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An Empirical study on significance of wearable healthcare gadgets

Ms. Keerthiraj D N, Mr. Prithwiraj Das
MBA student
Research Scholar

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ABSTRACT: The popularity of wearable technologies has increased over a period of time. Wearable technologies are expected to become an indispensable part of our daily life. The first one is the application of wearable gadgets in different part of healthcare management. The second aim of the study is study is to point out how wearable technologies will be a used for both for daily life of people and the way of doing businesses of the companies in the future. The potential applications indicate that the future will be safer, easier, healthier, quicker, and more entertaining with the wearable technologies.

I. INTRODUCTION

Wearable technology provides us with the potential to screen our fitness levels, song our location with GPS, and look at text messages greater fast. Wearable are related to our clever devices, transmitting these facts to them and permitting us to view it at later instances, as well as inside the second. The COVID-19 pandemic has expanded the scope of wearable clinical gadgets, as thisproduct can detect early symptoms of coronavirus in someone; manufacturers on this area have duly accelerated their method in launching products that may correctly tune signs and symptoms

Wearable fitness technology has weaved itself into society so that Fit Bits and smart watches are seen as mainstream; and the future of wearable devices shows no sign of slowing down. Piloted by the increasing demand of consumers to monitor their own health, use of wearable technology has more than tripled in the last four years. More than 80% of consumers are willing to wear fitness technology.

The scope of wearable technologies is very broad and amorphous, and determining the characteristics and specifications of wearable technologies is very thorny. Therefore, to understand the classification of wearable technologies based on the basic characteristics will be very beneficial. According tothe literature, the wearable technologies may be divided into three main categories. These categories can be called as wearable health technologies, wearable textile technologies and wearable consumer electronics. This paper has taken past 5 years of information into consideration.

Evolution of wearable gadgets

Horologist and inventor Abraham-Louis Periled is the first to create albeit rudimentary, pedometer, while it's also been suggested that American Founding Father Thomas Jefferson later produced his own mechanical pedometer, improving on Perrelet's original design.Fitness trackers, as we know them today, first seen in 1965 with the Manpo-kei, which translates to '10,000 steps meter' and was invented by Dr Yoshiro Hatano. Dr Hatano, a Japanese professor at the Kyushu University of Health and Welfare, was researching at the time how to combat obesity.He posited that 10,000 steps provided the correct balance of caloric intake and activity-based calorie expenditure to keep up a healthy body. Modern fitness trackers to the present day still use 10,000 steps as a benchmark goal; however, a recent study published within the International Journal of Obesity suggests that 15,000 steps may very well be a more beneficial target to aim for.Wearable tech began very differently from today's recognisable devices, with Sony's first transistor radio making its debut in 1955. "The Sony TR-55 served because the template for portable gadgets we use today. Everything from the iPod to the sport Boy can trace its basic handheld design to the TR-55's form factor."- Wired Magazine. In 1961, Edward Thorp and Claude E. Shannon created their own version of wearable technology – a computer sufficiently little to suit into a shoe. Designed to assist them cheat at a game of roulette, the pc was a timing device to

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predict where the ball would land. Wearable tech went mainstream in 1975, because the first calculator wristwatch was released. Worn by Sting on the duvet of The Police's Wrapped around Your Finger, and by Marty McFly in Back to the longer term, it became an icon of the 70s and 80s.The Walkman, launched in 1979, became our go-to music device throughout the 1980s. A revolution in music and wearable technology, the Walkman was so popular it sold over 200 million units. "Don't you're thinking that a stereo electronic equipment that you just can hear while walking around may be a good idea!" Sony Chairman, Akio Morita. In 1987, digital hearing aids were released, revolutionizing the healthcare industry. Usage of healthcare, wellness, and medical apps is up 16% from last year to twenty-eight of consumers. Nearly two-thirds of physicians said they might prescribe an app to manage chronic diseases like diabetes. In December 1994, Steve Mann, a Canadian researcher, developed the Wearable Wireless Webcam. Despite its bulk, it paved the way for future IoT technologies. Wearable technology conferences and smart clothing expos began to determine an increase in popularity throughout the last decade.

Wearable technology found its groove within the 2000s, with the introduction of Bluetooth headsets, the Nike iPod, Fitbits, and plenty of more. The wearable craze exploded in 2013, Google Glass entered the market, followed by the Apple Watch in 2015, and therefore the Oculus Rift Headset in 2016. Today, clothing designers are experimenting with fabrics and technology, signalling that smart clothing is on its thanks to the mainstream. Some innovative items are already available, just like the Nadi X Yoga Pants, which feature in-built haptic vibrations to encourage you to move over or hold positions.

APPLICATION OF WEARABLE HEALTH GADGETS

Wearable Fitness Trackers

Some of the modest and most original forms of wearable technology, wearable fitness trackers, are wristbands equipped with sensors to keep track of the user's physical activity and heart rate. They provide wearers with health and fitness references by syncing to various smartphone apps. The FitBit Flex was an early, popular option for wearable technology consumers. Users were attracted to its sleek look and ability to track their step progress all over the day with the device's five indicator lights.

Smart Health Watches

Company Product	Function	Feature
AliveCor KardiaBand/Watch	ECG-monitoring equipment watch	KardiaBand with six-lead ECG to detect abnormal heart rhythm and AFib consistent with existing KardiaMobile products and wearable device
AppleWatch	Wireless wrist watch for epilepsy management	Electrical heart sensor detects abnormal heart rhythm and AFib, along with fitness tracking, fall detection, and SOS
Empatica Embrace 2	Fitness and activity-tracking watch with ECG monitoring	Monitors physiological stress, arousal, sleep and activity; electrodermal response reaches a pre-set level (abnormal) alerts user/caregiver
Garmin	Fitness and activity-tracking watch	Tracks and shares distance, pace, heart rate, and calories data
OnePulse Smartwatch watch	Health Monitor	real-time alerts, medication reminders, and auto prescription refills; connects with EHR platforms
Samsung	CardioBand ECG	Displays ECG rhythms and

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		detects arrhythmias. Used for cardiac rhythm discrimination between normal/AFib/abnormal
Withings	Fitness and Activity Tracking Watch with ECG Sensor	Heart rate and activity tracking with sensor measuring ECG for AFib

Once only used to count steps and tell time, smartwatches have now transformed into clinically viable healthcare tools. Apple launched the Apple Heart Study app in 2017 to monitor users' heart rhythms and alert those who are experiencing atrial fibrillation. The company also recently released the "Movement Disorder API" to help researchers gather new insights into Parkinson's disease.

Smartwatches allow users to perform tasks they normally do on their phones - read notifications, send simple messages, make phone calls - while also offering some of the exercise- and health-tracking benefits of fitness trackers

Wearable ECG Monitors

Wearable ECG monitors are on the cutting edge of consumer electronics, and what sets these monitors apart from some smartwatches, is their ability to measure electrocardiograms, or ECGs. Business Insider recently reported on Witlings winning best wearable at the 2019 Consumer Electronics Show with their Move ECG product.

The Move ECG is able to measure an electrocardiogram and send the reading to the user's doctor, as well as detect atrial fibrillation. It's also able to track pace, distance, and elevation, as well as automatic tracking for walking, running, swimming, and biking.

Wearable Blood Pressure Monitors

Omron Healthcare launched Heart Guide in 2019, the first wearable blood pressure monitor. Though it might look like a typical smart watch, Heart Guide is an oscillometric blood pressure monitor that can measure blood pressure and daily activity - like steps taken, distance travelled, and calories burned. Heart Guide can hold up to 100 readings in memory and all readings can be transferred to a corresponding mobile app, Heart Advisor, for review, comparison, and treatment optimization. Heart Advisor users have the ability to store, tracks, and share their data with their physician while also gaining insights to determine how personal habits affect their blood pressure.

Biosensors

Biosensors are up and coming wearable medical devices that are drastically different from wrist trackers and smartwatches. The Philips' wearable biosensor is a self-adhesive patch that allows patients to move around while collecting

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data on their movement, heart rate, respiratory rate, and temperature.

Research from Augusta University Medical Centre showed that this wearable device registered an 89% reduction in patient descent into preventable cardiac or respiratory arrest. This determines the ability wearable's have to improve patient outcomes and possibly reduce staff workload.

Physical Activity and Interaction Monitoring

Sustained sedentary behaviour is associated with many adverse health outcomes. To investigate whether reminders could change student posture and positively influence their wellbeing designed wearable device-based system to monitor student activities. Vibration reminders were sent through the wearable devices after 20 minutes of sitting. The results show that the approach was effective in changing student behaviour, although the health effects of this change were inconclusive.

Evaluated the effectiveness of using wearable devices and smartphones for tracking language patterns. The study conducted a Language Environment Analysis (LENA) using a language-tracking wearable device to collect mother-child communication data. The collected data were used to provide feedback to mothers about the communication design. The after-study evaluation showed that mothers had a positive response to the device and felt that the communication data collected by the wearable device provided useful material to improve mother-child communication.

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Mental Status Monitoring

Preliminary wearable devices and algorithms to monitor mental conditions is a relatively new domain. Some wearable devices are equipped with sensors that can notice human physiology status, such as heartbeat, blood pressure, body temperature, or other complex vital signs (e.g. electrocardiograms). Using these signals, new systems can be developed to monitor mental conditions. Stress detection is the most common application of such systems.

To detect stress patterns of children, a framework using wearable devices and machine learning-based techniques. The wearable devices collected both audio and heart rate signals for stress detection. The structure has a potential to be used to remotely monitor child safety through stress patterns. The study results showed that by combining audio and heart rate signals, the system had a better performance in hostile noise signals when compared with audio-only methods. Support Vector Machine (SVM) is one machine learning method. The accuracy of the best algorithm (SVM+Wrapper) is 93.47%. A study showed that even simple electro dermal activity (EDA) sensors have the capacity to identify stress level. An EDA sensor can amount skin conductance, which usually is correlated with the stress level of a person. They described how a Swiss team developed an EDA-based system called Emotion Board. The system can collect and measure skin conductance signals. The collected signals were processed using linear discriminant analysis (LDA) and an SVM-based classifier was used to detect stress. The evaluation on 33 subjects exposed that the maximum accuracy was 82.8%.

Sports Medicine

Wearable devices can help athletes or coaches to systematically manage athletic training and matches. For example, Skazalski, Whiteley, Hansen, & Bahr (2018) used commercially accessible wearable devices as a valid and reliable method to monitor the jump load of elite volleyball players and to measure jump-specific training and competition load in the players' jumps. The results of this study also indicate that the devices showed excellent jump height detection capacities. The wearable devices can monitor practical movements, workloads, heart rate, etc., so they may be more extensively used in sport medicine to maximize performance and minimize injury.

Chen, Lin, Lan, & Hsu (2018) developed a method to monitor and detect heat stroke. Heat stroke can harm people when they are doing exercises in hot temperatures. The team proposed a logic-based method for differencing signals collected from multiple wearable devices, environmental temperatures and humidity sensors. The experimental results showed that the system can be used to monitor heat stroke risk and alert users.

Weight Control and Monitoring

Tracking physical activities using wearable devices has become a popular method to help people evaluate activity intensity and calories expended. There is a growing interest among health consumers to use wearable devices, especially

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consumer wearable devices, to track weight control activities and outcomes. The study devices included Fitbit Charge HR, Apple Watch, and Garmin Forerunner 225. The project registered 62 participants aged 18-38 and measured their heart rates and energy expenditures using all three devices. A hypothetical ideal "gold standard" test had a sensitivity of 100% and a specificity of 100%. The study showed a high magnitude of mistakes across all devices when related to the gold standard. This study indicated that these devices might be useful as a stimulus to growth activity, but they have limitations as a tracking and result measurement method.

Although there are studies that show that wearable devices can be used as a stimulus mechanism to surge user activities, there is still a lack of evidence-based studies to validate the use of wearable device for the outcome of weight loss. A recent randomized clinical trial was accompanied in Korea to examine the effectiveness of using wearable devices and smartphones to reduce childhood obesity. The project aimed to register a thousand 5th- and 6th-grade students to assess a wearable device-based intervention system called "Happy Me." The consequence measures of the trial were behavioural changes (e.g. physical activity, healthy eating) and anthropometric changes (e.g. body weight, body mass index, waist circumference). The results of the study attempted to provide scientific evidence for the effectiveness of using a wearable device system for weight control.

Patient Management

Wearable technology can also improve patient management efficiency in hospitals. Researchers hope to use wearable technology for the early detection of health imbalances. Wireless communication in wearable techniques enable researchers to design a new breed of point-of-care (POC) diagnostic devices. For example, garments integrated with wearable solutions, such as commercial portable sensors and devices in the emergency medical services (EMS), emergency room (ER) or intensive care unit (ICU) environments, have facilitated the continuous monitoring of risks that endanger patient lives. The system enables exposure of patient health-state constraints (heart rate, breathing rate, body temperature, blood oxygen saturation, position, activity and posture) and environmental variables (external temperature, presence of toxic gases, and heat flux transitory through the garments) to process data and remotely transmitsvaluable information to healthcare providers.

Wireless wearable devices have supported mobility in patients. Activity monitoring is used to manage chronic conditions of patients. Wearable device activity tracking abilities provide a mechanism to allow health consumers to enhance their self-management capacities. Many health consumers are tracking their weight, diet, or health routines in some way. Wearable devices further improve the self-tracking ability by providing sensor data as objective evidence.

Cancer Survivors

Endometrial cancer survivors are the smallest amount physically active of all cancer survivor groups and exhibit up to 70% obesity, but lifestyle interventions may end up in improved health outcomes. A study was conducted to judge the acceptability and validity of the Fitbit Alta™ physical activity monitor for sociocultural diverse endometrial carcinoma survivors (Rossi et al., 2018). The study found that the Fitbits were well accepted by 25 participants and also the physical activity data indicated an insufficiently active population. Physical inactivity and sedentary behaviour are common amongst carcinoma survivors. Another study used wearable activity trackers (WATs) as behavioural interventions to extend physical activity and reduce sedentary behaviour within this population (Nguyen et al., 2017). They found that wearable technique programs have the potential to supply effective, intensive, home-based rehabilitation.

Patients with Stroke

Stroke, predominantly a condition of advanced age, could be a major reason behind acquired disability within the global population. Conventional treatment paradigms in intensive therapy are expensive and sometimes not feasible due to social and environmental factors. Researchers used wearable sensors to observe activity and supply feedback to patients and therapists. During a study by Burridge and colleagues (2017), the researchers developed a wearable device with embedded inertial and mechanomyographic sensors, algorithms to classify functional movement, and a graphical computer programme to present meaningful data to patients to support a home exercise program.

Patients with Brain and Spinal Cord Injuries

Patients with brain and neural structure injuries need exercises to enhance motor recovery. Often, these patients aren't qualified to watch or assess their own conditions and that

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they need healthcare provider guidance. Therefore, there's a necessity to transmit physiological data to clinicians from patients in their home environment. Researchers like Burns and Adeli (2017) do just that, by reviewing wearable technology for in-home health monitoring, assessment and rehabilitation of patients with brain and medulla spinals injuries.

Chronic Pulmonary Patients

As a chronic illness, chronic obstructive pulmonary disease typically worsens over time, so extensive, long-term pulmonary rehabilitation exercises and patient management are required. A bunch of researchers designed a distant rehabilitation system for a multimodal sensors-based application for patients who have chronic breathing difficulties (Tey, An, & Chung, 2017). The system included a collection of rehabilitation exercises specific for pulmonary patients, and provided exercise tracking progress, patient performance, exercise assignments, and exercise guidance. Patients within the study could receive accurate pulmonary exercises guidance from the sensory data. Further evaluation studies are needed to verify if the proposed remote system can provide a snug and cost-effective option within the healthcare rehabilitation system.

Disease Management

Significant progress in the development of wearable device systems for healthcare applications has been made in the past decade. Wearable technology can make disease management more effective as outlined below.

Heart Disorders

Wearable devices are developed to try to cardiovascular monitoring and enable mHealth applications in cardiac patients. Low-power wearable ECG monitoring systems are developed. Some wearable devices can monitor pulse variability (HRV). In a study, a wearable patch-style heart activity monitoring system (HAMS) was developed for recording the ECG signal. The wearable devices are used efficiently as health monitoring system during daily routines in many places and situations.

Wearable technology can assess patient heart activity outside of a laboratory or clinical environment. It's possible to perform heart assessments during a good range of everyday conditions without interfering with a patient's activity tasks. As an example, researchers designed a textile-based wearable device for the unobtrusive recording of ECG, respiration and accelerometric data and to assess the 3D sternal seism cardiogram (SCG) in existence. Researchers also designed a conveyable and continuous ballistocardiogram (BCG) monitor that's wearable within the ear. The ear devices can reveal important information about cardiac contractility and its regulation.

The wearable cardioverter defibrillator (WCD) was introduced into clinical practice in 2001, and indications for its use are currently expanding. The WCD represents another approach to forestall sudden arrhythmic death until either Implantable Cardioverter Defibrillator (ICD) implantation is clearly indicated, or the arrhythmic risk is taken into account significantly lower or perhaps absentthe feasibility of employing a wireless watch as a wearable closed-circuit television for monitoring the vital signs of patients.

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The researchers compared the wearable system with traditional clinical monitors. The results showed that the tested wearable device provided reliable vital sign value for about 80% of the patients and also the overall agreement between the new device and clinical monitor was satisfactory because the comparison was statistically significant. The same study by Kroll, Boyd, & Maslove (2016) showed that a wrist-worn personal fitness tracker device may be wont to monitor the guts rate of patients although the collected heart rates were slightly not up to the quality of continuous electrocardiographic (ECG) monitoring.

As well, heat stroke are often potentially damaging for people while exercising in hot environments. To stop this dangerous situation, a researcher designed a wearable heat-stroke-detection device (WHDD) with early notification ability. If a dangerous situation was detected, the device activated the alert function to remind the user to avoid heat stroke (Chen et al., 2018).

Blood Disorders

Wearable trackers have drawn interest from health professionals studying blood disorders. Overall, the U.S. prevalence of hypertension among adults was 29.0% during 2015–2016 (Fryar, Ostchega, Hales, Zhang, & Kruszon-Moran, 2017). Wearable devices can detect hypertension with physiological signals. A number of the foremost widely used wearable devices are applications for evaluating and monitoring pressure level, including cuff-less force per unit area sensors, wireless smartphone-enabled upper arm pressure monitors, mobile applications, and remote monitoring technologies. They need the potential to boost hypertension control and drugs adherence through easier logging of repeated pressure level measurements, better connectivity with health-care providers, and drugs reminder alerts (Goldberg & Levy, 2016).

The study of blood flow is named hemodynamic. Patients with postural hypotension have pathologic hemodynamics associated with changes in body posture. Researchers designed a brand new cephalic laser blood flowmeter that may be worn on the tragus to research hemodynamics upon rising from a sitting or squatting posture. This new wearable cerebral blood flow (CBF) meter is potentially useful for estimating cephalic hemodynamics and objectively diagnosing cerebral ischemic symptoms of patients during a standing posture. In another study, researchers detected site-specific blood flow variations in people while running, employing a wearable laser Doppler flow meter.

Diabetes Care Management

Patients and healthcare providers must track many factors that influence blood sugar dynamics (e.g., medication, activity, diet, stress, sleep quality, hormones, and environment) to effectively manage diabetes. Recent consumer technologies are helping the diabetic community to require great strides toward truly personalized, real-time, data-driven management of this chronic disease (Heintzman, 2016). These consumer technologies include smartphone apps, wearable devices and sensors. One well-known example is that the wearable artificial endocrine pancreas for diabetes management, which could be a control system formed by a wearable glucose monitor and an implanted insulin pump. Closed-loop control (CLC) for the management of type 1 diabetes (T1D) may be a novel method for optimizing glucose control. More studies of CLC were conducted recently. For instance, overnight CLC improved glycaemic control in an exceedingly multicentre study of adults with type 1 diabetes (Brown et al., 2017). Researchers also explored the probabilities of using Google Glass to simplify the standard of living of individuals with diabetes.

With the increasing cost of healthcare, wearable devices and systems could have potential to facilitate self-care through monitoring and prevention. For example, a wearable bioelectronics technology was developed to produce non-invasive monitoring of sweat-based glucose level (Lee et al., 2017).

Parkinson's disease

To manage Parkinson's disease, wearable devices offer huge potential to gather rich sources of information that provide insights into the diagnosis and also the effects of treatment interventions. Ten-second whole-hand-grasp actionsare widely wont to assess bradykinesia severity, since bradykinesia is one amongst the first symptoms of Parkinson's. Researchers developed a wearable device to assess the severity of the Parkinsonian bradykinesia (Lin, Dai, Xiong, Xia, & Horng, 2017). Many assessments of dyskinesia severity in Parkinsonism patients are subjective and don't provide long-term monitoring. In another study an objective dyskinesia score was developed employing a motion capture system to gather patient kinematic data (Delrobaei, Baktash, Gilmore, McIsaac, & Jog, 2017). The portable

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wearable technology is used remotely to watch the full-body severity of dyskinesia, necessary for therapeutic optimization, especially within the patients' home environment. The Parkinson course of instruction (de Lima et al., 2017) showed the feasibility of collecting objective data using multiple wearable sensors during everyday life in a very large cohort.

Autism

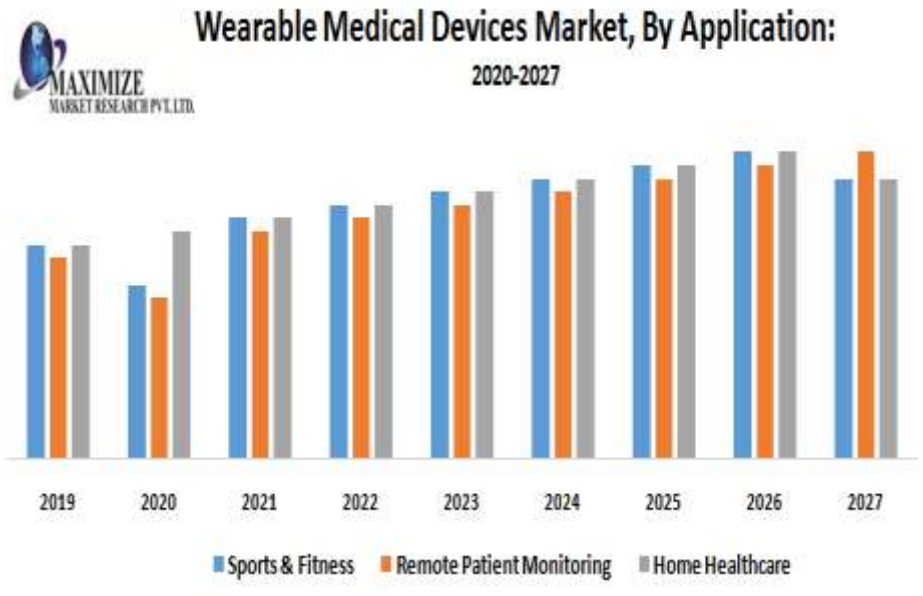
It is important for autistic children to acknowledge and classify their emotions, like anger, disgust, fear, happiness, sadness and surprise. Daniels and colleagues (2018) conducted a project that used Google Glass to review the feasibility of a prototype therapeutic tool for youngsters with autism spectrum disorder (ASD) to work out if the youngsters would wear such a tool. The feasibility study supported the utility of a wearable device for social affective learning in ASD children and demonstrated subtle differences in how ASD affected neurotypical controls children perform on an emotion recognition task.

Depression

Wearable technology may assist with the screening, diagnosis and monitoring of psychiatric disorders, like depression. The analysis of cognitive and autonomic responses to emotionally relevant stimuli could provide a viable solution for the automated recognition of various mood states, both in normal and pathological conditions. Researchers explored a system supported wearable textile technology and instantaneous nonlinear pulse rate variability assessment to characterize the autonomic status of bipolar patients. In another study, a wearable depression monitoring system was proposed with an application-specific system-on-chip (SoC) solution. The system accelerated the filtering and has extraction of heart-rate variability (HRV) from an electrocardiogram (ECG) to boost the accuracy of successfully recognizing depression.

RECENT DEVELOPMENT

In August 2020, Amazon launched wellness wearable Halo Band. It's sensors that include a temperature sensor, pulse rate monitor, accelerometer, and two microphones, though it lacks a screen. Also, it monitors a user's emotion by being attentive to the tone of voice and employing a three-dimensional rendering of a user's body to trace body fat percentage.



In January 2021, Facedrive Health launched V2 TraceSCAN Wearable Device. TraceSCAN V2 features an intensive set of improved functionalities to supply key health and safety advantages while enhancing the standard shortcomings of typical Bluetooth devices (which don't seem to be GPS-based) like privacy considerations, accuracy, data management, and sign monitoring capability.

Wearable products that use smart sensors to provide more and better data points have entered the market, delivering real-time healthcare

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measurements. These advanced devices apply AI (AI), machine learning, and behavioural-science-backed "nudges" to assist users act on resulting insights and maintain personalized wellness habits. As results of growing interest in wellness data, tech companies are promoting the healthcare aspects of wearable devices and pioneering new engagement strategies to broaden their appeal beyond the first core base that skewed primarily to affluent and active users

In 2020, activity monitors/trackers segment accounted for the biggest share of the wearable healthcare devices market. Growth during this market segment are often attributed to the rising adoption of sedentary and unhealthy lifestyles, increasing adoption of self-monitoring of vitals, rising prevalence of lifestyle diseases, the low cost of activity trackers, and therefore the presence of an oversized number of manufacturers with multi-functionality devices.

IMPACT OF COVID-19

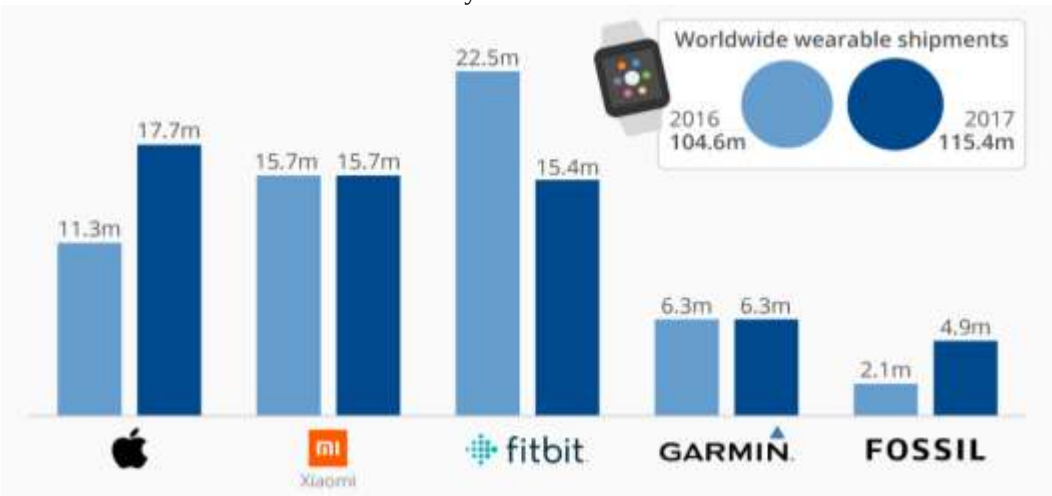
The COVID-19 has altered collective and individual behaviour, changing both workplace and healthcare. Technology offers devices to fulfil these new challenges. When it involves health, work, and economics amid COVID-19, wearables play a vital role within the entire continuum of care, moreover as in our work and leisure lives. In 2020, Philips launched a next-generation wearable biosensor for early patient deterioration detection, including clinical surveillance for COVID-19 within the u. s...

Also, in 2020, researchers in Washington developed a stamp-sized device, consisting of a collection of sensors, including ones that record blood oxygen levels and vital sign, an advance which will be wont to catch early symptoms and signs of COVID-19 and monitor patients because the illness progresses. North America dominated the general wearable medical devices market, with the U. S. emerging because the major contributor to the market. The U. S. holds the biggest share within the wearable medical devices market because of the high prevalence of cardiovascular and lifestyle-related diseases and increased adoption of wearable medical technology, together with high per capita medical expenditure. Combined with the rising incidence of diseases within the region, the marketplace for wearable medical devices is anticipated to grow at a moderate rate over the forecast period.

Additionally, most of the main players like Garmin Ltd, Fitbit Inc., and Biotelemetry Inc. are concentrated within the us and are investing within the research and development of innovative wearables. For example, in October 2020, Garmin Ltd launched Vivofit jr, three kids fitness tracker watch, which might help kids to be motivated to fulfill their activity goals to work out what happens next within the app adventure.

Key Companies & Market Share Insights

The global wearable medical devices market size was valued at USD 16.6 billion in 2020. It's expected to expand at a compound annual rate (CAGR) of 26.8% from 2021 to 2028. The expansion of industries like home healthcare and remote patient monitoring devices is anticipated to influence market growth. Additionally, increasing concentrate on fitness and a healthy lifestyle orientation also are expected to impact the market.



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The diagnostic devices segment dominated the market and accounted for the biggest revenue share of 62.5% in 2020. Among diagnostic, the neuromonitoring devices segment was the most important in 2020. The growing prevalence of neurological disorders is that the factor affecting the expansion of the segment. for instance, as per the survey "A Global Burden of Disease Study" in 2020, migraine was most the prevalent upset within the U.S. Around 95.0% of individuals are full of migraine within the U.S. during this case, neuromodulator devices are most generally wont to diagnose/treat migraine. additionally, increasing awareness of the population regarding the flexibility of neurological wearable's to assess cognitive capabilities of people continuously during everyday activities is additionally expected to drive the segment.

The therapeutic device segment is anticipated to witness the fastest CAGR throughout the forecast period due to the increasing influx of therapeutic devices. Moreover, a robust pipeline of therapeutic devices like intelligent asthma management products, wearable pain reliever devices, and insulin management devices is anticipated to help market growth. The therapeutic device segment is further bifurcated into pain management devices, insulin monitoring devices, rehabilitation device, and respiratory therapy devices. The insulin display was dominant in 2020 and is anticipated to stay dominant over the forecast period attributable to the massive population full of diabetes

The key players are specializing in adopting various growth strategies, like partnership, merger, and acquisitions, and expansion of product portfolio to retain their market position. For instance, In November 2020, Royal Philips and African Union announced a partnership to strengthen healthcare infrastructure and enhance access to worry in African unionist States by improving access to medical equipment. Through Africa Medical Supplies Platform (AMSP), the African Union and Philips will provide medical equipment, comprising patient-monitoring equipment, ventilators, ultrasound scanners to healthcare facilities, and COVID-19 patients. Also in November 2020, the corporate announced the introduction of Philips Ventilator BiPAP A40 EFL. This initiative would help the corporate in expanding its home healthcare portfolio for COPD patients. A number of the prominent players within the wearable medical devices market include:

- Philips Electronics
- Fitbit
- Basis Science
- Garmin
- Covidien
- Omron Corp.
- Withings
- Vital Connect
- Polar Electro
- Intelesens
- Everist Genomics
- Sotera Wireless
- Lifesense
- Apple
- Samsung
- Fitbit
- Garmin

Apple Inc.
Founded: 1976
Headquarters: California, U.S.
Website: www.apple.com

Apple is one amongst the world's top wearable technology companies. Apple Watch and Apple AirPods are the wearable products offered by the corporate. Apple Watch helps the user keep track of their daily activities and reach their fitness goals. The in-built accessibility features help even the blind, deaf and handicapped persons operate the watch with ease. For instance, the VoiceOver feature uses the speaker within the watch to assist people with low-vision navigates around easily by telling everything that's happening on the screen. Similarly, Taptic Engine in these watches creates a mild tap on the wrist whenever notifications are available thereby helping people with low hearing. The custom-made Apple W1 give AirPods allows it to produce unrivalled performance by offering efficient wireless connection, improved sound and longer battery life...
Key Products: Apple Watch Series 4, Apple Watch Nike+, Apple Watch Hermes, and AirPods

FitBit
Founded: 2007
Headquarters: San Francisco, California, United States
Website: www.fitbit.com

FitBit is one in every of the world's leading fitness wearable technology companies that designs a range of wearable devices which will work seamlessly with one another. It absolutely was the primary company to introduce automatic, wireless syncing in wireless devices. Its products are often synced with over 200+ phones on all platforms, including iOS, Android, and

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Windows. SmartTrack may be a FitBit wearable technology that records one's activity, exercise, weight and sleep thereby helping the user to take care of a fit and healthy life. Fit Bit employs Pure Pulse technology to develop automatic, chest strap-free wearable rate monitors that records pulse rate accurately.
Key Products: FitBit Versa, FitBit Ionic, FitBit Charge 3, FitBit Flex 2, and FitBit Ace

Xiaomi
Founded: 2010
Headquarters: Beijing, China
Website: www.mi.com

Xiaomi is world's 4th most dear technology start up and ranks among the highest 10 wearable technology companies within the world. Although, it's known for its smartphones, the corporate also manufactures wearable's like fitness trackers, earphones and VR headsets. Mi Band 3 contains a large OLED touchscreen and offers up to twenty days battery life. Except for real time activity tracking, Xiaomi's wearable fitness trackers will be accustomed view notifications, SMS, and calls, track steps and sleep pattern, monitor pulse and even locate one's phone.
Key Products: Mi Band 3, Mi Band – HRX Edition, and Mi VR Play 2

ODG
Founded: 1999
Headquarters: San Francisco, California, United States
Website: www.osterhoutgroup.com

The Osterhout Design Group (ODG) is one in every of the leading wearable device manufacturers within the world. It makes a speciality of the event of head worn computing and electro-optics
technology that's accustomed manufacture smart glasses. These smart glasses provide unparalleled mixed reality, augmented reality, and computer game experiences. ODG's product portfolio includes stereoscopic smart glasses, hazardous location certified sunglasses, and THX certified cinematic experience sunglasses which find use in various industrial, business and enterprise applications. The R7 smart glasses offered by the corporate are suitable to be used in heavy industries with hazardous work environment where it can get exposed to warm temperature, chemicals, and gases.
Key Products: R-7 smart glasses, R-8 smart glasses, and R-9 smart glasses

Garmin
Founded: 1989
Headquarters: Kansas, United States
Website: www.garmin.com/en-US

Garmin could be a wearable technology company that develops smart wearables for marine, automotive, aviation, and fitness industries. A number of Garmin's wearable devices come equipped with Garmin Pay contactless payment solution which enables easy, quick and effortless purchases along with your watch. The activity trackers and smartwatches manufactured by the corporate are often accustomed track one's activity then plan, save and share their progress with others. The corporate also offers wearable devices for household pets and sporting dogs which may be wont to train and track pets and dogs.
Key Products: Felix 5 Plus Series, vivomove HR, vivosport, Approach S60, and quatix 5 Series

HUAWEI
Founded: 1987
Headquarters: Shenzhen, Guangdong, China
Website: www.huawei.com

HUAWEI is one among the world's largest wearable device manufacturers. The corporate combines cutting-edge technology with traditional watch making to style and develop smartwatches of various styles. The corporate uses top quality materials like ceramic which is harder than chrome steel, lightweight, and abrasion immune to design the bezel on the HUAWEI Watch 2. The HUAWEI TruRelax technology employed in HUAWEI TalkBand B5 analyses stress levels and pulse rate which successively helps the user to require better care of their mental state. This fitness band also provides sleep care by monitoring different stages of sleep by using Harvard Medical School's CDB centre certified HUAWEI TruSleep technology.
Key Products: HUAWEI TalkBand B5, HUAWEI FIT, HUAWEI WATCH 2, and HUAWEI Band 2

Technavio's research report on "Global Smart Wearable Fitness and Sports Devices and Services Market 2016-2020" lists the major drivers, trends, and challenges affecting the growth of the market

Polar Electro
Founded: 1977
Headquarters: Kempele, Finland
Website: www.polar.com

Polar Electro is understood for the event of wearable pulse rate monitoring devices, fitness trackers, and GPS sports watches for fitness and grooming purposes. The corporate offers

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specialized wearable's for professional athletes that give accurate data. The Precision Prime sensor fusion technology in Polar Vantage V helps in monitoring vital sign even within the most disputes. The corporate also produces wearable accessories like optical pulse sensors that may be synced with Polar Electro smart watches and fitness trackers to urge highly accurate training data.

Key Products: Polar Vantage V, V800, M600, Polar A370, and H10 Heart Rate Sensor

Vuzix

Founded: 1997

Headquarters: Rochester, New York

Website: www.vuzix.com

Vuzix ranks among the highest 10 wearable technology companies within the world. It focuses on the look, manufacture and sales of wearable display devices including smart glasses and video viewing glasses. Vuzix's award winning iWear video headphones are capable of providing a viewing experience love a 125″ theatre screen viewed from 10 feet away. It is connected with phones, tablets, PCs, and console systems thereby enabling the user to possess a tremendous viewing and gaming experience.

Key Products: Vuzix Blade AR Smart Glasses, M300 Smart Glasses, iWear Video Headphones, and M100 Smart Glasses

Kopin

Founded: 1984

Headquarters: Massachusetts, United States

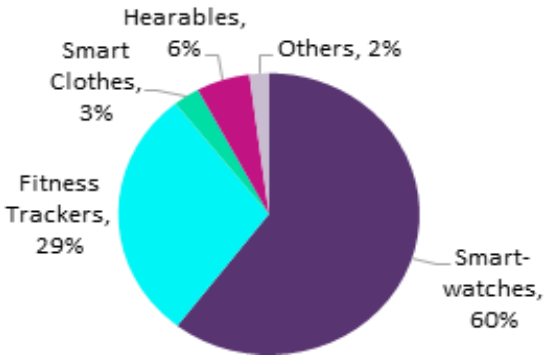
Website: www.kopin.com

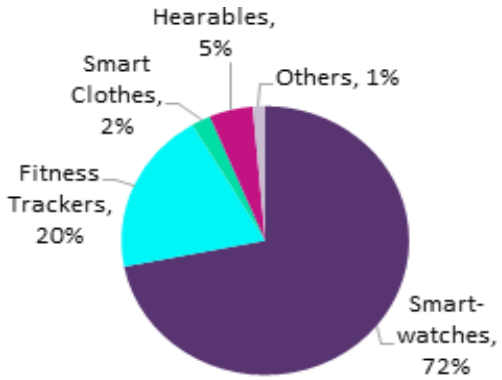
Kopin is one among the world's top wearable technology companies and leading developers of wearable technology that reinforces the visual, verbal, and audio capabilities of wearable headsets. The corporate has collaborated with several companies like Vuzix, Recon Instruments, and Motorola Solutions to develop wearable products. The corporate created the Golden-I 3.8D, a wearable headset reference design that enhances the efficiency and productivity when employed in industrial applications. Kopin's Voice Extraction Technology enhances the voice recognition capabilities of its wearable headsets even within the noisiest conditions.

II. FUTURE AND IMPACT

The future of how wearables could impact our lives remains relatively unknown; however, many companies have begun to live out their stalls, predicting what the subsequent big thing is. One such avenue that's being explored is taking the fitness tracker off the wrist and moving it to the finger within the variety of 'smart jewellery'.

Wearable tech market share by product, 2018Wearable tech market share by product, 2023





Smart glasses – fancy some smart sunglasses to travel along with your smart beachwear? You're in luck. Snapshot Spectacles 2.0 include a built-in camera that enables you to snap photos and videos directly from your glasses. The glasses link to a smartphone, so you'll share your photos and videos via the Snapchat app. Of course, whether your fellow beach-goers will welcome the concept of you effectively wearing a camera on your face is another matter

Exoskeletons will transform industry

Exoskeletons – effectively, robotic suits that humans wear – exist already. They're employed by some manufacturers to assist human workers perform better (for example, lift heavier weights without injury). Hyundai Motor Group has been testing its Hyundai Vest Exoskeleton, which helps to cut back pressure on

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workers' necks and backs, within the factory setting. Hyundai says the exoskeletons help to scale back injuries within the workplace and increase worker efficiency. My prediction is exoskeletons like this may become the norm in manufacturing and industrial settings round the world.

Prosthetics will become more intelligent

Wearable technology also encompasses the new wave of prosthetics and robotic limbs currently being developed. These are increasingly being kitted out with technology that permits the limb to become more intuitive – for instance, by responding to the system or brain signals. MIT's Media Lab is involved in an exceedingly scientific research that mixes special amputation surgery with intuitive prosthetic development. Special robot prosthetics are being designed for ten volunteers, and also the hope is that the volunteers are able to operate their prosthetics via the system nervosum. Within the future, intelligent prosthetics like this, which reply to the individual's commands more intuitively, may become the norm.

Labs will be 3D printing human tissue

If we will create replacement limbs, why shouldn't we create replacement organs? Researchers are already working towards this goal. In one example, a team at Rice University in Houston claims to own made a big breakthrough within the bioprinting of viable human tissue, giving hope that it'll be possible to print fully working replacement organs within the future. This, combined with advances in robotics and prosthetics, could revolutionize the globe of medication. So, if I would like a heart transplant within the future, it's feasible that I may well be given a choice between a robotic heart or a lab-grown hear

AI for the human brain

Companies like Facebook are racing to develop brain-computer interfaces that might, in theory, allow you to type your Facebook status update using only your mind (telepathic typing, to use the vaguely creepy technical term). Elsewhere, Elon Musk's Neuralink Company is functioning on a brain-computer interface that might help people with severe brain injuries. Announcing the plans in 2019, Musk predicted a future within which humans could have the choice of "merging with AI."

Smart clothing – the term wearable doesn't just apply to something you strap onto your wrist; it may touch intelligent clothing. Take Neviano smart swimsuits as an example. These include a water-proof UV sensor that communicates along with your smartphone to inform you when UV levels are high, meaning you ought to put on some more sunscreen.

III. CONCLUSION

In conclusion, wearable technologies have evolved gradually in parallel with technological advancements such as electronic chips, GPS systems, Wi-Fi systems, the internet, computers, and sensors. The main applications of the wearable technologies are within the health industry, textile industry and therefore the consumer electronics industry. Today, the diffusion of the wearable technologies is just at the early adopter stage both for the society and corporations. However, in the near future the evolution of wearable technologies, especially smart glasses and smart watches, will almost be completed their evolutions and these technological devices will be adopted by the societies and companies. The objective of the study is to signify how wearable technologies are going to be a milestone both for existence of people and the way of doing businesses of the companies in the long run. In this paper, it is proposed that wearable technologies will ease the life for the people with impairments; enable companies to interact with the opposite business people easier, to conduct research more effectively, to use sales and repair strategies more efficiently; enable policemen, firemen, military members to provide public and private safety; enhance the video game in games, and enable the doctors to monitor the health indicators of the people continuously. To sum up, the longer term will be safer, easier, healthier, quicker, and more entertaining with the wearable technologies

KEYWORDS
Wearable, fitness trackers, advanced AI, smart jewellery,wearable tech market, biosensors,health monitors

REFERENCE

[1]. https://www.marketsandmarkets.com/Market-Reports/wearable-medical-device-market-81753973.html
[2]. https://www.businessinsider.in/science/latest-trends-in-medical-monitoring-devices-and-wearable-health-technology/articleshow/70295772.cms
[3]. https://www.mordorintelligence.com/industry-reports/global-wearable-medical-device-market-industry

[4]. https://www.researchgate.net/publication/275580004_WEARABLE_TECHNOLOGIES_AND_ITS_FUTURE_APPLICATIONS
[5]. https://www.rgare.com/knowledge-center/media/articles/emerging-trends-shaping-the-future-of-health-and-wellness-part-i-wearables-get-smart(er)
[6]. https://www.grandviewresearch.com/industry-analysis/wearable-medical-devices-market
[7]. https://www.asme.org/topics-resources/content/7-wearable-devices-for-2020
[8]. https://mhealth.jmir.org/2020/11/e18907/
[9]. https://www.jmir.org/2019/9/e14017/4
[10]. https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-3059-0/figures/5
[11]. https://www.maximizemarketresearch.com/market-report/wearable-medical-devices-market-middle-east/2241/
[12]. https://www.google.com/imgres?imgurl=https://i1.rgstatic.net/publication/224610780_A_Survey_on_Wearable_Sensor-Based_Systems_for_Health_Monitoring_and_Prognosis/links/0deec52267a3054aa4000000/largepreview.png&imgrefurl=https://www.researchgate.net/publication/224610780_A_Survey_on_Wearable_Sensor-Based_Systems_for_Health_Monitoring_and_Prognosis&tbnid=QL-8G--qokCwTM&vet=1&docid=wpsUKSfIBWf1HM&w=850&h=1134&source=sh/x/im
[13]. https://www.businessinsider.in/science/latest-trends-in-medical-monitoring-devices-and-wearable-health-technology/articleshow/70295772.cms
[14]. https://www.dr-hempel-network.com/growth-of-digital-health-market/digital-health-wearables-market-hype/