Remote Monitoring of Protection System for VIP'S with GPRS

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Abstract: The system is composed of two parts, which are portable remote medical monitoring unit and the monitoring center. The portable remote medical monitoring unit consists of Advanced RISC Machines (ARM) with the embedded operating system, wearable, GPS and a GPRS (Gsm) module capable of transmitting information to processing centers. The monitoring centre is composed of the monitoring station and the information processing system.

1. Formulation of the Problem

This chapter discussed about how the problems are formulated when compared with the existing system.

a) Existing System

Present works tend to use emerging wireless transmission solutions like Bluetooth and ZigBee technology to improve mobility and minimize power consumption of the wearable part. These inventions carries out some advantages: the patients often are released from the hospital to give the priority to other heart patients on the waiting list, whom need to be hospitalized immediately. It does not only have an important positive economic impact, but it also produces an increment of the social wellbeing. These types of communication will only work for shorter distance and duration. It might also face more difficulties while monitoring the status in online

b) Proposed System

The proposed work of this project is to develop a system that can be supplemented with real-time wireless monitoring systems which are designed and implemented through GPRS network and are able to record and transmit bio-signals of patients. The aim of this project is to provide an ECG medical monitoring for the user at any time and any place, if there is any abnormal change of ECG data. It also explains the advanced relief measures for the soldiers such as automatic injection system and Vibrotactile system which is used for oxygen pumping this all contain one robot section in the robot we are going to control from the base station

2. System Architecture

It is composed of three parts

a) Person unit
b) Military base station.
c) Robot section

Person Unit

This unit consists of three types of sensors such as temperature sensor, pressure sensor and heart beat sensor. These sensors are used to measure the signals from the human body such as heat signal, human

body pressure and ECG signal respectively. After measurement, these analog signals are converted into digital signals and compared with the actual signals stored in the EPROM device. If any discrepancy occurs between the measured signals and the actual signals, then it is considered as an emergency.

The ARM 7 LPC2148 processor plays an important role in controlling all the devices. It has an inbuilt A\D convertor. when it detects the emergency(discrepancy in signal), it just skip over the control to relief measures such as automatic injection system and automatic oxygen pumping system. But these relief measures are temporary to maintain the pressure rate, temperature rate and oxygen sufficiency rate of the soldiers.

GPRS transmitter is used to transmit the signals from the sensors which are controlled by the ARM7 microprocessor. So to provide a permanent and immediate relief to the soldier, GPS system is used to locate the position of the soldier. It is very helpful for the relief team to rescue the soldier as soon as the emergency signal is received.

1. ARM7 Family

The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications.

The ARM7TDMI-S core is the synthesizable version of the ARM7TDMI core, available in both VERILOG and VHDL, ready for compilation into processes supported by in-house or commercially available synthesis libraries. Optimized for flexibility and featuring an identical feature set to the hard macro cell, it improves time-to-market by reducing development time while allowing for increased design flexibility, and enabling >>98% fault coverage. The ARM720T hard macro cell contains the ARM7TDMI core, 8kb unified cache, and a Memory Management Unit (MMU) that allows the use of protected execution spaces and virtual memory. This macro cell is compatible with leading operating systems including Windows CE, Linux, palm OS, and SYMBIAN OS.

The ARM7EJ-S processor is a synthesizable core that provides all the benefits of the ARM7TDMI – low power consumption, small size, and the thumb instruction set – while also incorporating ARM's latest DSP extensions and Jazelle technology, enabling acceleration of java-based applications. Compatible with the ARM9™, ARM9E™, and ARM10™ families, and Strong-Arm® architecture software written for the ARM7TDMI processor is 100% binary-compatible with other members of the ARM7 family and forwards-compatible with the ARM9, ARM9E, and ARM10 families, as well as products in Intel's Strong ARM and xscale architectures. This gives designers a choice of software-compatible processors with strong price-performance points. Support for the ARM architecture today includes:

- Operating systems such as Windows CE, Linux, palm OS and SYMBIAN OS
- More than 40 real-time operating systems, including qnx, wind river's vx works

2. LPC2148 Microcontroller

LPC2148 Microcontroller Architecture. The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

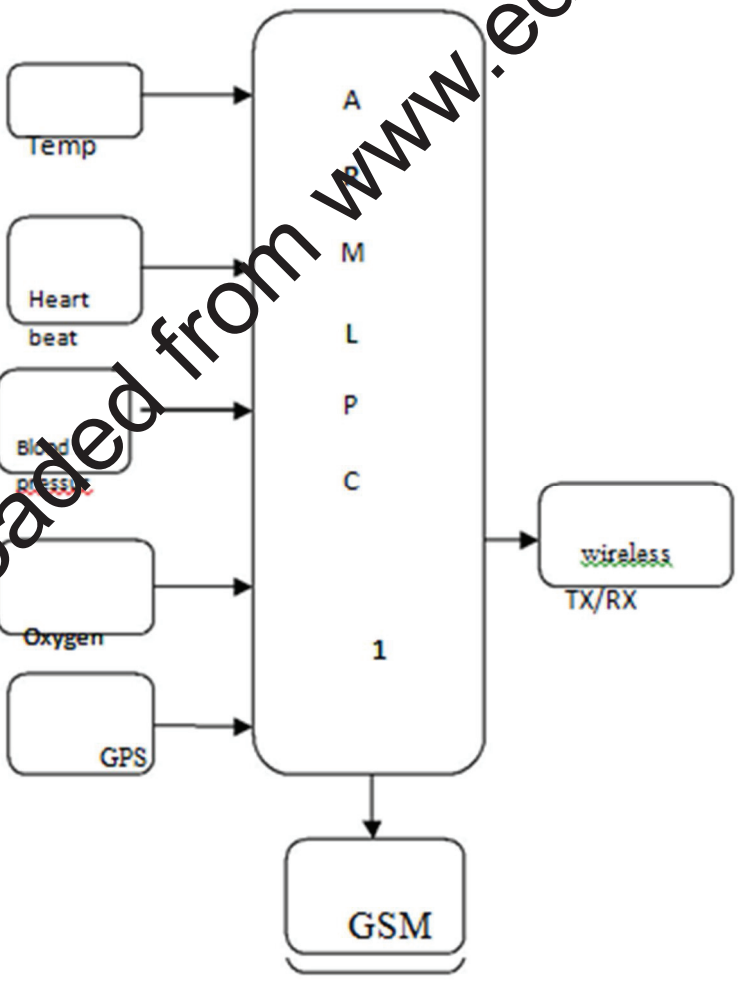
Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural 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:

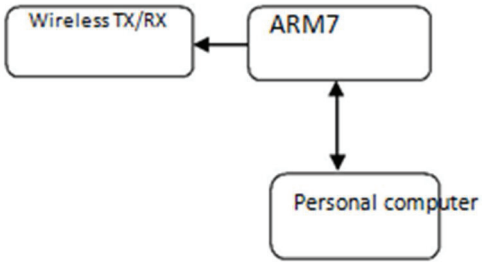
- The standard 32-bit ARM set. S processor has two instruction sets:
- The standard 32-bit ARM set.
- A 16-bit Thumb set.

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. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM processor connected to a 16-bit memory system.

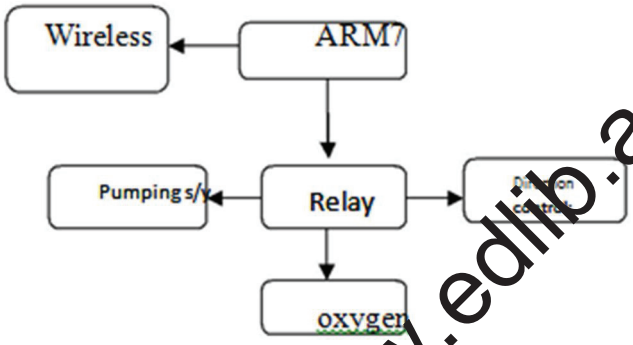
Medical monitoring system



Control room section

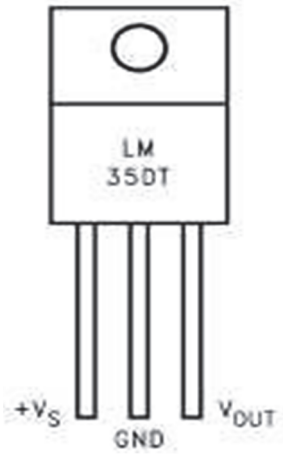


Robo section



Monitoring centre block will have the server to monitor the Sensor node values received via GPRS. Each server will be assigned an IP address. GPS receiver is used here to locate the position of the soldiers. GPS receiver is used here to locate the position of the soldiers. The continuous ambulatory monitoring is done in the base station to provide the immediate relief measures. The monitoring centre is composed of the monitoring station and the information processing system which realizes information management, real-time analysis, wireless transmission, a warning mechanism for emergency.

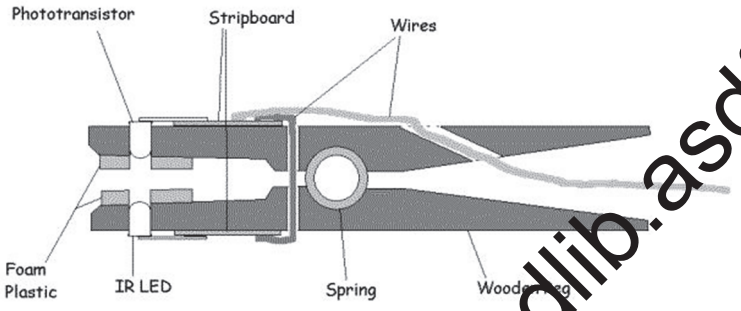
Temperature Sensor:



The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration

or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full –55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a –55° to +150°C temperature range, while the LM35C is rated for a –40° to +110°C range (–10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

Heart Beat Sensor:



The heartbeat sensor, also known as the heart rate sensor or heartbeat detector, is a device used in different fields for different reasons. For medical use, it measures the heart rate of an individual. In terms of security it can detect people hidden in vehicles.

1. Heart Rate Sensor

Medical heart sensors are capable of monitoring vascular tissue through the tip of the finger or the ear lobe. It is often used for health purposes, especially when monitoring the body after physical training.

2. Heavy Security

The heartbeat detector was created by the U.S. Department of Energy's Oak Ridge National Laboratory as a way to detect the presence of hidden personnel in vehicles around laboratories [2]

3. Military Equipment

According to a PowerPoint presentation about Micropower Impulse Radio given by the Lawrence Livermore National Laboratory and be found on the Defense Advanced Research Projects Agency's website, there are patents and research applications for military use of a heartbeat sensor. Among such uses are those that enable detection of people through solid obstructions.

4. Gaming

Some video games use weapons with a special attachment, called a heartbeat sensor. These weapon attachments can detect both friend and foe even through walls.

5. Vehicle Options

Some vehicles are capable of utilizing heartbeat sensors inside the vehicle. This sensor can tell if there is an intruder still in the car by detecting his heartbeat.

GPS Module:

The Global Positioning System (GPS) comprises three segments:

- The space segment (all functional satellites)
- The control segment (all ground stations involved in the monitoring of the system master control station, Monitor stations, and ground control stations)
- The user segment (all civil and military GPS users).

GPS Was developed by the U.S. Department of Defense (DOD) and can be used both by civilians and military Personnel. The civil signal SPS (Standard Positioning Service) can be used freely by the general public, whilst the Military signal PPS (Precise Positioning Service) can only is used by authorized government agencies. The first Satellite was placed in orbit on 22nd February 1978, and there are currently 28 operational satellites orbiting the Earth at a height of 20,180 km on 6 different orbital planes. Their orbits are inclined at 55° to the equator, ensuring that at least 4 satellites are in radio communication with any point on the planet.

During the development of the GPS system, particular emphasis was placed on the following three aspects:

a) It had to provide users with the capability of determining position, speed and time, whether in motion at rest.
b) It had to have a continuous, global, 3-dimensional positioning capability with a high degree of accuracy, Irrespective of the weather.
c) It had to offer potential for civilian use civil use. System accuracy had been intentionally degraded up until May 2000 for political and tactical reasons by the U.S. Department of Defense (DOD), the satellite operators. It was shut down in May 2000, but it can be started up again, if necessary, either on a global or regional basis.

B. Base Station RF transmitter and receiver RF Module (Radio Frequency)

Radio Frequency, any frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space. Many wireless technologies are based on RF field propagation Radio Frequency: The 10 kHz to 300 GHz frequency range that can be used for wireless communication. Also used generally to refer to the radio signal generated by the system transmitter, or to energy present from other sources that may be picked up by a wireless receiver.

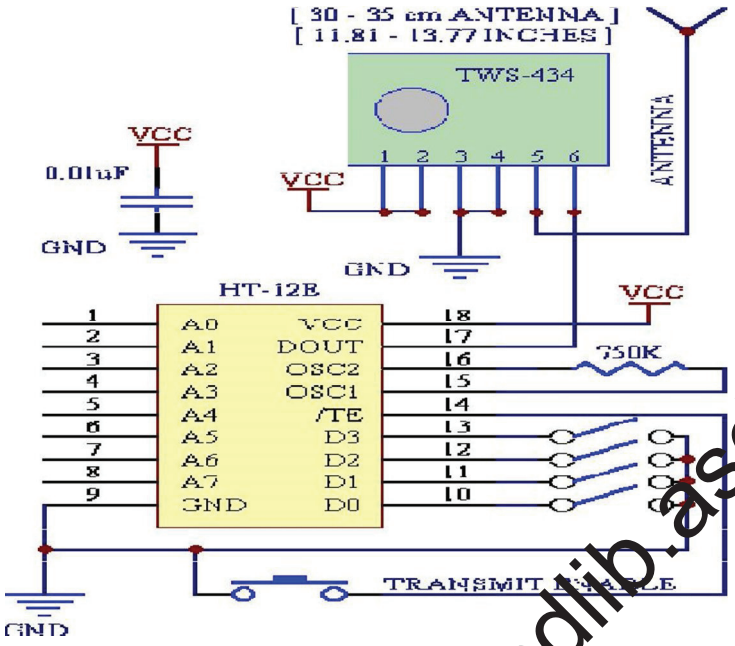
Transmitter

The TWS-434 extremely small, and are excellent for applications requiring short-range RF remote controls. The transmitter module is only 1/3 the size of a standard postage stamp, and can easily be placed inside a small plastic enclosure.

TWS-434: The transmitter output is up to 8mW at 433.92MHz with a range of approximately 400 foot (open area) outdoors. Indoors, the range is approximately 200 foot, and will go through most walls.

The TWS-434 transmitter accepts both linear and digital inputs can operate from 1.5 to 12 Volts-DC, and makes building a miniature hand-held RF transmitter very easy. The TWS-434 is approximately 1/3 the size of a standard postage stamp.

Application Circuit



Receiver

RWS-434: The receiver also operates at 433.92MHz, and has a sensitivity of 3uV. The WS-434 receiver operates from 4.5 to 5.5 volts-DC, and has both linear and digital outputs

Generating Data

The TWS-434 modules do not incorporate internal encoding. If you want to send simple control or status signals such as button presses or switch closures, consider using an encoder and decoder IC set that takes care of all encoding, error checking and decoding functions. Motorola and Holtek make these chips. They are an excellent way to implement basic wireless transmission control.

Receiver Data Output

A o volt to Vcc data output is available on pins. This output is normally used to drive a digital decoder IC or a microprocessor which is performing the data decoding. The receiver's output will only transition when valid data is present. In instances, when no carrier is present the output will remain low.

Decoding Data

The RWS-434 modules do not incorporate internal decoding. If you want to receive Simple control or status signals such as button presses or switch closes, you can use the encoder and decoder IC set described above Decoders with momentary and latched outputs are available.

Transmitting and Receiving

Full duplex or simultaneous two-way operation is not possible with these modules. If transmit and receive module are in close proximity and data is sent to a remote receive module while attempting to simultaneously receive data from a remote transmit module, the receiver will be overloaded by its close proximity transmitter. This will happen even if encoders and decoders are used with different address

settings for each transmitter and receiver pair. If two way communications is required, only half duplex operation is allowed

C. Robo section

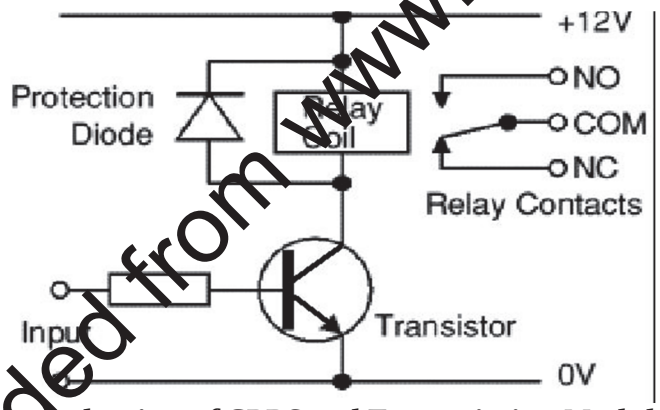
In the robo section the relay connection is going to control the robots direction, injection section, oxygen pumping system

Relay Circuit

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Hence a CB amplifier is used to achieve the current rating of the relay.

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (e.g. 1N4148) is connected 'backwards' across the relay coil to provide this protection.

Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs.



Introduction of GPRS and Transmission Module

The General Packet Radio Service (GPRS) is a connectivity solution based on Internet Protocols supporting a wide range of enterprise and consumer applications available now with almost every GSM network. GPRS is a method of enhancing 2G phones to enable them to send and receive data more rapidly. It promises data rates from 56 up to 114 Kbps and continuous connection to the Internet for mobile phone and computer users. GPRS supports a number of data services such as Short Message Service (SMS), Multimedia Messaging Service (MMS), Wireless Application Protocol (WAP) access, as well as Internet communications services. Additionally GPRS customers enjoy a number of advanced, feature-rich data services such as colour Internet browsing, e-mail on the move, video streaming, multimedia messages and location-based services. GPRS data transfer is typically charged per megabyte of traffic transferred, while data communication via traditional circuit switching is billed per minute of connection time, independent of whether the user actually is using the capacity or is in an idle state. GPRS is a best-effort packet switched service, as opposed to circuit switching, where a certain quality of service (QoS) is guaranteed during the connection for non-mobile users. 2G cellular systems combined with GPRS are often described as "2.5G", that is, a technology between the second and third generations of mobile telephony

Prioritizing easy operation, a GPRS module SIM300 provided by Simcom is chosen to be the transmitter/receiver so that the user could send his/her ECG signals at any time wherever GSM coverage is present.

SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 provides GPRS multi-slot class 10 capability and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in your industrial application, such as M2M, Telematics and other mobile data communication systems. SIM300 provides all hardware interfaces between the module and customers' boards except the RF antenna interface. The two serial ports can help you easily develop your applications. It is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode. Also the SIM300 is integrated with the TCP/IP protocol, Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications. Communication between the microcontroller and the SIM300 is made through an UART interface. It has been set to 57600bps, 8-bit data, 1 stop bit and non-parity. The module transmits the data grouped in logical frames. And it can be used as a modem in a computer system to connect to Internet; even there is no TCP/IP protocol stack in the software. These ensure the security of data transmission. GPRS facilitates instant connections whereby information can be sent or received immediately as the need arises.

In order to develop the ECG related software just like developing application software in Personal Computer (PC), the system uses an Operating System (OS) named uClinux. uClinux is a Linux derivative intended for microcontrollers without Memory Management Unit (MMU). It's free and open source software under GNU Public License. The original uClinux is a derivative of Linux 2.0 kernel intended for microcontrollers without Memory Management Units (MMUs). However, the Linux/Microcontroller Project has grown both in brand recognition and coverage of processor architectures. Today's uClinux as an operating system includes Linux kernel releases for 2.4 and 2.6 as well as a collection of user applications, libraries and tool chains. The uClinux is much smaller than Linux kernel while retaining the main advantages of Linux OS: stability, superior network capability and excellent file system support. We ported uClinux operating system on the NXP LPC2148 platform and the Embedded Operating System (EOS) supports a lot of kernel functions to handles interrupt, timer, task schedule and resources management of hardware. First of all, the firmware system will do initialization of UART, A/D conversions, LCD controller, and then create ECG data acquisition task, data transmission task, timer task, ISR task and so on.

7. Conclusion

The current technology being used in our paper is remote monitoring the soldiers with GPRS based protection system. It measures the heart beat rate, pressure range, temperature range and compared with the actual value stored in the EPROM. If any discrepancy occurs, then ARM7 processor will shift the control over to the relief system such as automatic injection system and Vibrotactile system to simulate the oxygen pumping and also transmit the Bio-Signals to the base station through GPRS

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