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GSM based Home Health Monitoring System

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Abstract: The measurement of vital health parameters like oxygen level, heart rate, and temperature is extremely crucial for serious cases like ischemia, fever, and others. A device for measuring vital health parameters properly has been developed as described in this paper to monitor the oxygen level, pulse rate, and temperature of the patient using it. Here a MAX30100 module, Thermistor, Arduino UNO, and LCD are interconnected with GSM to fulfill the mentioned measuring criteria. The goal of this project is to implement a wireless measurement system for the human body that will perform the observation and monitoring of the health parameters. It will be implemented using an ATmega328 microcontroller, GSM, and a Printed Circuit Board (PCB). The system gave results with more accuracy and feasibility in cost as compared to other components that might are employed in place of the components we have got used. This system can be used by elder or disabled persons who are unable to travel to the hospital for their regular checkups and might provide a live report back to their doctor using a global system for mobile communication.

Index Terms - ***Arduino UNO, Temperature, Oxygen level, Heart rate, Health, GSM***

I. INTRODUCTION

Health is being a major concern always for every person, whether we talk on a physical basis or mental basis. People do suffered earlier too, took rest and medicine, and recover. But at end of 2019 we saw something unexpected that is a novel coronavirus, it took the life of lakhs of people, and for the check-up of this brutal disease and communication of data like body temperature, pulse, and oxygen level, needed to be examined with extra precaution on regular basis, and, for each health parameter measurement, equipment was needed individually. The consequence was the lack of equipment, and problems for the old and disabled people because they couldn't reach to hospital by themselves for measurement of the symptoms they suffered.

So in this paper, the mentioned equipment is very well suited to each person for the vital health parameters examination and the most effective thing include that working will utilize the easy steps and communication of reading through GSM Module 900A to the respective mobile number. GSM Home based monitoring system will provide comfort, so there will not be a rush in hospitals. As a result, both patient and doctor won't be in panic condition. Doctors can pass on the instruction to remote patients easily as well as they can operate the patients present in the hospital. This will be a long-term beneficial process in the coming technology revolution and this report demonstrates a system that can be integrated as a single portable unit.

II. COMPNENTS REQUIRED

i. Arduino UNO

Arduino is very familiar term in electronics project because it carries many advantages with it, like, it is inexpensive, open source in hardware, open source in software, programming ease and IDE Software operates on any OS without creating issue. It has various types like Arduino UNO, Arduino Red Board, Arduino Leonardo, Arduino Mega and Lily Pad Arduino.

We are using Arduino UNO Board with ATmega328 Microcontroller equipped with it. The board is furnished with 6 analog input/output pins, which can be used to interface other shields or sensor for monitoring various physical parameters. UNO also consists of 14 digital input/output pins, among which 6 pins are capable of PWM output and is given power supply using USB Cable or 9V battery using DC supply jack. It consists of other pins like 5V, IOREF, AREF and LED pin which have their specific function. Arduino UNO provides a specific feature of serial communication using PIN 0 AND PIN 1 which are denoted as TX and Rx. ATmega328 microcontroller can be programmed with Arduino IDE and comes with a boot loader which can be used by the programmer to add new programs to it[1].

ii. GSM900A Module

GSM stands for Global System for Mobile Communication. GSM technology was developed as a digital system using the time division multiple access (TDMA) technique for communication purposes. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has the ability to carry 64 kbps to 120 Mbps of data rates [2].As per need of projects it has many versions. GSM 900A module is the

cheapest and small size module. It provide use of SIM and GSM technology.SIM 900A Module allows user to make calls and send sms using sim.It operates at 12 V for which 12 V adapter is used or the supply voltage may vary according to modules need. Bandwidth provided here is 900 MHz. Connection of module is done such that its Transmitter is connected to Receiver of Microcontroller and its Receiver is connected to Transmitter of Microcontroller. Also Ground to Ground connection is established between both the components..

iii. Thermistor

Thermistor is the sensor use for measuring temperature. It has two types one is NTC (Negative Temperature Coefficient) and other is PTC (Positive Temperature Coefficient).The working principle of both are reciprocal of each other. That is they work on excitation of electrons due to temperature, but for NTC thermistor when temperature increases resistance value decreases whereas for PTC thermistor when temperature increases then resistance value also increases.

iv. MAX30100 Module

MAX30100 module is a combination of, a pulse oximeter and a heart-rate sensor. It derives reading from two lights having different wavelengths, in which one is red and the other is infra-red, which is set to take a reading from the fingertip. Also, a photo detector is used for the measurement of pulsing blood absorbance. It has an inter-integrated circuit (iic) digital interface to set a communication with the ATmega328 Microcontroller.

MAX30100 power supply range is from 1.8 to 3.3V.This module can be powered down through software with negligible current and constant power supply. The advantage of using this module is that it has a fast data output capability [3].

Pin arrangements of the module:-

VIN Input voltage (1.8V to 5.5V) Pin
SCL Serial Clock Pin
SDA Serial data Pin
INT Active Low Interrupt Pin
IRD Infrared LED Cathode and LED Driver Connection Pin
RD Red LED Cathode and LED Driver Connection Pin
GND Ground Pin

v. PCB(Printed Circuit Board)

A Printed Circuit Board is a laminated sandwich structure of conductive and insulating layers. PCBs mechanically support electronic components using conductive pads in the shape designed to accept the component's terminals, and also electrically connect them using traces, planes and the other features etched from one or more sheet layers of copper laminated onto or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB board to both electrically connect and mechanically fasten them. Printed Circuit Boards are used in nearly all electrical products and in some electronic products, such as passive switch boxes. The size of the PCB is 5*6 cm and the thickness is 0.5mm-1mm [10]. PCBs can also be made manually in small quantities, with minimized benefits [10].

vi. LCD Display

The Liquid Crystal Library allows to control LCD displace that are compatible with the Hitachi HD44780 driver. The 16x2 LCD is named so because; it has 16 columns and 2 rows. There are a lot of combinations available but the most suitable and most used one in electronics project for simplicity is this one. So, it will have 32 characters in total and each character will be made of 5x8 Pixel Dots. The minimum and maximum logic voltage is 4.5V and 5.5V. The typical LED backlight voltage drop is 4.2V and current is 120mA. The supply current provided to the LCD is 2mA. Its weight is 35gm.

Table 1: Pin out of LCD

Pin	Symbol	Function
1	Vss	Ground(0V)
2	Vdd	5V logic supply voltage
3	Vo	Contrast adjustment
4	RS	H/L register select signal
5	R/W	H/L read/write signal
6	E	H/L enable signal
7-14	DB0-DB7	H/L data bus for 4 or 8 bit
15	A(LED+)	Backlight anode
16	K(LED-)	Backlight cathode

vii. Battery

An electric battery is a source of electric power consists of one or more electrochemical cells with external connections for powering electrical devices. Batteries have much lower specific energy than common fuels such as gasoline. In automobiles, this is somewhat offset by the higher efficiency of electric motors in converting electrical energy to mechanical work, compared to combustion engines [3].

The capacity of Alkaline is 550mAh, Carbon-Zinc is 400mAh, Lithium Primary is 1200mAh and NiMH is 175-300mAh. The operating temperature of 9V Battery is 0°C to 60°C. The length, width and height of 9V battery are 17.5mm, 26.5mm and 48.5mm.

viii. Connecting Wires

Connecting wires allows an electrical current to travel from one node to another node in a circuit because electrons need a medium through which they can move. Most of the connecting wires are made up of copper or aluminium. The Copper is cheap and have good conductivity. The length is 200mm and the weight is 30g, compatible with 2.54mm spacing heads, both the male and female wires are used [5].

III. BLOCK DIAGRAM

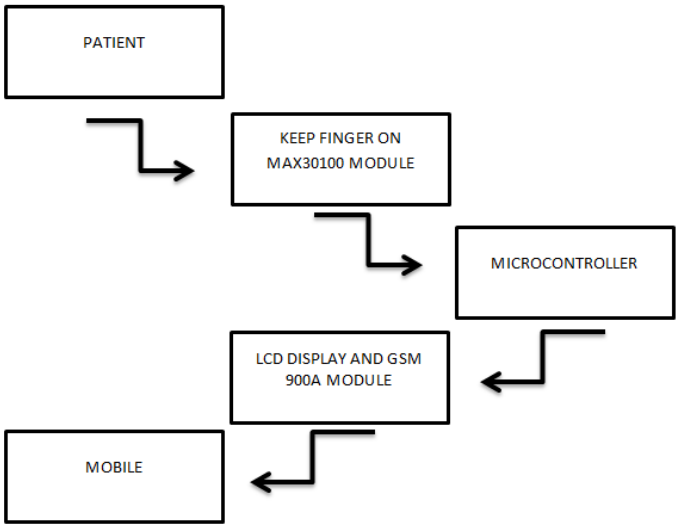

Figure1: Block Diagram of GSM based Home Health Monitoring System

IV. WORKING PRINCIPLE

1) Working of the MAX30100 Module

The sensor consists of a pair of Light-emitting diode which emits monochromatic red light at a wavelength of 660nm and infrared light at a wavelength of 940 nm. These wavelengths are particularly chosen as at this wavelength oxygenated and deoxygenated hemoglobin have very different absorption properties. As shown in the graph below, it can be seen that there is a difference between HbO2 (oxygenated Hb) and Hb(deoxygenated Hb) when subjected to these specific wavelengths.[3]

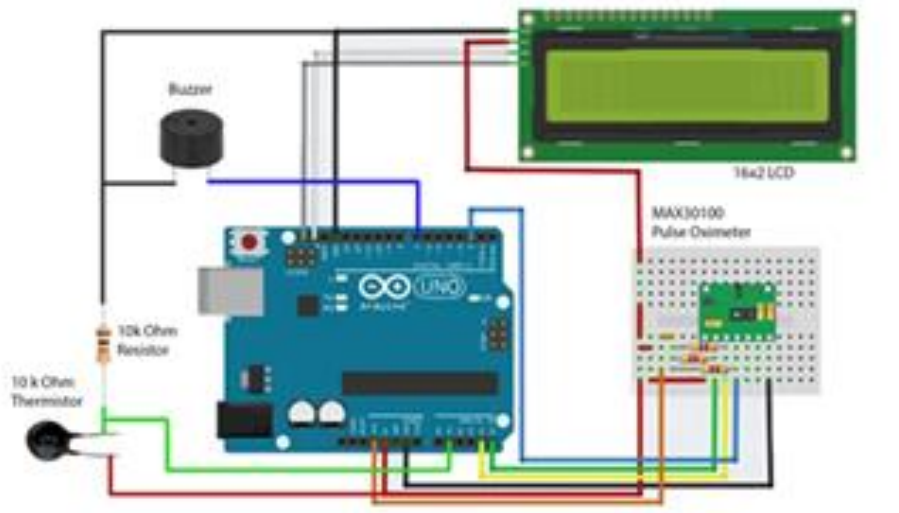

Figure 2: Circuit Diagram

2) Circuit Design of the GSM based Home Health Monitoring System

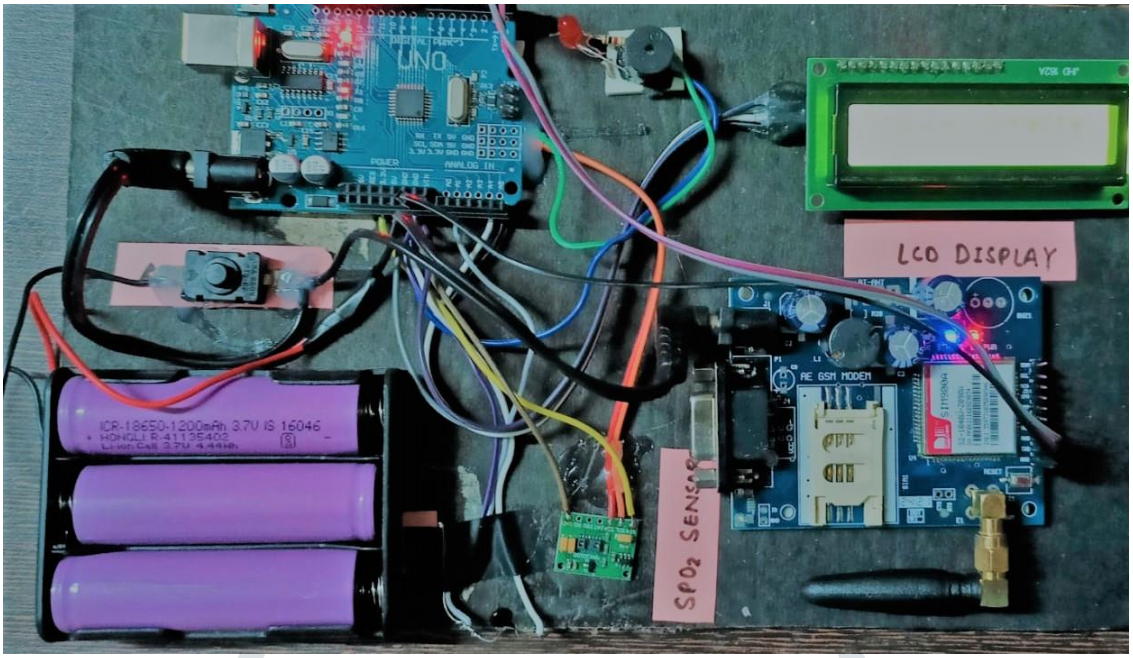

Figure 3: GSM based Home Health Monitoring System

3) Working of Circuit

Working of hardware components can take place either partially or fully. By partially or fully it means that, measure body temperature alone or body temperature, pulse, and oxygen level all together. First of all battery power supplies are given to circuitry that is microcontroller Arduino UNO which ultimately power up the LCD screen, MAX30100 module and Thermistor. Patient has to keep his index finger on the MAX30100 module properly which is connected to the analog pin of microcontroller, there the principle of heart rate and pulse oximeter is applied to display heart rate and pulse on the LCD 16*2 screen which is indirectly connected to the module, but the temperature will show the general reading. For measuring temperature patient has to grab the thermistor sensor with his fingers, as a result due to thermal agitation electrons will try to move faster, causing reduction in resistance and ultimately temperature increases and exact reading of body temperature will be displayed on the LCD screen. Here GSM 900A is powered up using external supply of 12 V through adapter. The data measured or can say the reading of health parameters will be send to respective contact number using sms.

V. CONCLUSION AND FUTURE SCOPE

The proposed system can be used to monitor the patient's temperature and heartbeat rate continuously, effectively, and remotely. The doctor can observe a patient's health remotely from any-where across the world using Global System for Mobile Communication (GSM) and depending upon measures can give consultation and the patient needs not to go for O.P.D. (Out Patient Department) in hospital. Thresholds have been set for both temperature and heartbeat rate. If any one or both of the values cross the threshold, then the notification is given. Also proposed system is cost-effective as the components used are affordable. It's compact in size, lightweight and easy for carrying along with patients anywhere. The proposed system is systematic and acceptable for effective assistance to heart patients. Specialists and doctors can easily look into the patient reports at the time of emergency and can take appropriate steps accordingly, hence giving proper guidance at the proper time to prevent a crisis the project is very helpful for people living in remote areas who don't have access to all the medical facilities. This can be signified as a small home clinic where you can just sit and get a regular check-up done.

The idea of mobile medicinal service will be a newly invented and different approach for the country. People can get the normal and routine check-up done at home and more easily than they used to. Utilizing the knowledge of sensors and the internet this project will help every person all over at any moment at any time. Reporting problems overtime to the doctor can save a life more-over can help someone to get proper treatment. This enforced project deals with finding the technical and advanced resolution to a significant downside at the hospital like watching the patient condition online and expected to unfold wide awareness on how technology may be utilized in emergency cases. This method is a moveable and real-time system. Wearable sensors may be used for higher health watching systems. This enforced project can be upgraded to a wireless emergency telemedicine system. Alternative physical parameters may be additional in step with demand like for position of the patient, sugar level detection, etc. Remote health watching improves the quality of care, reduces attention pay, and empowers patients. .

VI. RESULT

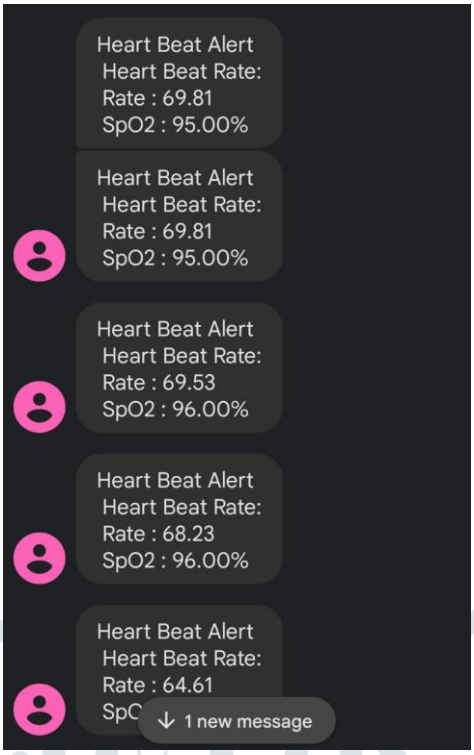

Figure 4: OUTPUT AT MOBILE USING TEXT SMS THROUGH GSM

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