DESIGN AND IMPLEMENTATION OF A REAL TIME ACTIVITY RECOGNITION SYSTEM USING RADIO FREQUENCY IDENTIFICATION

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ABSTRACT:
Real time activity recognition plays a major role in many applications as of in elderly care as the number of elder people are increasing day by day in the world. With the reduction of the costs in wireless sensing devices, there is a trend in deploying the body sensor network as the solution for the human centric applications like elderly care, health monitoring, and activities of the person inside a building. We utilize a multi-sensor approach to characterize two important aspects of activities. We use wearable acceleration sensors to infer characteristic body movements and RFID tags in combination with RFID readers to recognize object usage during execution of activities. The benefit of the proposed approach is that it is able to attain high recognition performance even when the number of sensors is significantly decreased to a single wrist worn sensor and just a few tagged objects. This is achieved by augmenting the learning process with additional information from complementary sensors.
Keywords*: Wi-Fi, MEMS, RFID.*

INTRODUCTION

Elderly care is one of the many applications supported by real-time activity recognition systems. Traditional approaches use cameras, body sensor networks, or radio patterns from various sources for activity recognition. However, these approaches are limited due to ease-of-use, coverage, or privacy preserving issues. In this paper, we present a novel wearable Radio Frequency Identification (RFID) system aims at providing an easy-to-use solution with high detection coverage. Our system uses passive tags which are maintenance-free and can be embedded into the clothes to reduce the wearing and maintenance efforts**.**

LITERATURE SURVEY

Activities of the person inside a building [1]. In this paper, we present an easy to install sensor network and an accurate but inexpensive annotation method. A recorded dataset consisting of 28 days of sensor data and its annotation is described and made available to the community. Through a number of experiments we show how the hidden Markov model and conditional random fields perform in recognizing activities. Many new applications are under active development to provide support for elderly people with diseases and impairments. Smart remainder system for people with memory impairment to monitor person's activities and set remainders when the daily routine is not followed [2]. This paper describes Auto reminder, a cognitive orthotic system intended to help older adults adapt to cognitive decline and continue the satisfactory performance of routine activities, thereby potentially enabling them to remain in their own homes longer. Auto reminder achieves this goal by providing adaptive, personalized reminders of (basic, instrumental, and extended) activities of daily living. Emergency response systems for falling detection and dangerous behavioral movements of a person [3]. We have designed an intelligent emergency response system to detect falls in the home. It uses image-based sensors. A pilot study was conducted using 21 subjects to evaluate the efficacy and performance of the fall

detection component of the system. Trials were conducted in a mock-up bedroom setting, with a bed, a chair and other typical bedroom furnishings. A small digital video camera was installed in the ceiling at a height of approximately 2.6 m. The digital camera covered an area of approximately 5.0 m 3.8 m. The subjects were asked to assume a series of postures, namely walking/standing, sitting/lying down in an inactive zone, stooping, lying down in a 'stretched' position, and lying down in a 'tucked' position. These five scenarios were repeated three times by each subject in a random order. These test positions totaled 315 tasks with 126 fall-simulated tasks and 189 non-fall-simulated tasks. The system detected a fall on 77% of occasions and missed a fall on 23%. False alarms occurred on only 5% of occasions. The results encourage the potential use of a vision-based system to provide safety and security in the homes of the elderly.

In this paper we propose a novel approach as the proposed system uses RF signals for detecting the passive RFID tags which in turn helps for the location of a person inside a building. We use the passive tags as they are of low-cost, Battery free and encapsulated devices that can be set on any area/location, these can be even easily wearable by the user. Once installed, these passive tags require no further maintenance efforts as of the BSN nodes and can even survive in harsh environments/conditions. Our system uses a RFID reader and this reader is equipped on the user's body along with other modules. Efforts were taken to increase the coverage and the accuracy in the readings by reducing the wearing and maintenance of the RF-based approach of the activity recognition [4].

Methodology

A sensor system is proposed in this paper which is based on micro electro-mechanical sensor (MEMS). The micro-mechanical device which is embedded with electronic/electrical system and fabricated through IC manufacturing and micro-machining process. In this micro machining process the material is shaped by etching away the micro layers and so called MEMS. We use MEMS because of its compact size and volume, it is cheaper and has very low power consumption, It is highly resistant to heat, shock, vibration with improved thermal expansion tolerance. The use of MEMS can be found everywhere in consumer appliances, automobiles, computer peripherals, military, biotechnology and so on.

In this project we use a 3- Axis orientation/Motion detection sensor(A low profile capacitive MEMS sensor featuring upto 6-bit data samples per second or at the rate of user configuration), with the weight of the sensor around 1.5 grams. In our project we propose a system with indoor location sensing or the location sensing with a very less radius by implementing the very easily accessible wireless devices so that we can make use of the existing infrastructures, 802.11, infrared, RFID, ultrasonic are the types of location sensing systems each having their own strength. In this paper we implement 802.11b (Wi-Fi) standard from transmitting the data from the reader module to a reading device (Laptop/Smartphone) in a specific range.

To sum up, this paper gives the following contributions: -

- A wearable RFID reader module and use of passive tags helps in high coverage area which is suitable for elderly care.
- The use of MEMS sensor to know the Real-time activities of the person for activity recognition.
- Data from the sensor is processed and sent to smart devices over an 802.11b standard (Wi-Fi) module, so it will be easier to track/monitor real-time activities and address the person when fall detection occurs. Various movements of the subject are tested and verified the time of response under the subject's abnormal movements/positions.

HARDWARE SYSTEM

In system construction, it mainly consist of two part namely as software part and hardware part.

In this Hardware part having two sections one is Data collection section, another one is Monitoring section.

DATA COLLECTION SECTION:

In this section, we introduce our setup and conduct the preliminary experimental results to show the tag readings and its performance characteristics under other controlled conditions and other for activity recognition. We use a RFID reader module (EM-18) for RFID tag readings. It has a reading distance range of upto 10cm (for the prototype) with a operating frequency of 125khz. The size of the reader module is 32 mm (length) × 32mm (width) × 8mm(height).

This has a 5v input. We use the RFID tags of the credit card size (we use passive tags). RFID tags are used to locate the person's location inside a particular setting or location (we can even say it might be a home setting). We use a MEMS sensor (MMA7660FC) for gathering the data on person's movements or positions. MMA7660FC is a 3- axis orientation/ motion detection sensor which is around 1.5 gms with a digital output. As the sensor has a digital output, we use a ARM7 processor of LPC214x series to analyze the output and send it to a reading device (we use a LCD device on the circuit board and also we use a Smartphone to read the output for the prototype) The input operating voltage of MEMS is of 2.4-3.6 volts and a temperature range of operating is -40 to +85. The output of the processor is sent to a Smartphone for easy accessibility of viewing. The data from the processor is sent to a Smartphone with the help of a Wi-Fi module (Wio4). Tag readings obtained from the reader are sent wirelessly through a serial-to Wi-Fi adapter and the readings are received over a Smartphone.

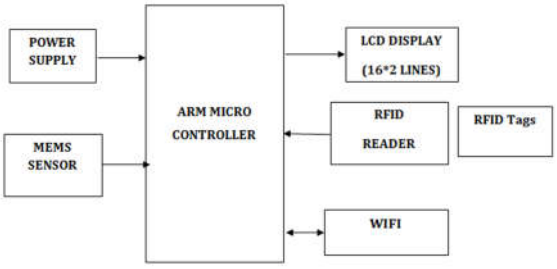

Fig.1. Block diagram

MONITORING SECTION:

In this monitoring section we are having Android based mobile for data receiving.

Fig.2. Monitoring section Block diagram

Hardware Requirements

RFID:

Radio Frequency Identification (RFID) is a silicon chip-based transponder that communicates via radio waves. Radio Frequency Identification is a technology which uses tags as a component in an integrated supply chain solution set that will evolve over the next several years. RFID tags contain a chip which holds an electronic product code (EPC) number that points to additional data detailing the contents of the package. Readers identify the EPC numbers at a distance, without line-of-sight scanning or involving physical contact. Middleware can perform initial filtering on data from the readers. Applications are evolving to comply with shipping products to automatically processing transactions based on RFID technology RFID Reader Module, are also called as interrogators. They convert radio waves returned from the RFID tag into a form that can be passed on to Controllers, which can make use of it. RFID tags and readers have to be tuned to the same frequency in order to communicate. RFID systems use many different frequencies, but the most common and widely used & supported by our Reader is 125 KHz.

Fig.6. RFID Reader

MEMS:

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through micro fabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micromechanical components are fabricated using compatible "micromachining" processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical

devices. MEMS promises to revolutionize nearly every product category by bringing together silicon-based microelectronics with micromachining technology, making possible the realization of complete systems-on-a-chip. MEMS is an enabling technology allowing the development of smart products, augmenting the computational ability of microelectronics with the perception and control capabilities of micro sensors and micro actuators and expanding the space of possible designs and applications.

Microelectronic integrated circuits can be thought of as the "brains" of a system and MEMS augments this decision-making capability with "eyes" and "arms", to allow micro systems to sense and control the environment. Sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through some decision making capability direct the actuators to respond by moving, positioning, regulating, pumping, and filtering, thereby controlling the environment for some desired outcome or purpose. Because MEMS devices are manufactured using batch fabrication techniques similar to those used for integrated circuits, unprecedented levels of functionality, reliability, and sophistication can be placed on a small silicon chip at a relatively low cost.

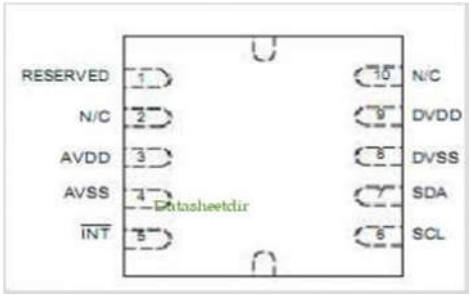

Fig.7. MEMS IC

RESULTS

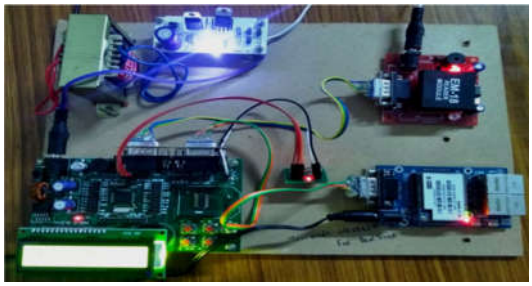

Fig.8. Hardware Model of Black Box

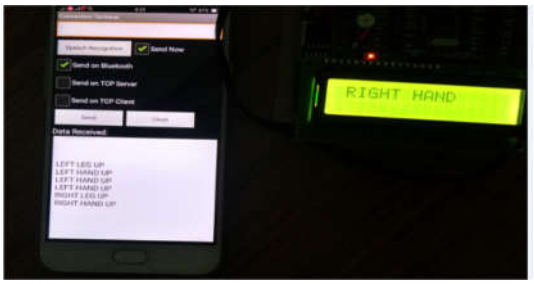

Fig.9 (a).

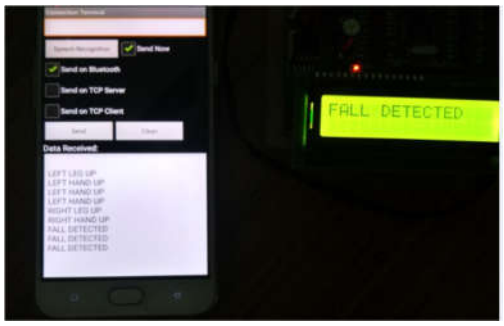

Fig.9 (b).

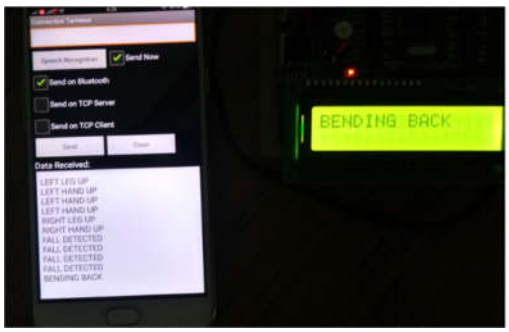

Fig.9 (C).

Fig.9 (a), 9(b), 9(c). Moments shown in LCD and android app

CONLCUSION

We present a RFID-based system for Real-time activity recognition as we aim in providing a easy usage of solution with high detection capacity by the use of MEMS which supports the applications like elderly care. We implement a proto-type model and the results are pretty satisfactory, apart from the time taken for recognition process, we get a very high possibility of movement detection without much delay as this is only a prototype model. By the use of the Wi-Fi module and a Smartphone with tags we gain a higher accuracy in detection of the subject along with the area location. As of this initial work, the limitations of our system are that firstly, RFID systems are still cumbersome for wearing. We use a RFID reader for reading tags which is included in the system which the subject wears and this makes the wearing system much more complex. Secondly, for the easy access in the readings we use a smartphone and a Wi-Fi transmission module. The Wi-Fi module consumes much more power as it should continuously on while the prototype is installed. So, as a result we use much more hardware and so, we require much more power for all the modules combined. We use a development board of the processor rather than a specific purpose processor for this prototype model. So finally as a result our whole system might be slightly complex for the subject to wear. So other than the use of the RFID systems we are working on areas of other detection mechanisms and the usage of much more optimized hardware solutions for mobile applications.

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