Review on Wearable Technology

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ABSTRACT: Wearable technology encapsulates a multitude of devices worn directly on a human, or loosely connected to them. The latter usually consists of smart phones, which have become an integral part of WT's success and functionality. This review paper addresses Wearable Technology developments and forecasts in the sport market. Analyzing the role of wearable technology for various users and why these devices are so important in their daily lives. This shows how different sensors affect the distribution of a number of readings which are useful in many ways in terms of sport or other applications. Wearables expand in function and through technology integration; consumers are collecting more data about themselves. There is a wide amount of wearable technology available, each with its own role to play in different industries. The inertial measurement unit (IMU) and the Global Positioning System (GPS) sensors are mainly found in sport wearables but can be designed for different needs. The differences are displayed to show which sensors are compatible and which ones can evolve sensor technology for sport applications.

KEYWORDS: Accelerometer, Gyroscope, GPS, Sensor and Wearable technology.

INTRODUCTION

Technology has allowed for more user-centric design solutions for different industries. There is a growing trend of increasingly quantifying the accomplishments that consumers use every day, whether they are related to fitness, wellness or work. Wearables[1] that have sensors that track how the body is man-evering give the user greater self-understanding. The explanation for data easing behind them can be attributed to one's desire to measure one's skill in an environment they want to gather more information. Sensor developments allow for deeper measuring capabilities. Users know more about themselves, so under their control changes in their lifestyle can be made. Another way of showing progress in sensor technology is by applying sensors to equipment. Wearable applications vary. Some need it, others want it. Details of when it is most common in workspaces. An individual will benefit from wearable intelligence if relevant data can be sensed by the body worn item to educate them about a procedure or identify safety concerns. Examples of when it is desired are when an individual sees a personal benefit opportunity, gaining valuable data from the function such as Fit bit. The trend in wearables crosses the fine line of wanting to be desired. This is because most systems are becoming more user-oriented, and the data are generated to better themselves. This can begin with an interest but adapts to necessity. The adaptation process is based on perceived utility of wearables including external factors toward real ergonomics. There is actually this self-obsessed age in which success is based on quantity data such as number of followers, number of views, etc.

Human-centered developments promote accessibility (e.g., voice recognition commands) and turn this way of living into a standard. This only causes an increase in the interest of individuals to be involved in their daily lives with this type of application (e.g. controlling home appliances from a smart watch). The best suited industry will always have it first when a new technology has been tested and tested just as it is marketable. The watch may only become available for other consumer markets after this. Smart-body wearing trackers[2] are an example of this, which the military benefited from the very first before they became useful for different purposes. Instances where the same wearables are used in multiple industries imply that the sensors involved generate data that can be interpreted for different uses, thus different consumers. This effect is that as wearable technology continuously solves needs. In this industry the military and space industries are continually major influencers. Wearable technology perception started from a worn computer and is part of the user that can be fully controlled, but can work without any thought or effort. In today's wearables this form can be seen somewhat, as they are considered Smart because they operate themselves with minimal human input in controls but also because they give the user the freedom to take action from the data presented from the wearables. Figure 1 shows the block diagram of fitness wearable pro.

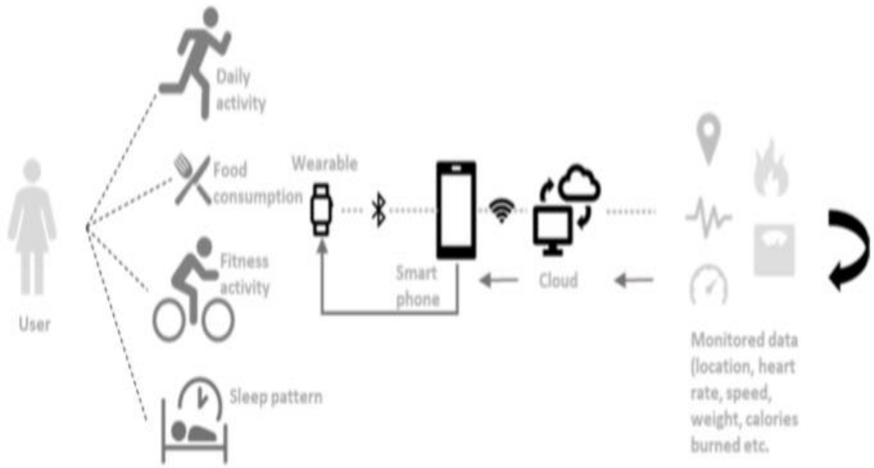

Fig.1: Block diagram of Fitness wearable's pro

Market research demonstrates how fitness and health goods for this sector should expand the most, but wearable technology advancing in multiple industries should not be overlooked, because research can be used as crossovers. Gaming is becoming a wearable technology market of renown. The emergence of virtual and augmented reality, which is heavily involved in this sector, plays a role in increasing the way in which a user can immerse him with the product and experience. Wearable technology[3] plays a role in this since it enables sensations to be sensed, giving the experience a more authentic feel. Figure 2 shows the wearable technology market size.

Fig. 2: Wearable technology market share

SENSORS

Microcontroller

A microcontroller[4] is the key component in making wearable technology work. This is usually seen as a mini-computer (on a chip system). This helps to be involved in this program on the Internet of Things (IoT). Importantly, it reduces the number of electronic components charged with performing different functions on a single chip. Due to its simplicity in programming, reprogramming, cost, scale, compatibility with other sensors and the ability to control complex outputs, including graphical displays, it is desirably used in wearable technology. The versatility enables designers to optimize the microcontroller to suit their user requirements. Several pieces include the microcontroller. Input data is read by the processor and the information is stored, which is programmed to make decisions and write output data. The oscillator is a timer clock which synchronizes all the required data. Storage has three parts, random access storage (RAM), which loses data when power loss occurs, reads only memory (ROM), which does not lose data when power loss occurs, and flash, where data is stored. The ports become a microcontroller's final piece of a microcontroller.

These are the connections input or output to and from the microcontroller. It reads the (polling) input data and writes the output data. An analog to digital converter (ADC) exists which allows the processing of analog inputs into digital readings. This device format on a chip is used to define which architecture the designer would be using with respect to how the electrode-based sensors need signal conditioning. The configuration of the microcontroller varies according to different types. The von Neumann architecture has three data buses that hold the data between in or out, the address bus memory tells the location, and the control bus decides whether the data is read or written, while others manage interruptions, pick memory, or ports. Harvard Architecture is a faster system with an additional fourth bus, the instruction bus. Operation by default is common. The supplied voltage gives all the components power, control logic will take precedence over all components and a timer stabilizes pulse sequences.

Accelerometer

Accelerometers[5] are common in wearables. Our sensing abilities come from various types of accelerations, such as linear and gravity. Its measuring capabilities allow the programming of controlled data for different uses. An example of this is when a user runs; it can produce maximum speed and acceleration. In addition, accelerometers track sleep patterns which can be related to seizures. Such two examples show that industries such as sport and medicine benefit from an accelerometer-based wearable because of its ability to produce a range of meaningful data. It is necessary not to influence the programmed algorithm, as this may corrupt the data being monitored during processing phase. That will make the raw data being tracked meaningless.

Accelerometers can be characterized by their limitations; this is usually their maximum acceleration measurement power, typically defined as a sensor which can turn physical motion into digital measurement. It does so by calculating the powers of acceleration. The location of the sensors allows flexibility in position, making the accelerometer a very multi-functional sensor.

Gyroscopes

Another can sensor used in wearables is the gyroscopes. These differ from accelerometers, since these solely measure angular accelerations. Many programs tend to use the accelerometer to determine the acceleration of rotation, while some would like to combine both to eliminate errors. This is to increase the accuracy of the data being tracked. Various types exist, such as gas bearing, optical and mechanical. Optical is the one that works differently (non-angular momentum), where the two of optic fiber coils are spun in alternating directions, thus moving different distances, which is monitored by Sagnac effect.

Essentially gyroscopes[6] measure angular velocity on their disk. Because of the Coriolis force, vibration gyroscope sensors detect angular velocities. These are natural forces which occur due to the rotation of the Earth, which acts on a vibrating element. The motion produces a potential difference, which becomes an electrical signal. This is used for measuring orientation and projection, making it beneficial for stats that involve angles or specific positioning. The method of tracking also means that the location of the sensor can be influential in data collection. If there is need to integrate the sensors with equipment, another consideration to factor will be selecting compatible electronics and locations around those sensors.

Magnetometers

Magnetometers[7] can typically be combined to form the inertial measuring unit (IMU) with accelerometers and gyroscopes. Depending on the type, each of these sensors can have three axes each. It is very close to what a compass does, so synchronization helps. While it is normally used with the other two sensors, by filtering the orientation of the movements it complements them. Magnetometers measure magnetic forces with respect to the magnetic field on Earth. This is achieved through the Hall effect principles where, if a current carrying conductor is put in a magnetic field, a voltage is produced across the conductor perpendicular to the current and the magnetic field.

The electrodes inside the conductor get disturbed (change in density) by the magnetic field capture, which results in the reading of the voltage. If the forces applied change, then the reading of the voltage changes proportionally, giving the magnetic field value and direction. This is then given out as an electrical quantity, due to the vector calculations, which gives the orientation. Detecting different movements of the same part of the body gives the IMU an extra scale to consider.

Global Positioning System (GPS)

GPS[8] is a very common sensor found in multiple appliances such as smart phones. It is used for navigation, as it informs users about their location. Data are sent to a satellite where the precise location and time are measured. This works as a transmitter and a receiver, where the information is fed back into the sensor to inform the location. It is used in wearables to measure key data, such as distance, which can be viewed in different ways for different applications. Designers have concerns about the power consumption of these sensors. GPS is useful in team sports, as it eliminates issues that arise with time motion analysis, and coaches can navigate positional team play. This is very important for coaches who prioritize multiple things and may not always provide individually based focus.

APPLICATIONS

- Health

Wearable devices[9] are likely to be used very often in health-related matters. Wearable devices are capable of constantly tracking people's health measures. If something goes wrong, the system will immediately send a signal to the emergency service and communicate the patient's current situation with the emergency service, and share the patient's exact location. In the future, other unique wearable systems can be incorporated into the patient's body and, in the event of an emergency, these tools that can provide the patient with care. For instance, when the insulin level decrease, the wearable device will inject insulin according to the amount that the body needs.

- Entertainment

There will also be a paradigm shift in the gaming industry, with the advent of wearable technology. Oculus Rift, which is a head-mounted monitor of virtual reality, can be viewed as the early iteration of this changeover. When a user wears the head-mounted display, he or she can almost see the virtual environment as real. Besides, users no longer need a keyboard, or joystick, with the new motion sensing input devices. The games are sensing the gamers ' true motions. Therefore, with just a head mounted display, users can play games like they are in real life. Moreover, by using this virtual reality head mounted displays of virtual amusement parks can be constructed.

- Service

Integrating smart glass, face recognition and data management will lead to an increased customer service. For example, when a customer signs up for the airline company's website, there are several questions that can be asked about their interests. When the hostess views a passenger during the flight, all of his / her details will appear on the Smart Glasses panel. The passengers will behave according to their wishes and this will increase customer satisfaction and loyalty. On the other hand, Smart Glasses can be used for repair issues. User can instantly access to the user's manuals while in action, if he could not find the solution, the specialist can connect to the mechanic's Smart Glasses and help the mechanics to solve the problem. In addition, the users can get instant online help for uncomplicated breakdown issues.

- Tourism

Enhanced reality integrated wearable technologies allow people to remotely visit towns, tourist attractions, without getting there. They also use virtual sightseeing tours through the area. In the near future new virtual tourism enterprises can arise. In other ways, tourism companies will show the hotels in practically 3D format to the customers. The clients should make the right choices here.

- People with impairments

One of the greatest impact wearable devices[10] will have on the people with disabilities. Smart Glasses can navigate both indoor and outdoor for the blind. Furthermore, they may know whom they encounter with the face recognition feature. The classes can also read the wearer's signals, and warn them if they encounter a dangerous situation. A new sector may emerge that will become the heart of visually impaired people. A paid person or a volunteer can connect to the blind person's smart glass and help the wearer when he or she must stop, navigate the road and keep him or her safe. For people with hearing impairment, a smart glasses may sense the voice and transform the speech into text format and show the text to the people with hearing impairment instantaneous.

CONCLUSION

Compatibility and wireless area network technology range shows how the wearable can communicate and work with other devices. In addition, this analysis discusses the importance of developments in sensors. Research into sensor priorities will help us understand where advances in electronic components can be most successful. Listing the main summary of the technology and market trends offers an idea of what wearables are now and in the future. Many sensors are more critical than others and use different applications in different industries. Current technological limitations affect the design considerations. It is important to outline key elements which revolve around hardware device wearables to understand how performance and injury monitoring data is handled in sport. Code is even more critical, since the feedback is where wearable's utility is truly understood. This review paper indicates that more work can be done on how different readings are provided by the specific type of sensors and that potential user experience studies could be very beneficial.

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