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AI economical wearable smart device to alert real time health reports to doctors

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Abstract—*The rapid expansion of information-sharing opportunities for efficient communication by establishing patient portals will help nurses and doctors by making it easier to access electronic health records. Wearable smart devices allow physicians to maximize treatment with the use of advanced technologies. The primary purpose of this paper is to build a portable AI smart device that doctors can use to access real-time health updates. Efficient access to a patient portal has proven greatly helpful for patient treatment. Advancing from the portal records to a wearable smart device will make it even beneficial in making health care decisions faster and administering treatment on time [1]. This is why this paper is proposing a smart device that utilizes AI technology to improve how healthcare is delivered by analyzing electronic health records in real-time. A patient's electronic health record (EHR) is a representation of the paper medical records in a digital version. Wearable devices provide close monitoring of all facets of human activity and physiology. Such measurements involve the most often assessed signs such as blood oxygen saturation, blood pressure, heart rate, posture, and physical activity using tools like electrocardiogram (ECG), ballistocardiogram (BCG), and other sensors [1]. Wearable video or photo applications could be able to provide detailed clinical evidence. Eyeglasses, shoes, earrings, gloves, clothing, and watches can all be equipped with wearable smart devices.*

Keywords: *AI, Smart Wearable Device, Electronic Health Records, Sensors, Telemedicine*

I. INTRODUCTION

Our society is being changed dramatically by modern technologies – our everyday lives and interactions have been shaped by smartphones, computers, and web-enabled applications. The industry in general, and that of medicine in particular, is an information-intensive environment [1]. Wearable connected devices are used by more than 325 million users worldwide, and smartphones are used by more than 2.5 billion people. The use of wearable technology in clinical trials has a lot of promise [2]. Increased access to information provided by electronic health records (EHRs) allows for better and more efficient healthcare delivery, and better compensation options [2,3]. Real-time, individualized information that can be provided quickly and reliably are essential in the context of care delivery. While traditional office-based healthcare records include the medical and medication history of patients, an EHR device may access a more complete picture of a patient's well-being. A core function of an EHR is to build and administer patient records in an electronic format that is exchanged with other practitioners for more than one medical institution. Approved providers may also offer information. They include information from any clinical person in a patient's treatment system to communicate directly with all medical professionals and organizations – such as hospitals, experts, diagnostic imaging services, clinics, schools, and other health facilities. Wearable technologies have improved greatly in recent years and have achieved mainstream recognition in the healthcare sector [4]. However, there is still a concern with their proper incorporation into medical facility work processes. Many medical facilities disregard wearable technology's great benefits and fail to leverage them [5]. In this paper, I hope the benefits of incorporating wearable health devices into the EHR system. My innovation is a wearable device that is connected to a hospital network system and can be synchronized with eyeglasses.

II. RESEARCH PROBLEM

The problem that will be solved using the device I am going to invent is improved care through faster access to information to doctors. My wearable mobile system can be used to access a patient's health records in real-time and can monitor their conditions which allow doctors to make decisions on how to prevent illnesses, and promote health outcomes, such as weight management and physical activity supervision. This AI-enabled wearable smart system would have a significant effect on clinical decision-making and improve health care outcomes while minimizing costs, such as patient recovery outside of hospitals. Both doctors and patients enjoy its features and services given that the market is shifting toward mobile medical services. Wearable devices have become more common as a result of this. Wearable devices in hospitals can help patients get better treatment [6]. Wearable tracking devices can provide the healthcare sector with many benefits. Some wearables assist in the management of health conditions, the prevention of illness, and the treatment of patients. It's all about monitoring when it comes to healthcare wearable technologies. They keep

track of the patient's rehabilitation by encouraging doctors to see how the patients are doing. Wearable devices are now being used to meet health objectives. Many people love using weight-loss wearable devices like step trackers or wellness applications that offer exercise and diet recommendations [7]. My innovation is different in terms of its application and its synchronization on eyeglasses.

III. LITERATURE REVIEW

A. Wearable technologies in healthcare

More and more people are incorporating wearable technologies into their daily life. Many are now using smartwatches and fitness trackers and their use is anticipated to rise to increase. Innovative technology will undoubtedly play a critical role in the optimal operation of the future world, especially in the medical systems [7]. The emergence of wireless communication, for example, has been attributed to the advancement of cost-efficient and portable sensor nodes. These nodes can detect, process, and transmit various signals. this innovation paved the way for portable, mobile, and computing devices. Health wearable devices refer to equipment that is worn around the body. These tools receive and process inputs. These innovative tools can be applied to patches and worn on clothes, as well as being embedded to body parts of a patient, including surgical implants [8]. A key advantage of a wearable smart system is its hands-free capability, which enables users to view their health data when performing everyday routine activities. Additional features include usability, wearability, practicality, comfortability, and multi-functionality. Some of these products, such as insulin sensors and heart incident monitors, are approved by the Food and Drug Administration (FDA) [9].

Wearable devices include fitness trackers, insulin pumps, and vital signs. A wearable mobile computer has the additional benefit of recording and monitoring physical movements (PA) and vital signs, which are linked to medical and health, and wellness, by using accelerometers and Micro-Electro-Mechanical Systems (MEMS) [9]. Most of these measurable characteristics include heart rate, sleeping cycle, pulse rate, stress levels, muscle function, oxygen saturation, blood pressure, and caloric intake. Sensor placement is required for each of these functions. These instruments are made up of three major components: sensors and data collection components, alongside communication hardware that relays data to a remote center and data analysis tools or techniques. health and wellbeing investigation equipment [10].

Wearable smart devices are designed to automatically gather data and process it in real-time. The Fitbit exercise tracker, for example, is a device that demonstrates the value of a wearable smart system for data collection. It tracks data such as measures, speed, caloric expenditure, temperature, humidity, pulse, and hours slept [11]. A portable smart tracker is mostly designed for athletes and fitness enthusiasts, but it may also be used to enable obese and diabetic patients to work out and track their normal eating habits. Studying a client's fitness progress helps the trainer and nutritionist critically analyze fitness goals and plans.

B. Applications of wearable smart device in Healthcare

Apart from personal wellbeing and wellness, these multi-parameter biomedical wearable sensors can be used to assess and quantify vital signs to facilitate medical interventions. For instance, a patient discharge after a surgical procedure or a patient at risk of heart disease is at greater risk, making remote monitoring of their vital signs with a wearable smart device important [11]. Disabled, deaf, paralyzed, visually impaired, and patients with impaired memory also benefit from this specialized care. A wearable smart device with controllable electrical and wave pulses

Wearable smart devices are self-monitoring with telemedicine functions that combine data collection and analysis features. Additionally, a wearable smart device is extensively used in the area of research. They have been used to get a better understanding of the physiology of rare diseases. For example, one study examined the capability of a wearable sensor to measure the walking efficiency and balance rate of patients with frailty syndrome, a condition marked by physical weakness [11]. Researchers were able to differentiate between three frailty levels using wearable sensors as well as in surveillance. Another research examined the sensors' ability to track patients with dementia's falling rhythm.

When physicians are interacting with patients in rural locations, multi-parameter physiological sensing devices may be beneficial. In China, an initiative dubbed the "wireless heart health program" used wireless health to track eleven thousand patients in the country's remote rural areas [12]. Smartphones with heart-rate monitors were used, and they were linked to the 96-digit phone numbers of local physicians, who could text and call them, as well as check and submit reviews [12,13]. Eventually, doctors revealed that 11,000 patients in the trial population had significant cardiovascular complications, warranting additional care at the hospital. The automatic drug infusion pump is another important use of wearable technology. It regulates the quantity and length of medications or nutrients injected into a patient's body. These pumps have been extensively used in the treatment of a variety of chronic disorders, including diabetes (insulin pump) as well as acute infections (antibiotic pump) [14]. Additionally, wearable technology advancements include transdermal drug delivery (TDD) applications or patches. The systems increase drug distribution into the systemic circulation by using heat, electric current, and sound waves. While TDD is still in its infancy, it seeks to improve patient satisfaction and quality of life [15].

C. *My proposed device*

Design

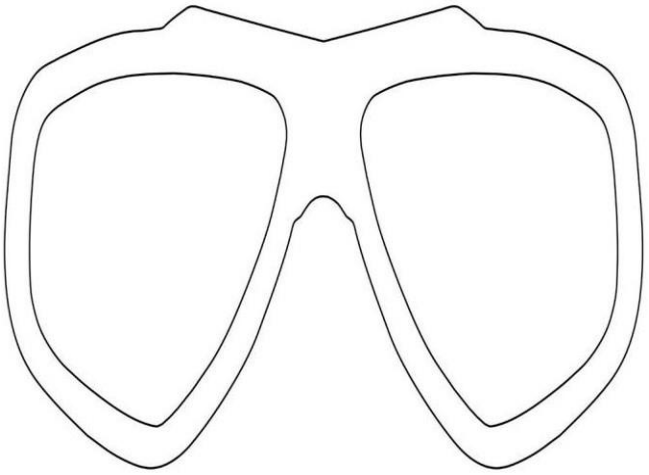


Fig i: The initial design of the front part

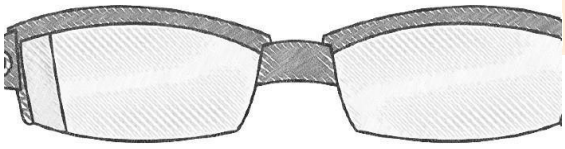
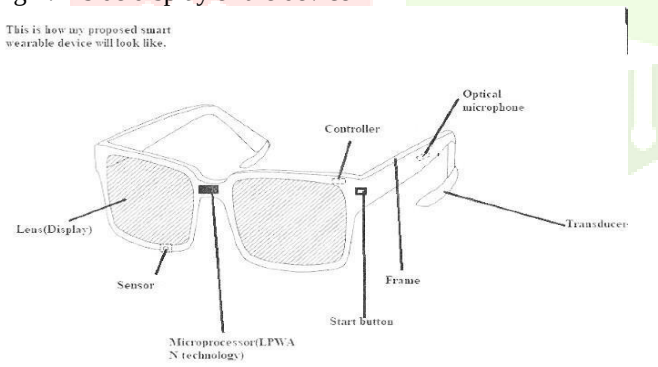


Fig ii: Inside display of the device



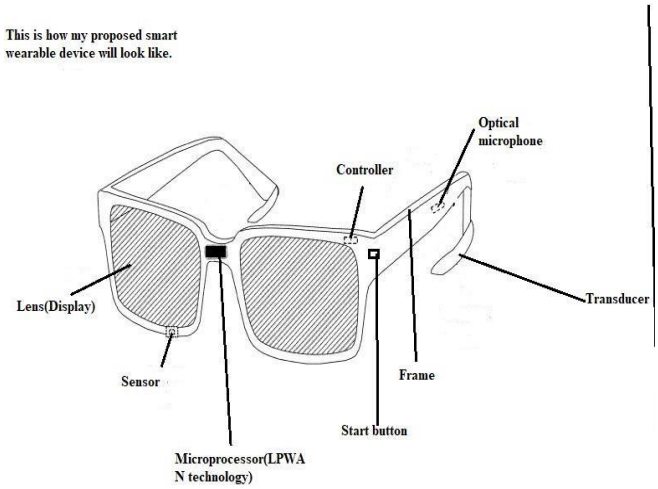


Fig iii: Finalized design

D. *How my proposed smart device works*

The design of these eyeglasses is done by including a communication system, the visual connection that directly connects to cloud information, an inbuilt microphone which is included near the end of the frame where the ear will fit, microprocessor. My device is an IoT device and will need to access data that is stored in the cloud. This data is the electronic health records of a patient. The proposed wearable device will act as a sensor that will collect data and process it before displaying it on its display lenses. The doctors can use this device in remote areas where there is no internet to access electronic health records in real-time. In most cases, devices that have been developed can access the cloud data through different methods like Wi-Fi, satellite, cellular connectivity, Low Power Wide Area Networks (LPWAN), and direct connection through the internet. My proposed device will connect to cloud data through Low-Power Wide-Area Network (LPWAN) because it is cost-efficient and is designed to allow long-range communications. The LPWAN will allow my smart device battery to last for longer with most IoT devices that have used operating for up to 10 years on a single battery charge. LPWAN technology enables the transmission of data in small periodic data packets varying in size from ten to one thousand bytes. This enables more performance and tailored speeds between 3 kbps and 375 kbps. Since LPWA Networks run more efficiently in terms of power and bandwidth and cover a wider territory, they need less infrastructure and hardware. These features lead to more cost-effectiveness. SThe lens displays data via an overlay of details that have already been processed by the microchip and is hoisted onto the eye by a prism receiving information from a mini projector within the lens. The practitioner can view the real world as well as the specific data related to computerized medical records.

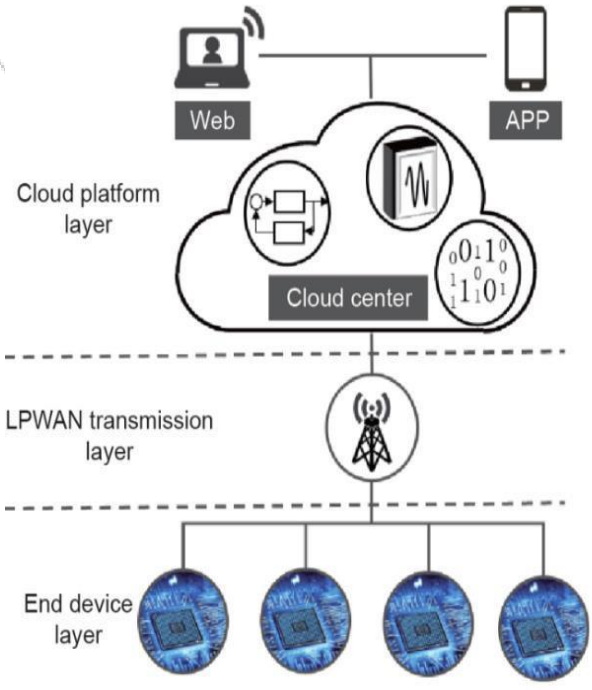


Fig iv: LPWAN in IoT system

My proposed device is customized with its processor to synchronize data from a portal on the front of the two displays when a user wears it. Controlling Corona Virus with the proposed device. This wearable technology plays a major role in detecting COVID-19 signs in support of newly infected

patients and vaccinated individuals. The main that are considered crucial in the clinical detection of coronavirus infections include fever, difficulty breathing, and cough. An individual infected with this virus has a respiratory rate (RR) of greater than 20 breaths per minute, a body temperature that is over 38 degrees Celsius (most cases), and a pulse greater than 100 beats per minute. When the general condition of the temperature, the percentage of oxygen in the remaining in the blood, and pulse rate must be assessed. My proposed wearable device looks at controlling the COVID-19 pandemic in assessing, monitoring, and evaluating the above parameters. It is installed with sensors like the piezoresistive sensor to measure the heart rate and artificial neural networks to measure the temperature in real-time, often at low costs, which makes these procedures very user-friendly. Temperature analysis is critical for COVID-19 diagnosis and has been widely used as an instant test to assess if travelers or people have been infected. This system for body temperature control is, unfortunately, not efficient since CO19 will spread before the fever starts showing up. Continuous skin temperature control can be a useful approach in this respect, which is even being used by most hospitals. My smart wearable device will integrate the Early Detection Algorithm (EDA) which is effective in identifying and warning the individuals before the emergence of the Covid-19 symptoms before it is too late. Application of EDA allows for self-identification, self-containment, and diagnostic opportunities which reduces the spread of infection.

E. The Benefits of Using my proposed Smart Device

Lately, translational bioinformatics approaches have made significant strides toward applying for genetic medicine at the point of care and integrating it with electronic medical records (EMRs) [16]. The incorporation of patient-generated exercise or medical data with big data such as current health data, as well as other biological and genetic data, into the EMR, is extremely strong and reliable. This combination has the potential to be an important, accurate, and dependable database for patient diagnosis and clinical studies. All integrated data mining helps doctors to make more informed decisions by evaluating how patients move from general health to an important pathological condition with a therapeutic significance to reanimation. Cohort findings are important for the same cause, but for the specified objectives user derived data by using a wearable smart device is more encouraging. My wearable smart device will provide instant feedback and don't need someone to remember something. Clinical tests, measurements, and so on, doesn’t require hospital visits and time for data collection. Second, unlike research trials, where manual analysis is commonly used, data from my wearable device is more systematic and precise in timing because it tracks all the information and analyses them immediately. Manual reporting is vulnerable to errors, and it can be skewed by the researchers. The third is patient eHealth awareness by teaching them how to use tracking technologies to assess their health status, which would encourage them to be more committed and active in self-management and push them to a high degree of delivering accurate information to healthcare providers. Furthermore, patients would be more likely to take preventative measures and discuss their issues with their doctor.

This move is essential for overall health and is also cost-effective. This wearable smart tracker is undeniably useful for recording and monitoring one's fitness and everyday activities. However, there are some questions about integrating these innovations into the healthcare system, including their cost, weight, discomfort in certain situations, insecurity problems, usability, and validity. The wearable smart device I have designed will be cost-efficient for the average consumer and it is one of the most innovative pieces of technology in the modern world. This wearable smart device is for all practical purposes, inexpensive due to the simple components they include, where small standards of technology are involved in developing it. It does not necessitate regular servicing and has a long lifespan. The increasing cost of integrating a wearable smart interface into the healthcare system is a concern for both consumers and providers. The amount of data that can be gathered needs more computers and backup systems. While technological advances have been made, this wearable smart device is relatively light since its components are light in weight. Users would find these components to be light and comfortable to wear. As a result, consumers are likely to experience comfort regularly.

A wearable mobile computer and devices' main concern is the privacy and protection of personal data created by users. Many users are wary of these applications since they do not have ownership of their records. Manufacturers, on the other hand, gather and store this information [16]. Users' records, such as email address, age, social media profiles, and location are also sent to producers, according to others. Additionally, there are worries about the sophisticated software capable of cross-referencing biometric data created by wearable devices with other digital traces of users' activity. There is a greater risk of identity theft if the personal information is disclosed to third parties in this manner. Furthermore, when left unattended, a wearable smart tracker will quickly be compromised, raising security concerns [17]. This is because they are linked to the company's server, which enables contact between customers and their respective offices. Bio-security concerns may arise when data regarding personal health and physical exercise are also stored in the same device [18]. As a result, consumers will be hesitant to use a wearable smart interface and might even oppose the proposal.

Its reliability and performance are two possible issues. Wearable smart devices are typically sold with the expectation that they can play a critical role in enhancing people's health – their health and fitness. Many vendors, on the other hand, are unable to provide "tangible" proof of these instruments' efficacy. Recent comparative research on the efficacy of various A wearable smart trackers developed to monitor physical activity have shown substantial differences in terms of accuracy between different models. These devices have a 25% error margin, according to the manufacturer [18]. Such disparity is of the greatest importance, indicating the potential for wearable medical applications to have positive outcomes. For instance, a study examined many wearable smart device applications of cancer detection through image processing methods. According to the findings, these technologies fulfill the requisite reliability requirements. This system, in essence, had a low failure rate. It's important to ensure that a wearable smart device is practical and used as a medical or wellness solution before commercializing it.

IV. FUTURE IN THE UNITED STATES

The U.S. has over 6,000 hospitals and 700 doctors, as well as 140,000 surgical centers [19]. Healthcare facilities, physicians, and doctors are constantly looking at opportunities to improve the quality of health care, be more effective, reduce medication errors and help to reduce misconduct claims. Smart wearable devices will redefine the approach in which doctors perform their tasks through digital transformation and interpersonal partnership with surgeons and doctors. Artificial intelligence is a concept that could lead to improved intraoperative assistance. The relationship between man and machine is a significant barrier to its clinical application. Inconvenient, outdated, or redundant information visualization may create misunderstanding and

distraction, diminishing utility. Context applications filter information automatically [19]. This intelligent system offers a context-aware computing framework that constructively offers surgeons the right resources, at the perfect time, in the right place, allowing them to improve patient care quality, minimize surgical errors, and maximize their performance. Sensitive details, such as patient life symptoms, pertinent medicinal dose, test reports and intra-operative imagery, health history, and treatment plans, are critical information is collected by this intelligent wearable interface that allows a physician to remain concentrated on the treatment while minimizing medical errors. Besides, the physician is advised by medical checklists and, once a report is complete, the checklist is registered on the electronic health record system in case of protection against malpractice claims.

V. ECONOMIC BENEFITS TO THE U.S

My proposed smart wearable device will be beneficial to the U.S in terms of sales made in the technology and electronic markets. Considering its efficiency in accessing electronic health records in real-time, there will be a demand for this product in the market. It will also cut costs in the U.S health sector as logistics involved in delivering healthcare to patients in remote areas will be cut. This smart wearable technology is designed for and is used in hospitals and can be seen to have the positive benefit of making work easier and more convenient for healthcare providers. On top of disease prevention, this wearable device can also save money wasted for instance on activities like bringing in people to do health checks and data processing. More importantly, this funding may be reallocated elsewhere within the budgetary allocations to use for, for instance, training or infrastructural development. This is not exclusive to healthcare only; other sectors are now cutting up on costs and rising productivity by using this wearable technology.

VI. CONCLUSION

This paper proposed one of the simplest smart wearable devices that health practitioners can use to access electronic health records in real-time. Its connectivity which is LPWAN is one of the most cost-efficient in the industry because it doesn't require sophisticated components to access clod data. The proposed device shows that it functions by connecting to patient's data which is already stored in the cloud. What is just needed is an IoT device which is the eyeglasses I proposed with an inbuilt microprocessor, a display lens, and LPWAN connectivity. All the data is processed by a microprocessor and is displayed in form of well-organized images of all the data for every patient. Data analytics is an important aspect of the proposed device. Patients who recently contracted the Covid-19 have their records stored in cloud systems of every center they got tested and vaccinated. It is therefore easy to track the spread of the disease by sampling all the data from every region and determine the number of patients who have been tested and found positive with the disease.

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