Wearable Computing: It's Application and Devices

ARUN KUMAR SINGH, DEEPSHIKHA AGARWAL

Abstract— Wearable computing is the new direction of technology that is fast emerging in the current scenario. It is one of the prime focuses of current technological research. The paper aims to provide an introduction of the wearable computing, its characteristics and components giving information of products of wearable computing which are currently in use and about the industries which are using wearable computing technology.

Index Terms— Wearable Computing, Sensors, head mounted display.body worn, portable, hands free, RFID tag.

1 Introduction

There are various technologies and products available in the market that efficiently helps the human being in various ways. It spans from desktops, laptops, electronic calculators and other PDAs. The idea of wearable computing emerges from the existence of the portable devices, calculators, electronic wrist watches, headphones etc. The main focus of wearable computing is that these devices can be carried anywhere and they take active participation in human activities. There are various commercial filed in this world that require a computer related work but they want their hands to be free. So wearable computing is trying to solve the problem of all these fields.

2 Definition of Wearable Computing

Wearable computing is a kind of computing in which the user wears the computing device on his/her body in the form of clothing or any other wearable aids. Wearable computers can be carried to the places where normal computer cannot be carried out. For e.g. Mining, construction site, war etc. Body worn computers can be operated and powered by different activities of human [1].Wearable computing devices are program-based computing aids which can be made functional ,active and can be controlled based on their programs. They are capable of taking decisions up to some extent.

3 Some Wearable Computing Devices

3.1 Smart Eye Glasses [3]

It is a hands free display system that is wore on eyes just like glasses. It has lenses that can act as a display unit. Its interface consists of a touch pad, a camera and a communication device. Through this you can see data graphs and other information on the position where ever you are working .Recently Google has also launched a prototype of its wearable display device that can be operated with the help of a ring in a finger. [4]

Fig 1:A smart eye glass that display images and reqired information [3]

3.2 iGlove [5]

It is a data Glove embedded with RFID (Radio frequency identification) reader which measures the motion of the hand and displays it in its displaying unit that what item the user is touching from his hand and fingers. All the items, where these iGlove are used, are equipped with RFID tags which give the information about the item to the user on their iGlove display.

Fig2: iGlove with RFID reader that gives information about what item the user is touching with his hand [5]

3.3 Ring scanner [9]

The ring scanner is mostly used at warehouses, billing counters of mega stores, packaging stores and courier companies. The main advantage of ring scanner is that it saves important time of the workers because it makes both the hands of the worker free and the user does not have to pick and drop the bar code scanner again and again. This ring scanner is integrated with a lightweight wrist mounted wearable computer

- *Arun Kumar Singh is currently pursuing masters degree program in Computer science and engineering Dept.in AmityUniversity, Uttar Pradesh, Lucknow, India. E-mail: arunksingh.it@gmail.com*
- *Deepshikha Agarwal is Sr. Lecturer in Computer science and engineering Dept.in AmityUniversity, Uttar Pradesh, Lucknow, India. E-mail: mita.ag1@gmail.com*

named HX2 developed by Honeywell.

Fig 3:A Ring scanner with wrist mounted wearable computer that frees the both hands of the worker while scanning the products [9]

3.4 Voice enabled wearable computer [10]

A Wearable computer developed by Vocollect that is used at book stores, ware houses, mega stores etc for picking up different items ordered by the customers. This computing device reduces paper work, increases workers efficiency of picking the right product. The order of the customer is transmitted to the wearable device of the worker. The order is heard by the worker in his voice based system and picks those items from the desired shelves.

Fig 4 :voice enabled wearable computer that guides the worker in picking up the right objects from the right counters and shelfs[10]

3.5 MsSAM [6]

This is the name of the device that can be used at the crime scene for the investigation purpose. The Technology in MsSAM uses RFID tags that are embedded in the bags in which evidences obtained from the crime scene is kept. This device is combination of cameras, GPS, Displays and headsets.

4. Characteristics of Wearable Computers [2]

4.1 Portable

The main advantage of the wearable devices is that they are very portable and easy to carry out. They can be carried anywhere with the users even at situations like war, while playing, while running etc where normal computer cannot be carried.

4.2 Hands free

Wearable devices are mostly hands free. User can give the input with his speech, with his motion with his gesture to the computer he is wearing. Even the heat from body and various kinds of motion of user can act as input to these devices. And they are programmed to give the desired output to the user according to these inputs

4.3 Operates in Real Time

This means that a wearable computer is always in active mode. As it is controllable by the user it may go to sleep mode but never in switch off mode as compared to portable devices which switches on only when we want to use them .Wearable computers always assist the wearer even when the wearer is not in active mode. In wearable Computing the user can interact with his environment and with his computer at the same time.

4.4 User Controllable

In wearable computing the device is fully controllable by the user. User can switch to other works and again picks the control on the wearable device where he was previously working on. In the mean while the device is working normally from the condition the user leaves the control from it. This characteristic make the user multitasking.

4.5 Supportable To wearer

In wearable computing the user not only use the computer but also the computer itself plays a very important supportive role for the user to help in various task like decision making, doing some task etc.

5. Components of wearable Computing

The component of wearable computer depends on their field of utility. Medical wearable use different components, military wearable use different components but here are some common components that are included in almost all wearable devices.

- A display System for seeing the output ,generally a head mounted display or wrist mounted display
- Battery backup
- Different kinds of sensors according to their use.
- A camera
- Various kind of recognition system depends on use
- Microphone and ear phone
- A keyboard that is worn on wrist or any other comfortable part of the body
- Wireless local area network connection

6. Industries Using Wearable Computing

There are many organizations in the world that are frequently using wearable products for time saving and improving their performance. Now in today's scenario wearable computing is not a hypothetical thing that can be only seen in sci-fi movies. Now it has taken a real shape and it is frequently used. As the

wearable computers are now getting used in many areas of life, many companies are coming forward in making the wearable products like Xybernaut Corporation ,Honeywell, Apple, ViA, Inc. ,Vocollect ,Body Media, fitsense and many more. The product of all these companies are used by many industries as described below:

6.1 Army

The DARPA project of US army was started in the year 1992 which aims to build wearable that can be carried out to the battle field. [7] The Land warrior project [8] was launched by the US army in 1994. The aim of the project is to enhance the effectiveness of the infantry soldiers. The systems used are equipped with a helmet with WLAN antenna and a head mounted display, a computer that reduces the burden of carrying lots of important documents by the soldiers, a soldiers control system and several other features.

With the help of wearable computing we can improve the performance of the soldiers in the battle field and their tactical awareness.

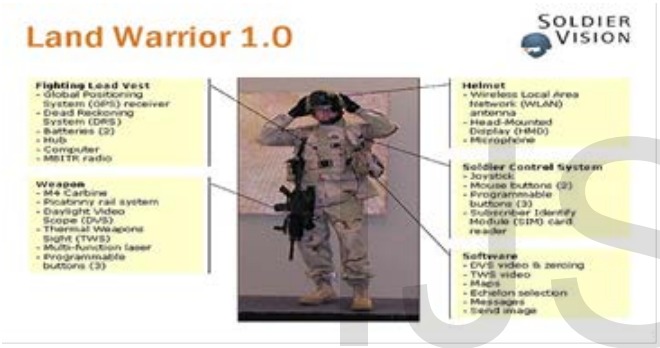

Fig 5: Displaying the different components of the land warrior project [8]

6.2 Medical [11]

The industry that uses wearable computing on large scale is medical and health industry. Companies like Body Media is working on healthcare wearable .They make world-class medical wearable that helps during the interrogation of the patient at various stages of their diagnosis. These wearable products are integrated with various sensors depending upon their uses such as accelerometer, heat flux sensor, Galvanic Skin Response (GSR) sensor, near-body temperature sensor are the few sensors those are used in these wearable products. The advantage of wearable aids for medicals is that the patient does not have to lie on bed all the time during the diagnosis, but he can do his normal work and it varies from disease to disease. These products monitor the calories burnt and consumed quality and quantity of sleep, mental state of the patient.

Fig 6: Body Media armband [11]

Sr.No.	Product	Manufacturer
1	IntelliVue MX40	Philips Electronics
2	BlueLibris	Numera
3	BioHarness BT	Zephyr Technology's
4	Body Motion Patch	Body Media and Avery Dennison Medical Solutions
5	Zoll Life Vest	Zollmedical Corporation
6	Basis B1	Basis
7	Fuel Band	Nike
8	Fit bit Ultra	fit bit
9	Body Media Link Armband	Body media

Table 1: Some medical wearable devices and their manufacturers [12]

Wearable computing will not only help in the patient monitoring but also the doctors and lab assistants to diagnose the patient,this way it plays a very important role in the healthcare indusry

6.3 Sports [13]

Sports industry is one of the emerging industry in the world .It also uses wearables at a very large scale for monitoring different activities of the players. With the help of wearable computing the trainer gets the feedback and patterns of the different best players and tries to use these feedbacks and patterns to improve the performance of other players. Different kind of sensors are used for different kind of monitoring that varies from sports to sports and these sensors are embedded in the clothing that players wear at the time of the play. These sensors are also used to monitor the health conditions like their heart beats, their fear factor, body temperature in some adventure sports like mountain climbing, parceling, bungee jumping etc. In addition to it wearable computers are also used to improve the judgment of the umpires and referees at different

sports. Games like taekwondo, boxing, karate are so fast that it is very hard by the referees to give the accurate scoring. A wearable computing system named TrueScore™ SensorHogu [14] is used to overcome the problem of scoring.

Wearable coputing enhances the level of soprts by increasing the accuracy in the results along with improving the performance of the players .

Fig 7: The TrueScore SensorHogu used to overcome the problem of scoring [14]

6.4 Construction [15]

Construction field is one of the dominating fields. The main problem this field is facing is changing the location of the site, environment and low vision. Wearable computing helps them in achieving their tasks easily and accurately. Normal computer cannot be carried to the places like underground, or hundreds of feet above the land .Different architects are facing the problem of modifying their designs as per sites and accessing the data on the spot. wearable computing solves this problem with the help of head mounted display system and other wearable computer where these architects modify their design on the spot and they have not to carry lot of papers and design charts with them.

This way wearable computing plays a very important role in the construction industry. It helps the engineers on the construction site to communicate with the other fellow member at the off site location. This will reduce lot of paper work thus reducing the cost of the construction industry as well.

6.5 Textile

There are various researches are going on in the textile industry to make the electronic textiles known as smart fabrics [16] which can be used to make cloths that cool your body in high temperature environment [17] .At present time some smart fabrics (silk organza) are discovered that are capable of making the electronic circuits which can be used to make the different components of the wearable computers. [18]

7 Future work and Conclusion

Researchers at MIT are designing a wearable brain scanner system called Brainput that tries to sense the situation of your brain when brain is trying to do multiple works at the same time. This system and their results are recently presented at Computer Human Interaction Conference in Austin Texas. [19]

Wearable computing will reduce the load of carrying mobile phones; calculators, laptops .It will reduce the man power as well as time consumption and save the cost of working. In this paper I describe almost all the industries which are currently using the wearable computing products. A number of researches are going on to make the human life more comfortable by the use of wearable computing. It is futuristic vision of technology that will change the way of performing different tasks in daily life and will involve the computing devices in the human life as easily as a wearable clothe.

References

[1] [IBM SYSTEM JOURNAL, vol 35, pp.3 -4, 1996] human powered wearable computing by: T .Starner

[2] http://www.eyetap.org/wearcam/icwc98/keynote.html

[3] "Augmented Reality Through wearable computing" MIT Media Lab TR No 397 by T. Starner, S.Mann

[4] http://www.patentbolt.com/2012/05/google-reveals-video-glasses-working-with-magic-rings-invisible-tattoos.html

[5] "Hands-On RFID: Wireless Wearable's for Detecting Use of Objects "by Kenneth P.fishkin Matthai Philipose and Adam Rea.

[6] "Wearable Technology for Crime Scene Investigation, "Chris Baber and his colleagues.

[7] Military applications of wearable computers and augmented reality by CC Tappert, A.S.Ruocco and others

[8] http://www.armytechnology.com/projects/land_warrior/

[9] http://www.bluestar-eu.com/lxe/Datasheets/ENG/DataSheet.HX2.UK.pdf

[10] Vocollect Incorporated, www.vocollect.com

[11] "A platform for wearable physiological computing", by Astro Teller from BodyMedia, Inc., 4 Smithfield St, Suite 1200, Pittsburgh PA 15222, USA

[12] http://www.informationweek.com/news/galleries/healthcare/mobilewireless/240000353?pgno=1

[13] "Improving sports performance with wearable computing" by Prof. Dr. Jan Borchers ,Emanuel Angelescu and Florian Reske , RWTH Aachen University, Media Computing Group

[14] "Killer App" of Wearable Computing: Wireless Force Sensing Body Protectors for Martial Arts by Ed H. Chi, Jin Song, Greg Corbin

[15] "A Case Study: Using The Wearable Computer In The Construction Industry" by Scott Fuller, Zhihui Ding, and Anoop Sattineni.

[16] "Electronic Textiles: Wearable Computers, Reactive Fashion, and Soft Computation " by JOANNA BERZOWSKA , Textile, Volume 3, Issue 1, pp. 2–19

[17] http://www.gzespace.com/gzenew/index.php?pg=thermaltech&lang=en

[18] "Smart Fabric or wearable clothing" by E.Rehmi Post and Margaret Orth , MIT Media Library.

[19] "Wearable Brain Scanner Tells Your Computer When You're Overwhelmed " IEEE Spectrum May 2012