RESEARCH ARTICLE                                                    OPEN ACCESS

# GSM BASED TELEALERT SYSTEM

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**ABSTRACT**
Telemedicine is widely considered to be part of the inevitable future of the modern practice of medicine. It is gaining more and more momentum as a new approach for patient's surveillance outside of hospitals (at home). Nowadays people are more aware of the health conditions. Homecare is the provision of health care services to patients in their own home. One of the main purposes of homecare telemedicine is to develop a wireless, low-cost and use-friendly system. This proposed system tests the health conditions of an individual by measuring his/her blood pressures, heart rate and temperature using Blood pressure monitor device, Heart beat sensor, Temperature sensor respectively. Monitoring health parameters get display on LCD, and if these monitoring parameters enter in critical section then these parameters send through an alert SMS. SMS can be transmitted using the GSM technology to the doctor and advises can be sought for saving the life of the patient.
*Keywords -* GSM, ARM, LCD, BP monitoring device, heart beat sensor, temperature sensor.

## I. INTRODUCTION

According to estimate, given by the World Health Organization (WHO), cardiovascular disease kills almost seventeen million people around the globe each year along with twenty million people at a risk of sudden heart failure. Some of these lives can often be saved if acute care and surgery is provided within the so-called golden hour. So the need for advice on first hand medical attention and promotion of good health by patient monitoring and follow-up becomes inevitable. Hence, patients who are at risk require that their cardiac health and BP level to be monitored frequently whether they are indoors or outdoors so that emergency treatment is possible. This project is developed for the Doctors to test the heart rate, temperature and blood pressure of the patient. If anything strange inform the doctor through SMS. When patient measures their body parameters, it gets displayed on LCD using ARM7. If the parameter value is below or above a certain range, ARM7 sends signal to the GSM controlling circuit. The GSM unit sends SMS to the Doctor. The mobile of doctor receives the SMS and accordingly displays the status of the heartbeat, blood pressure and temperature.

We describe a telemedicine system based on mobile messaging service namely: Short Messaging Service (SMS), which is an integral part of the original 2G GSM cellular system and subsequent generations since all new phones are SMS capable.

## II. SYSTEM ARCHITECTURE

The proposed BP level, heart rate, Body temperature Tele-Alert system is shown in figure 1

our model consists of cuff in which air is pumped through motor, then the pressure sensor senses the body blood pressure. Temperature sensor senses the Body temperature. Heart rate device senses the heart rate from the fingertip using IR reflection method this signal then given to operational amplifier that picks up the bio signal and given to ARM 7. Inbuilt ADC digitizes the analog signal coming from monitoring devices; the digitized signal is simultaneously given to LCD and GSM MODEM. GSM modem forwards the health checkup report to doctor's mobile using 2G technology.
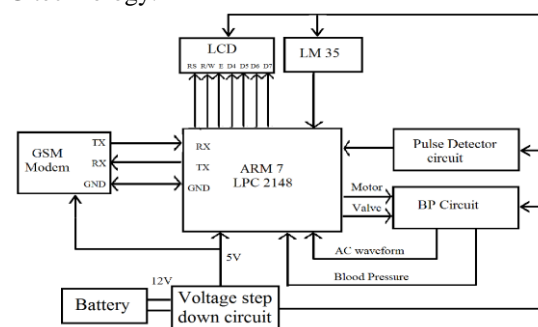


Fig. 1 Block diagram of GSM based telealert system

**2.1 Portable Digital Blood Pressure Monitor**
Portable blood pressure monitor device that can measure a user's blood pressures through an inflatable hand cuff. The device is consists of three main parts that are external hardwares (such as cuff, motor, valve and LCD), analog circuit, and ARM7. The analog circuit converts the pressure value inside the cuff into readable and usable analog waveforms. The ARM7 samples the waveforms and performs A/D

conversion, it also controls the operation of the devices such as the button and LCD. All of the components are put together in one package which is introduced as blood pressure monitoring device. It allows a user to take it anywhere and perform a measurement whenever and wherever anyone wants.
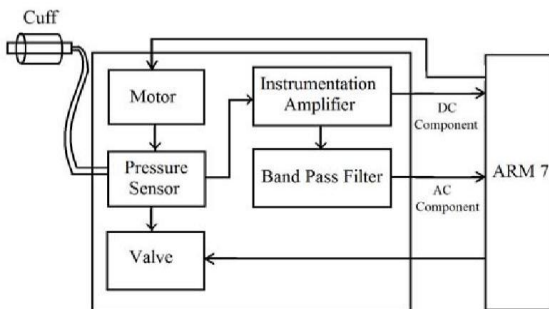


Fig. 2 Block diagram of portable digital BP monitor.

**2.2 Heart Rate Monitoring Device**

It uses optical sensors to measure the alteration in blood volume at fingertip with each heart beat. The sensor unit consists of an infrared light emitting diode (IR LED) and a photodiode, placed side by side. The IR diode transmits an infrared light into the fingertip (placed over the sensor unit), and the photodiode senses the portion of the light that is reflected back. The intensity of reflected light depends upon the blood volume inside the fingertip. So, each heart beat slightly alters the amount of reflected infrared light that can be detected by the photodiode. With a proper signal conditioning, this little change in the amplitude of the reflected light can be converted into a pulse. The pulses can be later counted by the ARM 7 to determine the heart rate.
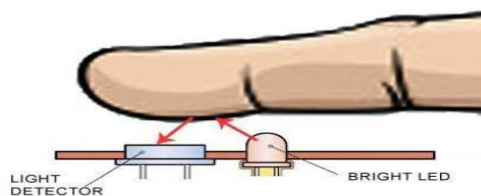


Fig. 3 Working operation to measure Heart rate.

**2.3 ARM**

The ARM7 is the main component that controls all the operations such as motor and valve control, A/D conversion and calculation, until the measurement is completed. The results of blood pressure then are output through and LCD screen for the user to see. The ARM architecture has evolved to a point where it supports implementations across a wide spectrum of performance points. Over two billion parts have shipped, establishing it as the dominant architecture across many market segments. The architectural simplicity of ARM processors has traditionally led to very small implementations, and

small implementations allow devices with very low power consumption. Implementation size, performance, and very low power consumption remain key attributes in the development of the ARM architecture. The ARM is a *Reduced Instruction Set Computer* (RISC), as it incorporates this typical RISC architecture.

*Features:*
1. A large uniform register file.
2. Uniform and fixed-length instruction fields, to simplify instruction decode.
3. Having 2 inbuilt ADC.
4. Auto-increment and auto-decrement addressing modes to optimize program loops.
5. Load and Store Multiple instructions to maximize data throughput.
6. Conditional execution of almost all instructions to maximize execution throughput.

These enhancements to a basic RISC architecture allow ARM processors to achieve a good balance of high performance, small code size, low power consumption, and small silicon area.

**2.4 Liquid crystal Display (LCD)**

Liquid crystals do not emit light directly. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. All LCD commands and data are transmitted serially via a single ARM pin.

**2.5 GSM**

The GSM MODEM supports popular "Attention (AT)" command set so that users can develop applications quickly. This product provides great feasibility for devices in remote location to stay connected which otherwise would not have been possible where telephone lines do not exist. Whenever the body parameters of patient is above or below the certain range, the ARM7 processor interfaced with GSM MODEM sends an alert SMS to the doctor's mobile number specified, deploying wireless technology.

Global system for mobile communication is globally accepted standard for digital cellular communication. GSM is the name of standardization group established in 1982 to create a common European mobile telephone standard that would

formulate specifications for a pan-European mobile cellular radio system operating at 900MHz. **A** GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone.
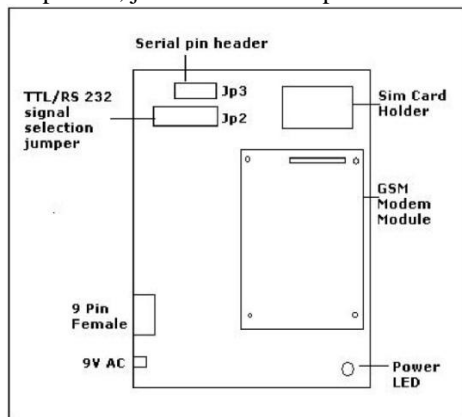


Fig. 4 GSM Modem

*AT COMMANDS:* The AT commands are standard control tools based on GSM to establish communication with the mobile GSM phone or modem.The command sets consist of strings, which will enable the exchange of serial data, according to certain syntax rules, between the mobile and the laptop or PC at the consultation/server unit if this arrangement is preferred. As an example, "AT +CMGS = 140" is a command for sending an SMS message, where "AT" is a prefix used for all commands, "CMGS" is a description to the kind of task to be performed, and "140" is the message length.

## III. PROCESSING STEPS
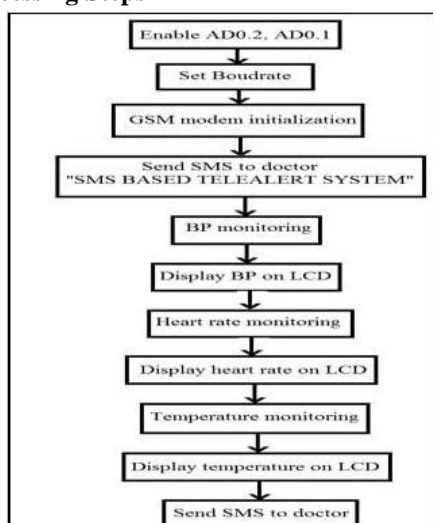### 3.1 Processing Steps in ARM7



Fig. 5 Flow chart of ARM 7

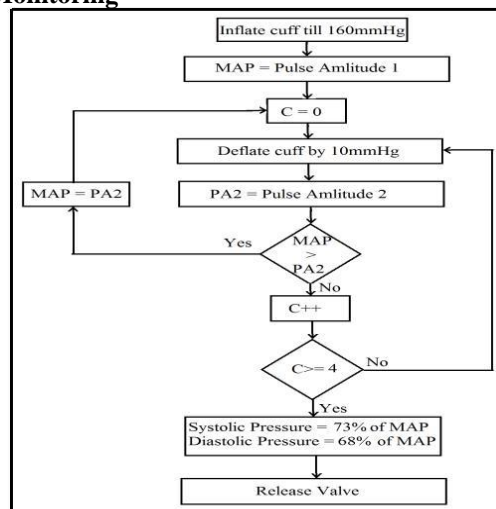### 3.2 Processing steps in Blood Pressure Monitoring



Fig. 6 Flow chart of Blood pressure monitoring

The measurement process begins by inflating the hand cuff. If the cuff-inflating procedure goes smoothly, the air will be pumped into the cuff until the pressure inside the cuff reaches 160 mmHg which is approximately more than the systolic pressure of normal healthy people. After that the motor stops pumping more air and the cuff is deflated through the slightly-opened valve and the air will be slowly released from the cuff. The pressure in the cuff starts decreasing approximately linearly in time by 10mmHg. When the pressure in the cuff decreases to a certain value, the blood begins to flow through the arm. At this time if we look at the oscilloscope, we will see the onset of the oscillation. The mean arterial pressure can be obtained at which the maximum pulse oscillation get occurs. When the pressure in the cuff decreases to a certain value, the blood begins to flow through the arm and then the amplitude of the pulse oscillations get decreased. The ARM7 will looks at the AC signal through the ADC pin and determines mean arterial pressure (MAP) of the user respectively. Once the ARM7 has obtained the values of MAP, the valve will be open to release air from the cuff quickly. Then calculations are done to calculate the systolic and diastolic pressure. Then it will report the result of the measurement by displaying the obtained data on the LCD screen.
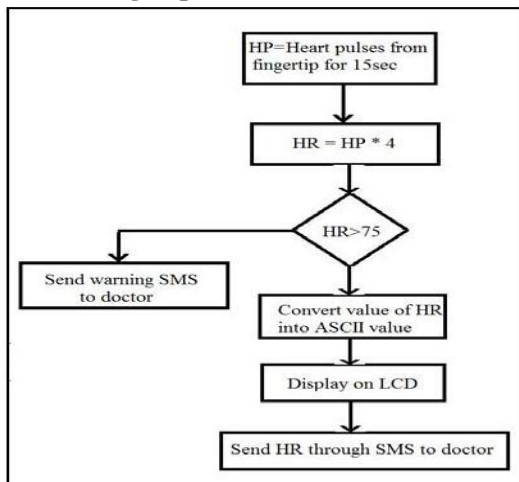
### 3.3 Processing steps in Heart Rate



Fig. 7 Flow chart of Heart Rate monitor

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. Count the number of pulses within a certain interval (say 15 sec), and easily determine the heart rate in beats per minute (BPM). It works on the principle of light modulation by blood flow.

## IV. PERFORMANCE ANALYSIS

**4.1** Duration of measurement
From the start until all the measurements are done, it takes about 2 minutes. For blood pressure measurement we require nearly 1.5minutes. And this BP measurement depends on each individual and how the cuff is worn. For each person, the amplitude of the waveforms may differ causing the operating time to vary. Still, the difference is small and is usually within 10 seconds. The heart rate and temperature of person are also depends on person to person. But for measuring heart rate and temperature we require 15sec for each measurement.

**4.2 Accuracy**
All the measurements are mainly dependent on the waveforms from the circuit and the sensors which are very sensitive to even a slight movement of the user. As a result, it is possible that sometimes the device fails to obtain the desired data, especially if the user does not stay still or wear the cuff improperly. And since the period of train of pulses of heart rate stays pretty much constant throughout the measurement, it is relatively easy to obtain an accurate result. And about temperature of body it is constant for at least 30 sec so to find the body temperature value it is easier and accurate.

**4.3 Safety in Design**
For the safety design, the ARM7 is programmed in the way such that if the pressure in the cuff is greater than 160 mmHg, the motor will stop. Other than this the device is run by low-voltage (12 volts) battery which cannot cause any major harm to human body.

For safety, when the patient's cardiac level goes beyond the threshold, our system alerts the doctor by sending an alert SMS to his/her mobile through the GSM MODEM. This proposed model is an enhanced version of the current patient/user monitoring system where we are providing mobility to both the doctor and patient.

**4.4 Usability**
Our project should be useable to most adults, since it is basically a regular blood pressure, heart rate and temperature monitor sold in the markets nowadays. The instructions LCD screen is pretty straight forward and easy to understand. Since this device is built to be portable, it can be used anywhere and anytime as long as the battery still has power.

**Result**
If the user stays still during the operation, the device can measure blood pressures (both systolic and diastolic) heart rate and temperature of body without any problem. The normal human health parameter measured by this system are heart rate 75RPM, BP 120/80 mmHg, temperature 37 °C.

## V. CONCLUSION

Blood pressure, pulse rate and body temperature are monitored by respective sensors. ARM7 is used for converting analog to digital signals, displaying health parameters on LCD and sending them on doctor's mobile through GSM using AT commands.

Describes monitor health parameter and an alert SMS can be transmitted using the GSM technology to the doctor and advises can be sought for saving the life of the patient. So far we have developed a model for enhancing the mobility of doctor alone and in future we will extend the prototype by providing mobility to both doctor and patient.

The overall conclusion of the project is that a monitor system that can successfully monitor the health parameter of person and send them on doctor's mobile via SMS.

## VI. Acknowledgements

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