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GSM Based Health Assistant for People with Chronic Diseases

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Abstract:- A GSM based health assistant for people with chronic diseases proposes and implements a prototype to help people with chronic diseases. The system is composed of two components namely, wearable body area network and a microprocessor unit with GSM and GPS. This project can track certain chronic diseases namely, heart problems, asthma, apart from the chronic diseases can also track blood pressure with sensors namely, electrocardiogram (ECG) sensor, temperature sensor, heart beatsensor and blood pressure sensor. This project keeps track of the readings from the sensors and if there are some abnormalities it would send messages via GSM stored in SIM.The location of the patient can be sent using GPS.

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I. INTRODUCTION:

The ability to move freely is highly valued by all people. However, it is sometimes difficult for a person suffering from chronic diseases as they run a risk of collapsing at random places. According to the World Health Organization's statistics, millions of people suffer from chronic diseases every day also all health parameter monitoring system are present in ICU but for people living in the rural area the ICU charges are not affordable. With wireless communication technology, miniaturization of sensors and internet technology, there has been considerable interest in development of wearable and wireless health monitoring systems. Most of the people would like to live a free life rather than the caged life enclosed in a room. GSM Based Health Assistant for People with Chronic Diseasesis a wearable health monitoring system. This system plays an important role in enabling ubiquitous communication between the patient and the physician which targets at ambulatory health status monitoring. Medical sensor is capable of measuring one or more significant physiological parameters, e.g. body temperature, heart rate, lung capacity and function of valves. This project can be used by the patient as a caretaking unit anywhere and everywhere. This prototype uses different sensors for monitoring the patient who would prefer the fresh air outside rather than the sick hospital smell. The different sensors connected to the patients are temperature sensor, heart beat sensor pressure sensor and ECG sensor and measure the biomedical parameter of patient these measured parameter are transmitted from transmitter. If any parameter is vary above or below this threshold value which is set by doctor then the Message is sent to the contacts stored through GSM module i.e. MODEM which is connected to the receiver circuit.

Chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality in the world, representing 60% of all deaths. Out of the 35 million people who died from chronic disease in 2005, half were under 70 and half were women.

Chronic diseases are responsible for 7 of 10 deaths each year, and treating people with chronic diseases accounts for 86% of our nation's health care costs and alsoit is said that 1 in 3 deaths in women are due to cardiovascular disease and stroke.Heart disease and stroke are cardiovascular (heart and blood vessel) diseases (CVDs).

Heart disease includes several types of heart conditions. The most common type in the United States is coronary heart disease (also known as coronary artery disease), which is narrowing of the blood vessels that carry blood to the heart. This can cause:

- Chest pain
- Heart attack (when blood flow to the heart becomes blocked and a section of the heart muscle is damaged or dies).

- Heart failure (when the heart cannot pump enough blood and oxygen to support other organs).
- Arrhythmia (when the heart beats too fast, too slow, or irregularly).

Stroke occurs when the blood supply to the brain is blocked or when a blood vessel in the brain bursts, causing brain tissue to die. Stroke can cause disability such as paralysis, muscle weakness, trouble speaking, memory loss or death.

Chronic diseases are ongoing, generally incurable illnesses or conditions, such as heart disease, asthma, cancer, and diabetes. These diseases are often preventable, and frequently manageable through early detection, improved diet, exercise, and treatment therapy. Hence it is important to develop a system for early detection. This system can indicate the person that his bio-potential measurements are increasing dangerously high.

Chronic disease is accompanied by the need to make adjustments in lifestyle, self-image, and the everyday life of the entire family. To expect physicians to have the expertise and time to guide patients and their families at every step of the way is unreasonable. In such cases a monitoring system is required to check the readings of certain organs of our body.

1 in 19 Australians (5.4%) had diabetes in 2011–12 (self–reported and measured data). This is includes approximately 1% of the population who did not self-report they had diabetes, which may indicate they were unaware they had the condition. Therefore, to avoid the gap between the awareness and ignorance of one's body this project comes in hand. 1 in 10 Australians (10%) reported having asthma in 2011–12. This rate is significantly lower than the rate of 11.6% in 2001.

II. SYSTEM ANALYSIS

2.1 EXSISTING SYSTEM:

The existing system aims at monitoring the patient in the general ward and sends the information to the medical expert in the server room.

Disadvantages

- Camera being used is expensive.
- This project proposed does not allow the patient to move.
- The microcontroller being used is 8051 which uses a Von Neumann architecture which consumes time when compared to ARM.
- The power consumed by 8051 is relatively high when compared to ARM.

2.2 PROPOSED SYSTEM:

The proposed system adds the feature of tracking the blood pressure and moreover, it does help the patient to move to any place and eradicates the fear of collapsing at any random place.

III. SYSTEM DESIGN:

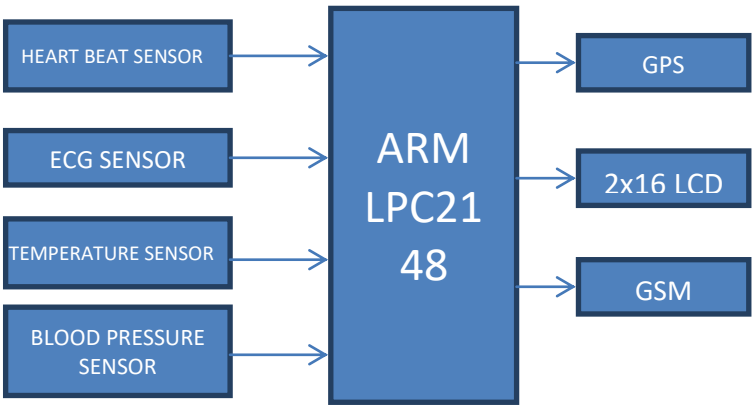

Figure 1.Block diagram proposed system

IV. HARDWARE DESCRIPTION:

4.1 MICROPROCESSOR:

An ARM processor is one of a family of CPUs based on the RISC (reduced instruction set computer) architecture developed by Advanced RISC Machines (ARM).ARM makes 32-bit and 64-bit RISC multi-core processors. RISC processors are designed to perform a smaller number of types of computer instructions so that they can operate at a higher speed, performing more millions of instructions per second (MIPS). By stripping out unneeded instructions and optimizing pathways, RISC processors provide outstanding performance at a fraction of the power demand of CISC (complex instruction set computing) devices.

ARM processors are extensively used in consumer electronic devices such as Smartphone, tablets, multimedia players and other mobile devices, such as wearable. Because of theirreduced instruction set, they require fewer transistors, which enables a smaller die size for the integrated circuitry (IC). The ARM processor's smaller size, reduced complexity and lower power consumption makes them suitable for increasingly miniaturized devices.

ARM processor features include:

- Load/store architecture.
- An orthogonal instruction set.
- Mostly single-cycle execution.
- Enhanced power-saving design.
- 64 and 32-bit execution states for scalable high performance.
- Hardware virtualization support.

The ARM7TDMI-S processor also employs a

unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue. The key idea behind Thumb is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code.

The particular flash implementation in the LPC2141/42/44/46/48 allows for full speed execution also in ARM mode. It is recommended to program performance critical and short code sections (such as interrupt service routines and DSP algorithms) in ARM mode. The impact on the overall code size will be minimal but the speed can be increased by 30% over Thumb mode.

4.2 LCD:

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock.

LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, includingsmartphones. LCD screens arealso used on consumer electronics products such as DVD players, video game devices and clocks. LCD screens have replaced heavy, bulky cathode ray tube (CRT) displays in nearly all applications. LCD screens are available in a wider range of screen sizes than CRT and plasma displays, with LCD screens available in sizes ranging from tiny digital watches to huge, big-screen television sets.

Since LCD screens do not use phosphors, they do not suffer image burn-in when a static image is displayed on a screen for a long time (e.g., the table frame for an aircraft schedule on an indoor sign). LCDs are, however, susceptible to image persistence. The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronics equipment more efficiently than CRTs can be.

4.3 GSM MODEM:

GSM/GPRS modem is used to establish communication between a computer and a GSM-GPRS system. GLOBAL SYSTEM FOR MOBILE COMMUNICATION is an architecture used for mobile communication in most of the countries. GLOBAL PACKET RADIO SERVICES is an extension of GSM that enables higher data transmission ate GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS 232, USB) for computer. The modem is the soul of such modules.

4.4 ECG SENSOR:

The electrocardiogram (ECG or EKG) is a diagnostic tool that is routinely used to assess the electrical and muscular functions of the heart.

The electrocardiogram (ECG) has grown to be one of the most commonly used medical tests in modern medicine. Its utility in the diagnosis of a myriad of cardiac pathologies ranging from myocardial ischemia and infarction to syncope and palpitations has been invaluable to clinicians for decades.

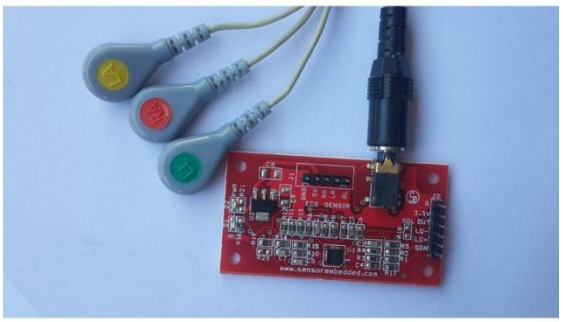

Figure: 4.a ECG SENSOR

The AD8232 is an integrated signal conditioning block for ECG and other bio-potential measurement applications. It is designed to extract, amplify, and filter small bio-potential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. This design allows for an ultralow power analog-to-digital converter (ADC) or an embedded microcontroller to acquire the output signal easily. The AD8232 can implement a two-pole high-pass filter for eliminating motion artefacts and the electrode half-cell

potential. This filter is tightly coupled with the instrumentation architecture of the amplifier to allow both large gain and high-pass filtering in a single stage, thereby saving space and cost. An uncommitted operational amplifier enables the AD8232 to create a three-pole low-pass filter to remove additional noise. The user can select the frequency cut-off of all filters to suit different types of applications.

4.5 BODY TEMPERATURE SENSOR:

There are a wide variety of temperature sensor ICs that are available to simplify the broadest possible range of temperature monitoring challenges. These silicon temperature sensors differ significantly from the above mentioned types in a couple of important ways. The first is operating temperature range. A temperature sensor IC can operate over the nominal IC temperature range of -55°C to +150°C. The second major difference is functionality. A silicon temperature sensor is an integrated circuit, and can therefore include extensive signal processing circuitry within the same package as the sensor. There is no need to add compensation circuits for temperature sensor ICs. Some of these are analogue circuits with either voltage or current output. Others combine analogue-sensing circuits with voltage comparators to provide alert functions. Some other sensor ICs combine analogue-sensing circuitry with digital input/output and control registers, making them an ideal solution for microprocessor-based systems.

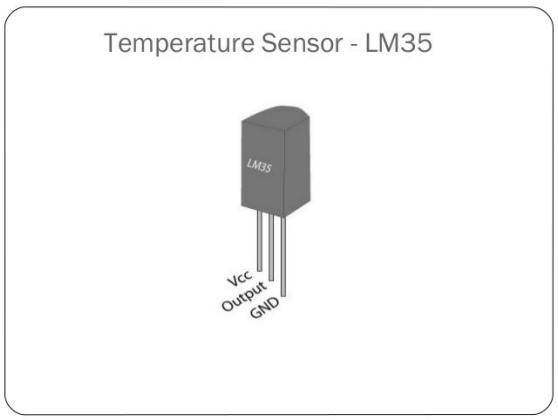

Fig. 4.b LM35

4.6 HEART BEAT SENSOR:

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Features

- Microcontroller based SMD design
- Heat beat indication by LED
- Instant output digital signal for directly connecting to microcontroller
- Compact Size
- Working Voltage +5V DC

4.7 BLOOD PRESSURE SENSOR:

The MP3V5050 series piezoresistive transducer is a state-of-the-art, monolithic silicon, pressure sensor designed for a wide range of applications, but particularly those employing a microcontroller or microprocessor with A/D inputs. This patented, single element transducer combines advanced micromachining techniques, thin-film metallization, and bipolar processing to provide an accurate, high level analog output signal that is proportional to the applied pressure.

Features

- 2.5% maximum error over 0 °C to 85 °C.
- Ideally suited for microprocessor or microcontroller-based systems.
- Temperature compensated over -40 °C to +125 °C.
- Patented silicon shear stress strain gauge.
- Thermoplastic (PPS) surface mount package.
- Multiple porting options for design flexibility.
- Barbed side ports for robust tube connection.

Fig. 4.c Blood pressure sensor

4.8 GPS:

A GPS navigation device is any device that receives Global Positioning System (GPS) signals for the purpose of determining the device's current location on Earth. GPS devices provide latitude and longitude information, and some may also calculate altitude, although this is not considered sufficiently accurate or continuously available enough (due to the possibility of signal blockage and other factors) to rely on exclusively to pilot aircraft. GPS devices are used in military, aviation, marine and consumer product applications.

Fig. 4.d GPS module

V. SOFTWARE USED:

5.1 KEIL –VISION 5:

MicroVision, the popular IDE from Keil Software, combines Project Management, Source Code Editing, Program Debugging, and Flash Programming in a single, powerful environment. It provides an overview of the most commonly used µVision5 features including

- Project Management, Device Setup, and Tool Configuration.
- Editor facilities for Creating, Modifying, and Correcting Programs.
- Target Debugging or CPU & Peripheral Simulation.

For experienced users, µVision5 adds new features such as Source Outlining, Function Navigation, Editor Templates, Incremental Search, 2 Configuration Wizard, Logic Analyzer, CAN and IC Simulation, Flash Programming, and JTAG Debugging.

5.2 PROTEUS:

Proteus is software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design. The proteus product range also includes our revolutionary VSM technology, which allows simulating micro-controller based design, complete with all the surrounding electronic.

The following features of Proteus software

- ISIS Schematic Capture an easy to use yet and extremely powerful tool for entering your design.
- PROSPICE Mixed mode SPICE Simulation industry standard SPICE3F5 simulator upgradeable to our unique virtual system modeling technology.
- ARES PCB Layout.
- Modern Graphical User Interface standardized across all modules.
- Runs on Windows 98/ME/2000/XP or Later.
- Technical Support direct form the author.
- Rated best overall products.

VI. RESULT ANALYSIS:

The message is sent from the prototype to a number stored in the memory. The patient is found to have an abnormal temperature and heart beat. Hence the sensors which senses abnormalities sends the message to ARM and from there via GSM is sent to the number. The location of the patient is sent to the same via a GPS module.

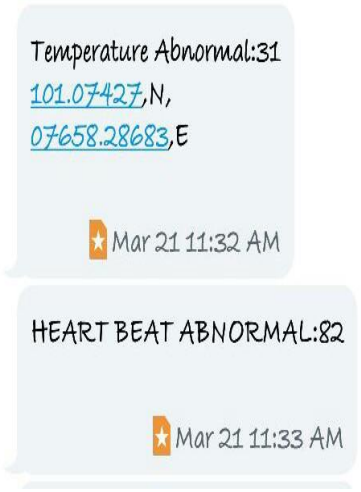

Fig. 6.a Output message

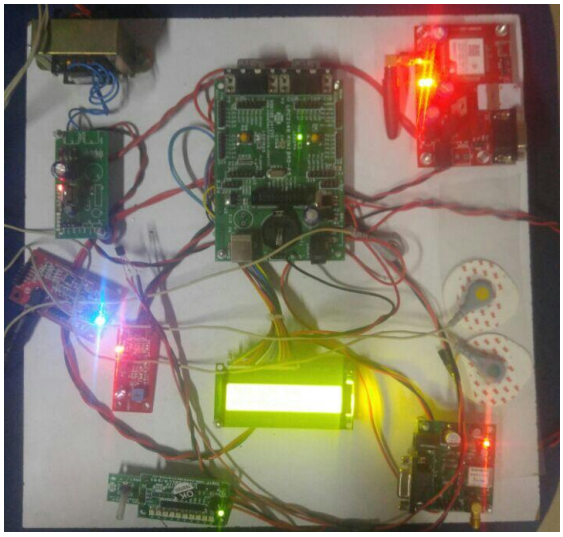

Fig. 6.b prototype of the system

VII. CONCLUSION:

The proposed model for people with chronic diseases will be enable the patients to move freely without the fear of collapsing and the cost of this proposed system is very less. Moreover the hardware used in this system is of low complexity. We have completed our project successfully. The project can be upgraded by storing in the parameters in a cloud storage, apart from this can be updated immediately as the parameters are picked up by the sensors.

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