Wearable Technology: Overview and It's Market Assessment

Abstract: *In the ancient times, human beings used to do all tasks and functions manually which was tiresome. The invent of basic calculator and computers made the work load on the person lesser and they started becoming dependent on machines. These machines use to occupy large spaces which led to the invent of much smaller size chips known as Integrated Circuits. At present, laptops and Smartphone's have replaced the desktop computers making our work more easy and comfortable. These devices are much portable to carry anywhere giving us more advantage. The technological advances achieved in the past few decades have totally changed the life of the people and even brought the revolution in the business world. The rapid advancement in modern devices has led to an outgrowth of new methods for people to communicate with each other in a convenient way. One such technology which has emerged as a great wave of innovation is Wearable technology. Wearable technology or wearable gadget is a term that refers to computer-powered devices that are worn by the user on body. Wearable technology has opened the way to the innovation and ideas to flow throughout all the fields. Spy cameras, spy voice and video recording devices, watch with computer, and spectacles with computing capabilities are some of the examples of wearable technology which have totally changed the era of digital world. This article presents wearable computers with its history, present and even the future. This article has described the categories of wearable technology, effectiveness of it and its impact on market. The article even describes some of the strengths and opportunities for wearable technology with the weaknesses and challenges faced by the enterprises and the organizations.*

Keywords: *Wearable computers, Emergence of technology, Strengths and opportunities, Weaknesses and challenges, Market assessment, Future of technology*

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I. INTRODUCTION

Many years have passed since invent of the computer took place. They have become more easy to accessible and more portable. New era computers no longer occupy huge spaces rather they can be pocketed and now they can be even worn as fully functional gadget accessories. One such technology which has evolved from the world of innovations is "wearable technology". Wearable technology is a term for computer-powered devices which can be worn by user on the body.

They are also called body-borne computers that have in its core an electronic device that is able to perform calculations and process information. This technology is more advanced than hand-held technology present in the market today because it can offer features of sensory and scanning such as biofeedback and tracking of physiological function [1].

Wearable computing facilitates a new way of communication between the human and computer consisting of body worn computer that is much accessible and ready to use. With voice driven system or touch screen display as input, it becomes very comfortable to handle various responsibilities even doing the routine work. These devices provide more PC Portability by bringing changes in mobile computing. Examples of wearable devices are watches, glasses, contact lenses and many more. Many wearable technologies provide expansion of user's access to information both in terms of speed and convenience. Some of them provide protection to a user from various hazards

The six tests that products must pass for the consideration in the scope of this research which is the need of above mentioned definition of wearable computing are:

Test1 (Wearable) – The user experience should enhanced significantly with these computers wearable for extended time periods

Test 2(Smart) – They should be smart enough to have advanced circuitry and wireless connectivity

Test 3-Access to information services should be constantly provided by them and the user are able to interact with them at any time without any interruption.

Test 4-They should have ability to sense the user's internal state and to provide cognitive support

Test 5-There should be less attention of user to be required in using them and they should even provide security as well as privacy.

Test 6-They should provide consistent interface between automated environment and the user

Wearable computers are useful in applications where computational support is required while the user's hands, voice and eyes are actively engaged with the physical environment. However, the 21st century has replaced the weapons of 18th century with the tool of information. There has been a drastically change in micro-management due to invent of wearable computers.

Operational modes of wearable computing are:

A. Constancy

The computer runs continuously and the user can interact with it anytime. Unlike hand-held devices, they need not to be opened up and turned on before accessing them. Instead the signals flow from human to computer and vice-versa in order to provide consistent user-interface
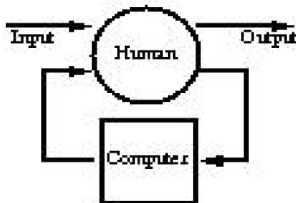

Fig. 1. constancy [2]

B. Augmentation

Traditional computing was based on the principle that the computing is the primary task whereas wearable computing doesn't rely on this principle. Rather their notion is that user can do anything else even doing the computing.
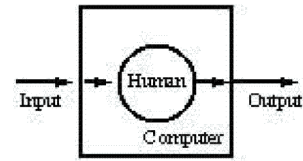

Fig. 2. Augmentation [2]

C. Mediation

Unlike hand-held devices wearable computers do not completely encapsulate us, but there is higher degree of encapsulation than traditional computers.
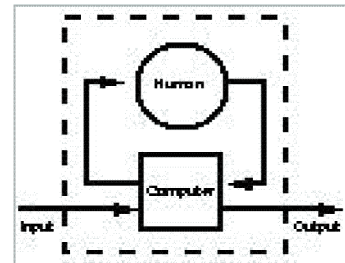

Fig. 3. Mediation [2]

Some Examples of wearable computing:

D. Star Trek

Science fiction which has always depict wearable technology with the help of its popular characters named 'Borg' and 'Geordi laforge'
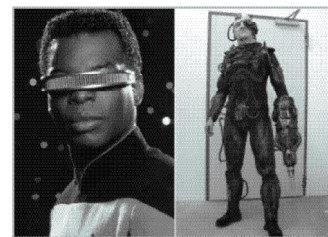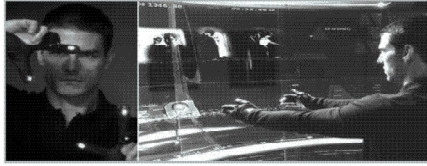

Fig. 4. Popular characters 'Borg' and 'Geordi Laforge' [5]

E. Minority Report

Made in 2002, the film showcases variety of futuristic technology, including various wearable technologies. The most used wearable technology used was the glove controlled interfaced manipulated by actor Tom cruise

Fig. 5. Tom cruise using glove controlled interface[5]

F. Commercial Devices

The best example is wrist-work computers

Fig. 6. wrist-work computer [5]

II. LITERATURE SURVEY

Till now, only the experts with the resources and the knowledge of building customized wearable devices were able to access the wearable devices but later on as the robotics was introduced to the students it started gaining popularity.

This section reviews the existing researches carried out by various researchers.

Smita Jhajharia et al[1] contributed paper "Wearable computing and its applications" which overviews the wearable computing applications from the early aircraft maintenance and military designs to current production models.

Dr Peter Harrop, Mr James Hayward, Raghu Das and Glyn Holland[9] in their work has described about the wearable technology and the current trends in the market.

Shyamal Patel, Hyung Park, Paolo Bonato, Leighton Chan and Mary Rodgers[10] in their work has reviewed about the recent developments done in the field of wearable sensors.

Nate Archer[5] contributed an article "Wearable Computers" describing about the wearable computing with some examples from different fields.

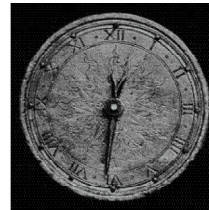## III. EVOLUTION OF WEARABLE TECHNOLOGY

This type of technology is one of the result of innovation in the technology. It might seem like a new concept but it has been a part of ancient times.

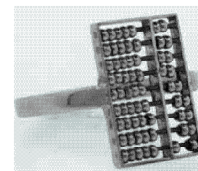### A. The First Wearable Eyeglasses in 1286

It was the first wearable eyeglasses invented in Italy. These glasses gave clear vision to many people in the world.

B. Nuremberg Egg-1510

The first mechanical time device which was invented in Europe and was used as status symbol

C. Abacus Ring-1600

It was invented during China's Qing rule before calculator watch invention.

D. Air Conditioned Top Hat-1800

This wearable technology was used by the Victorians

E. Electric Girl Lightening Company-1890

During this period, New York Times mentioned in its article that " Girls would help to lighten up houses for short duration of time" [3].
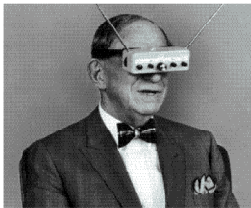
F. Pigeon Camera-1907

This technology was used during the First World War to take aerial photographs behind the lines of enemy.

G. Roulette Shoe-1961

This was an idea of two Mathematicians named 'Edward O Thorp' and 'Claude Shannon' which helped a lot to win at roulette.

H. TV Glasses-1963

Hugo Gernsback invented a small sized and portable television screen impoverished to the face.

I. Pulsar Calculator watch-1975

This was one of the most modern wearable technology which become most popular during that time.

J. Sony Walkman-1979

The first cheap and portable stereo which totally changed the way of listening music and bisecting the unwanted conversations made by public transport.

K. Seiko UC 2000 Wrist PC

This technology not only display the time but also provide up to 2Kb data as a input through a keyboard impoverished to the arm.

L. Private Eye-1989

The features like screen mounted to head seated screen, hand held device, hard drive of 85 mb size and motorbike battery were presented by this device.

M. Levis ICD+Jacket-2000

The jacket was attached with conductible harness used for mobile phone, mp3 player and headphones.

N. Bluetooth headset-2002

This was introduced by Nokia to make hands free calls anywhere and anytime.

O.   Nike+-2006

It was a collaborate device by Nike and Apple which is a fitness tracker tool to view time taken, distance covered and calories burnt during any workout

P.   FITBIT Classic-2008

It is a fitness based wristband to track time taken, distance covered , calories burnt and intensity of activity.

Q.   GOOGLE Glass-2013

This wearable technology was developed by Google and works on Android Platform having optical head seated display.

R.   Solar Powered Jacket-2014

Tommy Hilfiger invent this jacket which consists of solar panels embedded on it .It allows users to charge their phones even if they are on the way.

S.   Apple Watch

The smart watch which act as a tool to track fitness and also has capabilities which are health-oriented.

III. STRENGTHS AND OPPORTUNITIES

A.   Consistency - The computer runs continuously and the user can interact with it anytime. Instead the signals flow from human to computer and vice-versa in order to provide consistent user-interface.

B.   Multi-tasker - Wearable computers are useful in applications where computational support is required while the user's hands, voice and eyes are actively engaged with the physical environment.

C.   Mobility -Wearable devices are body-worn devices make them accessible anytime from anywhere. This property make them portable devices.

D.   Unrestricted Property-These devices has unique property that they enable user to even do other tasks even using them.

E.   Communicative devices-These devices can be even be used as medium of communication whenever required. Even with help of these devices, users can use their enterprise -oriented informatics systems without delaying their routine work

F.   Immediatable-These devices provide with the information quickly and even keep the users updated

IV. WEAKNESSES AND CHALLENGES

A.   Costly-These devices are much more expensive than the hand-held devices as they use high level technologies which make the end product much more costly.

B.   Loss of data accuracy-Any device is successful in the market if it provides with accurate data but this technology didn't provide with accurate data that make them less popular within the users.

C. Uncomfortabality-These devices adds on irritation to the user in the hot and humid conditions leading to many health problems of headache.

D. Small display size-The size screen is so small that the complete information and functions provided by the device is not displayed to the users using it.

E. Privacy and security problems-The privacy and security holes in these devices is one of the serious matter for the users.Even the Bluetooth facility provided by wearable devices also have some security issues.

V. MARKET ANALYSIS

The market of wearable technology is expanding with a high rate gradually. There is the expectation of crossing the business of US$8 billion by the end of 2018 with CAGR increasing by 17.7% from the year 2013 to 2018 widely in the world.
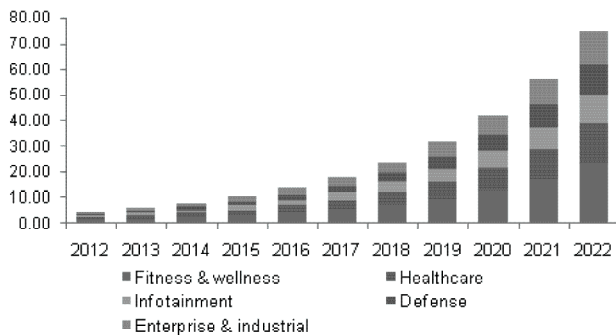

Fig. 7. Wearable Technology Market Analysis-Size, Share, Growth, Trends and Forecasts To 2022[7]
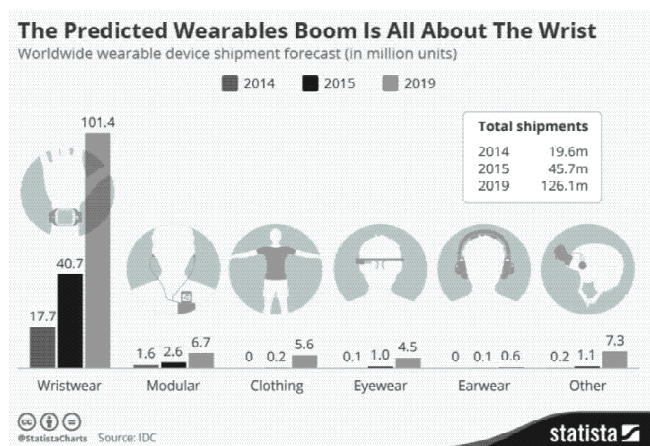

Fig. 8. Prediction of wearables[8]

Wearable devices do have wearable sensors embedded in it which captures body activities like blood pressure,heartbeat etc attracting the health industry[4]. The use of wearable sensors is increasing due to growth in health industry and people awareness towards health and fitness. The wearable devices used in the defense area are smart glasses and smart clothing.

There are many big names associated with new developments occurring in wearable devices such as Apple, Accenture, Nike, Samsung and may more.
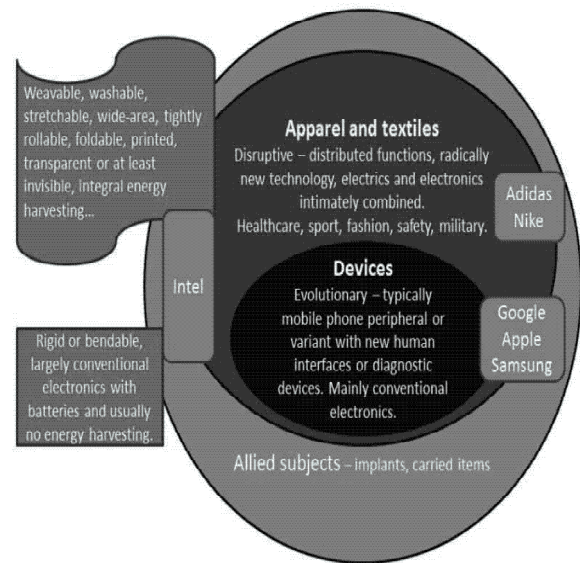

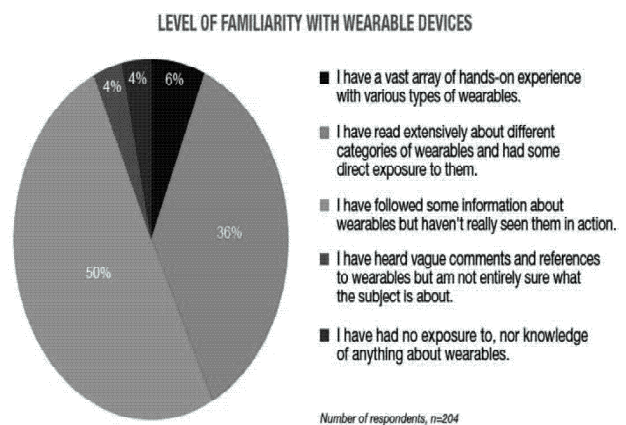**Fig. 9. The two main types of wearable technology and their typical characteristics[9]**

Fig. 10. Level of familiarity with wearable devices [6]

VI. FUTURE OF WEARABLE TECHNOLOGY

When it comes to new period of wearable computers, both startups and big companies are experimenting new features and developments. The main goal of wearable

technology is to design stylish and invisible wearable devices which leading to much competition in the market.

Technologies which are on arrival are Apple testing iWatch, iRing, S6 Golf Watch, Wrist Gear,Sony Smart Band, 3 High-Tech Eye Glasses, Google Glass, Bluetooth Ring, iPhone-Connected Jewelry with wireless security alerts, Smart contact lenses [1].

VII. CONCLUSION

Wearable technology has brought new hopes and opportunities in various field leading to development all over the world. These technologies would help to reduce workload and would create new capabilities. This technology would reach out to the population and would ruin the market. There is a need to make people aware of new technologies all around them in the market. This technology would reach out to the population and would ruin the market.

VIII. ACKNOWLEDGEMENT

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