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MOBILE TELE-HEALTH SYSTEM

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Abstract

Tele-health is an inter-disciplinary area where the delivery of health, medical information and services over large and small distances is possible by combining electronic information with communication technologies. Deaths from cardiovascular diseases have decreased substantially over the past two decades, largely as a result of advances in acute care and cardiac surgery. These developments have produced a growing population of patients who have survived a Heart attack. These patients need to be continuously monitored so that the initiation of treatment can be given within the crucial golden hour. The available conventional methods of monitoring mostly perform offline analysis and restrict the mobility of these patients within a hospital or room. Hence the aim of this proposed paper is to enhance the Tele-Health system by providing mobility to both the patient and doctor and regain their independence and return to an active work schedule, there by improving the psychological well being. It is achieved by detecting the changes in Heart rate and blood pressure of the patient in advance and sending an alert sms to the doctor through Global System for Mobile(GSM) Modem thereby gaining immediate medical attention and hence reducing the critical level of the patient.

Keywords: Heart rate, Blood pressure, GSM, Wireless transmission.

I. INTRODUCTION

Cardiovascular disease is the world's leading killer, accounting for 16.7 million or 29.2 per cent of total global deaths. With modernization, a large proportion of young people are trading healthy traditional diets for fatty foods. Also most of them are employed with deskbound sloth nature of jobs that lacks any physical exercise. They also lead a stressful city life when compared to the relative calm of the countryside. These risk factors contribute to an alarming increase in high-risk cardiac patient population Hence it becomes essential to monitor and alert the near ones of the patient and his family physician about the fatal condition that may occur at any instant. When appropriate health related professionals cannot be physically present to diagnose the patients, telecommunications technology can be used to connect these professionals to those in need of their expertise. In hospitals and homes, telemedicine has been shown to reduce the cost of health-care and increase the efficiency through better management of chronic diseases, shared health professional staffing, reduced travel times, and fewer or shorter hospital stays.

Tele-health is a fast-growing inter-disciplinary area, in which electronic information and communication technology is used to deliver health and medical information and services over large and small distances. Tele-health includes telemedicine, which offers empowerment, a better quality of life, and a reduced cost of care for patients with chronic disease, such as cardiovascular disease, diabetes, chronic respiratory diseases, and cancer. However, Tele-health also includes applications for healthy people, who want to maintain or improve their health.

For countries with limited medical expertise and resources, telecommunications has potential to provide a solution to telemedicine services to improve quality and access to health care regardless of geography. Telemedicine applications implemented using wired communication technologies are Plain Old Telephone System (POTS), and Integrated Services Digital Network (ISDN). However, modern wireless telecommunication using GSM and forthcoming Universal Mobile Telephone System (UMTS) allow operation of wireless telemedicine systems freeing medical personnel and patient from fixed locations.

Generally all monitoring systems are available for bedridden patients. All mobile telemedicine systems that have been designed so far have telemedicine systems that samples the medical data acquired, stores it for a short duration and then transmits to the doctor end .That is they are available only for monitoring and do not alert the doctor or the near ones about the panic situation of the patient. Hence by adopting the popular technique GSM, our project proposes the design and development of Tele-Health system based on mobile messaging services 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. Our Project proposes the design and development of a module that enhances the mobility of the doctor and the patient thereby leaping a step forward in the healthcare industry .It is achieved by detecting the changes in Heart rate of the patient in advance and sending an alert sms to the doctor

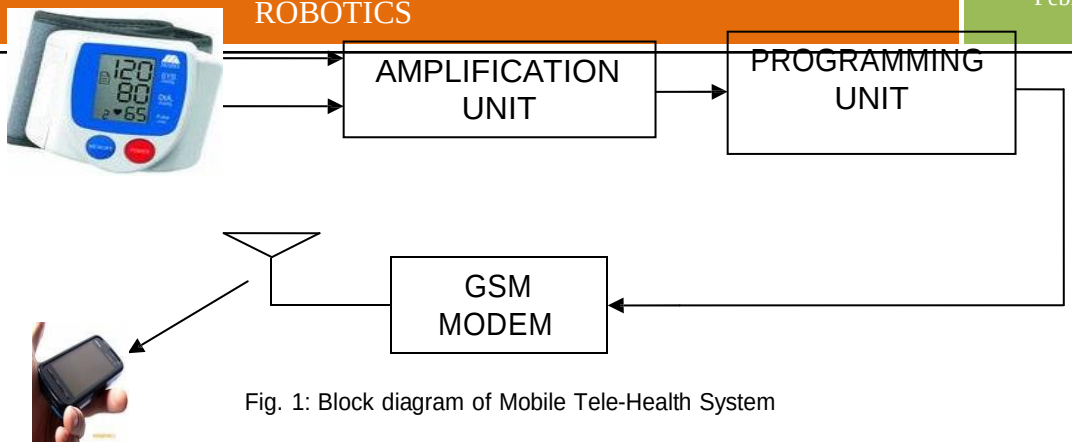

Fig. 1: Block diagram of Mobile Tele-Health System

through GSM Modem thereby taking suitable precautionary measures gaining immediate health care and hence reducing the critical level of the patient.

II. SYSTEM CONCEPT

The proposed Mobile Tele-Health system is shown in fig.1. Our model consists of a Heart rate sensor and Wrist Pressure sensor to pick up the heart beat and blood pressure. Then it converts into electrical signal, amplified by LM234 amplifier. Output is then programmed in AT89C55 Micro controller followed by the GSM MODEM. The patient (client) and the health-care professional can be located anywhere in the globe where there is 2G cellular network coverage. The primary purpose is to monitor patient's cardiac activity and blood pressure if there is a chance that patient has cardiac problems such as an irregular heartbeat or arrhythmia and stroke that require close monitoring or that occur intermittently. These sensors provide a simple way to study the cardiac activity and blood pressure. Unlike an electrocardiograph (EKG), which monitors the electrical signal of the heart, these sensors monitor the flow of blood through the veins.

III. PATIENT UNIT

The patient unit is comprised of the Heart rate and Blood pressure sensing circuit that comprises of a wrist type Sensor which is used for picking up the bio-electric potentials caused by heart muscle and also the systolic and diastolic blood pressure followed by an LM234 amplifier. The amplitude level of output is very low so here we are using two stage amplifier circuit (IC LM234) to boost the output signal level of the heart rate sensor which is fed into the micro controller with a threshold set by the medical professional.

A. HEART RATE AND BLOOD PRESSURE SENSOR

A wrist-type blood pressure meter as shown in fig.2 and fig.3 comprising: a microprocessor module; a screen module, wherein the screen comprises at least two of the displays visualizing measurement readings of systolic pressure, diastolic pressure and pulse rate in numeric figures and graphical plot. The method comprises: encircling a wrist-type blood pressure meter to a person's wrist whose blood pressure and heart rate is to be measured; pressing a start button on the wrist-type blood pressure meter and then measuring the blood pressure and heart rate of the person with a blood pressure measuring module and a ECG leads module, wherein the blood pressure measuring module and the ECG leads module is connected to the processor module. It provides an easy way to measure and monitor blood pressure and heartbeat rate. The unit is lightweight, easy to handle, extremely durable.

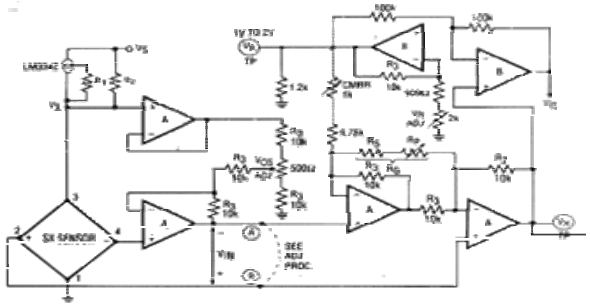

Fig.2: Heart rate and Blood pressure sensing circuit

The simple design and easy operation allows individuals to monitor the heartbeat during exercise and workouts. The device provides great safety to individuals with known heart problems. A normal, healthy, human heart beats about 72 times per minute. The output of the sensing

Fig.3: Front view of the sensor with output values

circuit is given to the controller .It decides whether the heart rate is normal or abnormal .When the threshold level is between 70 to 90 it frames a message as “Normal heart rate (70 to 90 beats/min)” and when the threshold level exceeds this normal level it frames a message as “Abnormal heart rate (>70, <90 beats/min)”.Similarly when systolic and Diastolic blood pressure is range is 90/60 mmHg it frames a message “Low BP” and when the range is 140/90 mmHg it frames a message “High BP”.

B. LM234 AMPLIFIER

The front-end following the Heart rate and blood pressure sensor is an operational amplifier (Fig.4). The LM234 has 3-terminal adjustable current sources characterized by an operating current range of 10000: 1 with an excellent current regulation and a wide dynamic voltage range of 1V to 40V. The current is determined by an external resistor without requiring other external components. Reverse voltages of up to 20V will only draw a current of several microamperes. This enables the circuit to operate as a rectifier and as a source of current in a.c. applications. Zero drift can be obtained by adding an additional resistor and a diode to the external circuitIt has a very high gain and requires very low supply current which is required for increasing the amplitude level.

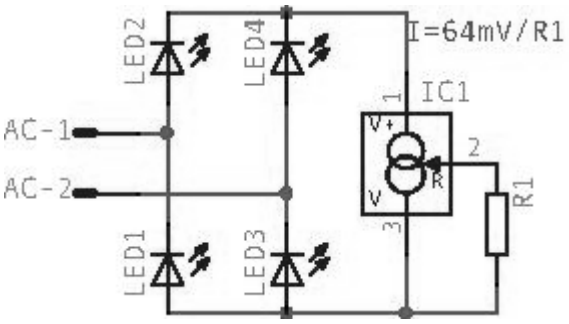

Fig.4: LM234 Amplifier

Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. The figure given above shows the pin connections of the LM234 amplifier.

IV. 89C55 MICRO CONTROLLER

The AT89C55 is a low-power, high-performance Complementary metal oxide silicon (CMOS) 8-bit microcontroller with 20K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using a ATMEL’S very high-density nonvolatile memory technology and is compatible with the industry-standard MCS-52 instruction set and pin out. By

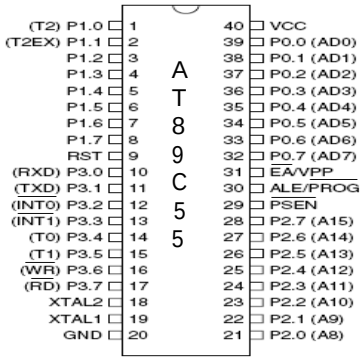

Fig.5: Pin diagram

combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C55is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications. Pin diagram of the AT89C55 Micro controller is given in Fig.5. The 89C55 flash reliably stores memory contents even after 10,000 erase and program cycles.

V. GSM MODEM

GSM Modem provides full functional capability to serial devices to send SMS and data over GSM Network. The GSM Modem supports popular "AT" command set so that users can develop applications quickly. The product has a

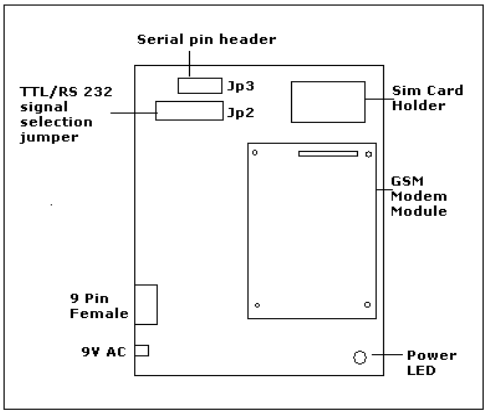

Fig.6: GSM MODEM

Subscriber Identity Module (SIM) card holder to which activated SIM card is inserted for normal use. The power to this unit can be given from UPS to provide the uninterrupted operation .

This product provides great feasibility for devices in the remote location to stay connected which otherwise would not have been possible where telephone lines do not exist. Connect any standard GSM antenna directly to the OSX connector of the GSM MODEM. Care should be taken in choosing the antenna. SIM card socket is located on the solder side of the module. The card can only be removed

while the GSM MODEM has been placed in shutdown mode. Communication to this board is performed through a standard UART channel.Whenever the safe range of the heart rate of patient is violated, the programmed microcontroller produces an alarm and GSM Modem interfaced with the microcontroller sends an alert sms to the doctor's mobile number specified deploying wireless technology

VI. RESULTS

As a general principle, connect sensor to the device & switch on the power switch then clip the sensor to the finger tip on the center of nail of fore finger or on ear lobe as per requirement. Proper readings may not be obtained if the fingers are very cold because this is due to an insufficient blood flow to finger ends.

A. Simulation results

Simulations were performed using LabVIEW. LabVIEW allows designing systems in an intuitive block-based manner in shorter times as compared to the commonly used text-based programming languages. The LabVIEW design and observed output for heart rate is shown in Fig 7 and 8

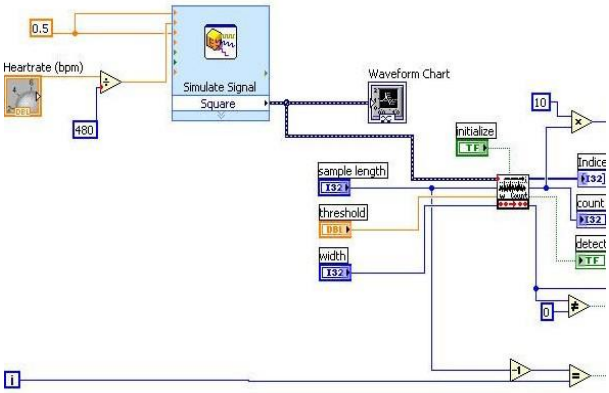

Fig.7: LabVIEW design

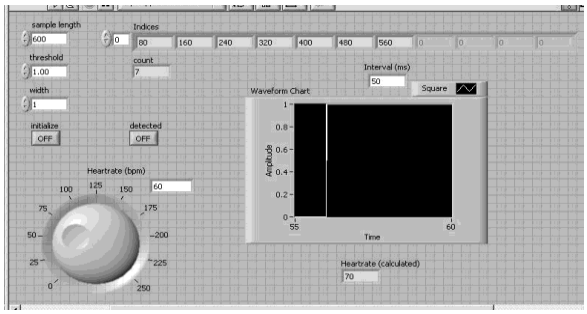

Fig.8: Observed results

The LabVIEW design and observed output for Blood pressure is shown in Fig 9 and 10.

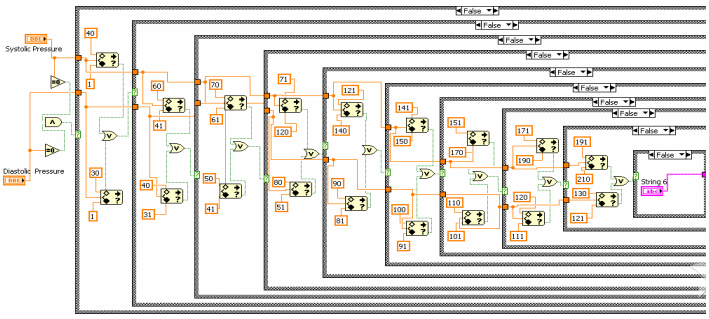

Fig.9: LabVIEW design for Blood pressure

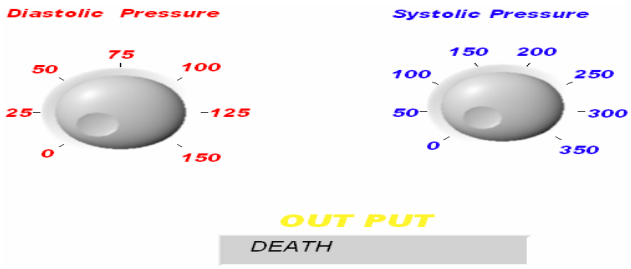

Fig.10: Observed results

VII. CONCLUSION AND FUTURE WORK

The major value of this Tele-Health system is in the detection of Heart rate and Blood pressure of the patients who are not in a position to report to the doctor for immediate treatment. An alert SMS can be transmitted using the GSM technology to the doctors 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

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