1. INTRODUCTION

A wearable computer is a computer that is subsumed into the personal space of the user, controlled by the user, and has both operational and interactional constancy, i.e. is always on and always accessible. Most notably, it is a device that is always with the user, and into which the user can always enter commands and execute a set of such entered commands, and in which the user can do so while walking around or doing other activities. This transformation allows it to be worn constantly, with the goal of becoming a seamless extension of body and mind, equipped with various sensors which measure heart rate, respiration, footstep rate etc, and can help in body maintenance. The ‘wearable computer’ apparatus is embedded within nontransparent clothing which provides shielding.

Electronic circuits are built entirely out of textiles to distribute data and power and perform touch sensing. The most salient aspect of computers, in general, (whether wearable or not) is their reconfigurability and their generality, e.g. that their function can be made to vary widely, depending on the instructions provided for program execution. With the wearable computer (Wear Comp), this is no exception, e.g. the wearable computer is more than just a wristwatch or regular eyeglasses: it has the full functionality of a computer system but in addition to being a fully featured computer, it is also inextricably intertwined with the wearer. This is what sets the wearable computer apart from other wearable devices such as wristwatches, regular eyeglasses, wearable radios, etc.

Unlike these other wearable devices that are not programmable (reconfigurable), the wearable computer is as reconfigurable as the familiar desktop or mainframe computer.
2. HISTORY

The concept of wearable computing was first brought forward by Steve Mann, who, with his invention of the ‘Wear Comp’ in 1979 created a pioneering effort in wearable computing. Although the effort was great, one of the major disadvantages was the fact that it was nothing more than a miniature PC. Absence of lightweight, rugged and fast processors and display devices was another drawback.

The 1980s brought forward the development of the consumer camcorder, miniature CRTs etc. brought forward the development of the eyeglass mounted multimedia computer. With the advent of the internet and wireless networking technologies, wearable devices have developed a great deal.

After its invention wearables have gone through 18 generations of development, with research going on at prestigious institutions like MIT, Georgia Tech and Carnegie Mellon University.
3. DISCUSSION

3.1 OPERATIONAL MODES

There are three operational modes in this new interaction between human and computer.

- **Constancy:**

  The computer runs continuously, and is ‘always ready’ to interact with user. Unlike hand-held device, laptop computer, or PDA, it does not need to be opened up and turned on prior to use. The signal flow human to computer to human, runs continuously to provide a constant user interface.

![Fig (1): constancy](image)

- **Augmentation:**

  Traditional computing paradigms are based on the notion that computing is the primary task. Wearable computing, however, is based on the notion that computing is NOT the primary task. The assumption of wearable computing is that the user will be doing something else at the same time as doing computing. Thus the computer should serve to augment the intellect, or augment the senses.
• **Mediation:**

  Unlike hand held devices, laptop computers, and PDAs, the wearable computer can encapsulate us. It doesn’t necessarily need to completely enclose us, but the concept allows for a greater degree of encapsulation than traditional portable computers.

  There are two aspects to this encapsulation:

  (i) **Solitude:**

  It can function as an information filter, and allow us to block out material we might not wish to experience, whether, it be offensive advertence or simply a desire to replace existing media with different media in less severe manifestations, it may simply allow us to alter our perception of reality in a very mild sort of way.

  (ii) **Privacy:**

  Mediation allows us to block or modify information leaving the encapsulated space. In the same way that ordinary clothing prevents other from seeing our naked bodies, the wearable computer may, for example, serve as an intermediary for interacting with untrusted systems, such as third party digital anonymous clash “cyber wallets”.

3.2 **ATTRIBUTES**
There are four information flow paths associated with this new Human–
machine synergy. The signal flow paths are, in fact, attributes of wearable
computing, and are described, that follows, from the human’s Point of view:

**UNRESTRICTIVE to the user:**

Ambulatory, mobile, roving “you can do other things while using it”, e.g. you can
type while jogging, etc.

**OBSERVABLE by the user:**

It can get your attention continuously if you want it to. Almost always
observable. Within reasonable limitation (e.g. that you might not see the screen while
you blink or look away momentarily) the output medium is constantly perceptible by
the wearer.

**CONTROLLABLE by the user:**

It means responsive to the user. You can grab control of it at any time you
wish. Even in automated processes you can manually override to break open the
control loop and become part of the loop at any time you want to. (E.g.: A big Halt
button you want as an application mindlessly opens all 50 documents that were
highlighted when you accidentally pressed “Enter” would make a computer more
CONTROLLABLE.)

Infinitely-often-controllable means the constancy of user-Interface results
from almost-always observability and infinitely-often controllability in the sense that
there is always a potential for manual override which need not be always exercised.

**COMMUNICATIVE to others:**

It can be used as a communications medium when you want it to.

3.3 PROPERTIES
The five properties for a wearable computer are given below:

- **CONSTANT:**
  
  Always ready. May have “sleep modes” but never “dead” Unlike a laptop computer which must be opened up, switched on, and booted up before use, it is always on and always running.

- **PERSONAL:**
  
  Human and computer are inextricably intertwined.

- **PROSTHETIC:**
  
  You can adapt to it so that it act as a true extension of mind and body. After some time you forget that you are wearing it.

- **PRIVATE:**
  
  Others can’t observe or control it unless you let them. Others can’t determine system status unless you want them to, e.g. clerk at refund counter in department store where photography is prohibited can’t tell whether or not you are transmitting wireless video to a spouse for remote advice, in contrast to camcorder technology where it is obvious you are taking a picture when you hold it up to your eye.

- **EXPRESSIVE:**
  
  Allows the wearable to be expressive through the medium, whether as a direct communication medium to others, or as means of assisting the production of expressive media.
4. DIGITAL FABRIC

Cotton, polyester or rayon don't have the needed properties to carry the electrical current needed for digital clothing. However, metallic yarns are not new to the clothing industry. We have seen these metallic fabrics worn to make fashion statements for years. Researchers at MIT's Media Lab are using silk organza, a unique fabric that has been used to make clothes in India at least a century.

Fig (3): Silk Organza

Silk organza is ideal for computerized clothing because it is made with two fibres that make it conductive to electricity. The first fibre is an ordinary silk thread; running in the opposite direction of the fibre silk thread that is wrapped in a thin copper foil. It's this copper foil that gives the silk organza the ability to conduct electricity. Copper is a very good conductor of electricity and some microprocessor manufactures are beginning to use copper to speed up microprocessors. The metallic yarn is prepared just like cloth core telephone wire, according to the MIT researchers. If you cut open a coiled telephone cable, there's usually a conductor that is made out of a sheet of copper wrapped round a core of nylon or polyester threads. These metallic yarns can withstand high temperatures; the yarn can be sewn or embroidered using industrial machinery. This property makes it very promising for mass producing computerized clothing.
A strip of the fabric would basically function like a ribbon of cable. Ribbon cables are used in computers to connect disk drives to controllers. One problem with using silk organza would result if the circuits were to touch each other; therefore MIT scientists use an insulating material to coat or support the fabric.

Once the fabric is cut into suitable shape, other components need to be attached to the fabric, like resistors, capacitors and coils. These components are directly sewn to the fabric. Other electronic devices can be snapped into the fabric by using some kind of gripper snaps, which pierce the yarn to create an electrical contact. These devices can then easily removed in order to clean the fabric.

At Georgia Tech, researchers have developed another kind of thread named as plastic optical fibres and other specialty fibres woven into the fabric. These optical and electrical conductive fibres will allow the wear comp to wirelessly communicate with the other devices, transferring data from the sensors embedded in it.

5. RATIONAL DETAILS

How do you operate a wear comp? What sort of software do you use in it? What do you use it as input and output devices? Where do you Store data? How do
you store them? All these are common questions that would arise in someone new to wear comp below given are brief answers to such common questions.

5.1 SOFTWARE

The commonly used operating system on a wearable computer is WOS (wear comp OS). Red hat and GNU Linux can be run in close coordination as an operating system too. Various software mostly GNU freeware such as GIMP (GNU image modulation program) as well as various calendar and planning programs can be run on a wearable computer.

5.2 HARDWARE

Prices of wearable computers tend to be in "thousands of dollars" whether you buy old or new. An alternative approach is to assemble a low cost system. For example, you can buy an old computer that has NTSC output and connect to small CRT from camera. Some such complete wearable computer systems have been built for as little cost.

5.3 DISPLAY:

A major part of the total cost of the wearable computer system lies in its display unit.

Mainly two types of display are used.

(i) Common portable LCD display

(ii) Head mounted display

Common portable LCD display

FEATURES:

• High resolution colour video image.
• Image that appears in the person's line of sight.

• Viewing angle comparable to viewing a 26" monitor from 2, meters (6.5 Feet) away.

• Ultra light-weight, no major disturbance in the eyesight.

**Head mounted display**

**FEATURES:**

A typical HMD has either one or two small displays with lenses and semi-transparent mirrors embedded in a helmet, eye-glasses or visor. The display units are miniaturised and may include CRT, LCDs, Liquid Crystal on Silicon (LCos), or OLED

![FIG (5): Head Mount Display](image)

**5.4 KEY BOARD**

At the higher end, you can get a "twiddler" from Hand key, or keyboard from info grip. You can connect micro switches that enable you to plug directly into the keyboard port. A combination keyboard that weighs 4 ounces and fits in the palm of your hand. The twiddler 2 is an existing technology of wearable computing.

**5.5 HARD DRIVE**

Many hard drives commonly used in laptop computers can withstand operational shock, it is common to go jogging while editing, and sometimes shoot
momentary video while on horseback or riding a mountain bike down the centre of a
line bumping over every railway tie, and capturing the experience on a hard drive. It
is possible to carry enormous amount of hard drive space on your body. Prof Martin
has 36GB hard drive installed in his wear. One of his waist bag systems contains
2GB of hard drive space and 512MB of RAM.

5.6 BATTERIES OF WEARCOMP

Low cost batteries

Early versions of wear comp used lead acid batteries. Lead acid batteries are
typically available surplus. For constant application you will want to obtain at least
two 12 Volt batteries.

High performance batteries

Li-Ion camcorder batteries are commercially available. A minimum of two batteries is required for constant running 12 Volt batteries.

5.7 VOLTAGE REGULATOR

These are used in order to keep the voltage of Li-Ion batteries constant as output voltage drops significantly, with usage from a full charge. Another reason for constant voltage is that various components of Wear Comp require different voltage

6. APPLICATIONS

Wisely designed technology can properly address the concern for humanistic property, and therefore need not be focused on external control just like taming with a piece of itself. In fact, the fundamental use of wear comp may very well in personal empowerment of the individual. Smart computing will allow us to explore all
potential of many modern technologies and ideas without wanting us to sacrifice freedom or privacy. Instead of current vision of smart floors, smart light switches, smart elevators, smart furniture and other smart technologies that watch us correspond to our actions, what we will witness is the emergence of smart people.

6.1 Mediated/augmented reality: -

It is the ability of the computer to offer enhanced presentations of reality to the user. The application of the augmented reality lies in adding to your perceptual field. To aid in repairing a broken photocopier, an overlay of the internal structure of the photocopier can be put in the repairing person's visual field, and thus can help him in his work.

6.2 MediWear:-

It closely monitors the wearer's body functions and the moment that any one of them becomes critical, the pre-defined medical unit is notified remotely. It is expected that the transmitted signals are internal and they are relayed on to an external source.

![Fig (6): Mediwear](image)

6.3 Smart eyeglasses: -

It would not appreciably obstruct the wearer's vision, or otherwise be encumbering, so that, for example, the wearer could play a competitive game of volleyball wearing the apparatus. It would not look unsightly. Ideally it would not be visible.
6.4 Smart shoes: -

Inside the shoes there is an array of transducers that picks up the impact upon the ground. The shoes supplies the personal worn computer with information about how the feet are impacting on the ground, and this information could be used to control an external process in an intimate manner.

Fig (8): Smart shoes

The fig.8 represents a internet-connected shoes. This shoe equipped with sensors, measure the impact of various parts of the shoe with the ground. This gives the wearer's computer a sense of the pace, so that, for example, joggers might pace themselves with a distant partner connected through wireless communications.

6.5 Smart cards and badges: -
Wearable Computers

Wear Cam is a simple apparatus for effortless capture, display, processing and transmission of visual Imagery. Wear Cam viewfinder goes beyond merely setting the camera correctly. Since the apparatus is worn on an extended period of time, one adapts to it, and it begins to function as a true extension of body. In this way, the viewfinder transcends being just a composition toward allowing the camera to "become" the eye of the wearer. A creative application Wear Cam is in personal documentary. The question of privacy is often raised with respect to Wear Cam. The apparatus suggests that shopkeepers and customers alike, police and ordinary citizens alike, etc. must respect the possibility that they could be caught on camera. With Wear Cam nobody will know whether or not a particular person is wearing a camera, as the present (and future) units are so small that they cannot be detected.

6.6 Safety net: -

A further improvement to the personal safety device includes the use of biosensors where the quotient of heart rate divided by foot step rate. Suppose that someone were to draw a gun and demand cash from the wearer. The likely scenario is that the wearer's hear rate would increase without an increase in the foot step rate to explain it. Such an occurrence would be programmed to trigger "may be I'm in distress" message to other members of the personal safety network. Personal Safety Network ("Safety Net"). In the future, groups of individuals connected together wirelessly might create a virtual small-town global neighbourhood watch to reduce crime.

*Fig (9): Safety Net*
Sensors, which measure heart rate, respiration, foot step rate, and even carry the entire medical history.

6.7 Military Applications:-

The smart shirt project at Georgia Tech was originally financed by the navy, beginning in 1999. At that time the shirt was being designed for soldiers in combat, so that medical personnel could find the exact location of a bullet wound. To pinpoint the location of the bullet penetration, a light signal is continually be sent from one end of the optical fibre to a receiver on the other end. This fibre is also connected to a personal status monitor worn on the hip. If the light from the emitter does not reach the receiver inside the monitor, this signals that the soldier has been shot. The light signal then bounces back to the point of penetration, which helps doctors to find the exact location of the bullet wound.

Fig (10): Smart shirt

7. ADVANTAGES

1. Portability.

2. Hands-free use.

3. Comfortable.

4. Always on for the task it is designed.
5. Quick to access.

6. Fashionable.

7. Functions of clothing will be very personal.

8. The reuse of clothes will be important (prolonged life cycle).

8. **DISADVANTAGES**

1. Equipment can be heavy.

2. Expensive.

3. Some Wearable Computers can consist of a lot of wiring.


5. Side-Effects such as Headaches.
6. It may become easier to get data on an individual if the item is lost / stolen.

9. CONCLUSION

People are carrying more and more electronic products: mobile phones, personal hi-fis, etc. Smart clothing is a combination of electronics and clothing textiles. These intelligent clothes are worn like ordinary clothing and will help in various situations according to the designed application. A piece of clothing works and helps actively to carry out a mission such as drying. A piece of clothing usually dries hanging, it requires a certain time to dry, so this means a passive drying.
Active drying can be accomplished with humidity sensor which notices humidity growing up and puts heating on. Therefore dissipating of water is more effective. Active characters of smart clothing can be heating, Cooling, changing of colour and active drying. Computerized Clothes will be the next step in making computers and devices portable without having to strap electronic gadgets onto our bodies. The intimate nature of clothing is that it is always with us and that we select accord, suggests a new trend or 'smartness' on people.

10. REFERENCES

- www.media.mit.edu/wearables
- www.wearcam.org/personaltechnologies
- www.howstuffworks.com/computerclothing.htm
- www.wearcomp.org/wearcompdif.html
• www.redwoodhouse.com/wearable