Heartbeat Monitoring System-First Report

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ABSTRACT

This paper describes to help the heart patients when they are helpless. This system uses pulse sensor, interfacing ICs, GPS antenna, atmel 8951controller. The pulse sensor senses the pulse of a person. The pulse sensor normally senses once in 5 seconds and then it is calculated for 60 seconds. The pulse detected from pulse sensor is converted into voltage. The voltage is amplified using LM324. Then the comparator compares the two signals and deliver the +12v to -12v square wave pulse at its output. The output from the comparator is given to input of atmel 8951 controller. The GPS antenna will receive the latitude and longitude from satellite and given to the controller. When the signal received from the comparator to the controller is beyond the programming range, the controller will send the output to the serial port which is connected to the mobile. Then the mobile will send the message to the desired number.

Keywords: Heart, Pulse, Sensor, GPS antenna, Mobile.

INTRODUCTION

Early diagnosis for heart disease is typically based on tape recording of ElectroCardioGram (ECG) signal which is then studied and analysed using a microcomputer. This paper however, presents the design and implementation of a compact microcontroller-based portable system used for control of heart rate on real time. Diagnosis of heart disease using ECG signals, may be achieved by either correlating the pattern of the ECG signal with a typical healthy signal [4], characterizing the typical ECG signal using basic logical decisions [9], or more complicated algorithms to process in depth the heart disease [2, 3, 8]. The first approach requires complicated mathematical analysis to obtain the required diagnosis, while the second one involves only simple analysis in most cases.

A long-term study of ECG signal during everyday activity is required to obtain a broad spectrum of heart disease categories based on heart rate changing. Many techniques have been implemented, such as the use of a minicomputer in intensive care to observe patients [5,7], or microprocessor-based card in portable system [7,10].

Coronary artery disease, the restriction of blood flow to the heart, is the leading cause of death in the United States. The chances of suffering myocardial infarctions are great and increases up to fifteen times after the first occurrence. During a heart attack, heart muscle is depraved of oxygen and will literally die if the artery remains blocked [1,6]. The first few hours are critical in saving much of the dying heart muscle and preventing permanent heart damage. Unfortunately, the symptoms vary and the most common reason for critical delays in medical treatment is lack of early warning and patient unawareness. The goal is to provide early heart attack detection so that the patient will be given medical attention within the first few critical hours, thus greatly improving his or her chances of survival.

PULSE RATE:

In medicine, a person's pulse is the throbbing of their arteries as an effect of the heart beat. It can be felt at the neck, at the wrist and other places. Pressure waves move through the blood vessels, which are pliable; these waves are not caused by the forward movement of the blood. When the heart contracts, blood are ejected into the aorta and the aorta stretches. At this point the wave of distention (pulse wave) is pronounced but relatively slow-moving (3 to 6 m/s).
As it travels towards the peripheral blood vessels, it gradually diminishes and becomes faster. In the large arterial branches, its velocity is 7 to 10 m/s; in the small arteries, it is 15 to 35 m/s. The pressure pulse is transmitted 15 or more times more rapidly than the blood flow [13].

The term pulse is also used, although incorrectly, to denote the frequency of the heart beat, usually measured in beats per minute. In most people, the pulse is an accurate measure of heart rate. Under certain circumstances, including arrhythmias, some of the heart beats are ineffective and the aorta is not stretched enough to create a palpable pressure wave. The pulse is irregular and the heart rate can be (much) higher than the pulse rate. In this case, the heart rate should be determined by auscultation of the heart apex, in which case it is not the pulse.

The pulse deficit (difference between heart beats and pulsations at the periphery) should be determined by simultaneous palpation at the radial artery and auscultation at the heart apex.

A normal pulse rate for a healthy adult, while resting, can range from 60 to 100 beats per minute (BPM). During sleep, this can drop to as low as 40 BPM; during strenuous exercise, it can rise as high as 200–220 BPM. Generally, pulse rates are higher in younger persons. A resting heart rate for an infant is as high as or higher than an adult's pulse rate during strenuous exercise. Besides its rate, the pulse has other qualities which reflect the state of the cardiovascular system, such as its rhythm, fullness and the shape of the pulse wave. Certain diseases cause characteristic changes in these qualities. The absence of a pulse at the temple of the skull can be a sign of giant cell arthritis.

Pulses are manually palpated with fingers or thumb. When palpating the carotid artery, the femoral artery or the brachial artery, the thumb may be used. However, the thumb has its own pulse which can interfere with detecting the patient's pulse at other points, where two or three fingers should be used. Fingers or thumb must be placed near an artery and pressed gently against a firm structure, usually a bone, in order to feel the pulse.[12,13].

**CIRCUIT WORKING DESCRIPTION:**

This circuit is designed to measure the pulse rate in the blood flow. The pulse rate is measured by IR transmitter and receiver.

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. The IR transmitter and receiver are placed in the pulse rate sensor. When you want to measure the pulse rate, the pulse rate sensor has to be clipped in the finger. The IR receiver is connected to the Vcc through the resistor which acts as potential divider. The potential divider output is connected to amplifier section.

When supply is ON the IR transmitter passes the rays to the receiver. Depending on the blood flow, the IR rays are interrupted.

Due to that IR receiver conduction is interrupted so variable pulse signals are generated in the potential divider point which is given to A1 amplifier through the capacitor C1. The coupling capacitor C1 is used to block the DC component because the capacitor reactance is depends on the frequency. For DC component the frequency is zero so the reactance is infinity now capacitor acts as open circuit for DC component.

The amplifier section is constructed by the LM 324 quad operational amplifier. It consists of four independent, high gains and internally frequency compensated operational amplifiers named as A1, A2, A3 and A4 amplifiers. The varying pulse from the potential divider is amplified by the A1 amplifier.

Then amplified signal is given to inverting input terminal of comparator. The comparator is constructed by the A4 amplifier in which the reference voltage is given to non inverting input terminal. The reference voltage is generated by the A3 amplifier. Then the comparator compares the two signal and delivered the +12v to -12v square wave pulse at its output.

Then the square wave signal is given to base of the BC 557 and BC547 switching transistors in order to convert the TTL voltage 0 to 5v level. Finally the TTL output is given to MM 74C04 inverter to invert the square pulse. Then the final square wave signal is given to microcontroller or other interfacing circuit in order to monitor the pulse rate.
For those who are unfamiliar with the term, GPS stands for Global Positioning System, and is a way of locating a receiver in three-dimensional space anywhere on the Earth, and even in orbit about it. GPS is arguably one of the most important inventions of our time, and has so many different applications that many technologies and ways of working are continually being improved in order to make the most of it.

To understand exactly why it is so useful and important, we should first look at how GPS works. More importantly, looking at what technological achievements have driven the development of this fascinating positioning system.

In order for GPS to work, a network of satellites was placed into orbit around planet Earth, each broadcasting a specific signal, much like a normal radio signal. This signal can be received by a low cost, low technology aerial, even though the signal is very weak.

Rather than carrying an actual radio or television program, the signals that are broadcast by the satellites carry data that is passed from the aerial, decoded and used by to the GPS software.
GSM

As recently as a year ago, tracking by GSM mobile phone cells was a still fledgling technology. Even mobile phone network operators themselves were apparently cautious about its appeal. However, it has quickly entered the mainstream, driven mainly by location-based service (LBS) providers, who predict huge demand from consumers for services such as “show me the nearest cash point”.

Now those companies are targeting corporate users, and are having such success that in some market sectors, traditional GPS tracking systems face a serious challenge.

GSM tracking, by contrast, takes advantage of the fact that the mobile phone network operators already track the location of ordinary mobile phones all the time they are switched on. They do this as a matter of course, so that their networks know which “cell” any given mobile is in, and can feed transmissions to and from it. So it was a logical step for them to package the positioning information into a commercial product, which is now offered through a growing number of third-party suppliers.

So does it really matter whether you use GPS or GSM to track your vehicles or mobile workers? Certainly a lot of noise is currently being generated by the GSM tracking providers. If you believe the hype, you could be forgiven for thinking that GPS systems are old hat, and unnecessarily complex in today’s wireless world. However, GPS still confers some advantages, especially if your primary need is to track vehicles rather than mobile workers.

When it comes to cost, there are pros and cons to both technologies. GSM tracking has the advantage of low set-up costs and fast roll-out. It works with any current mobile phone via its GSM SIM card. So long as the user gives you permission, you can track existing mobile phones simply by registering them with your chosen LBS provider.

MICRO CONTROLLER

The microcontroller checks the pulses counted by the sensors with the reference value. If any abnormal conditions occurs means in that time the microcontroller transmits the counted pulses with position of the patient (from GPS receiver) through the message to the doctor’s mobile.

The microcontroller is a BASIC Stamp 2 which will run a real time program to constantly monitor the output of the Sensor, comparing current data samples against stored samples. It will include an algorithm to process both the amplitude and frequency of the heart beat, to cover as many possible cases of a heart attack as reliably as possible. Once a heart attack is detected and confirmed, relevant data such as the time of occurrence will be collected, and a signal is sent to the doctor’s mobile to initiate the emergency dial up sequence via the cell phone.

ADVANTAGES OF MICROCONTROLLERS

The microcontroller has got RAM, ROM or EPROM and all peripheral facilities on a single chip so development of a similar system with a micro controller reduces PCB size and cost of the design.

Micro controller can control external device. That is if you want switch “ON” or “OFF” a device, you need peripheral ICs to do this work with Micro controller you can directly control the device.

This Micro controller have inbuilt 4K bytes of flash ROM, 256 bytes of RAM, 32 I/O lines (4 bit ports) and 6 vectored interrupts

The major Features of 8-bit Micro controller ATMEAL 89C51:
• 8 Bit CPU optimized for control applications
• On - Chip Flash Program Memory
• On - Chip Data RAM
• Bi-directional and Individually Addressable I/O Lines
• Multiple 16-Bit Timer/Counters

LCD DISPLAY:

The microcontroller counts the pulses and it is displayed on the 7 segment LCD display. Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. The
LCD’s are lightweight with only a few millimeters thickness. Since the LCD’s consume less power, they are compatible with low power electronic circuits, and can be powered for long durations. The LCD’s don’t generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark.

RS-232 INTERFACE

RS-232 is simple, universal, well understood and supported but it has some serious shortcomings as a data interface. The standards to 256kbps or less and line lengths of 15M (50 ft) or less but today we see high speed ports on our home PC running very high speeds and with high quality cable maxim distance has increased greatly. The rule of thumb for the length a data cable depends on speed of the data, quality of the cable.

Microcontrollers have also proven to be quite popular recently. Many of these have in built SCI (Serial Communications Interfaces) which can be used to talk to the outside world. Serial Communication reduces the pin count of these MPU’s. Only two pins are commonly used, Transmit Data (TXD) and Receive Data (RXD) compared with at least 8 pins if you use a 8bit Parallel method (You may also require a Strobe).

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
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<tbody>
<tr>
<td>1</td>
<td>Data Carrier Detect</td>
<td>6</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>2</td>
<td>Received Data</td>
<td>7</td>
<td>Request to Send</td>
</tr>
<tr>
<td>3</td>
<td>Transmitted Data</td>
<td>8</td>
<td>Clear to Send</td>
</tr>
<tr>
<td>4</td>
<td>Data Terminal Ready</td>
<td>9</td>
<td>Ring Indicator</td>
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<tr>
<td>5</td>
<td>Signal Ground</td>
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CELL PHONE – A modified NOKIA 6200 will be the phone platform. This phone meets the requirements for having both Bluetooth and GPS built in. A Java applet application will be written to establish the link between the sensor package and the phone and to pass GPS and subscriber information to emergency personnel.

BENEFITS
• Provides early detection of heart attacks
• Eliminates delays in receiving medical treatment
• Improves healthcare services to at risk population
• Saves lives and improves quality of living

CONCLUSION

Life is a precious one. Our paper’s main theme is to save the human life. In our paper, if the patient is in abnormal condition (heart attack occurs) means, immediately a message will be sent to the respective doctor or patient’s relative along with the place where the patient is located. Afterwards the patient can be easily recovered and his life will be saved as soon as possible.
REFERENCES


