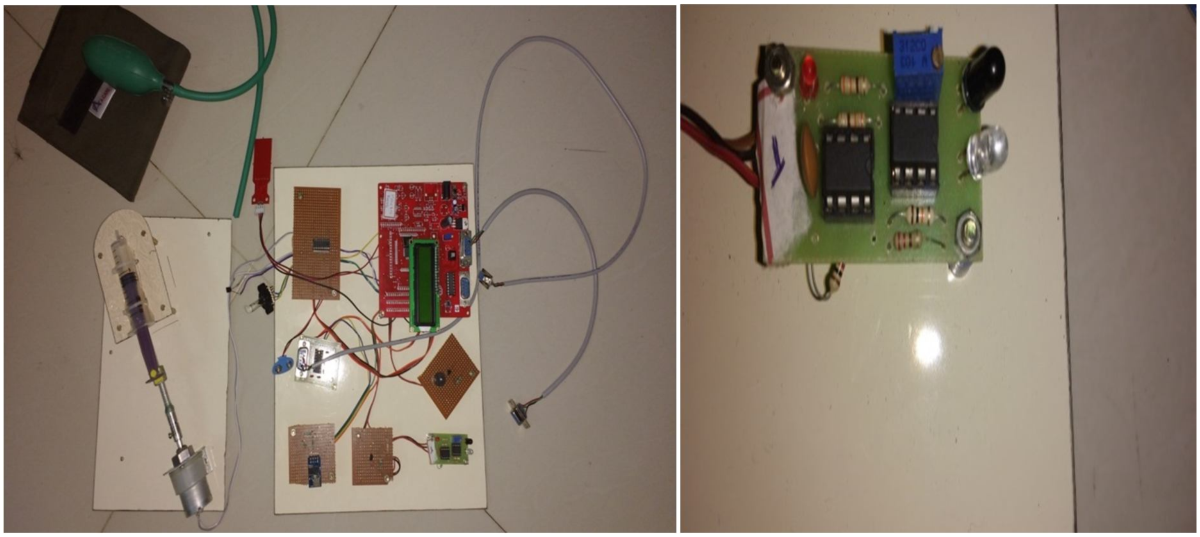

Fig 7. Experimental Setup and Heart Rate Sensor

VII. CONCLUSION

In the proposed system, the vital parameters of patient have been monitored and transmitted it using wireless techniques like GSM and IOT. In this fast pace world, everything is being digitized, in order to save time and to be precise. These technique help to save the time of the doctor as well as save the patient, in case of emergency.

A. *Scope of Future Work*

The future work is to propose a digital drips meter in the place of manual drips meter and different measuring unit can be incorporated into a single unit to make it more compact. Drip annunciator concept can be incorporated to avoid the formation of air bubbles in the intravenous solution before entering the patient's body.

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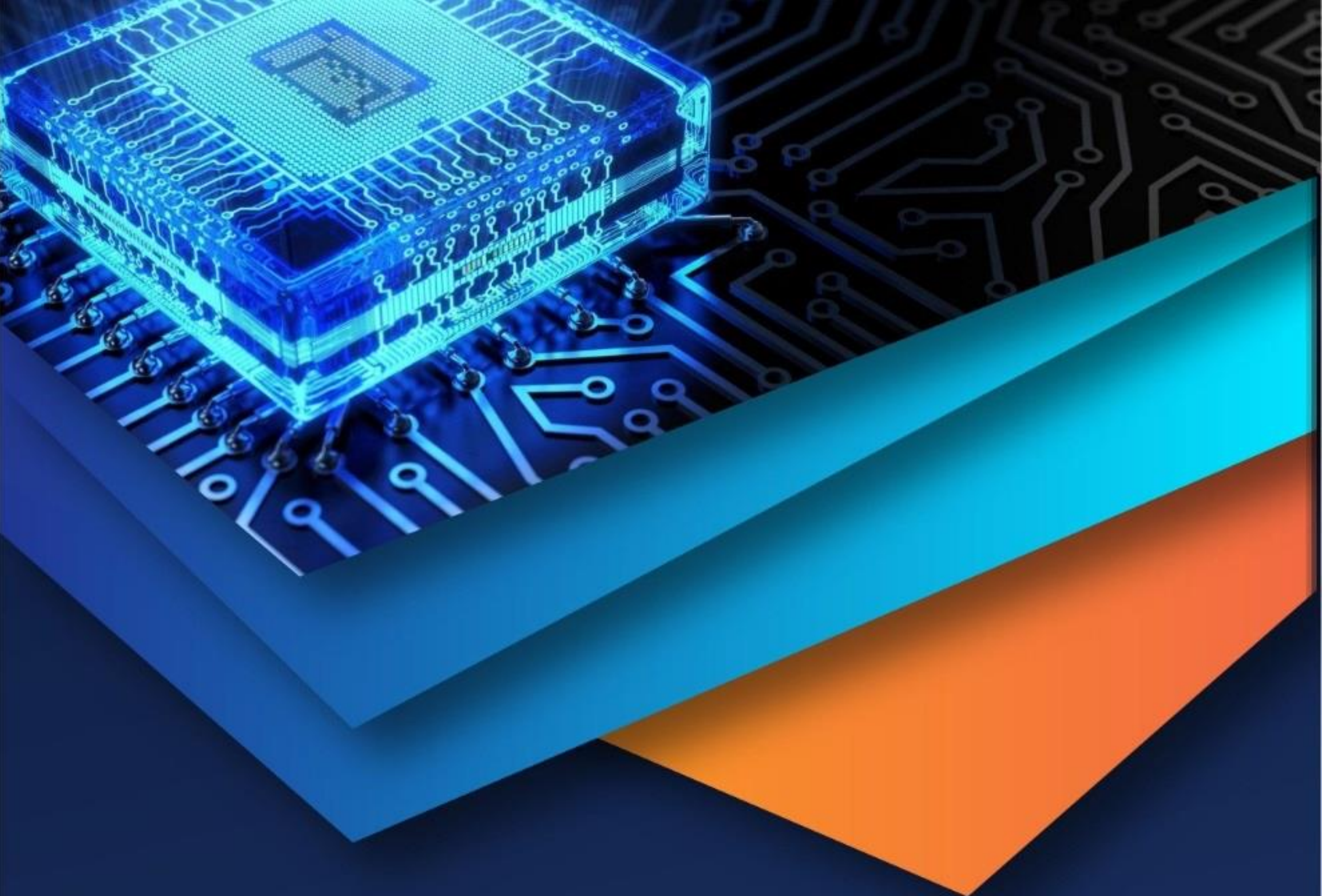

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