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Wearable RFID Based Real Time Activity Recognition System

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Abstract: *In the past couple of years, there is growing interest in passive UHF RFID technology. Activity recognition plays an important role in many applications. One of such applications is care of old people that are supported by activity recognition systems. In this paper a wearable radio frequency identification (RFID) system using passive tags which are smaller and more cost-effective to recognize human activities in real-time scenario are used. Backed up by a step-down transformer for power supply to the circuit, the tilt and fall detection sensors, walking and running activities can be traced out in this project. These RFID tags are arranged at the room premises and when a person enters a specific room, it alerts by special commands. We exploit RFID radio patterns using passive RFID tags to check the person's position and his presence in a particular location.*

Keywords: *Activity recognition, Wearable RFID, ARM7 TDMI*

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I. Introduction

Elderly care is a critical application that is upheld by ongoing action acknowledgment frameworks. Here, the system utilizes passive tags which are without support and can be implanted into the garments to lessen the wearing and upkeep less efforts. Activity recognitionsystems have a vital part in numerous applications. One such critical application that involves much of interest is elderly care due to the increase in growing number of elderly people around the world. For the daily support of old age people with different degrees and types of impairments new applications are actively being developed.

II. Literature survey

In [1], Passive UHF RFID Tags are being used for the toll collection on highway for Automatic Vehicle Identification. Here the system is implemented by a connector loop and a RFID chip, with unique ID, is fixed in a card, which can be attached to and separated from the card holder. For operation, the card, with the connector loop and chip, has to be inserted to a card holder, where the antenna is set in inside the card holder. Two passive UHF RFID tags have been used here; they are Removable Windshield Tag and a thin-wire Vehicle Headlamp Tag. Both these designs are used for vehicle identification. In this method it occupies a marginal area and it is useful for the vehicle identification. There may be certain possibilities of tag uncertainty because during night time the head lamp of the vehicle will be in ON condition and it may lead to the heating of the tag and may not be possible to sense the ID of the vehicle. The read range is limited to a few meters and this can be further increased in nearby future. In [2] Radio Frequency Identification (RFID) technology is used by assigning an exclusive identifier to each product in the textile and laundry industry. The paper analyses the weak points of actual passive UHF RFID tags and proposes keys regarding the architecture and the materials used in construction of tags suitable for laundry applications. They should be washable and wearable, sturdiness enough to operate in harsh environments. But there is a drawback which is, there is a limit on washable cycles which may cause fade away of tag and also if the product is squeezed then there is also chance of breaking of the tag.In [3] for the body temperature observing, an on-board temperature sensor is installed in RFID label structure. The temperature sensor may exchange its flag specifically into label memory and being read by reader together. This can help user tracking of user health and the signal processing is done effectively. There are 3 layers, data extraction layer at bottom, to employ RFID devices and sensing devices, for tracking individual health record. The center layer is the framework incorporation layer, which utilizes structure and lattice innovation to create capacities, for example, benefits association, record stockpiling, and information examination to serve. It acts as link between two layers. The top layer is the application service layer, which, provides the user with demands such as health consultations such as medical reports, temperature etc., and provides the equivalent interactive services so that the overall system operation can be realized effectively.In [4] a different design of wearable radio frequency

identification (RFID) sensor patch made of conductive fabric and integrated on clothes is used for the measurement of body temperature. This flexible prototype was designed to be sewed into clothes or to adhere with the skin. The measurement range of the temperature sensor is from -40 to 105 degree Celsius. The power required for the circuit depends on the energy scavenging system in this chip. The tag is worn at the collar for temperature measurement. The temperature recorded is time to time sent to the mobile along with the patch details. And hence the device is easy to wear but it has limitation on the washing of the product.In [5] the method employed is somewhat similar to this project. Here the RFID tags are placed near the hand, chest area and back of the person's clothes and also antennas are placed at the right and left foot and also at different body parts for the communication. For each data segment, it extracts both temporal and spatial features to illustrate the radio patterns. The hardware consists of serial to Wi-Fi adapter and RFID reader and antenna on the other hand smartphone and RFID tag are present at the user end. They have also implemented a special algorithm to find the person's activity like running, cleaning table and vacuuming. All the data collected is sent through antenna to the smartphone employed for this purpose. The results were also most effective. [6] separate wearable radio-frequency identification (RFID) tag with sensing, processing capabilities is prepared. It consists of a Photovoltaic cell embedded into which antenna patch and power connections are present inside it. It is wearable by the person on such as on the chest and the IOT mechanism is used and the person's availability is found by the antenna radiation patterns. The tag relies on a dedicated textile shorted circular patch antenna with tailored radiation pattern for operation in a smart floor/ceiling environment. Here the radiation is emitted in monopolar direction between ceiling and floor. Measurements under free-space conditions and in a accurate indoor scenario demonstrate excellent wearability, very high read rang

Existing systems

Existing sorts of observing frameworks can comprehensively be ordered into rich information organizations, for example, video and receiver frameworks, including non-wearable sensor frameworks and sensor frameworks that involve exclusively or mostly of wearable sensors:*Video :*The most direct type of activity acknowledgment framework is video. Notwithstanding, this approach postures numerous issues. The information is extremely rich and in this way unpredictable, as is hard to investigate naturally and subsequently exorbitant as far as examination and information stockpiling. The greatest concern is protection. In spite of the fact that frameworks have been created which safeguard protection to some degree, for example, just chronicle many individuals would in any case be careful about having a video framework implemented in the homes [7].
Microphones: The Microphones can likewise give a rich wellspring of information, as a few exercises have a particular sound mark. Stationary omnidirectional mouthpieces have been utilized to quantify exercises in a few rooms [8]. In any case, because of the effect of ecological contrasts (e.g. room estimate, design, materials of surfaces), the action acknowledgment calculation would should be prepared in each setting, which would be unfeasible for a framework expected to be versatile. In addition, amplifiers could most likely not separate between practices of two people in closeness and will have very poor acknowledgment for basic family unit exercises. Because of these constraints, video and mouthpieces don't meet our prerequisites. A few classes of sensors track areas of individuals inside a space. This should be possible utilizing movement sensors on the roof (e.g. [11,12]), or weight tangles on/under the floor or things of furniture (e.g. [12]). Through learning examples of regular conduct, calculations can figure out how to distinguish people (e.g. [12]), however this requires broad preparing, and acknowledgment can even now be poor when there are a few people in a single setting [13]. What's more, area following frameworks can't identify what exercises are being performed regardless of the possibility that a man is identified in a specific region. Movement sensors, for example, these have been joined with reed switches (a parallel sensor measuring open or close states which can be effortlessly fitted to drawers, entryways and so on.) to endeavor to recognize practices being performed. While this can give genuinely great acknowledgment of more elevated amount exercises, for example, individual cleanliness or cooking, it can't decide more point by point data about protest use [14], so isn't adequate to screen particular practices. Thus this demonstrates the current strategies have a few disadvantages for the activity recognition

III. Proposed System

RFID is a wireless non-contact framework that utilizes RF electromagnetic fields to exchange information from a label joined to a question, for the reasons for programmed recognizable proof and following. A few tags require no battery and are controlled by the electromagnetic fields used to peruse them. Others utilize a nearby power source and emit radio waves (electromagnetic radiation at radio frequencies).Transmitter: The proposed method is a prototype. In the proposed method, a tiny RFID reader is ragged on the user's body to spread the detection coverage [13] as the user moves. We exploit RFID radio patterns and extract both spatial and temporal features to characterize various activities. Antenna and tag selection is done automatically to explore the minimum number of devices required to achieve target accuracy. Here with the help of RF communication, the activity of the person can be found by radio patterns. We are using LPC2148 MCU at both transmitter and

receiver end. The transmitter part consists of a tilt sensor, emergency help switch, a reset button, and read sensor at right shoe and also at waist, the magnet is also placed at the respective positions. To detect the activity clearly we are also employing a LCD display at the transmitter and receiver part. Also a buzzer is placed at the receiver end so that if any danger is detected then the buzzer is alarmed. The transmitter part is as shown in below figure 1.

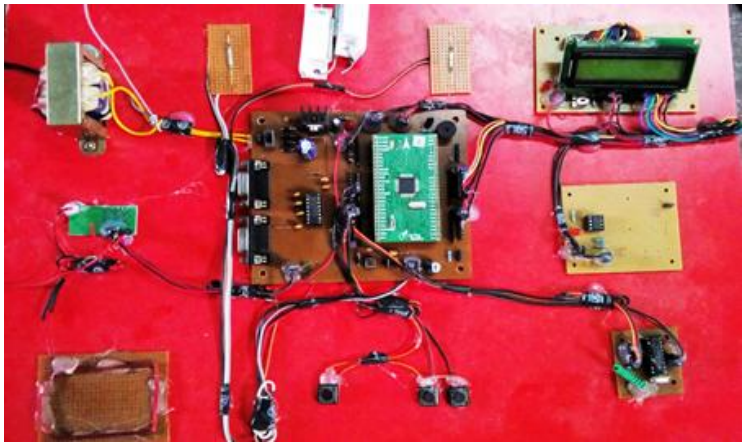

Fig.1 RF Transmitter with RFID tag reader, LCD screen and sensors

For this purpose we are placing RFID tags in three rooms like hall, kitchen and bedroom and also the emergency switch is placed near the person's body for any emergency purpose. Now as the person moves into the different room the rfid tag is read and the result is displayed in the LCD placed at the transmitter end. If any sudden tilt is detected then a buzzer is horned assuming that there is an emergency. In this prototype system we are using a step down transformer for the power supply to the entire unit. In the real time scenario we can use a high powered battery source to the circuit.Receiver: The receiver part also consists of LCD display and RF receiver, to which the decoder is attached. Also at the receiver end we are using step down transformer for the power supply of constant 5V to the circuit.

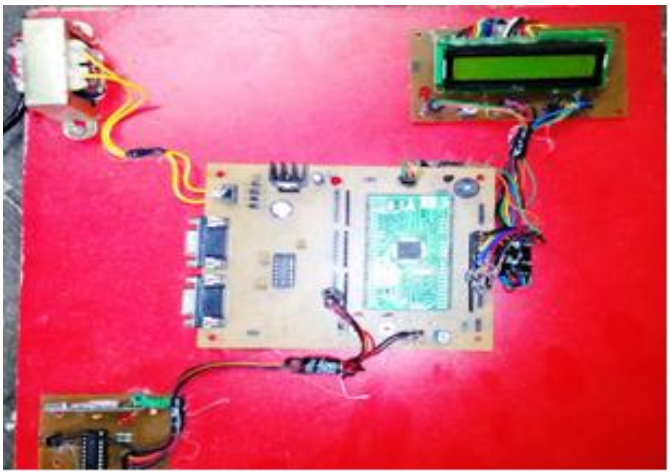

Fig. 2 RF receiver along with decoder circuit and LCD display

The LPC2148 is based on a 16/32 bit ARM7TDMI CPU with real-time simulation and embedded trace support, along with 128/512 kilobytes of flash memory which is embedded. Here one magnet is placed at the waist and sensor to the hand and other magnet to the leg and sensor to the other leg. So that if the person is walking then the magnet induces a field with the sensor and displays the result in the LCD. In this way the sensors work. There is also a panic button at the user end and if any panic is detected the user presses it then the buzzer is activated at receiver end. In this way we can enroll and delete the desired room selection by enroll button. The program is stored in EEPROM. In this way a wearable RFID system is designed

IV. Results

The system can effectively be implemented and it is robust. The system works in a better way by using GSM module. Additionally the hardware requires only two antennas and four tags attached to body parts to achieve a high recognition. Initially the circuit is switched on by Regulated power supply. The step-down

transformer is used here. The RFID initial state can be seen on the LCD screen at the transmitter and the receiver circuits as shown below. The details such as place the card is displayed at the transmitter and it will be displayed until the further command is prompted. At the receiver end activity waiting is displayed as shown in the figure 3 and 4.

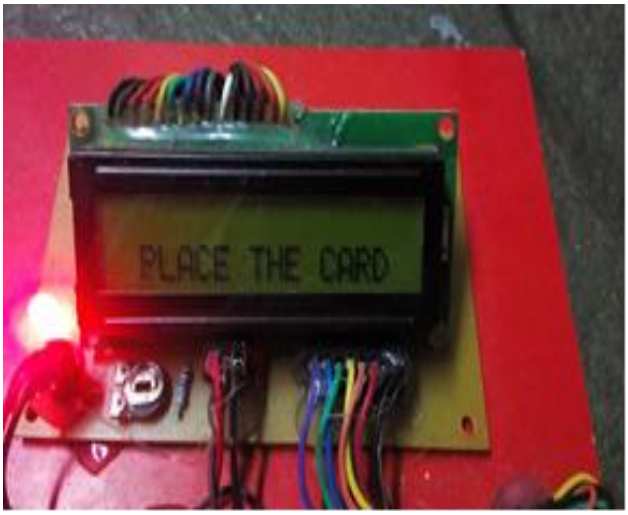

Fig. 3 Display at the transmitter

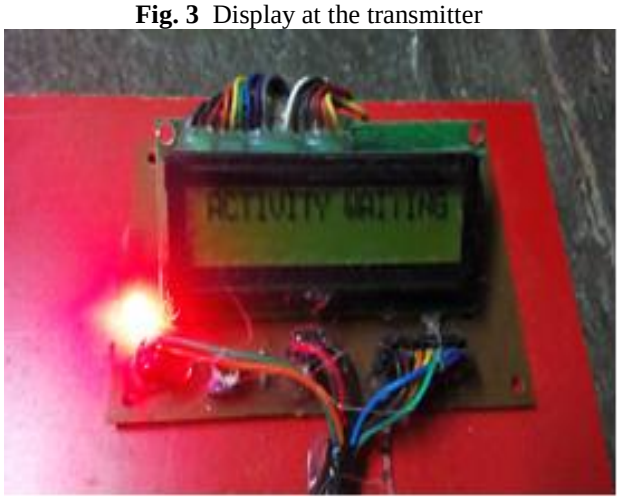

Fig. 4 Display at the Receiver

V. Conclusion

The experimental result shows that the designed system can perform better activity recognition and achieve the highest recognition accuracy rate using a power source. The number of tags can be read by a RFID reader during a scan is limited. Tag placement strategies and RFID reader are used in this system. A RFID reader is activated sequentially to detect tags within their reading ranges.The range of the signal transmission can be increased by using a repeater and also the receiver part can be replaced by a smartphone by using Wi-Fi network. There can also be other sensors embedded to the system.

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