

WIRELESS SENSOR NETWORK BASED HEALTHCARE MONITORING SYSTEM FOR HOMELY ELDERLS

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ABSTRACT

In this paper, we reported a mechanism for estimation of elderly well-being condition based on usage of household appliances connected through various sensing units. Wireless-sensor-network-based home monitoring system for elderly activity behavior involves functional assessment of daily activities. MEMS, temperature and pressure sensors are used to determine the wellness of elderly based on daily activities. This paper describes ZIGBEE based home monitoring system for elderly based on daily activities the sensor node is composed of temperature sensor, force sensor and MEMS sensor, ATMEL microcontroller, LCD module & a ZIGBEE transceiver model is operated at 2.45GHZ band industrial scientific medical band. The developed system for monitoring and evaluation of essential daily activities was tested at the homes of four different elderly persons living alone and the results are encouraging in determining wellness of the elderly.

KEYWORDS: *wellness determination, MEMS sensor, WSN (Wireless sensor node), ZIGBEE, LM35, Pressure sensor.*

I. INTRODUCTION

A normal person performs daily activities at regular interval of time. This implies that the person is mentally and physically fit and leading a regular life. If there is decline or a change in the regular activity the wellness of the person is not in normal state. Elderly people desire to lead an independent lifestyle but old age people become prone to different accidents. So living alone has high risk and it's recurrent. Development of the system to monitor the activities of an elderly person living alone so that help can be provided before any unforeseen situation happened. Elderly people desire to lead an independent lifestyle, but at old age, people become prone to different accidents, so living alone has high risks and is recurrent. In the present work, an intelligent home monitoring system based on ZIGBEE wireless sensors network [1,2] has been designed and developed to monitor and evaluate the well-being of the elderly living alone in a home environment. Wellness of elderly can be evaluated for forecasting unsafe situations during monitoring of regular activities. The developed system is intelligent, robust and does not use any camera or vision sensors as it intrudes privacy. Based on a survey among elderly we find that it has a huge acceptability to be used at home due to non-use of the camera or vision based sensors. The intelligent software, along with the electronic system, can monitor the usage of different household appliances and recognize the activities to determine the well-being of the elderly. The developed software system continuously reads the data from the coordinator and efficiently stores on the system for further data processing in real time. An initial decline or change in regular daily activities can be identified by home monitoring system and triggers alarm to the appropriate care provider about the changes in the functional abilities of the elderly person.

A variety of systems for monitoring and functional assessment for elderly care have been proposed and developed in recent times. Other than camera, infrared based Small Motion Detectors(SMDs), passing sensors, operation detectors and MEMS based motion sensors have been incorporated in the house for monitoring the human activity behavior [3] and the interpretation of human activity is

limited to only to a few human activities. There are a number of projects available on wearable health Devices [4]. Systems using RFID communication technology in elderly center were introduced [5, 6]. Though these devices are for specific purposes, they have severe concerns related to security, privacy and legal aspects [7]. Systems like remote human monitoring using wireless sensor networks [8, 9]. Technology could assist with transitions from one level of care to the next and help prevent premature placement in expensive assistance domains [10]. To deal with issues such as monitoring the daily activities, performance tracking of normal behavior and well-being of the elderly living alone a system which is noninvasive, 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 DESIGN MODEL

1.1 Wellness Characteristics Of Elderly

Health care providers assisting the elderly can have a more comprehensive, longitudinal evaluation of the monitored elderly activities than the snap shot assessment obtained during an annual physical examination. If the elderly person needs assistance with some of their Activities of Daily Living (ADLs) - An index or scale which measures a patient's degree of independence in bathing, dressing, using the toilet, eating and transferring (for example moving from a bed to a chair) as these are used to determine the need for long-term care or Instrumental Activities of Daily Living (IADLs), professional care givers accessing the elderly activity reports will have an objective assessment of their actual needs and appropriate care services based on the daily functional assessments of the person. There are numerous wellness concepts suggested by experts from various domains, each of which is defined from their specialist perspective and contain several dimensions of wellness. Several authors are of the same opinion that it is not just the state of mind or free from illness and disease; it is not a single state. It also have multiple dimensions or levels.

However, an integrated definition does not exist. Hence, there are various instruments and methods for wellness assessment. Wellness is a very wide and multifaceted perception and it is difficult to define the term completely because the term it is developed overtime and changed by different influential factors such as culture, experience, belief, religion, context etc. Wellness meaning in our context is how "healthy" the elderly living alone is able to perform his essential daily activities in terms of the usage of the house-hold appliances.

1.2 Hardware System Design

The hardware design modules designed using various hardware components are presented in detail. Figures 1.shows block diagram of the hardware modules developed for the design system. There are three modules 1) MEMS sensor for sensing the intruder motion 2) TEMP sensor (LM35) for detection of temperature 3) force sensor sense the pressure of the device.

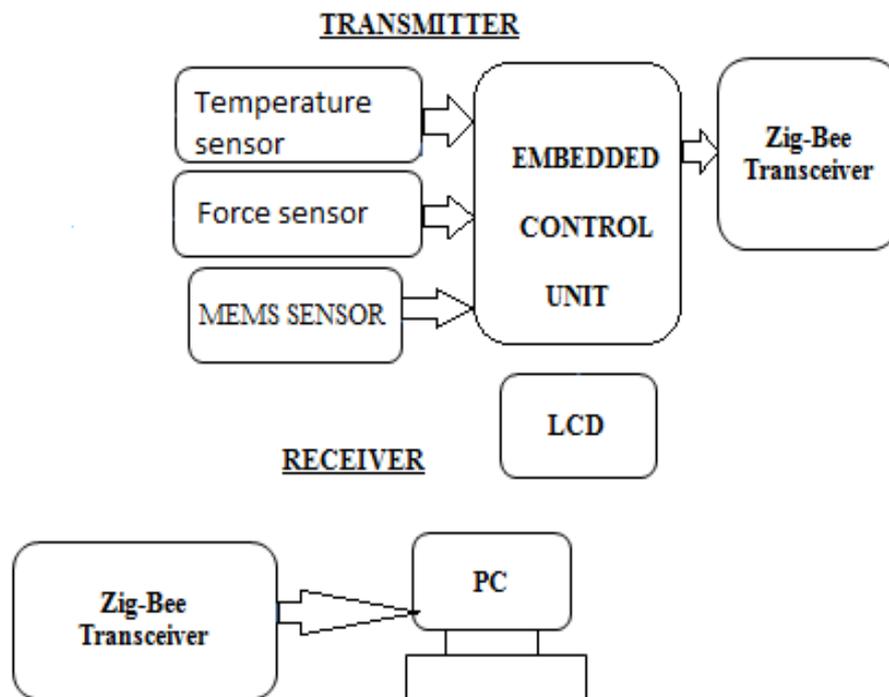


Figure: 2.1. (a) block diagram the representation,(b) implementation representation

1.3 Hardware Implementation And Interfacing

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 is shown in the figure 2.



Figure: 2.2. Fabricated sensing unit with ZigBee module.

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.

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

3.3 Force Sensor

This type sensor relies on the mechanical motion of the MEMS structure due to the Lorentz force acting on the current-carrying conductor in the magnetic field. The mechanical motion of the microstructure is sensed either electronically or optically. The mechanical structure is often driven to its resonance in order to obtain the maximum output signal. Piezoresistive and electrostatic transduction method can be used in the electronic detection.

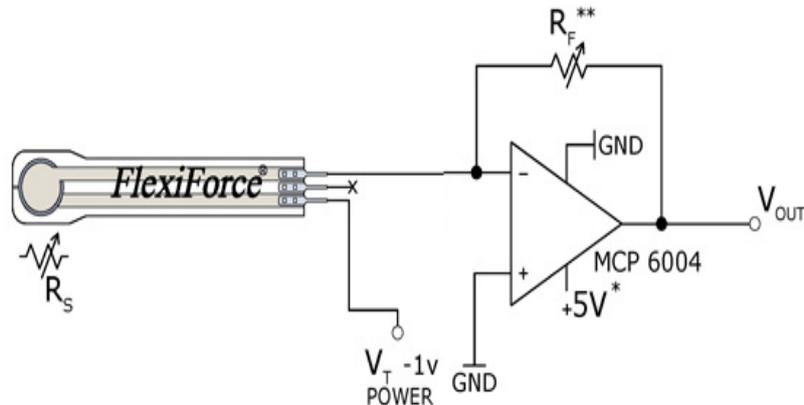


Figure: 3.3.pressure sensor circuit.

3.4 Network Configuration

In a wireless sensing network for fire safety, lots of nodes can be connected. So, that fire can be detected anywhere in an infrastructure. In order to increase the coverage of the flame detection, the peer-to-peer topology is selected instead of the point-to-multipoint topology. The decentralized nature of Peer to Peer networks increases robustness because it removes the single point of failure that can be inherent in a client-server based system. For fire safety, as shown in Fig: 6.a WSN configured in an ad hoc infrastructure is designed for the UV detection of flame. It includes the WSN node and a control center. The low-power consumption short-range communication technology ZigBee is used, and it has 16 channels of data rate 250 kb/s in the license free industrial, scientific, and medical band of 2.4–2.4835 GHz.



Figure: 3.4.ZIGBEE WNS network.

IV. CONCLUSION

Wellness is a wide and multifaceted phrase. In this research Wellness is about well-being of elderly in performing their daily activities effectively at their home. This will facilitate the care providers in assessing the performance of the elderly activities doing independently. The developed home monitoring system using WSN is low cost, robust, flexible and efficiently monitor and assess the elderly activities at home in real-time.

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