Wearable Computer Applications
A Future Perspective

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Abstract— Wearable Computer, a sub branch of Mobile computing devices, means the computing device which we can wear on our body. Now a day's cell phones are the most powerful and day to day need of any human being. If we think about the past, we were doing our computing work manually. After the invention of basic calculator and further computers our most of work that we are doing will be with the help of computers. In its ancient age of computers the size of computers was too much big such that it occupies a space of approx two rooms. After invention of Integrated Circuits its size becomes much small. In the middle era of computers we were using desktop computers which can be fitted on a small desk. At present we are using Laptops and Smartphone, which helps us to do our computing task anywhere. We can take these computing devices with us everywhere. In other words we can say that we can carry our office with us. The new era that we are seeing in past few years or that we will see in next few years is the era of Wearable Computers. Spy camera, Spy voice and video recording device, watch with computer, Spectacles with computing capabilities are few examples of this kind of devices. This paper presents wearable computers with its history, present and perspective of its future and its hazards.

Index Terms— Wearable Computers, Wearable Computer Applications, Wearable Devices, Wearable Devices Hazards

I. INTRODUCTION

The term wearable computer is a computing device which is small and light weight so that it can be worn on our body. When we talk about the word mobile computing, it gives us the first picture of Cell phone in our mind. Now a day's cell phones are the most powerful and fulfill day to day need of any human being. If we think about the past, we were doing our computing work manually. After the invention of basic calculator and further computers our most of work that we are doing will be with the help of computers. In its ancient age of computers the size of computers was too much big such that it occupies a space of approx two rooms. After invention of Integrated Circuits its size becomes much small. In the middle era of computers we were using desktop computers which can be fitted on a small desk. At present we are using Laptops and Smart phones, which helps us to do our computing task anywhere. We can take these computing devices with us everywhere. In other words we can say that we can carry our office with us. The new era that we are seeing in past few years or that we will see in next few years is the era of Wearable Computers. Unlike a laptop or a palmtop,

wearable computer is constantly turned on and interacts with the real-world task. The major difference between a typical wearable computer and Laptop or palmtop is wearable computer can be powered through battery or even it can be human powered. Any human being can carry it on a belt or in a jacket. The display would be with a head mounted unit. Typically the input is either voice driven or with wireless wrist mounted devices. The data storage is local and does not depend on any network connection. The hardware and software used in this type of computer depends on its usage. Developing wearable computing requires as much attention to the medium as the message. Wearable computing may be described as the pursuit of an interface ideal – that of a continuously-worn intelligent assistant that augments the wearer's memory, intellect, creativity, communication skills, physical senses, and physical abilities [1]. Wearable computers often perform background tasks such as providing reminders, capturing information or experience, and retrieving time-sensitive information in support of the user. The wearable computer provides us various benefits like hands-free, heads-up operation with complete mobility and large computing power. With the help of wearable computing any person can communicate with their enterprise information systems without interrupting his / her routine work. As mostly wearable computer comes with voice driven system or touch screen display to give input, it becomes very easy to handle various responsibilities while doing other routine work. The user may be at work or in transit or at home, wearable computers could enable users to maintain communication with company computers through direct connection or Internet. These devices bring a whole new concept in mobile computing by offering the ultimate in PC portability. Much like conventional hand held and palmtop computers, wearable computers can upload and download data and software from various systems to desktop PCs. With the help of wearable computers, workers on the site or at the time of doing his / her tasks can have the full functionality and connectivity of workers sitting at a desktop PC. We have to keep in mind that all wearable computers are not equal. All wearable computers do not have same performance and capabilities. In this paper we start with the history of wearable computers and further we discuss various applications of wearable computers and at last we will see what will be the future perspective of wearable computers. The idea during a time was to have a full, wearable mechanism shade that could be used for entertainment,

gaming and even work applications. If we had to select between a smartwatch or a glasses/goggle-like form factor, I'd opt for a smartwatch. It replaces an appendage that many already wear today, so there is no new function to be learned. Second, there are a series of other inclination out there, like Nike's (NKE) Fuelband that could make for a good transitory product to a smartwatch. Better yet, how about a smartwatch with Fuelband inside. Now that's a product that I'd like to have. From an financier perspective, if we had to demeanour for a approach to play this intensity product difficulty it would be by a supply chain. In other words, "buy bullets, not a guns."[12]

II. HISTORY

Due to the varied definitions of "wearable" and "computer", the first wearable computer could be as early as the first abacus on a necklace, a 16th century abacus ring, the first wristwatch made by Breguet for the Queen of Naples in 1810, or the covert timing devices hidden in shoes to cheat at roulette by Thorp and Shannon in the 1960s and 1970s. [2]

Table 1 : History of Wearable Computing

Year	Description
1268	**Invention of eyeglasses:** Roger Bacon has made first the lenses for optical purpose. On the other hand in China and Europe reading glasses were already used.
1665	**Augmented senses:** Robert Hooke has inserted artificial organs to the natural which improve our other senses of hearing, smelling, tasting, and touching."
1762	**Pocket Watch:** John Harrison has invented first practical marine chronometer to determine longitude at the time of travel through ship.
1907	**First wrist watch:** Alberto Santos-Dumont, who was working as pilot has given idea to famous jeweler Louis Cartier to create a time piece so that he can keep his hands free for piloting.
1945	**Memex Device Proposal :** Vannevar Bush has proposed for a memex device which will work like any individual can store all his books, and communication so that it can be available with the person at anytime and anywhere.
1960	**Head mounted stereophonic television display :** Heiling has presented the idea of virtual reality simulator with handle bars, binocular display, vibrating seats, stereophonic speakers, cold air blower, and a device close to the nose that gives us effects of virtual reality [4]
1966	**First wearable computer use to predicate roulette wheels :** The system was a cigarette-pack sized analog computer with 4 push buttons. A data-taker would use the buttons to indicate the speed of the roulette wheel, and the computer would then send tones via radio to a bettor's hearing aid. [5] [6]
1966	**First computer based head mounted display:** Sutherland created a tethered HMD using two CRTs mounted beside each of a wearer's ears, with half-silvered mirrors reflecting the images to the user's eyes. Another system determined

Year	Description
	where the user was looking and projected a monoscopic wireframe image such that it looked like a cube was floating in mid-air. The bulk of the system was attached to the ceiling above the wearer's head, earning the system the nickname "Sword of Damocles.
1967	**Bell Helicopters :** Bell Helicopter Company performed several early camera-based augmented-reality systems. In one, the head-mounted display was coupled with an infrared camera that would give military helicopter pilots the ability to land at night in rough terrain. An infrared camera, which moved as the pilot's head moved, was mounted on the bottom of a helicopter. The pilot's field of view was that of the camera.
1967	**Analogue wearable computer with eyeglass-mounted display to aid lip reading :** Hubert Upton has designed an analogue wearable computer which will work as an aid for lip-reading. Using high and low-pass filters, the system would determine the words spoken by the person. An LED mounted on ordinary eyeglasses illuminated to indicate the phoneme type. The LEDs were positioned to enable a simple form of augmented reality; for example, when a phoneme was voiced the LED at the bottom of the glass illuminated, making it seem as if the speaker's throat was glowing.
1968	**One Handed Keyboard :** Douglas Engelbart has demonstrated one handed keyboard for word processing, outline processing shared documents, email filtering etc. in Fall Joint Computer Conference on Dec. 8, 1968
1972	**Digital Camera :** Alan Lewis has used a radio link data taker and gives better performance.
1977	**Wearable Camera :** After 10 years of research C.C. Collins of the Smith-Kettlewell Institute of Visual Sciences developed a five pound wearable with a head-mounted camera which was used by the blind persons. [8]
1977	**Calculator Watch :** Hewlett-Packard has launched 28 keys calculator on the watch. It also has the facility of Date, Time, Alarm, and Memory.
1978	**Digital Wearable Computer in a shoe :** Eudaemonic Enterprises developed a wearable computer using CMOS 6502 microprocessor with 5K RAM. This is the only machine with toe-control and inductive radio communications with between a data taker and better. This is the only known roulette machine of the time to show a statistical profit on a gambling run, though they never made the "big score." [9]
1979	**Walkman :** Sony introduces the Walkman, a commercial wearable cassette player.
1981	**Backpack-mounted computer to control photographic equipment :** While still in high-school Steve Mann wired a 6502 computer (as used in the Apple-II) into a steel-frame backpack to control flash-bulbs, cameras, and other photographic systems. The display was a camera viewfinder CRT attached to a helmet, giving 40 column texts. Input was from seven

Year	Description
	micro switches built into the handle of a flash-lamp, and the entire system (including flash-lamps) was powered by lead-acid batteries.
1983	**Toe operated computers :** In 1983, Keith Taft was selling Z-80 based shoe-computers with special software for card-counting in blackjack.
1986	**Bicycle with on-board computer and chording keyboard :** In 1986 Steve Roberts builds Winnebiko II which is bicycle with on-board computer.
1990	**Demonstration of first electronic notebook :** The IBM/Columbia Student Electronic Notebook Project used Toshiba diskless AIX notebook computers (prototypes) using direct sequence spread spectrum radio links to provide, the providing all the usual TCP/IP based services, NFS mounted file systems, X windows and a stylus based input systems + virtual keyboard, and running the Andrew environment. [10]
1991	**First Hip-PC :** Doug Platt's system was a shoebox-sized computer based on the Ampro "Little Board" XT module. The screen was a Reflection Technology Private Eye display and the keyboard was an Agenda palmtop used as a chording keyboard attached to the belt. It included a 1.44 megabyte floppy drive.
1991	**Wearable computer to view blueprint data :** Students in a Summer-term course at Carnegie Mellon's Engineering Design Research Center developed the VuMan 1, a wearable computer for viewing house blueprints. Input was through a three-button unit worn on the belt, and output was through Reflection Tech's Private Eye. The CPU was an 8 MHz 80188 processor with 0.5 MB ROM.
1993	**First wearable computer with GPS system:** BBN's Pathfinder system was completed in Fall 1993, and included a wearable computer, Global Positioning System (GPS), and radiation detection system.
1993	**KARMA augmented reality system in Columbia:** Steve Feiner, Blair MacIntyre, and Dorée Seligman at Columbia University developed **KARMA:** Knowledge-based Augmented Reality for Maintenance Assistance. Users would wear a Private Eye display over one eye, giving an overlay effect when the real world was viewed with both eyes open. KARMA would overlay wire frame schematics and maintenance instructions on top of whatever was being repaired. For example, graphical wire frames on top of a laser printer would explain how to change the paper tray. The system used sensors attached to objects in the physical world to determine their locations, and the entire system ran tethered from a desktop computer.
1994	**"Forget-Me-Not," a continuous personal recording system :** The Forget-Me-Not was a wearable device that would record interactions with people and devices and store this information in a database for later query. It interacted via wireless transmitters in rooms and with equipment in the area to remember who was there, who was being talked to on the telephone, and what objects were in the room, allowing queries like "Who came by my office while I was on the phone to Mark?"
1994	**Wrist computer with half QWERTY keyboard :** Edgar Matias and Mike Ruicci of the University of Toronto, has demonstrated this "wrist computer" which gives an alternative approach to the emerging HUD + chord keyboard wearable. The system was built from a modified HP 95LX palmtop computer and a Half-QWERTY one-handed keyboard. With the keyboard and display modules strapped to the operator's forearms, text could be entered by bringing the wrists together and typing.
1994	**Transmitting images from head mounted camera to Web :** In December 1994, Steve Mann developed the "Wearable Wireless Webcam." Webcam transmitted images point-to-point from a head-mounted analog camera to an SGI base station via amateur TV frequencies. The images were processed by the base station and displayed on a webpage in near real-time.
2002	**Wearable computer in neck less form :** In 2002, as part of Kevin Warwick's Project Cyborg, Warwick's wife, Irena, wore a necklace which was electronically linked to Warwick's nervous system via an implanted electrode array. The color of the necklace changed between red and blue dependent on the signals on Warwick's nervous system. [11]
2002	In 2002 Panasonic introduced a wearable brick computer coupled with a handheld or arm worn touch screen.
2005	On 5 Jaunary, 2005 Fossil Wrist PDA which was running on palm OS was available in the market
2009	The W200 wearable computer from Glacier Computer was introduced in 2009
2010	Sony has launched Android compatible wrist watch called as Sony Smart Watch
2013	Apple has launched iWatch – which is wearable computer can be wear on wrist and can work as full flagged mobile phone
2013	Google is also planning to release its new product in wearable computing market. The product will be named as Google Glass.

Fig 1: Sony Smart Watch
(Source: www.ubergizmo.com)

Fig 2: Apple i-watch
(Source: www.telegraph.co.uk)

Fig 3 : Google Glass

III. APPLICATIONS OF WEARABLE COMPUTERS

Wearable computers can be used in many applications. In wearable computer user's skin, hands, voice, eyes, arms as well as motion or attention are actively engaged as the physical environment. Various application areas of wearable computers are as follows:

(1) Augmented Reality
(2) Behavioral Modeling
(3) Health Care Monitoring Systems
(4) Service Management
(5) Smart phones
(6) Electronic Textiles
(7) Music Player through Eyeglasses
(8) Fashion Designing
(9) Military Services

IV. FUTURE OF WEARABLE COMPUTERS

In future Wearable computers will have a very much big market because now a day's people want much small components in computing devices. In future many wearable computers are used to cure so many medical diseases. In military also wearable computers are useful to search hidden things from enemies. In entertainment world wearable computers will give us improvement in music players, Computer Games etc. There may be wearable gloves or shoes which will handle game objects. In future wearable computers can be used in following forms:

(1) Smart Fabric work as Wearable Computers
(2) Garments need not to be washed

(3) Shapes and colors of clothes can be changed as per our wishes
(4) People can create clothes that can sense and react to environmental conditions.
(5) Fitness trackers, like the Amiigo, are available with sensors which helps us take control of our health.
(6) It will show the results on our hand held devices and with that we can respond to the health system whenever needed.
(7) For example a wearable computer like The Zeo headband, will help us know how well we have taken our sleep.
(8) Light up the neck tie.
(9) With the help of neck tie, a music player can also be connected which shows LED lights to be up-down according to music.
(10) GPS unit can be attached with clothes to find way when you are new in the city.
(11) Even google glass is not in the market, there are Tons of applications are already developed for it. It shows the future of Wearable computers.

V. HAZARDS

Technology has made major advancement the IT field especially. Computers have now been made portable and even wearable all in a bid to make their use more convenient for users. Wearable computers have proven to be useful in different fields such as medicine or even construction. However, wearable computers also come with a couple of hazards.

Expensive: Wearable computers are one of the most sophisticated pieces of technology existing today. Sophistication comes with expense as it requires high levels of technology to come up with wearable computers making the end product price high and unaffordable to many. In the case of a construction company, wearable computers have the potential to increase efficiency but are undermined by the high costs of setting up local area networks, LANS, which would aid in the synchronization of data.

Heavy: Wearable computers can be quite heavy. This is due to the many components one has to attach to the body. A wearable computer, like any other computer, requires a Central Processing unit, CPU, as well as a monitor and peripheral devices that enable the input of information into the computer. Where these components are separate from each other, they can be tedious to wear and constantly carry around. The computer can also be quite heavy if all these components are built into the wearable computer.

Discomfort: During hot weather or high energy activities, wearable computers tend to irritate the user or wearer. This is because the computer emits its own heat despite its inbuilt cooling system, and the users too emit heat due to the daily activities they are engaged in. Like regular computers, wearable computers also tend to leave users with a slight headache as a side effect from their prolonged use.

Security: Wearable computers can be openings for

security breaches if left unattended. Whether personally or commercially used, wearable computers could easily be hacked by anyone as they are exposed to everyone you meet during the day. In the case of organizations, wearable computers are connected to the company's server to enable easier communication between individuals out in the field and their counterparts in the office. If left unattended or unsecured, wearable computers provide anyone interested in retrieving information about a person or an organization with an opportunity to do so and use this information to either steal company or personal secrets. Major effects that are harmful to the human being by using wearable computers are users may find that they experience side effects such as headaches and difficulty sleeping.

VI. CONCLUSION

In this paper we have tried to give some idea about the past, present and future of Wearable computers. We are dam sure that if in any area wearable computer technology is applied then it will definitely improve the quality of life and make day-to-day life easier. It is only our imagination which will limit the number of applications for this new emerging technology. Wearable computer is a platform for the rapid application development. On the other hand, as we know that there are two sides of a coin, here as the benefits are there of wearable computers we do have to take care about various hazards discussed in the paper.

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