A Study on Upcoming Trends in Elderly Home Monitoring System

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Abstract-Wireless-sensor-networks add extra advantage combined with the advancements in MEMS technology. These are nowadays widely used in the bio-medical applications. WSN based home monitoring system for elderly activity behaviour. By regular monitoring we can determine the wellness of elderly. The system can also be used to monitor physiological parameters, such as temperature and heart rate, of a human subject. Using MEMS sensors to detect falls and to measure different vital signs, the person is wirelessly monitored within his own house; this gives privacy to the elderly people. The captured signals are then wirelessly transmitted to an access point located within the patients' home. This connectivity is based on wireless data transmission at 2.4-GHz frequency. The access point is also a small box attached to the Internet through a home asynchronous digital subscriber line router. Afterwards, the data are sent to the hospital via the Internet in real time for analysis and/or storage. Programmed system will minimize the number of false messages to be sent to care provider and supports inhabitant through suitable prompts and action to be performed when there is irregular behaviour in the daily activity.

Index Terms—Elder Care, Electrocardiogram (ECG) signals, Home monitoring, MEMS, Wireless sensor network, ZigBee

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1   INTRODUCTION

In day today life everyone in the family are busy with their routine work and office pressure. This is a barrier for the family people to take care of the elderly seniors in the house. To overcome this often, family members come to the conclusion that seniors need an elderly monitoring system. It is undeniable that incorporating senior home monitoring into your parents life will have long-term positive effects. Getting help quickly during an emergency allows them to recover quickly from any injuries and continue to live a long, healthy, and happy life free of lasting medical problems from falls. Seniors are sometimes against the idea of having senior home monitoring though. So the trick is how to approach this issue properly among elderly people. No matter what, you need to talk to them about having a medical alert. They need to be a part of this decision. Better safe than sorry! And elderly monitoring systems really are about keeping elderly people independent for many years without taking away their independence.

Recently, in many cases, the reason for a patient staying in the hospital is not that he or she actually needs active medical care. Often, the principal reason for a lengthy stay in the hospital is simply continual observation. Therefore, efforts have been made to avoid acute admissions and long lengths of stay in the hospital. In recent years, emergency admissions and long lengths of stay have become extremely costly. On the other hand, elderly people desire to lead an independent lifestyle, but at old age, people may become prone to different accidents within home or outside; so living alone has high risks.

The United States Department of Health and Human Services the older population reports that by 2030, there will be about 72.1 million older persons, more than twice their number in 2000. People 65-plus years old represented 12.4 % of the population in the year 2000, but that is expected to grow to be 19 % of the population by 2030. This clearly shows that there will be more demand for elderly care facilities in the upcoming years.
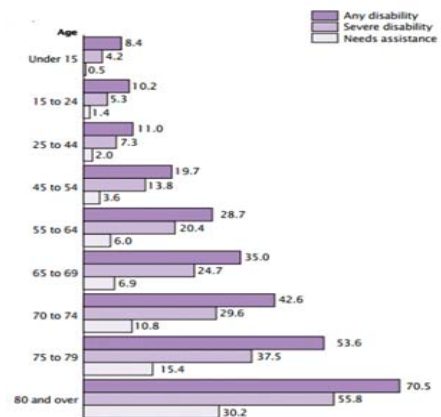

Fig 1. Disability prevalence and the need for assistance by age

During the current decade, multiple methods are proposed for observing and efficient estimation of elderly behaviour in smart home. Monitoring activities of the person based on camera based sensors or Charge Coupled Devices (CCD) cameras are reported [1, 2] for surveillance and security in which the images of the person are taken and analyzed. However, in real circumstances systems of camera based for home monitoring activities require acceptability of the elderly which may not be possible.

Significance of the developed system is that no vision sensors (camera or infra-red) are used, the system is non-invasive, respects the privacy and has found wide acceptance. Feedback from the users of the system indicates a huge acceptability among the elderly community.

In addition to camera based systems, infrared based Small Motion Detectors (SMDs), passing sensors, Operation detectors and IR motion sensors have been incorporated in the house for monitoring the human activity behaviour [3] and the interpretation of human activity is limited to only to a few human activities. There are projects involving wearable health devices [4, 5] integrated with sensors providing continuous monitoring of person's health related issues and daily activities. Using Radio Frequency Identification (RFID) communication technology in elderly centre with the necessary hardware gadgets was introduced [6, 8]. However, these projects are for precise purposes and have severe concerns related to security, privacy and legal aspects [7].

Monitoring the activities of daily living (ADL) is often related to the fall problem and requires a non-intrusive technology such as a wireless sensor network. An elderly with risk of fall can be instrumented with (preferably) one wireless sensing device to capture and analyze the body movements continuously, and the system triggers an alarm when a fall is detected. The small size and the light weight make the sensor network an ideal candidate to handle the fall problem.

The development of new techniques and technologies demonstrates that a major effort has been taken during the past 30 years to address this issue. However, the researchers took many different approaches to solve the problem without following any standard testing guidelines. In some studies, they proposed their own guidelines

2 AN OVERVIEW OF EXISTING HMS

There are home monitoring systems which can be used by the elderly people to lead their lives independently. No one over 60 wants to live with his or her children. It feels like an imposition to both parties; neither the child nor the parent is fully free to do what he or she wants, and thus independence is slowly stripped from the individual, and with it, a portion of his or her identity.

Fortunately, getting the right system like home monitoring systems by the elderly can extend the amount of time that they are able to remain independent while still having the peace of mind that someone will be there, if something bad happens while the person is at home alone.

There have been several stories about how someone has fallen at home while he or she was alone. The resulting broken bone, whether hip or leg, kept the person from being able to contact someone for an extended period of time. It is a horrible feeling of helplessness mixed with fear and the confrontation of true mortality - what if no one comes and I can't get to the phone?

Children who worry about their parents' health and safety should know that there is help for when their parents cannot do for themselves. When someone has fallen and can't get up, most home monitoring systems have some sort of device that is worn about the elderly person will activate the emergency service. The device may be as simple as pressing a button to activate and alarm or a more sophisticated communication system that allows the elderly person to talk to someone about what is going on.

Either system can provide peace of mind, but the latter system also allows the person to help emergency responders prepare for what they are going to find. It also allows the person to have the comfort of a human voice and the sure knowledge that someone is coming to help. Sometimes faith can be the strongest reason to survive.

One of the High Tech Gadgets that has been around for years is the home monitoring system (PERS) Personal Energy System. This device is like a panic button that a person wears around their neck and if they need assistance they push the button to receive assistance. The problem with PERS is that the person may not be alert

Offline analysis mechanisms are not suitable for applying in real-time data processing system of inhabitant activity behaviour analysis. There is a big requirement for a stable system which can continuously run without any interruption and can execute several tasks in parallel for maximum behavioral analysis with intelligent mechanism, less cost, flexible, and robust.

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A Limitation of Wearable Systems

The conventional wearable physiological monitoring system cannot be used for wellness monitoring applications at home due to the following reasons

1. The conventional physiological monitoring systems are bulky to be used for wearable monitoring.
2. The gels used in the electrodes dry out when used over a period of time, which lead to increase in the contact resistance and thereby degrading the signal quality.
3. The gels used in the electrodes cause irritations and rashes when used for longer durations.

4. There are number of hampering wires from the sensors to the data acquisition system.

5. The signals acquired are affected with motion artefact and baseline wander as the electrodes float on the layer of gel.

6. The sensors used in conventional monitoring systems are bulky and are not comfortable to wear for longer durations.

3 SURVEYS OF RESEARCH ON MONITORING TECHNOLOGIES

"Intelligent Video Surveillance for Monitoring Elderly in Home Environments",2007 was used in a vast range by many people around the world, but the drawback is that the elderly people never felt comfortable doing things in front of the camera as well the change of software for recording the visuals according to the storage capability was bit costly
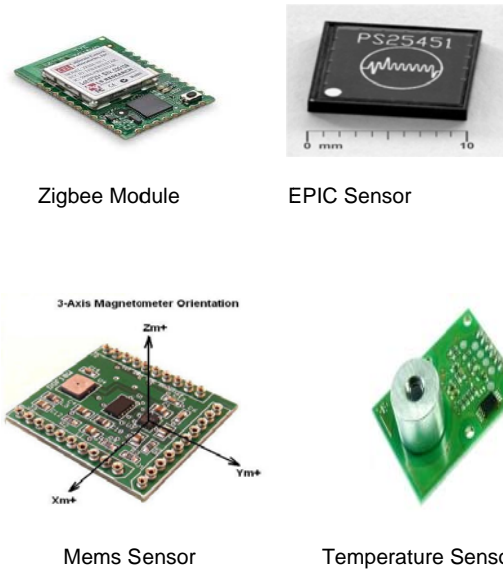
"Wireless Sensors for Home Monitoring", 2008 in this paper they have used numerous numbers of sensors are connected inside the home which is helpful but still the installation issue arises.

"Wireless Sensor Network Based Home Monitoring System for Wellness Determination of Elderly",2011 this paper reports that appliance monitoring units are fabricated to support two electrical appliances on a single power inlet, having the intelligence to detect which particular device is on. But still it is not necessary using so many numbers of sensors for monitoring elderly. If there are well and good that is more than enough for us**.**

4 IMPROVEMENT IN TECHNOLOGY

If a person lives alone, having peace of mind is always a nice thing! While it may not be essential to deal with a complex system, it is nice to have something. This helps not only the elderly individual but also the loved ones of this person will know that they are safe.

Not being able to check on your loved ones all the time can be stressful. This is why it is quite nice to know that there is something out there to protect them while you are away. Being a caregiver in any sense of the word can be incredibly exhausting. Even if you do not go over daily to help your parent or loved one, the stress of worrying about them living alone is quite stressful. Having a quality system like this can reduce your burden of stress and might just make your life much easier as you want to provide space to your loved ones who would like to live alone.

Zigbee Module   EPIC Sensor

Mems Sensor   Temperature Sensor

The current intelligent home monitoring system based on ZigBee wireless sensors has been designed and developed to monitor the elderly people. Fig: 2 depicts the structural design of the developed system. Wireless Sensor Network is designed and developed by following IEEE standard 802.15.4 of ZigBee. ZigBee is a relatively new, wireless personal area network technology based on IEEE 802.15.4, with a transmission range of 100+ meters [8]. ZigBee based communication devices consume very little power and hence the battery life of 1000+ days is common. ZigBee has enormous advantages compared to Bluetooth when used in wireless sensor networks. The reasons include more coverage area, Less power consumption, and secure networking. ZigBee operates in the industrial, scientific and medical radio bands - 868 MHz in Europe, 915 MHz in the USA and 2.4 GHz in most other countries in the rest of the world.
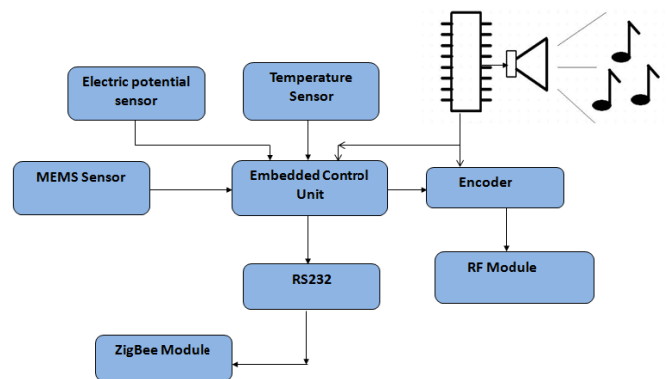

Fig 2.Block Diagram Representation

For this, WSN consisting of different types of sensors such as MEMS sensors to analyse the gestures such as (walking, sleeping & sitting), EPIC and temperature sensors with ZigBee module sensing units are installed.

EPIC is a capacitive sensor and so does not rely on contact to the body for measuring bio-electrical signals. It therefore has the ability to measure ECG without direct skin contact. Signals measured on the human body always include a large amount of noise, the major component of this being 50 or 60 Hz power line noise capacitively coupled to the body from the mains electricity supply. Measurements such as ECG depend on being able to extract the small electrophysiological signals from the much larger noise signals.

In non-contact ECG measurement there is – by definition -no skin contact, and thus no direct connection can be made between the subject's body and the system ground. Some other method of reducing the power line noise is therefore required to enable the ECG signal to be extracted reliably and accurately. One such method utilises an approach very similar to the Driven Right Leg (DRL) system that is used for the same purpose in conventional ECG. In conventional ECG the DRL signal is coupled directly to the patient's skin; in non-contact ECG it is coupled capacitively to the body, through clothing, via a piece of conductive material placed – for instance – on the seat or back of a chair.

There are several applications where EPIC can be used in cars. For example, driver monitoring for health and alertness by detecting heart rate and respiration or determining the occupancy of the car to adjust the ride, handling and air bag deployment depending on the size and location of occupants. The EPIC sensor electrodes can be easily and discretely incorporated inside the seat backs to acquire the necessary biometric data. In our project each sensor connected to various divisions are considered as nodes.

Communication is established and managed by the functional set of the modem configuration with appropriate values for Network, security, serial and I/O interfacing.

The low level module consists of sensors interconnected along with a panic button. The fabricated sensing unit communicates at 2.4GHz (Industrial Scientific and Medical band) through radio frequency protocols and provides sensor information that can be used to monitor elderly person. A smart sensor coordinator which is nothing but the embedded control unit (ARM-7 microcontroller) collects data from the sensing units and forward to the computer system for data processing.

Rather than in-home monitoring if the system is ON at home then we can monitor from anywhere around the world through web monitoring system (i.e. with the help of IP address). Web monitoring describes the use of a system that constantly monitors a computer network for slow or failing components and that notifies the network administrator (via email, SMS or other alarms) in case of outages. It is a subset of the functions involved in management. The major task of our work is to recognize the essential daily living behaviour of the elderly through sensor fusion by using minimal sensors at elderly home

5 ADVANTAGES OF THE SYSTEM

Summarizing, the advantages of the home monitoring system are listed as following:

- WSN is low cost since minimal number of sensors is used.
- Robust & Flexible.
- Abnormal or unusual incident is detected as fast as possible.
- No installation issues.
- Physiological parameters are assessed together where wellness of the elderly is determined then and there.

6 CONCLUSION

This paper has reviewed different wireless sensors used for home monitoring especially to care elder people. The monitoring system is based on the integration of different sensors which has the capability of transmitting the data via wireless communication. Depending on the situation the actions are defined as unusual or abnormal. If the system detects any abnormal activity a warning or alarm message can be transmitted to the care-giver. The availability of low-cost wireless sensing system for this type of application has a great potential to save human life especially elder people. The developed home monitoring system using WSN is low cost, robust, and flexible which efficiently monitor and assess the elderly activities at home.

ACKNOWLEDGMENT

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