

WEARABLE COMPUTING

A SEMINAR REPORT

Submitted by

DEEP SUREJA (20BECE30255)

JASH UMRETIYA(20BECE30270)

DHRUVIN VACHHANI (20BECE30271)

HITARTH UPADHYAY (20BECE30286)

In fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

Computer Engineering



LDRP Institute of Technology and Research, Gandhinagar

Kadi Sarva Vishwavidyalaya

April,2023

LDRP INSTITUTE OF TECHNOLOGY AND RESEARCH

GANDHINAGAR

CE-IT Department



CERTIFICATE

This is to certify that the Seminar Work entitled **“Wearable Computing”** has been carried out by **Deep Sureja (20BECE30255)** under my guidance in fulfilment of the degree of Bachelor of Engineering in Computer Engineering Semester-6 of Kadi Sarva Vishwavidyalaya University during the academic year **2020-24**.

Dr. Lokesh Gagnani

Internal Guide

LDRP ITR

Dr. Sandip Modha

Head of the Department

LDRP ITR

LDRP INSTITUTE OF TECHNOLOGY AND RESEARCH

GANDHINAGAR

CE-IT Department



CERTIFICATE

This is to certify that the Seminar Work entitled **“Wearable Computing”** has been carried out by **Jash Umretiya (20BECE30270)** under my guidance in fulfilment of the degree of Bachelor of Engineering in Computer Engineering Semester-6 of Kadi Sarva Vishwavidyalaya University during the academic year **2020-24**.

Dr. Lokesh Gagnani

Internal Guide

LDRP ITR

Dr. Sandip Modha

Head of the Department

LDRP ITR

LDRP INSTITUTE OF TECHNOLOGY AND RESEARCH

GANDHINAGAR

CE-IT Department



CERTIFICATE

This is to certify that the Seminar Work entitled **“Wearable Computing”** has been carried out by **Dhruvin Vachhani (20BECE30271)** under my guidance in fulfilment of the degree of Bachelor of Engineering in Computer Engineering Semester-6 of Kadi Sarva Vishwavidyalaya University during the academic year **2020-24**.

Dr. Lokesh Gagnani

Internal Guide

LDRP ITR

Dr. Sandip Modha

Head of the Department

LDRP ITR

LDRP INSTITUTE OF TECHNOLOGY AND RESEARCH

GANDHINAGAR

CE-IT Department



CERTIFICATE

This is to certify that the Seminar Work entitled **“Wearable Computing”** has been carried out by **Hitarth Upadhyay (20BECE30286)** under my guidance in fulfilment of the degree of Bachelor of Engineering in Computer Engineering Semester-6 of Kadi Sarva Vishwavidyalaya University during the academic year **2020-24**.

Dr. Lokesh Gagnani

Internal Guide

LDRP ITR

Dr. Sandip Modha

Head of the Department

LDRP ITR

ACKNOWLEDGEMENT

I take this opportunity to humbly express our thankfulness to all those concerned with my Seminar.

I am thankful to **LDRP ITR** for undertaking this Seminar. I am sincerely in debted to **Dr.Lokesh Gagnani** for giving me the opportunity to work on this Seminar. Her continuous guidance and help have proved to be a key to my success in overcoming the challenges that I have faced during my Seminar work. Her support made the Seminar a pleasantly memorable one. Without her help at all stages in spite of her own work load; the completion of the Seminar would not have been possible.

There are so many persons without whose help I would never have conceived and learnt , to whom I would like to express my gratitude — my friends , colleagues, and of course CE & IT Department of LDRP ITR.

Last but not least I am thankful to almighty GOD and my PARENTS for giving me such a good atmosphere to work hard and to succeed.

Hitarth Upadhyay (20BECE30286)

Dhruvin Vachhani(20BECE30271)

Jash Umretiya (20BECE30270)

Deep Sureja (20BECE30255)

ABSTRACT

wearable technology offers many opportunities which trigger the thoughts and imaginations of people of all fields. In this age of technology, the dependence on computers and other interfaces required them to be omnipresent. This requirement paved way for the development of wearable technology, computers which can assist specialized professionals in personal activities by aiding and augmenting everyday life with the tech savvy world. In reality obstacles imposed by factors such as battery life, processor power, display brightness, network coverage and form factor have led to the delay in the widespread introduction of wearable computers.

However in the past 10 yrs many successful implementations and the continuous relentless effort to miniaturize computers promise the emergence of viable applications. In this paper wearable computing applications are reviewed from the early aircraft maintenance and military designs to current production models including designs for personal entertainment, communication and health monitoring. This paper also highlights the scope and market of wearable technology in India and the way in which it can bring revolutionary changes in our country. The hurdles presented by these applications are identified and discussed.

TABLE OF CONTENTS:

Acknowledgement	i
Abstract	ii
Table of Contents	iii
1 Introduction	1
1.1 Background of the topic	1
1.2 Motivation	2
1.3 Objective	2
1.4 Scope	3
2 Literature Review	
2.1 History	4
2.2 Architecture of Wearable Computing	4
2.3 Purpose	4
2.4 Impact	5
3 Research design and approach	
3.1 Design Method	6
3.2 User Centered Approach	7
4 Use Cases	
4.1 Healthcare	8
4.2 Fitness and Sport	8
4.3 Marketing	8
4.4 Defense and Security	9
4.5 Industrial Applications	9
5 Future work	10
6 References	12

1. Introduction

1.1 Background of the topic

- Today, wearable devices are exploding onto the market, with everything from smart glasses (Google Glass) to smart watches (Samsung Galaxy Gear) on the rise. As for smart watches, the technology isn't exactly new, however, as it began in the 1970s with the release of the first calculator watch. The calculator watch, specifically first released in 1975 under the Pulsar brand, became a widely popular tool for science geeks and math nerds everywhere. These early "smart" watches had their heydays through the mid-1980s and although their popularity went downhill, many companies still produce calculator watches to this day.
- The terms "wearable technology", "wearable devices", and "wearables" all refer to electronic technologies or computers incorporated into items of clothing and accessories, which can comfortably be worn on the body. These wearable devices can perform many of the same computing tasks as mobile phones and laptop computers; however, in some cases, wearable technology can entirely outperform these hand-held devices.
- Wearable technology tends to be more sophisticated than hand-held technology on the market today because it can provide sensory and scanning features not typically seen in mobile and laptop devices, such as biofeedback and tracking of physiological functions. Generally, wearable technology will have some form of communications capability and allows the wearer access to information in real time.
- Data-input capabilities are also a feature of such devices, as is local storage. Examples of wearable devices include watches, glasses, contact lenses, e-textiles, smart fabrics, headbands, beanies and caps, jewelry such as rings, bracelets, and hearing aid-like devices designed to look like earrings (Mann, 1997).
- As the potential uses of wearable technology in various fields continues to grow, the sociological and cultural impact of wearable technology in the future should not be minimized. Already, the current hand-held devices available to consumers, such as Smart Phones, iPods and tablets, have changed the technological.

1.2 Motivation

- The motivation behind wearable computing devices is to provide users with new and innovative ways to interact with technology in their daily lives. Wearable devices are designed to be portable and easily integrated into the user's daily routine, offering a seamless way to access and interact with technology.
- Wearable devices also have the potential to improve health and well-being. For example, wearable fitness trackers and health monitors can help users track their physical activity, monitor vital signs, and receive alerts about potential health issues. This can encourage users to adopt healthier behaviors and make more informed decisions about their health.
- Another motivation behind wearable computing devices is to enhance productivity and convenience. For example, smartwatches and other wearable devices can provide users with notifications and reminders, allowing them to stay connected and organized throughout the day. Wearables can also be used to control other devices, such as smart home appliances or vehicles, making daily tasks more efficient and convenient.
- In addition, wearable devices can provide new opportunities for communication and social interaction. For example, wearable devices with messaging and social media capabilities can allow users to stay connected with friends and family, even when they are on the go.
- Overall, the motivation behind wearable computing devices is to provide users with new and innovative ways to interact with technology in a way that is convenient, efficient, and beneficial to their health and well-being. As technology continues to evolve, wearable devices are likely to play an increasingly important role in our daily lives.

1.3 Objective

- The objective of wearable computing devices is to enhance the user's experience of interacting with technology by providing a seamless, convenient, and personalized way to access and use digital information and services. Wearable devices are designed to be worn on the body or integrated into clothing, allowing users to access information and services on-the-go without being tethered to a computer or smartphone.

- Some specific objectives of wearable computing devices include :-
- **Health and Fitness Tracking** : Wearable devices with sensors and tracking capabilities can monitor physical activity, heart rate, sleep patterns, and other health indicators, allowing users to track and improve their overall health and well-being.
- **Productivity and Efficiency** : Wearable devices with messaging, calendar, and other productivity features can help users stay organized and on-task throughout the day, improving their productivity and efficiency.
- **Convenience and Mobility** : Wearable devices allow users to access information and services without being tied to a specific location, providing greater mobility and convenience.
- **Personalization** : Wearable devices can be customized to the user's preferences and needs, providing a personalized experience and allowing users to interact with technology in a way that is tailored to their individual needs.

1.4 Scope

- Today, we can say, “This is the era of wearable technology. You can find them everywhere and see how wearable technology is rapidly dominating in every field. We present here some of the important areas where wearable technology is growing the fastest.
- Scope in Medical Science
 - The year 2014 may well go down as the year of wearable technology. The impact of wearables is already being felt in education, communication, navigation, and entertainment; but perhaps the greatest potential lies in healthcare.
- Scope in Entertainment
 - Smart wearable devices such as miniature cameras can easily be worn on a garment while being controlled via a mobile app. This development is largely due to the availability of better touch screens and higher resolution cameras.

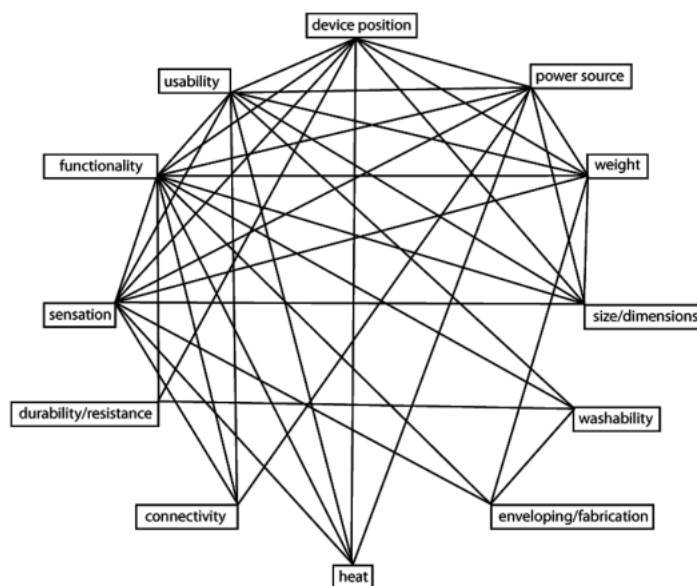
2. Literature Review

2.1 History

- It could be argued that wearable technology goes back a long way, at least to the invention of glasses around 800 years ago. The wristwatch is another obvious example of an early wearable technology as large clocks were refined into something people could take with them everywhere. However, in the age of computers, wearable technology started its modern journey in the 1950s, only a few years after computer technology itself became established.

2.2 Architecture of Wearable Technology

- The first architecture proposed by Joreemiah Nugrohu is shown below (Figure). This architecture shows how wearable devices function and are connected by the human control system. In this architecture he described how $\text{Art} + \text{Fashion} + \text{Computing} = \text{Wearable Technology}$.



2.3 Purpose of Wearable Technology in Education

- Most everyone has seen children's shoes with lights turning on when the child walks around in the shoes. Many other examples of electronics being embedded into clothing exist in more experimental works such as, on stage and in the military.

- For engineering students, a course or program of studies can provide the opportunity to apply prior knowledge of embedded electronics and programming in a new and creative way. It also provides an understanding of the creative approach for projects taken by the art/design students.

2.4 The Impact of Wearable Technology on Society

- In this section, we describe the impact of wearable technology on society. Nowadays, very few people are using this technology. At this time, it is not only creating life saving devices but also becoming increasingly helpful to the intelligence agencies, media, entertainment, education, accounting, business, management, etc. So in this section we provide a brief overview regarding the influence of wearable technology in society.
- Wearables showed an increasingly diverse field of application such as COVID-19 prediction, fertility tracking, heat-related illness, drug effects, and psychological interventions; they also included underrepresented populations, such as individuals with rare diseases.

3. Research design and approach

3.1 DESIGN METHOD

- A designer has to understand how to shape technology in a desirable way for the users and the real meaning of the “comfort”. Designing a wearable system needs to find inspiration from the human body, in respect of the many ways that form follows the function. Designer’s objective is to achieve an “anatomically correct design”. A wearable is a second skin for the human body, a protection shell, a housing which changes body shape. The wearables fix body silhouette inhibiting or making easier movements and postures through ergonomic and enveloping shapes. The target is to define the interaction between the human body and the wearable object, by trying to figure out a flexible shape without interfering with human motion.
- It’s fundamental for a product in close contact with human body to be totally adaptable to human anatomy. From this point of view, the wearable is not an overlapping structure or close architecture but an enveloping film, “a second skin”. A wearable needs to be designed to be worn on the body according to the principle the form follows the function.



Figure 0: Wearable forms by Carnegie Mellon

3.2 A USER CENTERED APPROACH

- When designing wearable technologies it is important to understand the needs of potential users/consumers. For many years product designers have been aware of how important users are within the design process. Incorporating the 'wearer' into the design process will be essential for designing appropriate wearable systems, which are acceptable to people outside the 'wearables' community.
- Technology needs to be acknowledged that the motivating factor behind all technological activity is the desire to fulfill a need.
- The goal is the exploitation of the device as a natural and consolidated form of contact between the body and the object. In this case the interface is expressed as a place of exchange of physical information moving from one place to another. Inserting the device in a common context, like clothing, the function of monitoring becomes more understandable because the user reacts in a usual way. Also, it is possible to have continuous and long-term contact between the body and the clothing.
- The aspects that complete a wearable system with the necessary characteristics are principally focused on the dimensions of the body part and the user, with notable individual and cognitive variables. The brain perceives the presence of the sensors much more than the body, and such perception is modified according to multiple reasons, tied to the physical state and the development of the body. This perception is also associated with variations in dimensions and form so the human body is taken as a whole in order to create the accessibility of the object on it.

4. Use Cases

4.1 Healthcare

- Wearable technology in healthcare is a powerful solution to save both time and hospital resources. For instance, there are wearable medical devices like the Zephyr Anywhere BioPatch. It can be affixed to a patient's chest to monitor medical status and convey real-time information to doctors. It's a medical instrument that can deliver alerts to doctors' smartwatches or smartphones, aiding in intensive care cases. Wearable IoT technology can also successfully incorporate artificial limbs, wheelchairs, and various other supportive devices.
- Wearable devices tie into the rising popularity of augmented reality technology. AR use cases in healthcare, when combined with wearable devices, shows a great deal of promise for saving time, money, and even lives.

4.2 Fitness and Sport

- Over 3,000 health and fitness professionals were interviewed by The Worldwide Survey of Fitness Trends for 2020. All of them responded that the wearable fitness tracker would be the top trend next year. They cited the fact that millions of Americans are already using such technology.
- A wearable blood pressure monitor watch is at the top of many individuals' wish lists this holiday season.
- Those who utilize fitness wearables can accurately monitor their exercises, heart rate, calorie consumption, sleep quality, and step count throughout the day. The best wearable tech has made it easier than ever for users to collect this sort of critical health data. It also enables them to work with fitness professionals and health care providers to improve exercise efficiency. They can develop healthier lifestyles, manage chronic diseases, and ultimately, make the quality of their lives better.

4.3 Marketing

- Well-known wearable gadgets like Google Glass and smartwatches enable marketers to collect vital information on the purchasing habits of the niche that they are targeting.

- Business owners, entrepreneurs, and app developers can also identify lucrative possibilities from this trend. The existence of smart wearables means developers must create apps for contemporary systems. They must also devise improvised data collection techniques for wearables.
- Savvy companies will be able to come up with an affordable wearable. Sports fan sites will advertise it, and then the fans will wear it to games. It will eliminate the need to bring paper tickets that can be easily counterfeited.

4.4 Defense and Security

- These two areas have also shown an interest in wearable tech for practical purposes. There are already tactical vests that can be worn by combat troops and law enforcement officers which can monitor their vital signs. These vests can transmit critical real-time surveillance and mapping intelligence.
- Other wearables being developed include cameras, radio systems, rugged computing, and night-vision goggles integrated with augmented reality elements. Advanced switches, hubs, batteries to recharge devices, and nano-drones that connect with wearable tech are also in the works.

4.5 Industrial Applications

- As it relates to industrial applications and wearable tech, smart Personal Protective Equipment (PPE) such as glasses and gloves are being developed. That's in addition to head-mounted displays, embedded cameras, and audio devices which can improve worker safety and health management in physically demanding, hazardous occupations. Some of those would be construction, mining, energy development, oil and gas, and similar manufacturing processes. Industrial wearables can make dangerous jobs safer.
- Wearable technology is both the present and the future. As the industries that we've mentioned become more interested in it and devote more money to developing this tech, others are sure to take notice.

5. Future Work

- The future of wearable computing devices looks promising, with new advancements in technology expected to lead to smaller, more powerful devices with longer battery life. Here are some potential future developments in the wearable computing industry.
- **Advanced Sensors:** Wearable devices are likely to incorporate more advanced sensors, including biometric sensors that can monitor heart rate, blood pressure, and other vital signs. This will enable wearables to provide more detailed health and fitness tracking data to users.
- **Augmented Reality:** Wearable devices are expected to incorporate augmented reality (AR) technology, which will allow users to overlay digital information onto the real world. AR technology is already being used in some smart glasses, but it is likely to become more widespread and advanced in the future.
- **Artificial Intelligence:** Wearable devices are likely to incorporate more advanced artificial intelligence (AI) capabilities, such as natural language processing and facial recognition. This will enable wearables to become more personalized and responsive to users' needs.
- **Flexible and Foldable Displays:** The development of flexible and foldable displays will allow wearable devices to be more compact and comfortable to wear. These displays will also enable wearables to be used in new ways, such as being incorporated into clothing or other accessories.
- **Improved Battery Life:** One of the biggest challenges facing wearable devices is battery life. However, new developments in battery technology are expected to lead to longer-lasting batteries that can power wearables for days or even weeks on a single charge.
- **Wearables for Medical Applications:** Wearable devices are expected to become more important in the healthcare industry, with applications such as remote patient monitoring and telemedicine. Wearable devices with advanced sensors and AI capabilities will enable doctors and healthcare providers to monitor patients in real-time and provide more personalized care.

- Overall, the future of wearable computing devices looks bright, with new technologies and applications driving growth in the market. As wearable devices become more powerful, compact, and personalized, they are likely to become an even more integral part of our daily lives.

6. References

- [1] Lymberis A. (2003) Intelligent biomedical clothing for Personal Health and Disease Management: State of the Art and Future Vision, Telemedicine journal and e-health volume 9, number 4, 2003
- [2] Pasher, E., Popper, Z. and Raz H. (2010.) WearIT@work: a wearable computing solution for knowledge-based development. Int. J. Knowledge-Based Development, Vol. 1, No. 4
- [3] Wolfe, B.. Limbo. Carroll & Graf Publishers, 1987
- [4] Fiorani E., Abitare il corpo: la moda, Lupetti, 2003
- [5] Assis, H.S. (2009) Empowering the Mobile Worker by Wearable Computing- Wearit@work.
- [6] McCann J., Bryson D. (edited by) Smart Clothes and wearable technology, Woodhead Publishing in Textiles, feb 2009.
- [7] Smith, D. (2009). The rise of the virtual trainer. PDDnet.com. Retrieved from <http://www.pddnet.com>.
- [8] Big data, wearable devices create anxiety about storage practices. (2013). Trend Micro. Retrieved from <http://blog.trendmicro.com/big-data-wearable-devices-create-anxiety-storage-practices>
- [9] Twentyman, J. (2014). A business magazine report based on wearable technology. Retrieved from [http:// raconteur.net/technology/welcome-to-the-wearable-workplace](http://raconteur.net/technology/welcome-to-the-wearable-workplace).

