An insight into the world of Wearable Computing

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Abstract - Wearable Computing is a discipline devoted to exploring and creating devices that can either be worn directly on the body, or incorporated into a user's clothing or accessories. Wearable computers are very personal computers that can be worn on the human body. This small, fast and convenient computer can be worn as a piece of clothing or eyeglasses, and can interact with people based on the various contexts of communication. Wearable computers bring a new level of digitization into everyday life. Unlike a laptop or a PDA, a wearable computer follows us around, and merges into our style of living and everyday interactions. A wearable computer is a computer that is incorporated into the personal space of the user, controlled by the user, and has both operational and interactional constancy i.e. is always on and accessible. This paper aims at studying the growth and emerging trends of wearable computing. Further, the paper also tries to throw light on the pros and cons of incorporating this emerging technology as 'wearables'.

Index terms- Digital Eyeglasses, Latest Trends, Smart Clothing, Wearable Computers.

I.   INTRODUCTION

Wearable computing is the study or practice of inventing, designing, building, or using miniature body-borne computational and sensory devices. Wearable computers may be worn under, over, or in clothing, or may also be themselves clothes (i.e. "Smart Clothing" (Mann, 1996a)).

One of the principles of this evolution is that technology is getting smaller, faster, cheaper, and more powerful every day. In fact, in terms of physical size, computing technology is becoming 100 times smaller each decade. The computing power of the ENIAC computer that filled a whole room back in 1956 now fits inside the tiny chip of a "musical greeting card".

These computers can multi-task as a communication device, a recorder and a reference device. They support instant communication, records visuals or audios and helps collecting local or remote resources while the users are doing other physical movements. Consistency is also emphasized in the features of a wearable computer. A constant interaction associates wearable computers and its users with the facility that people don't need to turn the computer on or off.

II.   HISTORY OF WEARABLE COMPUTERS

Today, computers go everywhere with its users. Devices, such as pen drives, mobile phone, laptops, palmtop, and compact disk player are portable. But some of them are not small enough to be seamlessly wearable. A wearable computer should be comfortable, intelligently and continuously. Mann Steve describes the wearable like smart clothes.

Wearable Computers were first introduced in the 1500's with the pocket watch. The first wearable computer that fits into the 20th century image was a computer designed to predict Roulette Wheels, this was invented in 1961by Mr. Edward O Thorpe [7]. A data tracker hidden in his shoes would track the speed of the Roulette Wheels and the computer would indicate what to be take care about it.

In 1967, Hubert Upton developed a technology which allowed the person wearing the glasses to read lips; this was using the LED device. Even in the 1980's and the 1990's wearable computers were being created. Many people think that wearable computers can now be taken full advantage of as the technology has developed over the years and the wearable computers can now become more comfortable to wear and it will not be in the case of devices hanging of the persons clothes.
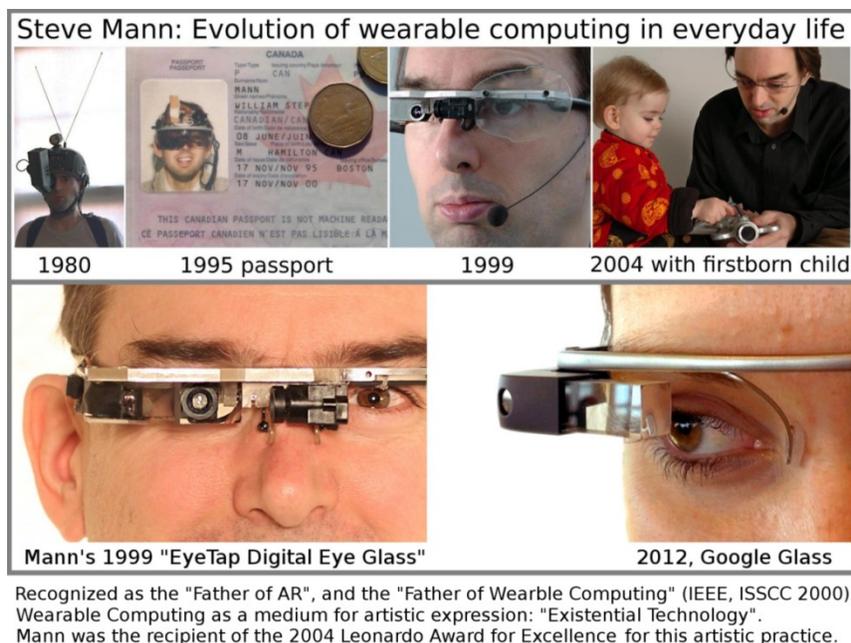
Figure 1: Evolution of Wearable Computing.

According to studies, the generation-4 glass was completed in the year 1999. The eye itself is the camera. This is why the 'Digital Eye Glass' is also known as the 'GlassEye', *(Figure. 1)* This eliminates long-term dizziness, vertigo, and flashback effects that can otherwise persist long after the Glass is removed. In Google Glass, the camera is on one-side of the eye which classifies itself to Generation -1 Glass [2].

Further, Mann's project **EyeTap Digital Eye Glasses** incidentally bears a striking resemblance – both aesthetically and functionally – to those produced by Google Glass. According to Mann, these EyeTap Glasses can be fixed to Mann's skull and connect to the user's brain via a BCI. This allows the user to record a permanent visual log of one's life – called 'Lifelogging'.

The other prominent developer of wearable computing devices is Thad Starner, who worked with Mann in the Wearable Computing Group at MIT's Media Lab. Starner began wearing his computer in 1993. Starner's personal wearable computer is based on a pair of black-rimmed glasses that are similar to Mann's, however Starner's model is an optical vs. a video-driven display.

In the 1990s, MIT researchers Thad Starner, Bradley Rhodes, and Steve Mann were the cyborg pioneers of wearable computing, augmenting their bodies with backpack computers, handheld keyboards, cameras, and eyeglasses embedded with displays. Today, due to continued miniaturization and ubiquitous wireless networking, wearable computing has emerged from the laboratory in the form of Google Glass, Sony's smartwatch, fitbit and a number of other body-worn sensors.

First generation wearable computers were plagued by bulky hardware, buggy software and short battery life making any comfortable use impossible. Nonetheless, much of the interesting discussions on the theory of wearables occurred while the hardware was still very much under development. At Georgia Tech, Tad Starner considered the future of wearables in a text on wearable computing, published in 2001 [1].

Wearable computing is increasingly blending into the fabric of our lives. And in the near future, that fabric will literally be laden with computation.
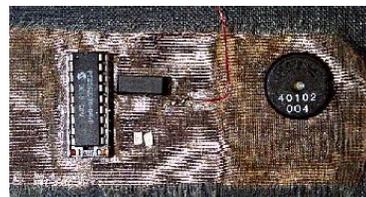
Figure 2: A fabric broadband.

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A wearable computer is expected to stay with its user 24/7 and be of service continuously. To actually achieve this it is necessary to have a constant supply of power. It would defeat the purpose, if it was necessary to charge our wearables every couple of hours. The body consumes energy at a surprising rate. One idea that is being explored is the possibility of this power being stored, providing a constant power supply to the wearable computer. One of the plausible solutions is the use of shoe inserts made of piezoelectric materials like polyvinylidene fluoride (PVDF). These can be used to recover some of the power in the process of walking. Research done at IBM indicates that 5W of electric power can be generated by a 52 kg user walking at a brisk pace [3].

With heads-up displays, unobtrusive input devices, personal wireless local area networks, and a host of other context sensing and communication tools, the wearable computer can act as an intelligent assistant, whether it is through a Remembrance Agent or augmented reality (e.g., allow architects to build virtual houses or intellectual collectives) [6].

III. THE LATEST TRENDS OF WEARABLE COMPUTING

➢ The nascent field of e-textiles enables sensors in the form of fabrics to be woven into clothing. They can do things such as predict motion and sense body and environmental changes. In the future, wearable garments will be prevalent. One will be able to wash them!!

➢ The pebble watch downloads apps and connects to Android or iPhone smart phones via Bluetooth.

➢ The motoactv is a wearable apparatus for athletes that track heart rate, cadence and other parameters. Accessories can provide GPS and other functions.

➢ The Neptune Pine is a smart watch that can send and receive voice calls, browse the Web, check email and perform other functions usually done by smart phones.

➢ Oculus Rift is a total immersion goggle platform that enables users to step into virtual reality games.

➢ FYiiii is a wearable sensor, the size of a few stacked quarters that gives an assured push to users for important reminders and smartphone notifications immediately and discreetly. It is also available to app developers with the 4iiii API. FYiiii is perfect for people who miss notifications and phone calls because their ringer is off or can't be heard. FYiiii enables users to be reached even when for instance a phone ringer is muted inside a purse or backpack. Whatever notifications you receive on your smartphone can be selected and pushed to FYiiii: calls, texts, calendar appointments, Facebook and Twitter notifications. Notifications can even tell you when a timer elapses [5].

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Figure 3: Wearable Computing: Competition Analysis. (Source: Recorded Future).

IV. ADVANTAGES OF WEARABLE COMPUTERS

- It helps in better and enhanced communication.
- Wearable Computers can be used to recognize a person in a high alerted area such as an airport.
- A personal Wearable will facilitate the wearer's needs.
- Unlikely to be dropped or lost as there are embedded to the clothes as opposed to the handheld devices.
- Able to use wearable computers to complete daily tasks such as a computer which tracks the movements and habits of a person.
- It is flexible in use.
- Work from anywhere.
- Makes tasks more comfortable such as Wearable Computers can be used by Surgeons (a Wearable Computer attached to their arms),which can allow data to be transferred to their computers, this can save time where the surgeons can look at the wearable for information, this will help improve the efficiency of an operation.

To add to the advantages, many standard applications such as word processors, scheduling packages, and networking software will find new uses when put on a wearable. Wearable computers can be used anywhere a notebook computer would be used, with one big advantage: you don't need a table to put them on. This makes standard applications available to people who can't work at a desk [4].

V. DISADVANTAGES OF WEARABLE COMPUTERS

- The equipment could be heavy.
- The cost is on the higher side.
- Wiring problems may interfere with the normal working conditions.
- User can be irritated due to heat dissipated from the equipment.
- There are chances of health related side-effects such as Headaches, body ache.

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- Wearable Computers can invade privacy.
- Can be used to gain an unfair advantage over others such as Casinos.
- It can be easily tracked.
- It may become easier to get data about an individual if the item is lost /stolen.

VI. CONCLUSION

As with the desktop computers, there are many diverse applications for wearable computers. Though the wearable has not seen the widespread acceptance given to the desktop, work continues to meet the challenges that inhibit its growth. User interfaces need to become more intuitive and easy to learn and use; processors and sensors need to be effectively integrated into textiles; and displays, whether head or body mounted, need to be effective under a wide range of lighting conditions - all of these must be comfortable to wear and unobtrusive.

The future of computing and microchips lies in wearable technology. Wearable computers have extensive use in the army, medicine, mining, oil and gas and just about 'anywhere'. With the touch of a finger, pictures and videos can be transferred unchanged from a computer to any smooth surface like that of a bowl, table, or wall. Wearable computing may definitely be the largest technological advancement of the century.

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