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E-Garments for Health Monitoring In Metaverse

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Abstract*—An artificial setting known as the metaverse *combines aspects of social media, online gaming, augmented reality (AR), virtual reality (VR), and cryptocurrency. The fusion of augmentedreality, mixed reality and virtual reality into our daily lives is referred to as the "metaverse"Nowadays, the term metaverse is widely used to represent a fast-evolving universe that has thepotential to drastically alter the manner in which we work, live and play. There is no singlevendorordevice-independentmetaverse.Avirtualcurrencythatoperatesindependentlyandissupported by digital money and non-fungible tokens (NFTs). Virtual reality serves as the Metaverse's primary support system. Users of Metaverse can communicate, network , and work together in 3D virtual reality. By participating in virtual conference sand performances, foot ball games, and other activities, users can engage in social interaction and play with one another in the digital world. Avatars can be customized, and their cultural, physical, andsocialtraitsdifferfrom those of reality. The avatar can interact with other creatures and accomplish tasks. Theirmost apparent use in healthcare is in the administration and protection of our immenselyimportant health data. Now, data is frequently exchanged between numerous organizations inways that are both wasteful and opaque to the data's owners. The proposed work is to designwearablegarments(Shirt/T-Shirt)to record health parameters and to beviewed in Metaverse

Keywords—metaverse, health parameters, virtual reality

I. INTRODUCTION

This project primarily focuses on patients in rural areas who find it challenging to travel overlong distances for their medical needs. The metaverse is a development in web 3 that allows individuals to socially interact with one another in spite of barriers like distance and area. Form any years, providing healthcare needed direct physical contact between a patient and a doctor in order to perform procedures like surgery, receive medical treatment, or make diagnoses.

Healthcare is only one of the many spheres of life where the metaverse is set to bring about adisruptive revolution. Given that it integrates augmented reality (AR) and virtual reality (VR)technology to operate in virtual settings, the Metaverse has incredible potential. Virtual healthhas changed how healthcare is delivered because it uses technology to overcome locationrestrictions. People's way of life have been profoundly changed by the ongoing coronavirusdisease2019,whichhasbeenassociatedwithseveresocialrestrictionstodecreasetransmission. This has made the need of virtual health for improving access to healthcare andloweringtheexposureriskconnectedwithin-personconsultationsmoreapparentthanever. Toreduce physical encounters in ophthalmology, clinical workflows required to be reevaluated and digitalized

II. PROPOSED WORK

A garment that utilizes sensors for the metaverse could have a number of potential uses. Onepossibilityisasmartsuitdesignedforuseinvirtualrealitygamingorsocialenvironments.Thesuitcouldincorporatevarioussensorstoenhancetheuser'sexperienceandprovidefeedbacktothevirtualenvironment.Forexample,thesuitcouldhavemotionsensorsthatdetectthewearer'smovements and translate them into corresponding actions in the virtual world. The suit couldalsoincludehapticfeedbacksensorsthat simulatetouchsensations,allowingthewearertofeelthevirtualenvironmentand interactwithitinamoreimmersiveway. Inadditiontothesebasicsensors, the garment could also incorporate more advanced sensors such as biometric sensorsthat track the wearer's heart rate, breathing rate, and other vital signs. These sensors could beused to provide feedback on the wearer's physical and emotional state, which could be used toenhancethe overallexperienceinthemetaverse.

Anotherpotentialuseforasensor-enabledgarmentinthemetaverseis forhealthcareorfitnessapplications. For example, a smart shirt could incorporate sensors that monitor the wearer'sposture, movement, and heart rate during exercise, providing real-time feedback and coachingto help the wearer optimize their workout. Ultimately, the possibilities for a sensor-enabledgarment in the metaverse are limited only by our imagination. With the rapid development ofvirtualrealityandotherimmersivetechnologies,thepotentialapplicationsforsuchagarment are virtually endless.

Temperature Sensor

Themedicalparameterslikетemperature,heartrate,andpulserate,weemployagarmentembeddedwiththepropersensors,suchastemperaturesensors andpulsesensors.Wediscoveredthesensors for the garment—a heart rate sensor and a pulse sensor—to track the patient's pulseandheartrate.WeusedjumperwirestoattachsensorstotheArduinoboard,uploadthenecessarycode, and get the sensors up and runningFollowing that, we took the operational sensors'readings. A temperature sensor is a device thatmeasures the temperature of an objectorenvironment and converts that temperature into an electrical signal that can be measured andanalyzed. There are various types of

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temperature sensors, but the most common type is athermocouple. A thermocouple is a type of sensor that consists of two distinct metals attached at oneend. Avoltagethat isproportionaltothetemperaturedifferentialbetweenthejoinedendandtheotherendofthetwometalsisproducedwhenthejoinedendofthetwometalsisheatedorcooled.Thevoltagegeneratedbythethermocouplecanbemeasuredandusedtocalculatethetemperature of the object being measured. The temperature is calculated using a formula that takes into account the properties of the two metals used in the thermocouple, as well as the voltage generated.

Regardless of the type of temperature sensor used, the principle is the same: the sensor detects a change in temperature and converts that change into an electrical signal that can be measured and used to determine the temperature of the object or environment being measured.

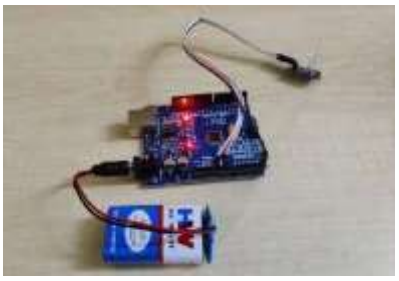

Fig 1. Temperature Sensor

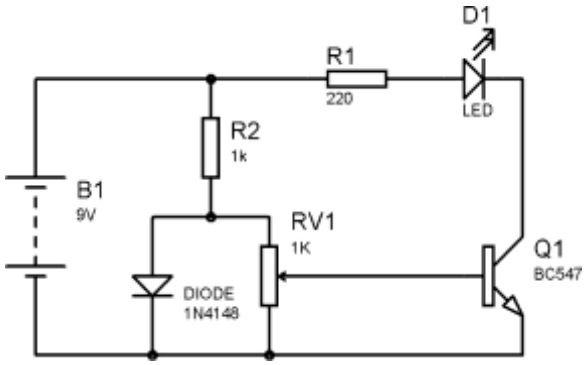

Fig. 2. Working of Temperature Sensor

Pulse sensor

Anopticalpulsesensorworksbyshiningalightontotheskinanddetectingthechangesinbloodvolume that occur as blood is pumped through the arteries. When the heart beats, there is an increase in blood volume in the arteries, which causes morelighttobeabsorbedbytheskin.Thesensordetectsthischangeinlightabsorptionandusesittodeterminetheheartrate.Anotherty peofpulse sensor is an electro cardiogram(ECG)sensor. Through electrodes affixed to the skin, an ECG monitor measures the electrical activity of the heart. As the heart beats, it produce selectrical signals that can bed etected by the ECG sensor and used to determine the heart rate.

These devices use the pulse sensor to continuously monitor the wearer's heart rate and providereal-time feedback on their level of activity and overall health. Some pulse sensors also includeadditional features such as sleep tracking and stress monitoring. Overall,

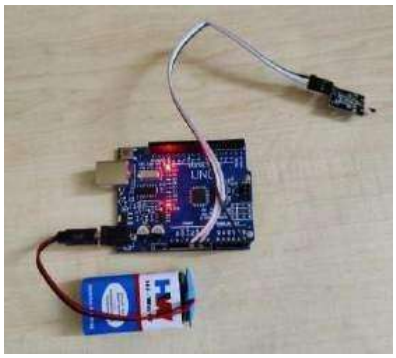

Fig 3 Pulse Sensor

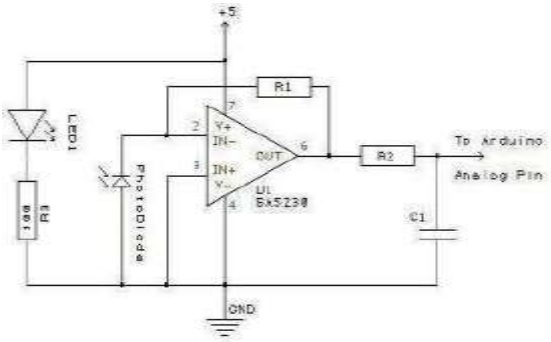

Fig 4 Working of a Pulse Sensor

Gyroscopic Sensor

A gyroscope is the gadget that detects and records direction and angular velocity. A gyroscope sensor measures an object's angular speed, tilt, or lateral orientation. There are multiple axes of gyroscope sensors available. These sensors are used in situations where the orientation of an item is difficult for humans to detect. With the incorporation of the Gyroscope sensor, more accurate measurements of orientation and movement in 3D space were feasible. A number of sensors in devices that are worn can aid in the recording of walking and running data; spatiotemporal and kinematic factors may then be computed in gait analysis. The gyroscopic sensor is one such sensor that we have included in our garment.

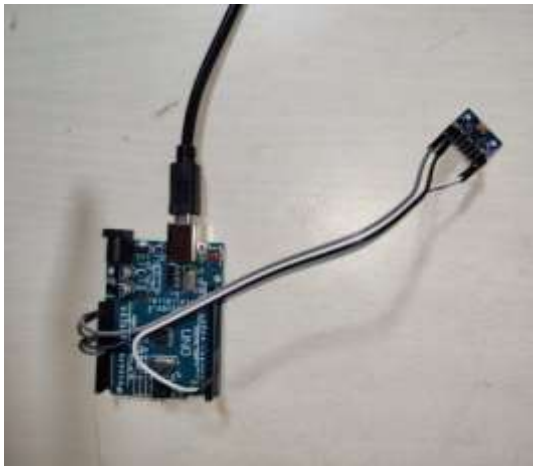

Fig 5. Gyroscopic sensor

2.4 Oximeter sensor

A pulse oximeter measures both the blood oxygen levels and your pulse rate. Low oxygen saturation may occur if you

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have certain medical conditions. The use of pulse oximetry is a noninvasive test that evaluates the level of saturation of oxygen in your blood. It is capable of detecting even little differences in levels of oxygen in actual time. These levels show how well your blood distributes oxygen to your extremities farthest away from the heart, such as your limbs and arms.

The hemoglobin in our blood is essential for effectively monitoring blood oxygen saturation. The amount of oxygen in hemoglobin influences our blood's ability to absorb red and infrared light rays. Optical SpO2 sensors monitor oxygen levels using red and infrared light sensors, detecting changes in those levels by observing the color of the blood. The sensor monitors the volume of oxygen in your blood depending on how light travels through your finger and sends the information to the device's screen, which displays the percentage of oxygen in your blood

Fig 6.Oximeter sensor

Garment with connections

Fig. 7Metaverse Garment

The integration of the Internet of Things (IoT) into the metaverse could enable new and excitingopportunitiesforimmersiveexperiencesandinteractions.ByincorporatingIoTdevicesintovirtual environment.

A digital twin is a virtual representation of a physical object or system, and it has numerousapplications in healthcare. In healthcare, a digital twin can represent a patient's body or a specificmedical device or system. By creating a digital twin, healthcare providers can simulate variousscenariosandtestdifferenttreatmentswithoutputtingthe patientatrisk.

Oneapplicationofdigitaltwin technology in healthcare is predictive modeling. By using data from sensors and other IoTdevices, healthcare providers can create a digital twin of a patient's body and use it to simulatevarious scenarios. For example, a doctor could use a digital twin to test different treatments for aparticular conditionandpredicthowthe patientwould respond

This could enable more personalized and effective treatments for patients. Another application ofdigital twin technology in healthcare is medical device development. By creating a digital twin ofamedicaldevice,manufacturerscantestandrefinethedevicebeforeitisputintoproduction.Thiscan help to reduce costs and improve the safety and effectiveness of medical devices.

Theeducation of healthcare workers can be enhanced with the help of digital twins. Healthcareprofessionalscanpracticeandimprovetheirskillsinasecureandcontrolledsettingbydevelopingvirtual simulations of medicalprocedures. This can lessen the possibility of medical errors andenhancepatientresult.

One potential use of IoT in the metaverse is to create smart homes and smart cities within thevirtualenvironment.IoTdevicessuchassensors,cameras,and smartappliancescouldbeintegrated into virtual homes and buildings, allowing users to interact with these devices as theywould in the physical world. For example, users could control virtual thermostats, lights, andsecurity systems using their virtual reality headsets or other devices. IoT could also be used tocreatemorepersonalizedandtargetedadvertisingwithinthemetaverse.Byusingdatafromsensorsandother IoTdevices,advertiserscouldcreatemorerelevantandpersonalizedadsthataretailoredtotheinterestsandpreferencesof individualusers.

III. METAVERSE IMPLEMENTATION

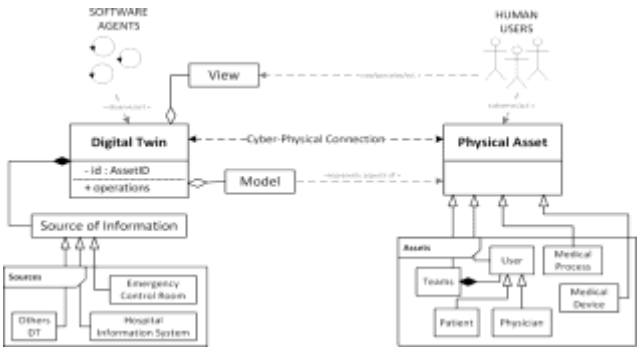

Fig8.Metaverseblock diagraminhealthcare

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Fig9Metaverseblock diagram

IV. Applications Of Metaverse

*Gaming:*The metaverse is often associated with gaming as it provides an immersive and interactive gaming experience. Virtual reality and augmented reality games can be created and played within the metaverse, providing gamers with a more realistic and engaging experience.

Social Networking: The metaverse can be used as a social network platform, where people can interact and connect with each other in a virtual world. Users can create their avatars, chat, attend events, and even attend virtual concerts within the metaverse.

*Education:*The metaverse can be used as an educational platform, providing students with an immersive and interactive learning experience. Virtual classrooms and labs can be created, where students can learn and experiment in a safe and controlled environment.

*Business:*The metaverse can be used for business purposes, allowing companies to conduct meetings, presentations, and even sell their products and services in a virtual environment. It can also be used for virtual trade shows, providing a more cost-effective and environmentally friendly alternative to physical trade shows.

Healthcare: The metaverse can be used in healthcare to provide virtual medical consultations, training, and simulations. It can also be used to create virtual hospitals and clinics, providing patients with a more comfortable and safer environment.

V. DataVisualization

The virtual representation of a patient's body or medical condition, healthcare providers can helppatientstobetterunderstandtheirconditionandtreatmentoptions.Thiscanhelptoimprovepatientoutcomesandsatisfaction.

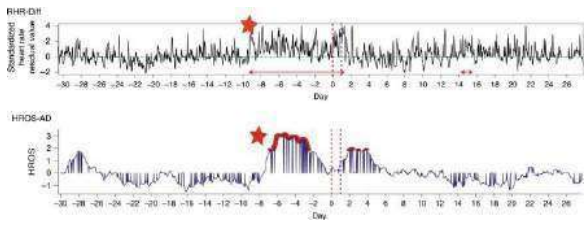

Fig10DataVisualizationofTemperatureand Pulse

Overall,digitaltwintechnologyhasnumerousapplicationsinhealthcare,frompredictivemodelingtomedicaldevicedevelopment,tohealthcareprofessionaltrainingandpatienteducation.

As the technology continues to evolve, we can expect to see new and innovative uses of digitaltwinsinhealthcareemerge.

VI. Conclusion

The integration of the metaverse with IoT has the potential to transform the way we experienceand interact with clothing and other wearables. By incorporating sensors and other IoT devicesinto garments, it is possible to create more immersive and interactive experiences that are closelytiedtothephysicalworld.Theuseoftemperaturesensorsandpulsesensorsingarmentscanenablea range of applications, from tracking fitness and wellness to improving safety in hazardousenvironments.Similarly, theuseofmotionsensorsandgesturerecognitiontechnologycanenablemore natural and intuitive interactions with virtual environments and objects. In addition to thepotential applications in the fashion industry, the integration of IoT with the metaverse has thepotential to revolutionize healthcare by enabling remote patient monitoring, immersive healtheducation experiences, and improved medical research. Digital twin technology can also be usedto create virtual simulations of medical procedures and test

References

[1] C.R.Macedo,D.A.Miro andT.Hart,"TheMetaverse:FromScienceFictionto Commercial Reality—Protecting Intellectual Property in the VirtualLandscape",NYSBABrightIdeas,vol.31,no.1,2022.

[2] Sitharthan, R., Vimal, S., Verma, A., Karthikeyan, M., Dhanabalan, S. S., Prabaharan, N., ...&Eswaran, T. (2023). Smart microgrid with the internet of things for adequate energy management and analysis.Computers and Electrical Engineering, 106, 108556.

[3] Articles12and3ofthe FrameworkActonIntellectualPropertyNo.10629,[online]Available:https:

[4] M.K.Park,H.J.Kim,W.H.Jeongand K.H.Kim,"AStudyontheBusinessModel of Copyright-Based Platform; Focusing on Korean and U.S. cases",Internationalarea StudiesReview, vol.24,no. 2,2020.

[5] H.Y.Yoon,"TrendsofContentUsein2021DigitalTransformationEra",KoreanCreativeContentAgency,vol. 11, 2021.

[6] Addcolortocosmeticbrandnames,52014,[online]

[7] Available:https://www.beautynury.com/news/view/61945/cat/10.

[8] C.R.Macedo,D.A.Miro andT.Hart,"TheMetaverse:FromScienceFictionto Commercial Reality—Protecting Intellectual Property in the VirtualLandscape",NYSBABrightIdeas,vol.31,no.1,2022.

[9] Rajesh, M., &Sitharthan, R. (2022). Introduction to the special section on cyber-physical system for autonomous process control in industry 5.0.Computers and Electrical Engineering, 104, 108481.

[10] M. Grieves, “Digital twin: manufacturing excellence through virtual factory replication,” White paper, vol. 1, pp. 1-7, 2014.

[11] H. Julian , T. Chung, and Y. Wang,“Adoption of Metaverse in South East Asia. Strategies and Opportunities for Technology in the Metaverse World,” 10.4018/978-1-6684-5732-0.ch012, pp. 196-234, 2023.