A REMOTE HEALTH MONITORING MESSENGER

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Abstract- **Health is an important factor of every human being. Remote health monitoring messenger is needed for the people to reduce their inconvenience in travel to hospitals due to ailing health. Ill-patient requires accurate decision to be taken immediately in critical situations, so that life-protecting and life-saving therapy can be properly applied. In recent years, sensors are used in each and every fast developing application for designing the miniaturized system which is much easier for people use. A remote health monitoring messenger informs the doctor about the patient condition through wireless media such as Global System for Mobile communication. The system specifically deals with the signal conditioning and data acquisition of heart beat, temperature, and blood pressure of human body. The Heart beat sensor is used to read the patient's beats per minute (bpm) and temperature sensor to measure the body temperature of patient externally and pressure sensor to measure the level of pressure in blood. Signals obtained from sensors are fed into the microcontroller for processing and medicine is prescribed as first aid for patient to control the parameters through visual basic. A message is then sent to the doctor for further actions to be taken for treatment of patient after first aid. The system has a very good response time and it is cost effective.**

Keywords - Remote Health Monitoring, GSM modem, PIC Microcontroller, Wireless Sensor Network node, Graphical User Interface (GUI).

I. INTRODUCTION

In earlier days large devices were used in many applications which are not so comfortable for the people usage. Especially in health monitoring system, devices such as Home Transmitting Unit (HTU) was connected to the medical instruments at the patient side which collected and transmitted the physiological parameters information to the receiver side [5]. In spite of those large devices, sensors are used to miniaturize the system which is easy for the people usage in order of sensing and transmitting the information to the respective caretaker. A Recent development has taken place in each and every application. In medical field, health is an important concern. Health monitoring system plays a major role in the fast moving world where many developments were made to monitor the health in various ways. The sensors used to monitor the physiological parameters of human beings can be contactable and non-contactable; information about patient health can be collected and transferred to the caretaker through information gateway such as mobile phones [4]. Nowadays biomedical sensors are used in fast developing world to detect and control the physiological parameters of people. Wireless transmission technology is used for the purpose of communication between the patient and respective caretaker. Wireless health monitoring systems were getting improved to provide real time care for patient. The zigbee network is used for the transmission of data [11]. The Global System for Mobile communication (GSM) is used as a well known network for immediate response to the patient whereas zigbee network also did the same. It is applicable for certain short ranging distance and also requires more amount of zigbee nodes to be implemented which leads to the increase in cost. In remote health monitoring messenger, mobile phone plays a major role for sending Short Message Service (SMS). The sensors used in the system send the detected values of physiological parameters to the caretaker through the SMS gateway. This digital output is transferred to the Graphical User Interface of Visual Basic in order to show the each and every detail of detected parameters of a patient which reveals the patient health condition and treatment to be carried out by the doctor to respective person [10]. AMON system is the most popular remote health system, a wearable medical monitoring system for cardiac patients allow continuous monitoring of physiological signals for advancement in diagnosis and treatment. Blood pressure monitoring provides patient's measured detail of pressure according to two pressure levels. Most ambulatory blood pressure monitoring devices rely on the repeated measurement of systolic and diastolic blood pressure at predetermined intervals. Invasive monitoring schemes supply such information and they are limited due to arterial damage and infection. Non-invasive monitoring schemes are essential to acquire such information for the development of devices [9]. A health monitoring system with nurse call station was implemented especially for the bedridden patient in hospital who does not have communication

with others. The push button is employed in a bed of patient to initiate call and to alert the nurse during the abnormal situations for the treatment to proceed. The call can also be initiated automatically to respective caretaker. The automatic call can be initiated due to exceeded values of normal physiological parameters. The unique identification number is provided for patient where the details of patient can be indicated to nurse through voice message and SMS [6].

II. LITERATURE SURVEY

For patient monitoring, wearable sensors are used with emerging wireless techniques like Bluetooth and Zigbee technology for mobility and low power consumption by the system. The advantages are treatment can be given to the patient in priority to the disease they have when comparing with other patients, when in critical situation they can be hospitalized. These types of communication will only work for shorter distance and duration [2]. A study was done to determine the types of vital signs that are routinely measured for a patient by doctor. The vital signs are body temperature, pulse rate and detection of fall. Body tissues mass-weighted average temperature and skin temperature are measured. Direct temperature measurement of peripheral tissue is more complex than core temperature measurement [3]. Vital signals of patient health can be monitored by biomedical system using zigbee. The system is two tiered, used for gathering and processing biomedical signals. First the device with number of biosensors has to be placed on the body and second is processing by a local base station using the raw data transmitted on request by the mobile device [8]. Smart wearable remote health monitoring systems are increased in usage for good quality in health services and low cost, by avoiding unnecessary hospitalizations and to ensure urgent care. System contributes to the enhancement of disease prevention with cost effective telemedicine platform [7]. For physiological parameters measurement the network is approached to deal with monitoring and analysis of patient health. Data from sensors are acquired and transmitted to server by the network. Physiological parameters can be processed and automated by system and displayed on the monitor [1].

III. SYSTEM OVERVIEW

A Remote Health Monitoring Messenger consists of three main modules such as data sensing module, data processing module and data communication module. The data sensing module consists of temperature sensor, heart beat sensor and pressure sensor which senses the changes in the respective physiological parameters and conveys the information in a manner to the PIC microcontroller of data processing module which analyzes the input signals. The noise signals are filtered and if the processed value exceeds than normal value, medicine which is to be given as a first aid for patient is displayed on the personal computer using GUI. The communication module is used to transfer data between person and equipment. This has basic components such as the message, the sender, the receiver, the medium and the protocol by which the message is sent to the doctor through mobile phones by information gateway for the treatment to be taken.

IV. DESIGN AND IMPLEMENTATION

In this process, design and implementation of "Remote Health Monitoring Messenger" is done with modules of data sensing, data processing and data communication as shown in Fig. 1. Three sensors are contained in data sensing module such as temperature sensor, heart rate sensor and pressure sensor. Temperature sensor is used to measure the body temperature through external skin. Heartbeat sensor is used to measure the function of heart by blood flow through Finger. Pressure sensor is used to measure the blood pressure of human being. The output of each sensor is interfaced with Analog to Digital circuit (ADC) pins of microcontroller. Data processing module consists of PIC 16F877A a 40-pin 8-Bit CMOS FLASH microcontroller of Harvard architecture which is a high-performance RISC CPU and MAX232 circuit used to solve problems in conversion of RS232 signal voltage to TTL voltage and needed to communicate the PC and mobile of data communication module for prescribing medicine through VB and sending SMS through information gateway, LCD is used as a display unit in connection with microcontroller for displaying the current details of physiological parameters.

A. Data Sensing Module

It consists of three sensors to detect and measure the values of physiological parameters of human body such as Temperature, Heart beat and Blood Pressure.

1) Temperature sensor: The LM35 is a temperature sensor used to measure the body temperature through external skin and it is a precision integrated-circuit. Output voltage of sensor is proportional to the Celsius (Centigrade) temperature and varies by 10 mV. The LM35 sensor is advantageous than other temperature sensors which are calibrated in ° Kelvin and requires external calibration from user, which is not needed in
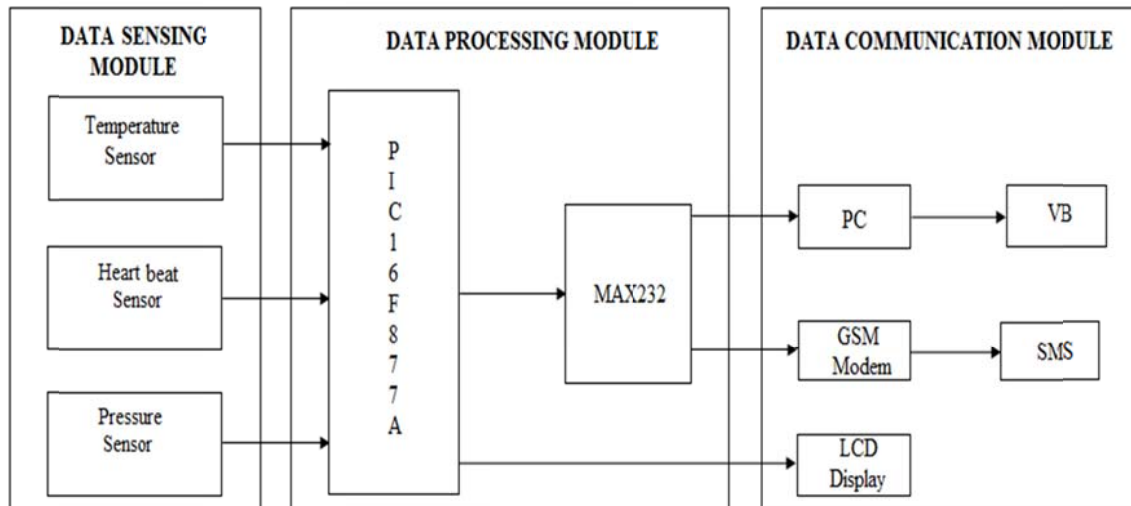
Fig. 1. Overall System Design

LM35 sensor to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range. Temperature measurement is done accurately with LM35 sensor more than a thermistor and also possesses low self heating where temperature does not rise than 0.1 °C.

2) *Temperature measurement algorithm:* The normal temperature of human body is 98.6° F which is 37 °C and it can change due to various factors. LM35 sensor is highly accurate than other sensors. The formula used to calculate temperature in °C is given as, Temp in °C = [(V_{out} in mV) - 500] / 10. For LM35 sensors the temperature in °C can be calculated as, Temp in °C = (V_{out} in mV) / 10.

3) *Heart beat sensor:* Heart beat sensor is used to measure the function of heart by blood flow through Finger. Heart beat detected by using Infra red (IR) LED and Infra red receiver. The finger illuminated with IR rays transmitted by LED for detection. Changes can be caused in IR rays transmission due to the variation in blood flow. High glowing LED is used to indicate detection of blood flow, noise signals can interrupt the accurate pulse sensing by means of external signals. Noise signals are higher than the pulse signal. Accurate measurement needs raw signal processing. Comparator is used in heart beat sensor to compare the voltages and produce larger output by suppressing noise signals.

4) *Heart beat measurement algorithm:* Heart beat is contraction of heart to pump blood to the body. The normal human beings have 60-100 beats per minute and the average heart beat of resting heart is 72. Heart beat can be detected for every 60 seconds using the Timer 0 through blood flow in body and accurate pulse is measured using the formula, HB = Pulse * 60.

5) *Pressure sensor:* Pressure sensor made up of silicon measures the pressure level in blood. It is used in many health monitoring applications particularly with a microcontroller or microprocessor where analog signals are measured and converted into digital value. In sensor, micromachining techniques and metallization of thin-film are combined by transducer and bipolar processing provides an accurate analog output signal which is proportional to the applied pressure.

B. *Data Processing Module*

The data processing module contains a PIC Microcontroller used for processing and controlling functions of the system and MAX232 circuit used for the conversion of signals to perform the communication. PIC uses Harvard architecture for a small, simple and fast working embedded microcontroller with strong I/O capabilities and separate program as well as data bus where data can be flown to the Central Processing Unit (CPU) in large amount. PIC has two types of Program storage such as EPROM and Flash where PIC16F877 has flash memory which is rewritable and uses 14 bit instruction and it consumes low power for the application usage. PIC has inbuilt Analog to Digital Circuit (ADC) for sampling and conditioning of signals. PIC is widely used in many applications for its various features such as more program storage and consumption of low power. MAX232 circuit is a driver or receiver used to solve problems in conversion of RS232 signal voltage to TTL voltage and to communicate data between PC and mobile.

C. *Data Communication Module*

For Communication between the patient and doctor, mobile phone is used so that the message can be sent through the GSM modem and Personal Computer with Visual Basic is used to display the medicine details for first aid and LCD displays the details of physiological parameters.

Global System for Mobile Communication Modem provides Short Message Service. The 160 alphanumeric characters can be sent in a message. If there is a power off of subscriber's mobile unit or the

network coverage area is left, the message can be stored, retrieved and sent when entered the network. The GSM Modem supports popular "AT" command by which user can able to develop application quickly. The product SIM-300S module is used which has SIM card and used with respective number for sending emergency messages about the condition of patient to doctor.

The Personal Computer on the patient side shows the details of medicine to be used for the critical condition of indicated parameters, so that by consuming the medicine, patient can able to overcome the critical situation immediately.

V. FLOWCHART

The overall system functions with respect to the Measured value (Mvalue) of parameters detected from the people is represented in Fig. 2.
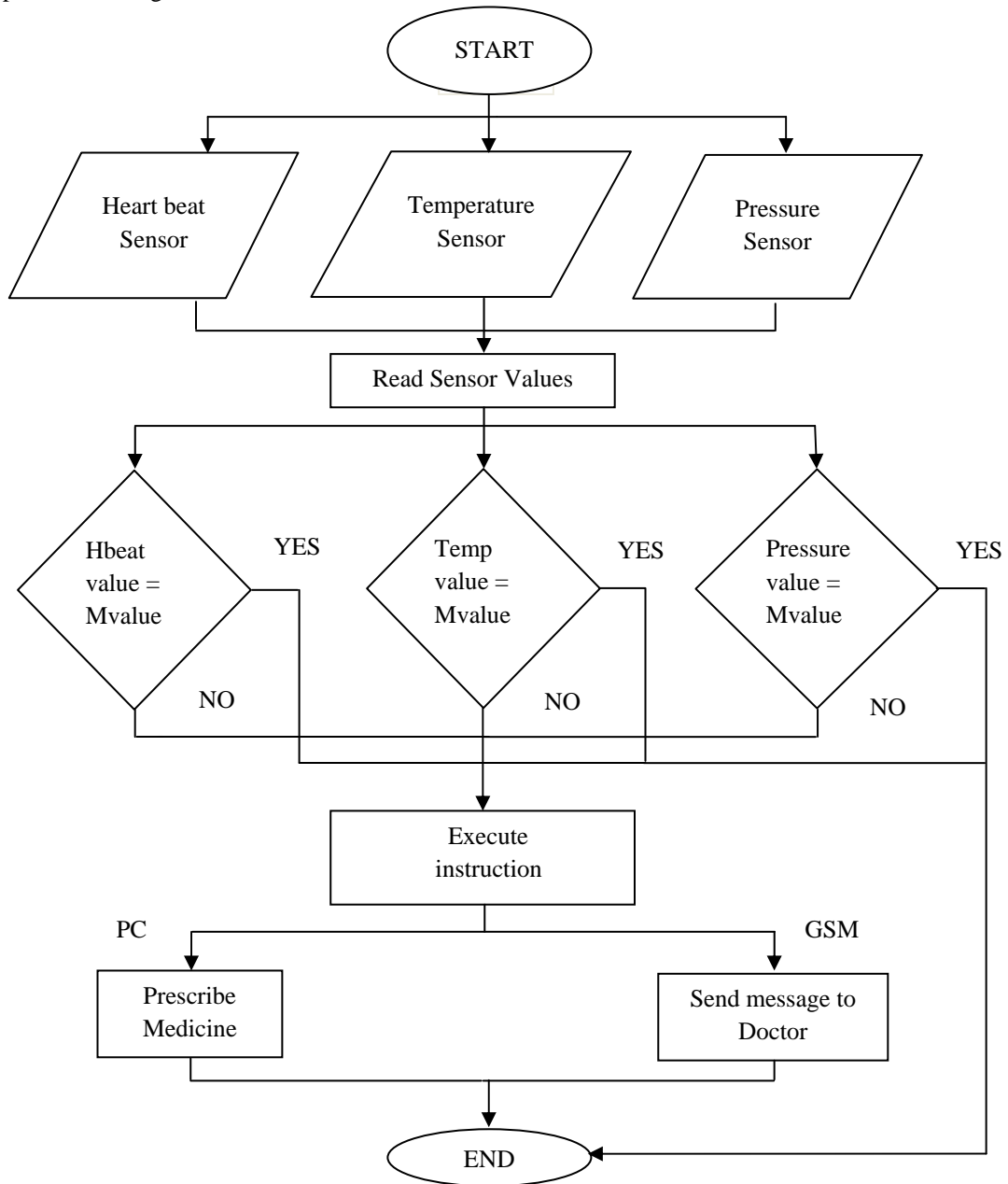

Fig. 2.System Flow Diagram

VI. EXPERIMENTAL RESULT

The "Remote Health Monitoring Messenger" detects various parameters of people and assists them to overcome the critical health condition. The heartbeat of a patient is shown in Fig. 3.
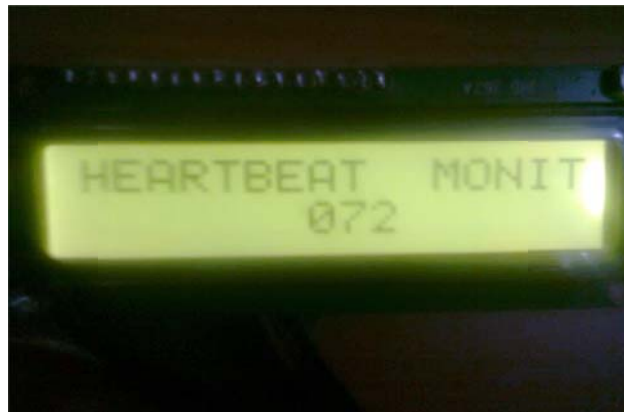
Fig. 3. Output for Patient heart beat

VII. CONCLUSION AND FUTURE WORK

The system was developed mainly to assist the people for monitoring and detecting the major physiological parameters such as temperature, heart beat and blood pressure through the respective sensors for sensing and providing the accurate signals by conditioning and processing through the microcontroller. GSM modem was used to send the measured parameter details of patient through SMS to the indicated mobile number and abnormalities in health conditions with medicine details are displayed in PC. The main focus of this system is that the people can overcome the critical situation and be cautious about their health condition. In future, the work can be extended by making it web based to pass the information and detect several other parameters.

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