ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Special Issue 7, October 2015

Internet of Things in the Field of Mobile Tele-Communication

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ABSTRACT: Today human-machine interaction is moving away from mouse and pen and is becoming pervasive and much more compatible with the physical world. With each passing day the gap between machines and humans is being reduced with the introduction of new technologies to ease the standard of living. Gestures have played a vital role in diminishing this abyss. In this paper, a rigorous analysis of different techniques of "Human-Machine Interaction" using gestures has been presented. Gestures can be captured with the help of an accelerometer. In this paper, a rigorous analysis of different techniques of "Human-Machine Interaction" using gestures has been presented. Gestures can be captured with the help of an accelerometer, however, with the evolution of smart phone its independent usage has been rendered useless. This paper analyzes the motion technology to capture gestures through an android smart phone with an inbuilt accelerometer and an Internet module.

KEYWORDS: Gesture, Smart Watch, Smartphone, Bluetooth, Accelerometer, Gyroscopes, Orientation Sensors.

I. INTRODUCTION

In recent years, Internet has become increasingly ubiquitous. Besides allowing people to connect anytime and everywhere, the Internet is evolving into communication medium objects that are embedded into the physical world. The coupling between such objects and a worldwide standard-based communication infrastructures constitutes the Internet of Things (IoT) and is characterized by machine-to-machine (M2M) communications. The Internet of Things (IoT), also called as Internet of Everything or Network of Everything, is the network of physical objects or things embedded with electronics, software, sensors, and connectivity to enable objects to exchange data. IoT is a widely distributed, locally intelligent network of smart devices – will enable extensions and enhancements to fundamental services in education, health and other sectors, as well as providing a new ecosystem for application development.

As we all know smart phone which is a powerful device changes rapidly with the human interaction which is a machine embedded with accelerometer sensor, Bluetooth and many more and are power by different operating system [1]. With help of this smart phone we can connect any other device such as "Smart Watch" and other device to it. This Smart Watch has brought computer to our wrist, we can control these watch we few click of our fingers, this helps the user control their smart device by sampling making hand gestures [2]. Using this Smart Watch we can make or receive the call and to can communicate with the other person without other device by. In this project I am connecting this device to the internet and person can receive his call with help of his smart watch but the smart phone may in remote place but both are connected to the internet.

In this paper, research is done recognizing of the gestures that has been used in Smart Watch. This is done by using motion sensor accelerometers, gyroscopes, orientation sensors,

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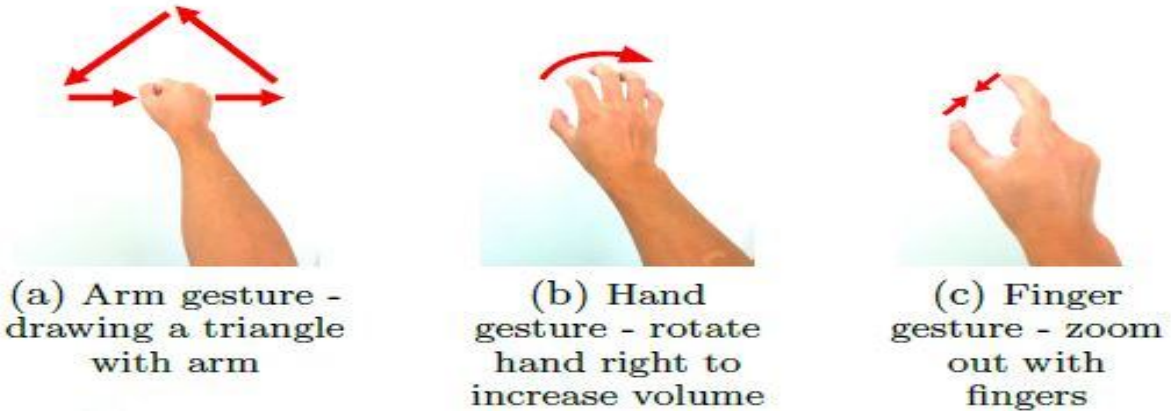

Fig 1: Examples of Arm, Hand and Finger gestures

This motion sensor recognize the movement that are done by the hand takes those motion as input given smart phone. Most of the smart watch has built in accelerometer and gyroscope sensors, by using these sensor we can capture and analyze the sensor data by which we can understand the user's arm, hand and finger gestures [4].

II. PROCESS

In this section, describing the experiment settings and showing how we can determine the gesture type using the measured motion energy from the smartwatch.

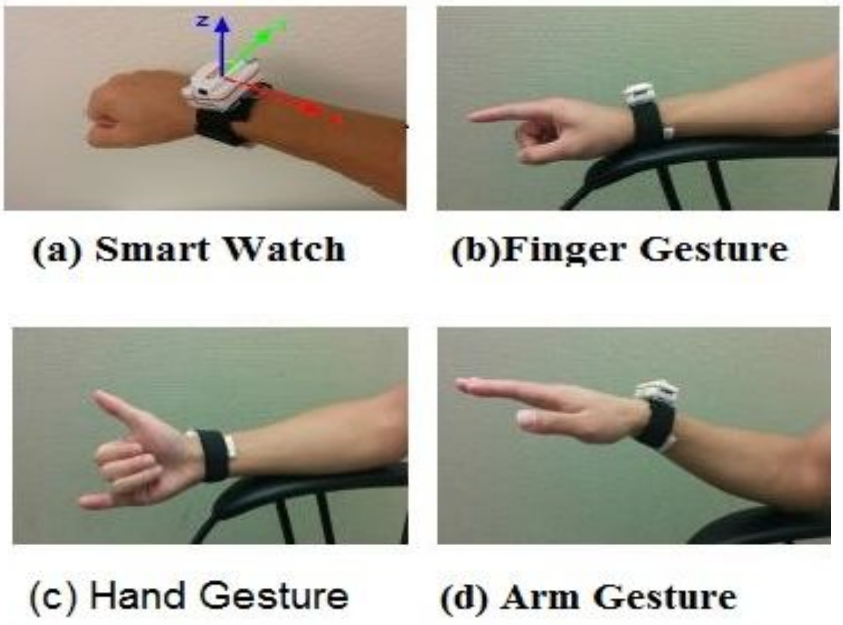

Fig 2: Showing different gestures are formed

Above figure represents how we can make gestures using arm, finger and hand. These gestures which are generated needed to be processed so that we can interpret the result using some suitable technique. Using some device we can collect the data that is given by the smart watch.

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A. Sensor Data Collection: Data that are generated through the smart watch need to be gathered by some sensor detection devices. These data which are collected are transferred to the smartphone via internet. Data sent to smartphone are then processed to get actual generated result through the gesture.

B. Gesture Interpretation: Once the data is collected from the sensor and sent to the smartphone then these data need to be interpreted. This interpretation is done by classifying the different type of gesture and comparing all type gesture that has been defined at the time of experiment of the device as shown in table 1.

C. Gesture Type: In this it is necessary to classify which type gesture made user. Gesture may vary in the form speed, motion, energy etc., every gesture that has been made need to classify accordingly. Gesture can be made through the fingers, hands and so on. Some of the gesture that are done are as follows.

Type	Gestures
Arm	ThumbsDown, Push, Left, Right, Up, ClockwiseCircle, Cross, AntiClockwiseCircle, LeftTwice, RightTwice
Hand	AntiClockwiseCircle, ClockwiseCircle, DownOnce, DownTwice, GunShoot, LeftOnce, LeftTwice, Phone Call, RightOnce, RightTwice, RotateLeftVolume-Down, RotateRightVolumeUp, UpOnce, UpTwice
Finger	IndexFingerClick, ZoomIn, ZoomOut, One, Two, Three, Four, Five, OneTwice, ThumbsUp, Singleclick,DoubleClick, TwoTwice

Table 1: This table shows the list of gesture that can be generated

Each gestures that is been made has some sought motion energy that may be produced. By using motion energy we can calculate what type of gesture was made whether Hand, Arm or Finger [4]. This can be found out by using the formula.

$$\text{Energy} = \sum_{i=1}^{\text{window\_length}/2} \text{magnitude}_i^2$$

Here magnitude value are the Fast Fourier Transform (FFT) coefficient calculated over the time window. Because all gestures considered in this work last for very small duration, we set the window size to be the time of the complete gesture. The energy is only calculated for half the window since the remaining magnitude values are redundant which follows from the symmetry of FFT. We only choose to calculate the energy within the lower frequency range of 0 to 1 Hz which is known to indicate low intensity activities and minor changes in posture [4].

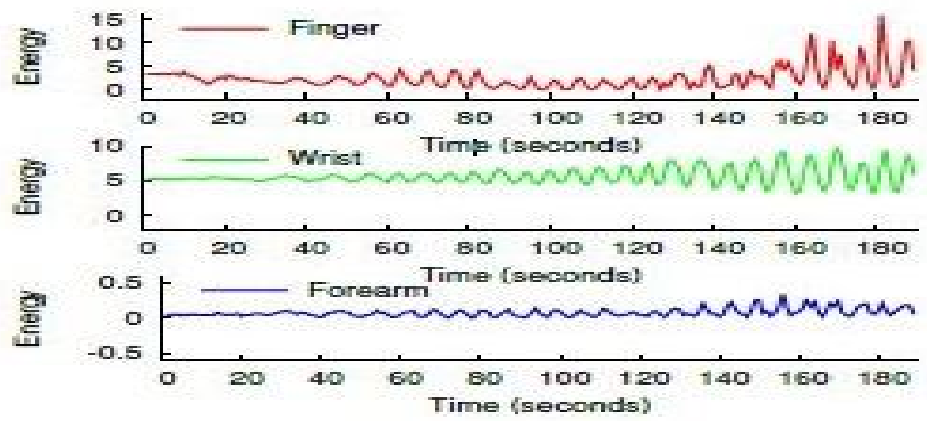

Fig 3: Motion energy finger, wrist and forearm when doing a finger gesture

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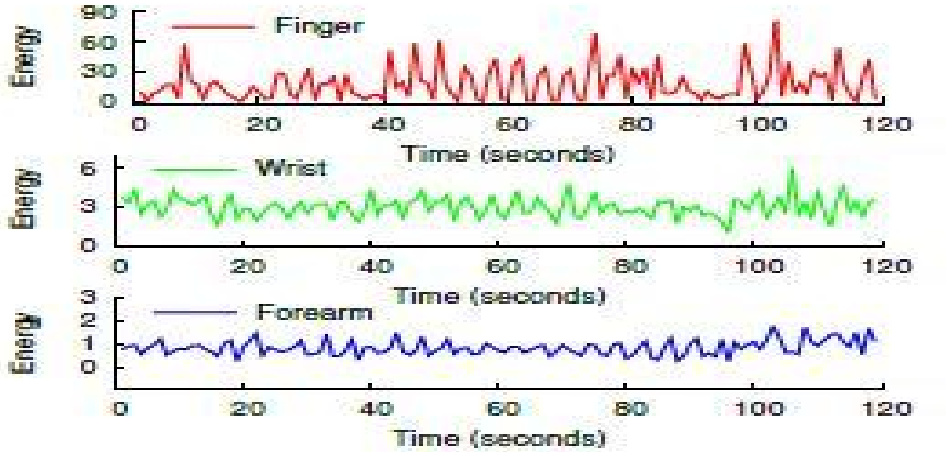

Fig 4: Motion energy finger, wrist and fore arm when doing a hand gesture

D. Gesture Recognition: Motion energy which is observed in wrist when performing a finger or hand gesture can be used to recognize the gesture that is produced which helps us to build gesture recognition technique. Some of the technique are as follows.

Primitive Gestures: To demonstrate the movement of tendons which can be used to distinguish different gestures**.** Taking examples of Primitive gestures and to show how smartwatch accelerometer and gyroscope data is different for each of them.

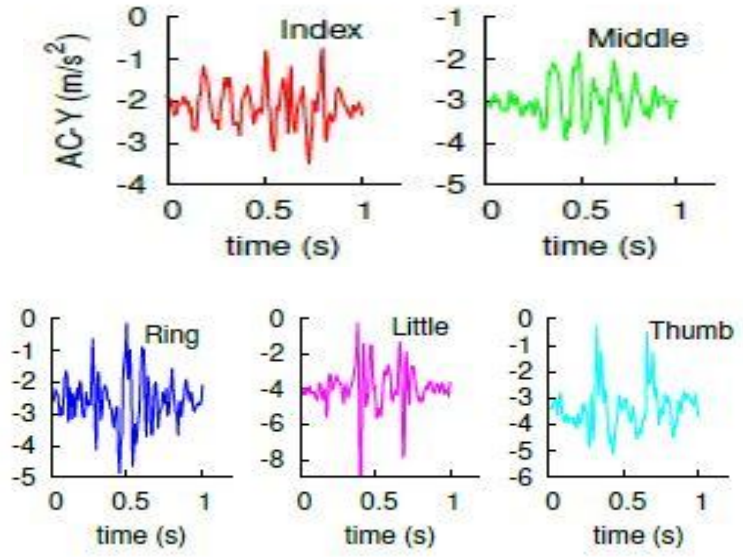

Fig 5: Accelerometer Y-axis when performing the same Up-down gesture with four fingers and the thumb

In the above figure Fig. 5 shows the accelerometer data for Y-axis when the four fingers and the thumb individually perform a simple up-down gesture once. Simple visual inspection reveals that each finger (or the thumb) has clearly distinct pattern when performing the same gesture.

Also test how the accelerometer pattern is different when performing different gestures using the same finger. For this, user performs three different gestures - up-down, circular motion and left-right - using her index finger.

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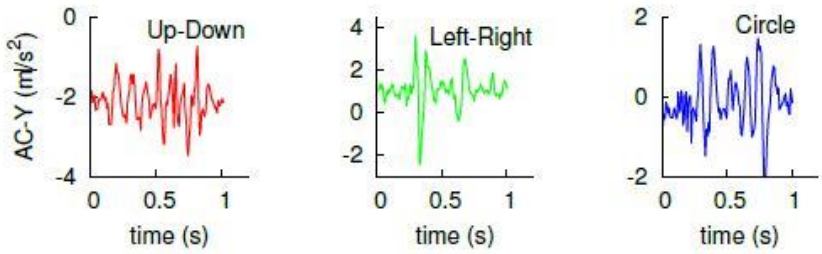

Fig 6: Accelerometer Y-axis when doing three different primitive gestures with index finger

In the above Fig 6 it shows that the accelerometer data from smartwatch is sufficiently different for each gesture even when performed using the same finger.

III. CONCLUSION & FUTURE WORK

In this work, we explored how smartwatch can be used for gesture recognition. We found that smartwatch sensors can accurately detect arm, hand and even finger gestures. Gesture recognition using smartwatch can be used to create novel applications for interacting with nearby devices and remotely controlling them. As a part of the future work we are going to increase the distance connection between smart watch and smart phone.

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