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An Enhanced Fall Detection System for Elderly Person Monitoring

Sajid Faisal Khan
M.Tech (Embedded Systems),
Department of ECE,
VIF College of Engineering and Technology.

Imthiazunnisa Begum
HOD,
Department of ECE,
VIF College of Engineering and Technology.

ABSTRACT:

Fall detection is among major problems in modern healthcare and a serious threat for elderly population. As a result, most of the wireless monitoring systems tend to include automatic fall detection into their functionality. Modern Smartphone's are often equipped with a set of powerful sensor technology and start to play a significant role in healthcare development. Recent studies proved that accelerometer, gyroscope and magnetometer can comprise an independent fall detecting tool or be a part of the fall detection framework. Commonly, acceleration data is collected and stored on the Smartphone with subsequent on-line or off-line processing depending on the current circumstances. Alternatively, some of the studies propose algorithms where contextual or visual data collected by environmental sensors is deployed to detect a fall. In this case obtrusiveness of the process is relatively low since patients do not require wearing any devices. At the same time, these types of systems are often facing privacy issues and require additional ethical approve. Due to these reasons and complexity of the fall process in general several attempts were made to combine both types of data to improve overall performance of fall detection systems. In the following section we provide main fall characteristics, describe popular approaches and explain how fall detection can be included in a general monitoring model implemented in a smart home environment.

Index-Terms:

ARM11 processor, GPS, Wi-Fi Router and Heart Beat Sensor, Accelerometer.

I. INTRODUCTION:

In this project, we are giving the complete description on the proposed system architecture. Here we are using Raspberry Pi board as our platform. It has an ARM-11 SOC with integrated peripherals like USB, Ethernet and serial etc.

On this board we are installing Linux operating system with necessary drivers for all peripheral devices and user level software stack which includes a light weight GUI based on X Server, V4L2 API for interacting with video devices like cameras, TCP/IP stack to communicate with network devices and some standard system libraries for system level general IO operations. The Raspberry Pi board equipped with the above software stack is connected to the outside network and a camera is connected to the Raspberry Pi through USB bus. The world's elderly population is increasing. This has become an important topic in every country. By the year 2000 there were around 600 million elderly, which is about 10% of the world's total population. According to the United Nations the world's elderly population will reach 2400 million in 2050. The United Nations advises three priority actions: development for an ageing world, advancement of both the health and the well-being of the aged and the creation of environments which are not only enabling and but also supportive.

II. RELATED WORK:

2.1 EXISTING METHOD:

In the existing system the Lab monitoring system is design and controlled by using RF technology which can monitor and control the system inside the lab only in places where network availability is more. They are bit more costly because cost of components is increased. Not so easy to implement as you have to take great care of noise, Because of antennas it is bulkier.

2.2 PROPOSED METHOD:

The proposed method is used to overcome the drawbacks present in existing method. Here we are using ARM Intelligent Monitoring Center which uses Samsung's processor as its main controller. The environmental conditions present inside the lab can be monitored using sensors like temperature, gas and LDR. All the sensors are connected to sensor board.

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From the sensor board we are sending monitored values to control room (ARM board) through RS232 serial cable. The serial cable is connected to one of UART port of ARM board. Whenever a person is entered inside the lab, the person's image can be captured by camera and send it to controller. The controller transmits the data to remote PC through Ethernet by using FTP. FTP is a protocol through which users can upload files from their systems to server. Once data is placed at server we can view the data at remote PC (with internet) on web page with unique IP address. We can view continuous streaming of video as well as senor's data. If we want to control the devices based on sensor's information we can control through web page from remote location using HTTP protocol. HTTP protocol continuously requests the server for control (turn on or turn off) the devices. In this way we can monitor and control the devices through remote PC.

2.3 BLOCK DIAGRAM:

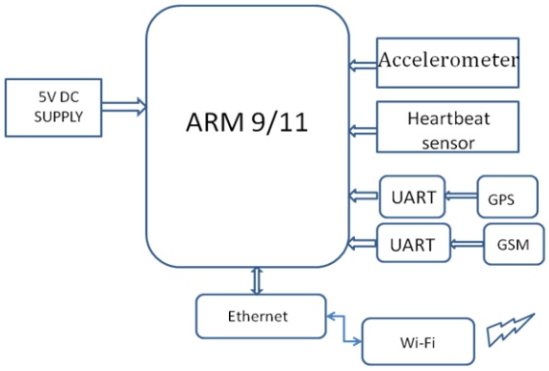

Figure-1: Block diagram.

III. HARDWARE IMPLEMENTATION:

3.1 RASPBERRY PI PROCESSOR:

Figure-2: Raspberry Pi processor

The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools.

The Raspberry Pi is manufactured in two board configurations through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Ego man. These companies sell the Raspberry Pi online. Ego man produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pis by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers. The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and persistent storage. The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC (via the RISC OS image or the Brandy Basic clone for Linux),C, Java and Perl.

3.2 ARDUINO:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip.

3.3 ETHERNET CABLE RJ45:

Since its commercial release, Ethernet has retained a good degree of compatibility. Features such as the 48-bit MAC address and Ethernet frame format have influenced other networking protocols. Ethernet initially competed with two largely proprietary systems, Token Ring and Token Bus. Because Ethernet was able to adapt to market realities and shift to inexpensive and ubiquitous twisted pair wiring, these proprietary protocols soon found them competing in a market inundated by Ethernet products and by the end of the 1980s, Ethernet was clearly the dominant network technology. In the process, 3Com became a major company. 3Com shipped its first 10 Mbit/s Ethernet 3C100 transceiver in March 1981, and that year started selling adapters for PDP-11s and VAXes,

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as well as Multibus-based Intel and Sun Microsystems computers. This was followed quickly by DEC's Unibus to Ethernet adapter, which DEC sold and used internally to build its own corporate network, which reached over.

3.4 TEMPERATURE SENSOR (LM35):

LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. . The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to read-out or control circuitry especially easy. It can be used with single power supplies, or with plus and minus sup-plies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air.

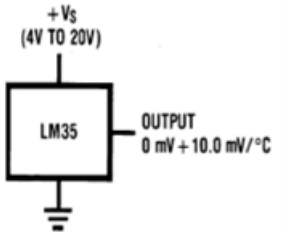

Figure-3: temperature sensor

3.5 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. For further information please refer to its datasheet.

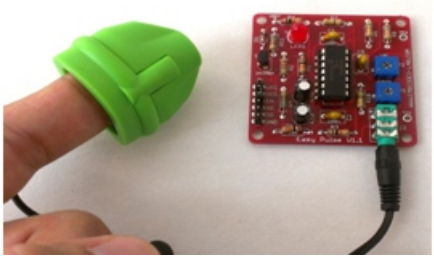

Figure-4: Heart beat sensor

3.6 MEMS Sensor:

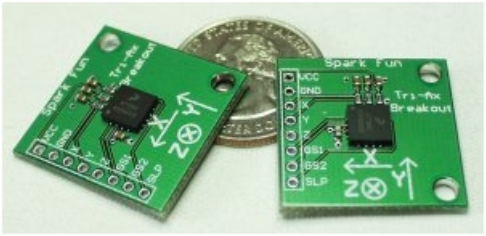

Figure-5: MEMS sensor

The MEMS is 3-axis accelerometer. An accelerometer measures acceleration (change in speed) of anything that it's mounted on. Single axis accelerometers measure acceleration in only one direction. Dual-axis accelerometers are the most common measure acceleration in two directions, perpendicular to each other. Three-axis accelerometers measure acceleration in three directions. Accelerometers are very handy for measuring the orientation of an object relative to the earth, because gravity causes all objects to accelerate towards the earth. A two-axis accelerometer can be used to measure how level an object is. (This would be a good place to fill in equations to calculate a body's angle from the X and Y accelerations on the body). With a three-axis accelerometer, you can measure an object's acceleration in every direction.

3.7 GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM):

GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION) is the most popular standard for mobile telephony systems in the world. The GSM Association, its promoting industry trade organization of mobile phone carriers and manufacturers, estimates that 80% of the global mobile market uses the standard. GSM is used by over 1.5 billion people across more than 212 countries and territories.

This ubiquity means that subscribers can use their phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a second generation (2G) mobile phone system. This also facilitates the wide-spread implementation of data communication applications into the system.

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IV. RESULTS:

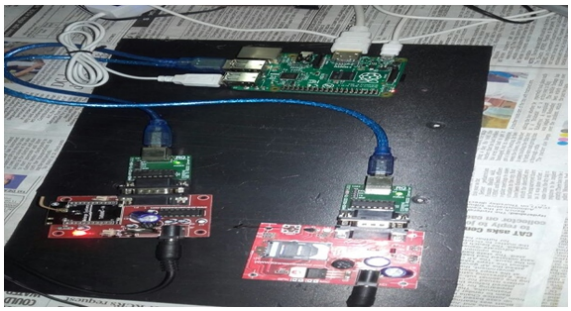

Figure-6: Hardware implementation

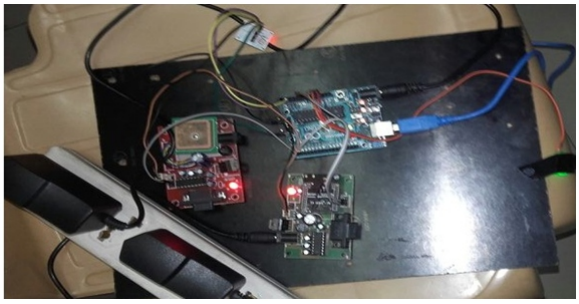

Figure-7: Interfacing of GPS and Arduino.

V. FUTURE SCOPE:

» The cost of ARM11 is more that's why in future we can implement this system using ARM CORTEX A8, Beagle bone etc as well as updated processors with high frequencies will work fine.
» As the storage space is also less in future we can also record these live streaming data by connecting external memory storage.
» We can complete our project using wireless technology.
» In future we can provide more security to data by using encryption, decryption techniques.

VI. CONCLUSION:

The project "An Enhanced Fall Detection System for Elderly Person monitoring using Consumer Home Network" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM Cortex A8 Processor board and with the help of growing technology the project has been successfully implemented.

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