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Predictive Modeling of Wearable Technology Adoption for Advancing Sustainability: An AI-Driven Approach"

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ABSTRACT

This research aims to identify the essential background factors that influence consumers' perception of the adoption of wearable technology. Wearable technology is becoming popular across the world. Changing customer priorities and advancements in IoT accelerated the use of wearables. Smartwatches like devices with innovative features benefiting people for health and fitness monitoring. Consumers have started exploring it and the researcher is trying to assess whether wearable technology has a strong impact. Wearable technology is a powerful tool for increasing awareness about health in general. These devices have capabilities that enable evaluation and tracking of health and daily routine. The study explored the main predictors of smartwatch adoption using the Technology Acceptance Model (TAM) to analyze the behavioral intention. Based on an online survey of 90 individuals of different age groups, two hypothesis were statistically supported and show that perceived ease of use positively influences the adoption of wearable. Perceived usefulness supports that consumers would like to use the technology if it is innovative and useful and it overall influences behavioral intention. Hypothesis testing in the study used a variance-based analysis method. The research also revealed that the use of wearable technology in conjunction with health solutions helps to maintain quality of life. Wearables can reduce the healthcare burden associated with sedentary lifestyles. A healthier population can lead to lower healthcare costs and it promotes health and wellness that can indirectly contribute to a sustainable society. The research found this technology can be considered a current and next-generation technology.

Keywords: Wearable, Smartwatch, Health Monitoring, Technology Acceptance, Sustainable Society

INTRODUCTION

In this era of technological revolution, IoT-based wearable devices are gaining much popularity. The use of wearable technology to encourage sustainable living has gained popularity in recent years. Advancements in the Internet of Things(IoT) and the easy availability of Internet-powered mobile devices have brought a significant change in our lives. Wearable devices are used across industries such as healthcare, automobile, manufacturing, communication, and businesses. "Wearable technology" has been defined in a variety of ways. In contrast to the method of just holding small tiny computing devices, the technology is characterized as "wearable" as its name implies. It is perfect for the people who are on the go. To expand its use with the public, it is necessary to pay attention to the essential principle of wearables—that they should be closer to users' daily lives than any other devices. fitness tracking devices that are accessorily used to maintain individual health status worn on a wrist [2]. Since the wearable device market is in its early phase, the smartwatch is a popular one that is used for tracking your daily routine and health monitoring. Maintaining a healthy lifestyle is crucial nowadays as people have busy schedules. The research focuses on smartwatches as extensions of wearables. Wearable technology services can show the user's activity level and heart rate as well as be useful to monitor the sleep pattern. One can connect it to the mobile and manage the track of the health in basics easily.

A sustainable society is one in which people take steps to remain healthy and wearable technology helps the emergence of wearable devices that have provided an opportunity for people to monitor and maintain a healthy routine. A sustainable society where people are aware of their health monitoring and continuously use wearable technology for the betterment of health. Sustainable societies are that where people have taken steps to remain healthy over the long run and wearable technology helps people to achieve this goal. These societies prioritize healthy environments and make effective use of resources.

This study aims to determine significant antecedent factors influencing the intention to use smartwatches in order to close the previously identified research gaps using TAM. More researchers and companies are focusing on researching wearable applications and services that can provide the best value from the users' perspective [2]. The Technology Acceptance Model was proposed by Davis [9]. He states that perceived usefulness and perceived ease of use shape users' attitudes towards technology use [9], and that these attitudes influence users' behavioral intention of using or rejecting technology. It is a theoretical model that explains and offers a valuable framework for the attitudes toward new technology [10]. The most important elements influencing the adoption or rejection of new technology are perceived utility and simplicity of use, while other aspects additionally have a role. The technology acceptance model has been used in many research to look at how people feel about new technologies.

Background of the Study

The first mass portable device to capture the market of athletic and health-conscious consumers was invented in 1960. Originally, fitness trackers were intended to measure step counts, calories burnt, and heart rate, followed by exercise recommendations. Today, smartphones are considered a practical medical tool, offering a varied number of functions, including heart rhythm measurements. Wearable devices come in a variety of ranges including fitness trackers, smart health watches, wearable ECG monitors, blood pressure monitors, biosensors, and sweat sensors. These devices can be an alternative for remote patient care. Medical experts are putting more effort than ever into improving remote patient care after the COVID-19 pandemic. In the area of health care, practitioners can acquire pertinent and accurate data promptly and act more quickly thanks to portable technology. The early detection of health issues made possible by smart gadgets leads to better patient care. Indirectly, they are promoting a healthier lifestyle.

This study provides a review of wearable technologies available nowadays which is accepted by people as it helps them to keep track of their health in general. Thus it contributes to a sustainable society. More and more new devices with better design, function, and applications are coming into the market every day, making a significant contribution to personalized healthcare and health management.

Objectives

The objectives of the research are as follows:

1) To understand how wearable technology works
2) To evaluate the acceptance of a wearable technology
3) To explore the factors influencing the adoption of wearable technology

Overview of the technology:

Electronic devices known as wearables are placed on a person's body, usually near to the skin, and are used to accurately transmit vital medical, biological and exercise data to a database. They have motion sensors that capture an image of your daily activity and sync it with laptops or mobile devices. These devices have processing capabilities. Jewellery, accessories, medical equipment, and clothing or garment-related objects are examples of these gadgets, which can come in a range of shapes and sizes. We can track our GPS locations, keep an eye on our fitness levels, and read text messages more rapidly thanks to wearable technologies.

The best part is that the majority of the gadgets that let us accomplish this are hands-free and portable, so we don't need to take them out of our pockets. These gadgets offer robust data-collecting capabilities and are useful for monitoring physical fitness, heart rate, and overall health which enhances the quality of life. Modern wearable technology falls under a broad spectrum including Smartwatches, activity trackers, rings, fitness trackers like FitBit, body sensors, and AR VR headsets to name a few. easy availability of mobile devices, network connectivity, and reduction in sensor size have contributed to the development of wearable technology. smartwatches and fitness trackers are popularly used by users. Not only in sports and fitness, users can also use it to monitor their daily lives.

Sensors embedded in wearables record bodily motions, provide biometric authentication, and aid in location tracking. The most common types of wearables, such as activity trackers and smartwatches, have straps that go around the user's wrist and track their daily activities or vitals. IoT works in conjunction with wearable devices. The gadgets are hands-free, useful tech items that run on microprocessors and have the added benefit of being able to send and receive data over the Internet. Due to their quick uptake, wearable technology is now at the forefront of the Internet of Things. To function, wearable IoT

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devices typically need Bluetooth, WiFi, or cellular connectivity. Wearables use remote smart sensors and accelerometers to track motions and speed. These technological wearables continuously monitor data.

How does wearable technology work?

Wearable technology, also known as "wearables," refers to a class of electronic devices and it is integrated into everyday products that are comfortably worn on the body and have extra features for tracking large amounts of big data in real-time. It can be worn as jewelry, embedded in clothing, implanted in the user's body, or even tattooed on the skin. They have specially developed motion sensors that can record your daily activities and update that information by synchronizing with mobile devices or laptop computers. So, any computer device outfitted with the requisite sensors to process, measure, or analyze one or more health indicators for the individual wearing it is considered a wearable device [1]. Smartwatches are most prominently used for tracking healthy routines. It can run apps and play back all sorts of digital media like audio tracks or radio streamed to Bluetooth headphones. Many of these watches have touchscreens, which allow you to access functions like a calculator, thermometer, compass, and more. Due to their limited storage and computing capabilities, wearables may be unable to process data locally. As a result, they transfer captured data to a powerful remote computer or a cloud implementation, where the sensor information is deciphered, deconstructed, and results are meaningfully generated, interpreted, and presented to the user [5]. Communication networks facilitate the intercommunication of sensors and control systems. Fitness tracking measurements, such as step counts, distance covered, altitude climbed, rate of walking/running, and body temperature are all useful and are now well integrated into smartphones. Sleep sensing may also be done using movement sensors [3]. An accelerometer built into a smartwatch can track activity and sleep habits. wearable data is always on to record the real-time values and can provide a steady stream of real-time health information that can offer a more complete picture of overall wellness. Headbands or sweatbands are worn across the forehead during the workout to absorb sweat and block it from reaching the eyes.

The expansion of mobile networks facilitated the development of wearable technologies. Fitness activity trackers were the first wave of wearable technology to gain popularity among consumers. The wristwatch was then transformed into a screen, and more powerful mobile applications were added. These devices are an alternative to managing health progression. People can get data from Wi-Fi networks using Bluetooth headphones, smartwatches, and web-enabled eyewear. With virtual reality and augmented reality headsets, the game business adds additional wearables.

LITERATURE REVIEW

Wearable technology is still in its early stages of development. Anything that can be worn to conduct everyday tasks is considered wearable. Wristbands and smartwatches are examples of wearable gadgets, as are chest bands and other sensors based on textiles. The devices are connected to gather data, monitor actions, and then tailor the experiences to meet the needs of the users depending on the obtained and recorded data [1]. Another frontier of wearables is represented by multifunctionality: wearables should simultaneously monitor many different parameters, through the embedding of several biophysical and biochemical sensing units [6].

Compared to smartphones and laptop computers, wearable devices offer consumers more convenience. This convenience can be attributed to their lightweight, accessibility, possibility to use while the user is in motion, possibility to use non-keyboard commands such as voice and hand gestures, and provide the user with control [7]. As the smartwatch is widely perceived as the next generation mobile device and wearable devices will become the most intimate ICT to human beings in the upcoming era of the Internet of Things (IoT; i.e., ubiquitous computing), excavating consumers' perceptions and their relationships towards the intention to adopt the technology will be highly meaningful for future researchers and practitioners in the related industry [8]. In the context of smartwatch wearable devices, the effectiveness can be measured through the degree to which smartwatch use can help users to organize tasks and monitor fitness workouts and health. A meaningful consequence after adoption of a new technology is whether the user ultimately intends to recommend its use to others [12]. Compared to smart phones and laptop computers, wearable devices offer consumers more convenience. This convenience can be attributed to their light weight, accessibility, possibility to use while the user is in motion, possibility to use non-keyboard commands such as voice and hand gestures, and providing the user with control. Wearable technologies have a large number of potential benefits that can dramatically change the landscape of societies and businesses. These devices can improve individuals' wellbeing and help them make better and more informed decisions [13]. This type of technology is perfectly aligned with Sustainable Development Goal (SDG) 3 (Health and Well-being). Currently, there are a multitude of wearable devices capable of measuring physiological data such as heart rate, steps, blood oxygen levels or even electrocardiograms. All these data can be used to analyze the health status of the user and improve their well-being,

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allowing synergy with SDG 3 [14]. Smartwatch users feel the device is very useful and beneficial to use, particularly with a health tracking function [12] .

Technology Acceptance Model (TAM) Theory
The technology acceptance model (TAM) is an information systems theory that models how users come to accept and use a technology. The actual system use is the end-point where people use the technology. Behavioral intention is a factor that leads people to use the technology. The behavioral intention (BI) is influenced by the attitude (A) which is the general impression of the technology.

The technology acceptance model (TAM) has been extensively used for investigating determinants of new technology acceptance. The theoretical framework has also been extensively employed in various information technology adoption studies. Davis has developed the first technology acceptance model (TAM) [8] in which perceived usefulness and perceived ease of use were shown to be two main factors affecting the attitude of a user toward new technologies. In this study, the Technology Acceptance Model is used to assess the adoption of wearable technology on the consumer's part. According to the original logic of TAM, how people perceive the benefits of technology to their daily tasks is an integral influential factor in their attitudes towards using the technology [8].

The actual system use is the end-point where people use the technology.

- Perceived usefulness (PU): The degree to which a person believes that using a particular system would be free from effort (technology is easy to use)
- Perceived ease-of-use (PEOU): the degree to which a person believes that using a particular system would enhance their job performance

Due to its few factors, TAM is easy to comprehend and yet has demonstrated a high level of predictiveness.

HYPOTHESIS

Hypothesis related to influential factors on the adoption of wearable technology
Ha1: There will be a positive relationship between perceived ease of use and adoption of wearable technology.
Ha2: There will be a positive relationship between perceived usefulness and adoption of wearable technology.

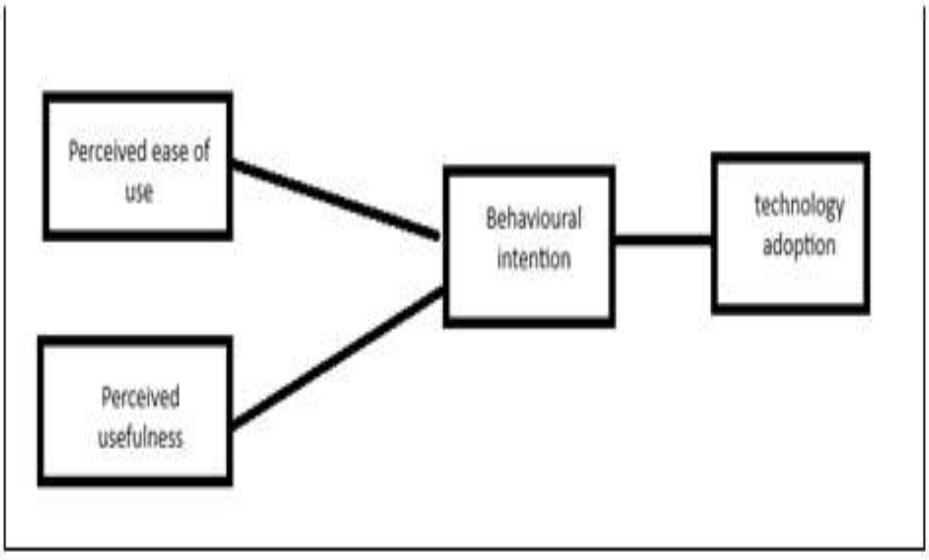

Fig. 1 : Technology Acceptance Model

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RESEARCH METHODOLOGY

Data Collection

To understand the user's perspective toward the acceptance of wearable technology, a survey is conducted resulting in 90 respondents. A structured questionnaire was circulated among the respondents using google forms. The convenience sampling method was used to collect the data.

Convenience sampling entails gathering samples from the community based on the researchers' proximity to and availability of access within it. We chose a sample of educated participants for this study because we think they are mature enough to comprehend the new technology and are making its use for the purpose of the study.

The results are used to analyze consumers' awareness about using wearable. Participants were informed that their identities would remain anonymous and that participation in the study was completely voluntary. The first section of the questionnaire was about demographic questions like participants' age, gender, years of education, and job status.

The second section of the survey was multiple-choice questions using five-point Likert scales (ranging from 1 to 5), which were modified for use with wearable technology. The questionnaire was hosted using Google Forms and data was collected over two weeks which was imported on a SPLS platform for further analysis.

DATA ANALYSIS AND RESULTS

The demographic and background information obtained from the respondents is shown in the table below.

Table 1: Demographic and background information of the respondents for the assessment of adoption of wearable technology

Gender	%	Age	%	Qualification	%
Male	16%	Under 18	0%	Upto graduation	8.7%
Female	84%	18-40	9.8%	PG & Above	91.3%
		40-55	75%		
		55 and above	15.2%		

Table 1 shows that of the people who participated in this study, there were 16% male and 84% female among them, 9.8% were between the ages of 18-40 and 75% were between the ages of 40-55. This shows that the people of the age of 40-55 are more towards having awareness of their health. However, data is collected using convenience sampling. All the participants are Indians who filled out the questionnaire and among them, most of them(91.3%) are qualified with PG and above.

Table 2: Usage pattern

Ownership	%	Reason for ownership	%	Frequency of use	%
Yes	93.7%	Health and fitness tracking	78.3%	Regular	80%
No	6.3%	Notification	6.4%	Not Regular	20%
		Time	13%		
		Productivity	2.3%		

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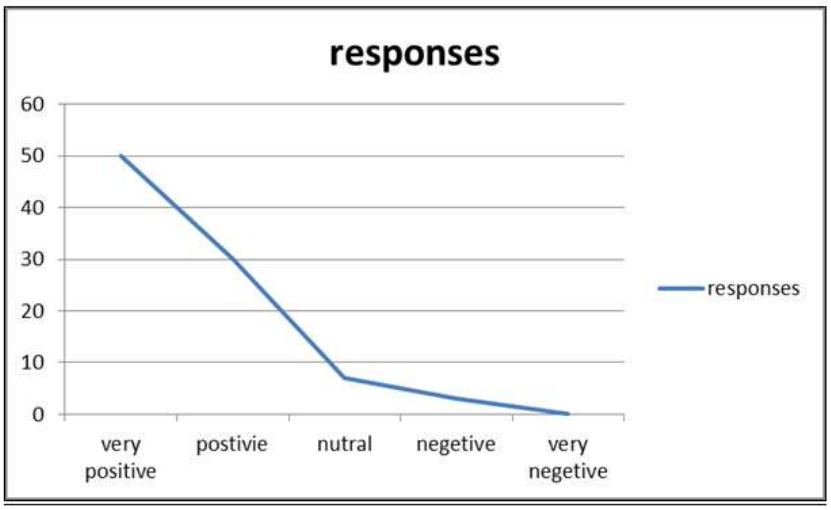

Figure 2: **The thought of using wearable having positive impact on society**

The below figure shows that most of the respondents (75%) believe that wearable technology has a somewhat positive impact on society and individuals as well and it can play a major role in promoting sustainability in society. Smartwatches are mostly used in the range of wearable technology. This study employed partial least squares-based structural equation modeling (PLS-SEM), which is appropriate for undertaking causal model research. The research is carried out to check the factors influencing the adoption of wearable technology among Indian consumers. The results revealed that there is a positive relationship between perceived ease of use and adaptation of wearable technology and people prefer to use wearable technology if it is easy to use. The result also shows that the perceived usefulness of the technology is there and it has a positive relationship. The devices with appropriate features are accepted by the users as it helps them to monitor their daily routine in the context of basic health checks. Their experience is limited to monitoring the number of steps, sleep patterns, and heart rate. Observing these values helps them to maintain track of their health rate. More the people use it, the better the sustainable society will be as it will reduce the burden on the healthcare industry by being healthy citizens. Wearable devices that promote health and wellness can indirectly contribute to sustainability. Fitness trackers can encourage physical activity, reducing the healthcare burden associated with sedentary lifestyles. A healthier population can lead to lower healthcare costs and a reduced environmental footprint of the healthcare industry. People who want to live more sustainably and with less carbon impact are starting to adopt wearable technologies more and more. Perceived ease of use and perceived usefulness influenced the adoption of wearable (t-value = 6.255, p-value=0.002; t-value=3.45, p-value=0.003) and the p-value is less than the typical significance level of 0.05 ($p < 0.05$). Therefore, we reject the null hypothesis that there is no relationship between perceived ease of use and technology adoption and no relationship between perceived usefulness and technology adoption. The relationship is considered statistically significant and both the hypotheses were accepted . As an individual's perceived ease of use of a given technology increases, their intentions to use the technology also increase. As an individual's perceived usefulness of a given technology increases, their intentions to use the technology also increase. The findings reveal that perceived value is a strong predictor of adoption intent. Wearable technology allows us to track fitness levels, track whereabouts via GPS, make a call and receive text messages more rapidly. Best of all, most of the technologies that enable us to do so are hands-free and portable, removing the need for us to take our devices out of our pockets.

CONCLUSIONS

This research has delved into the intricate relationship between wearable technology adoption and its potential to contribute to a sustainable society, employing the Technology Acceptance Model (TAM) as a framework for analysis. The findings emphasize the importance of user perceptions, ease of use, and perceived usefulness in affecting the effective incorporation of wearable technology into daily lives. The TAM framework has provided useful insights into the psychological and behavioral factors that influence people's decisions to use wearable technology. A great user experience, along with a clear knowledge of the real benefits that wearable technology may give in terms of health, efficiency, and resource-saving, is undeniably important in developing universal acceptance. This technology can be considered a current and next-generation

technology. Future research can focus on the variables used to bridge the gap between technological innovation and societal well-being. The study investigates the variables affecting the use of wearable technology and its relation to social sustainability. The study found that the impact of perceived usefulness is stronger implying and customers prefer to make use of wearable regularly. After COVID-19, people are more aware about heat-related illness, drug effects, and psychological interventions and smart watches help to monitor health in general.Health monitoring wearable devices as enabling technologies for sustainable enhancement of life quality in smart environments. Although the findings of this study provide useful insights into the adoption of wearable devices, conducting comparative or multiple studies would enhance our findings in future research. Future research could extend and refine these findings by looking into the moderating impact of individual variables like gender and age. Despite its shortcomings, this study contributes to a better understanding of the adoption of wearable devices. Sustainable society aims to contribute to sustainable goals through health and wellness that can be made possible through wearable devices. It aids people to maintain a healthy lifestyle and make their lives better. This study calls for the thoughtful integration of wearable technology, which will lead us to a future in which technology improves our lives while also contributing to the larger good of the world.

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