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TECHNOLOGY IMPROVEMENTS IN ELDERLY MONITORING SYSTEM

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Abstract-WSN based home monitoring system for elderly activity behaviour involves functional assessment of daily activities. In this paper, we reported a mechanism for estimation of elderly well-being condition based on the activities which they perform. We defined two new wellness functions to determine the status of the elderly on performing essential daily activities, (i) Activity recognition (ii) Wellness determination. 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 home. The device detects if a person is medically distressed and sends an alarm to a receiver unit that is connected to a computer. This sets off an alarm, allowing help to be provided to the user. The device can be easily adapted to monitor athletes and infants. The low cost of the device will help to lower the cost of home monitoring of patients recovering from illness. A prototype of the device can be fabricated and extensively tested for good results.

Index Terms—Elder care, home monitoring, smart home, wellness, wireless sensor network.

I.INTRODUCTION

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.

Constant monitoring is also required in case of hospitals where the patients must be under active medical care or under continual observation for longer duration. Even though the patient is not in dangerous situation, the doctors would still need confirmation on their health. In recent times, the expenses for hospitalization and medical care are unimaginably high and expensive. Hence the health policies in countries like USA, UK has shifted its focus from providing reactive, acute care to providing preventive care outside the hospital.

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]

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This paper discusses about providing ambient intelligence to home monitoring unit for elderly care. Integrated wireless sensors unit are fabricated to function properly and are used for identifying and recognizing the habitual nature of the elderly person.

The system is designed to support people who wish to live alone but, because of old age, ill health or disability, there is some risk in this, which worries their family or friends. The system works on the principle of using wireless sensor units (SU) to monitor the elderly person throughout a house and detect when certain desired safety measures are required. In accordance with this analysis physiological parameters such as heart rate and temperature can also be sensed with the help of EPIC (electric potential integrated circuit) and temperature sensors.

To deal with issues such as monitoring, performance tracking of normal behaviour and well-being of the elderly living alone a system which is non-invasive, flexible, low-cost and safe to use is designed and developed. An initial decline or change in regular daily activities can be identified by the home monitoring system and trigger messages to the appropriate care provider about the changes in the functional abilities of the elderly person.

II.SYSTEM DESCRIPTION

Intelligent home monitoring system based on ZigBee wireless sensors has been designed and developed to monitor the elderly people. Fig: 1 depicts the structural design of the developed system. Wireless Sensor Network is designed and developed by following IEEE standard 802.15.4 of ZigBee. 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).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.

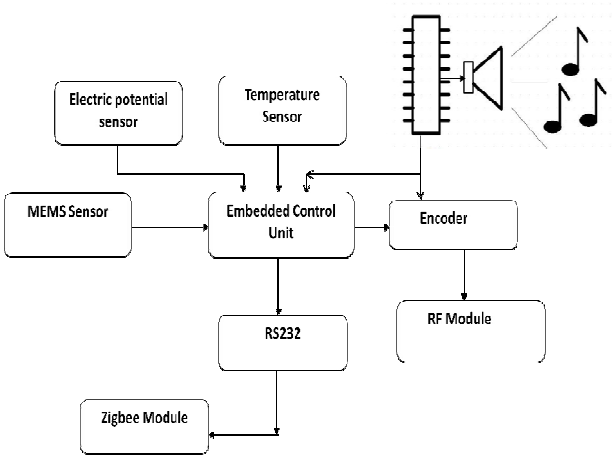

Fig 1.Block Diagram Representation

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 sensors can be used to measure ECG signals without physical skin contact. While sensors can be embedded in a chair or seat, the techniques are equally applicable to sensors mounted on a mattress, in clothing or in other situations.

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.

III.SIMULATION RESULTS

Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP, UDP) can be done using NS2.For WSN related projects NS2 gives detailed simulation results regarding nodes ,their signal transformation and their trace format details

A.NETWORK ANIMATOR

Nam is a Tcl/TK based animation tool for viewing network simulation traces. It supports topology layout, packet level animation, and various data inspection tools. Initial condition for our simulation is creating a simulator, network (nodes, links), transport connection & routing

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algorithm. As a result of the coding which we presented in network simulator the results are processed as below in Fig 2.

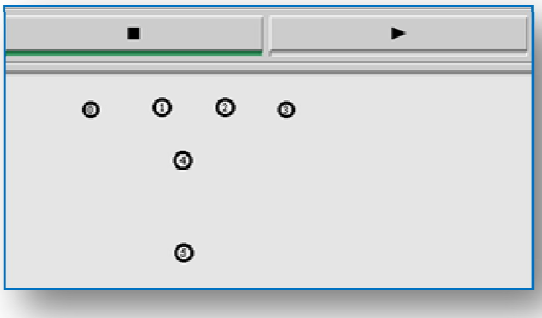

Fig 2.Stage 1

Stage 1: In stage 1 we could see the initial assumption of nodes (i.e. sensors) which we are using for implementation, with a raw sensor collecting unit and end user.
Stage 2: In stage 2 as in fig 3 we could see the transformation of data by black dotted lines to the raw sensor collecting data.
Stage 3: In stage 3 as in fig 4 we could see the colour change in node 1, this denotes that the sensor is in active or the person is in critical situation and they need some assistance.

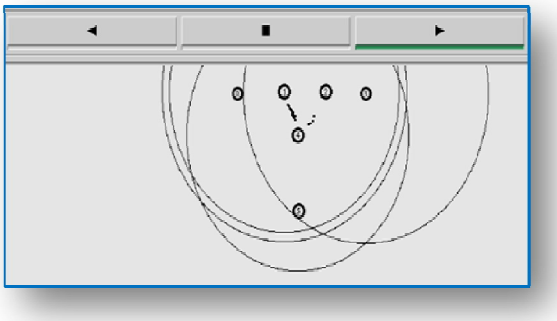

Fig 3.Stage 2

1V.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.

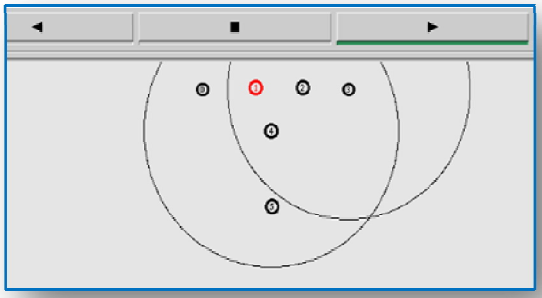

Fig 4.Stage 3

V.CURRENT AND FUTURE WORK

The reported home monitoring system based on MEMS technology is based on different sensors. It is used for comparison of activities like monitoring, physiological parameter rates (heart rate, temperature) for determining the wellness of elderly. For future developments related to outdoor activity as well as for indoor activity we can make use of a single sensor which is of a sim card shape which monitors all activities. The cost of the complete system may be a critical factor for its global usage amongst all the houses to monitor and to give support for the elderly people. In future, this research has to be targeted towards developing a low-cost system with the sensors essential for monitoring.

VI.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.

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