Wearable Technology in E-Learning and Health Care

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ABSTRACT

The rapid increase in the mobile and wireless technology has led to the establishment of various design approaches to the user's requirements. Thus among the recent developing technologies the wearable technology has seen a increasing demand and thus it is a growing field. The wearable technologies are those intelligent devices with a variety of sensors to track the physical movements of a person, these devices are lightweight very easy to carry and bendable.

With the latest emergence and the adoption of the internet and mobile technology, now the wearable technology is also a impactful solution to manage and increase the classroom involvement. There a wide variety of wearable devices which are available like smartwatches, Google lenses, smart clothing, etc. And it is often complex for the educators to implement these advanced techniques to higher educational contexts. This paper focuses on studying the different applications of this evolving technology in the e-learning field.

KEYWORDS: wearable technology, wearable, education, e-learning, Google glass, cloud computing, virtual reality

INTRODUCTION

After nearly three decades of the development of the calculator watch which was a very helpful in calculating arithmetic problems simply on a watch rather than taking out the large calculator was very convenient, the wearable technology is now considered as the rapidly growing and popular in the consumer electronics sector. The activity trackers from the companies Nike, Fitbit, Jawbon and Xiaomi have entered the market and marketing their product to people for trying to improve their health and physical fitness. The smartwatches from the companies like the Apple, Samsung, Fossil promise to provide a great convenience to the users in connecting to social networking sites, mobile phones, etc. The "Google Glass" offers the always on connectivity using the heads up display that can augment reality based on one's location. These are some of the popular examples in the space of wearable technologies.

We can assume that such wearable technologies are on the path to become a part of our technological ecosystem in the same way that the laptop computers, tablets and smartphones have already become. If this is the situation, we can also expect that interest in their educational potential will grow rapidly (e.g., Murray & Olcese, 2011), which will lead us to ask the question that: What might technology-supported teaching and learning activities look like when classrooms have access to the wearable devices?

In health care the wearable technologies enable the constant monitoring of the human physical activities and various behaviours, as well as physiological and biochemical parameters during daily life. The most common data which is studied include the heart rate monitoring, blood pressure and body temperature, posture, and physical activities through the use of electrocardiogram (ECG), ballistocardiogram (BCG) and other devices. Wearable devices can be attached to shoes, eyeglasses, clothing and watches. Wearable devices can also be attachable to the skin. The sensors can be embedded into the environment, such as chairs, car seats and mattresses. A smartphone is mainly used to collect the information and transmit it to a remote server for storage and analysis. In this research paper we will examine the usage of the wearable devices in studying the physical activity data and the usage of wearable devices in the educational firms.

Figure1. The evolution of wearables

Literature Review:

1. "Wearable Technology Applications in health care", authors Min Wu and Jake Luo have discussed the various techniques of how the wearable technologies can be an innovative solution for the health care problems [November 2019].

2. "Teaching and Learning with Wearable Technologies", authors Bard Ketil Engen, Tonje H. Giaever, Louise Mifsud have discussed the different possibilities and

challenges in using wearable computers in teaching and learning.

3. "Wearable Technology: Facilitating or Complexing Education?" authors Belsam Attallah and Zakea Ilagure have investigated the different factors associated with the application of the wearable technology in the education field [June 2018].

4. "Enhancing Learning with Wearable Technologies In and Out of Educational Settings" author Kadir Demir has discussed the integration of wearables into education by presenting recent practices for instructional purposes [January 2017].

5. "Wearable Computing in E-Education" authors Aleksandra Labus, Mladen Stevanovic and Suzana Milinovic have studied some ethical and social aspects of using wearable technologies are also considered, especially for students with disabilities [March 2015].

6. "Using Fitness Trackers and Smartwatches to Measure Physical Activity in Research" authors Ashenafi Zebene Woldaregay, Miroslav Muzny, Gunnar Hartvigsen, Laila Arnesdatter Hopstock and Same line Grimsgaard have examined how the consumer market for wearable devices has evolved over the course of time and analyzed and summarized the available devices that can measure physical activity and heart rate [March 2018].

Objective of the study:
➢ To study how the wearable technology can be defined and discuss how the wearables can be integrated into teaching and learning activity.
➢ To study the availability of various wearables for fitness and also to compare different brands and examine the collected health data to see that has the health of people improved after using the wearable devices.

Research Methodology:
➢ **Wearable Technology in E-learning:**
The second half of the 20th century introduces a new era of computing technology which is reduced in size but increased in prevalence in the everyday usage. Computers are becoming ubiquitous in nature the term used is "Ubiquitous Computing" which means that computers everywhere. This means that the devices can be small in size, flexible and mobile and eventually this has led to the evolution of that devices can be directly attached to the human body and these devices can communicate with other devices. The wearable ideology assumes that those devices under existence which can indirectly interact with humans. The wearable computers can hence be described as the devices which are always connected to its user, while the user is using it in comfortable way. Thus wearable computing can be understood as having those devices which can be worn in the same way as clothing which are always available for usage and they can perform various kinds of computing.

Wearable devices in general include a wide range of devices and their different possible usages. It is necessary for the wearable devices to fulfil the requirements of persistence and consistency to be accepted. Nowadays the implementation of the wearable devices is limited and it depends on the manufacturer for the creativity and contribution.
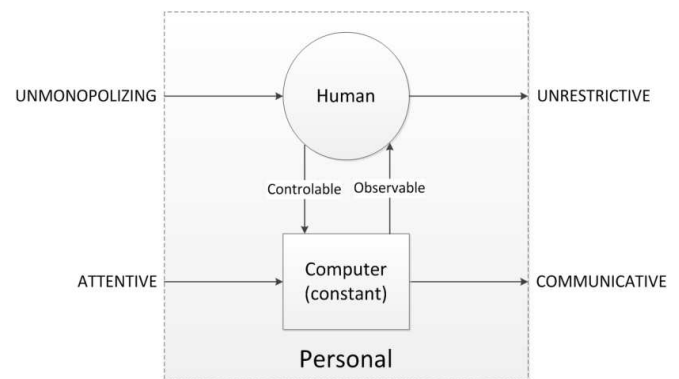

Figure2. A detail view of wearable computing

Unlike the traditional education or learning technique, the e-learning is a field where new technological possibilities are quickly explored and adopted. The e-learning is significantly improved by new learning techniques and ideas. The innovative method of presenting the information to the new learners is very helpful to even the less motivated learners.

Google Glass:
The device such as the Google Glass is considered as the most important device in the education. The Google Glass allows students to watch and listen to the lectures remotely without their physical presence. For example, a student of medical field can watch the surgeon's lecture of doing a surgery in real time which will benefit him better understand the process practically rather than theoretically. Google Glass also enables the students to receive the text messages or alerts regarding their course, e.g. the assessment deadlines or the notification from their faculty. It also provides the features of answer/translate questions or their answers in a foreign language. This wearable device also allows the educators to stay connected to their students in an interactive environment where it allows the facial recognition feature of the student where the teacher can get all the details of the student by just looking at the student. Just by looking at the student the lecturer can get the academic as well as non-academic performance of the student and also the attendance rate which will help the lecturer to generate the annual report of the student and the lecture timings. The Google Glass also allows the educators to see from the learner's point of view so the educator can decide the teaching pattern or can improvise according to the students understanding.

Virtual Reality (VR):
The Virtual Reality (VR) is another wearable device which can be used in the education as it is more interactive and interesting than the traditional classrooms. The VR are head mounted wearable devices which are light-weight, comfortable to wear, provide a wide field of view and are also affordable in price. The various virtual reality devices in market are the Samsung Gear VR, Google Expedition and many more. They allow the learners to learn differently without any risks involved. For example, space studies, chemical engineering, archaeological study and aviation study. The usage of virtual reality wearable devices provides the students a hands-on, engaged and collective participation on students in learning process as compared to the traditional way of reading or watching the lessons. The Google Expedition is another type of virtual reality wearable device which can be used in education. It can provide a unique experience to the educators to guide their students

on a guided virtual field trip just by sitting in the classroom. It provides a 360-degree experience to the students which allow them to explore unknown locations anywhere in the world without even physically travelling. For example, study of underwater marine animals, study of the space, study of the volcanoes, wildlife study etc. These devices can make delivery of the knowledge to the students more interesting and enable them in deep learning.

Smart jewellery/watch:

The smart jewellery or a smart watch is another type of wearable device which can be worn on the wrist and it monitors the different aspects of human body. The smart bracelet is one of the examples of smart jewellery. The smart watch is considered as one of the most important and precise wearable display device in education. The smart watch can monitor the steps covered, heart rates and breathing rates, sleep behaviour and also gives or send a notification. It transmits the data to a tablet or a smart phone where the lecturer can monitor the student's physical activity and he can be sure that the student achieves his/her target. The smart watch is becoming more and more popular among the people as it has a simple and easy to use system and it is becoming a productive and convenient alternative to smart phones. It allows the students to sends messages to their teachers to ask for doubts and the teacher can reply back to the student irrespective of the location. Many popular companies like the Apple, Samsung, Motorola, Xiaomi, Huawei, Fossil, etc. now provide smartwatches with a large set of functionalities and many premium features just as smart phone.

Figure3. Wearable Technology in e-learning

Limitations of wearable technology in learning/education:

➢ An important disadvantage of the wearable technology in education is the overreliance on that technology. Some of the educators believe that the continues use of the wearable devices by the learners can make them totally dependent on this technology. The learners might become reliant on these wearable devices to give them answers and/or solutions on what to do next, which reduces their ability to think on their own.

➢ While using the Google glass for educational purpose the lecturer has to wear that glass at all times during the course of lecture and he has to upload the course material to the internet while recording and this requires a stable internet at all times for the material sharing even though the students can directly access the material from the internet.

➢ It also requires a certain level of computing skills to both the students as well as educator to achieve the feature.

➢ It also causes a level of distraction to the students which much higher than the distraction caused by the smart phones.

➢ The continues usage of the Google Glass can cause health issues mainly the reduce eyesight and the constant access to the social media applications can damage the personal life of the user.

➢ As the wearable devices are smaller in size they have a small capacity battery so the continues usage drains the battery quickly and requires frequent charging. The wearable devices are constantly connected to a smart phone so without it they are of very little use.

Wearable Technology in Health Care:

The wearable technology can be a very innovative technology for the health care problems. There are many wearable devices which are used in health care in that some devices are developed by the health care professionals to monitor the walking patterns these include accelerometer, multi-angle video monitors and gyroscope. Other devices have been developed for the health care consumers include the wrist worn activity trackers and many mobile phone apps and add-ons. The wearable devices and data analysis algorithms are often used together to perform health assessment tasks in various scenarios. There are many companies in market which offer the activity trackers with various functionalities like the FitBit, Fastrack, Garmin, Mi Band and many more.

Some of the wearable technology applications are designed to improve the users health and also for the prevention of diseases like weight control and physical activity monitoring. Many believe that the wearable devices might improve the quality of patients health care with also reducing the cost of the health care. The big data which is generated by these wearable devices are both a challenge as well as opportunity to the researchers to apply techniques on that data and use that data to study about prevention of the unknown diseases or the invention of the medicines to cure those diseases.

For Patient Monitoring:

Tracking the physical activities using the wearable devices is now growing day by day among people. They use these devices to track the activity intensity, the number of calories burned after a period of time, total steps walked, to track weight control and many more. The health care providers also use the wearable devices to monitor the patients health as the wearable technology is can also help to improve management of patient efficiently in hospitals. Researches think of using the wearable technology to early detecting the health problems. The wireless communication in the wearable devices will enable the researchers to design new techniques of diagnostics devices. For example, the wearable devices can be integrated to the clothes of the patient, such as the sensors and devices in the emergency services, emergency room or the intensive care unit (ICU) to continuously monitor the patients. The enables the detection of the various patient's health condition parameters like the breathing rate, heart rate, body temperature, blood oxygen saturation, posture, activity and position. It also helps to detect the external environmental parameters like the external temperature, the presences of toxic gases, etc and process the data and transmit this useful information to the health care providers.
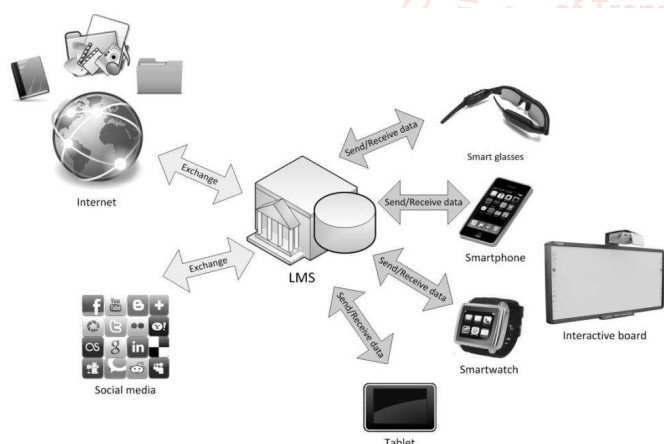
The wearable devices activity tracking abilities help the health consumers to enhance their self managing capabilities. It helps the consumers to track their weight, diet or health routines in many ways. Thus the wearable devices further help to improve the self tracking ability as the objective evidence is taken from the data which is provided by the sensors also the various machine learning algorithms are used to support the clinical decision making as the predictions should be accurate as inaccurate results can prove dangerous to both the health care providers and the data scientists.

Wearable Fitness Trackers to Increase Physical Activity:

Wearable activity trackers are referred to as the wearable devices which are sensor based and they can automatically track and monitor various parameters of physical activities like the number of steps walked, stairs climbed, calories burned or consumed, breathing rate, heart rate and also quality and duration of sleep. These activity trackers link this data with the user's personal account and ensures that it can be easily accessed from the device to which it is connected. Although some features can vary depending upon the brand and model of the tracker, older adults mainly use the activity trackers to monitor the distance covered, sleep time, heart rate, calories burned and also steps covered. This makes the activity trackers a useful tool for the adult age group to provide the feedback about the amount and intensity of the physical activity.

A proper physical activity in older adults helps in reducing the risk of chronic diseases like obesity, stroke and hypertension, improve mental health, reduce the risk of falls and maintain a longer as well as independent life. The activity trackers make a relevant technology for the older adults aged 65 years and above as 84% of the people of these age groups do not meet the physical activity requirements. Activities such as bicycle riding, jogging, walking are some the physical activities which are tracked by the wearable devices. Activity trackers have the advantage of boosting the physical activity by techniques such as goal setting, self monitoring, goal sharing, social support, feedback, reward and social comparison as it provides the goal sharing on the social networking sites where the user can share his/her goal and can compare with their friends.

Figure4. A typical fitness tracker

Limitations of wearable technology in health care:

➢ User acceptance:

The wearable devices should be easy to maintain and operate, embedded and compact. It should also not directly replace the health care providers. The user preferences need to be taken into consideration to design these devices to gain the acceptance of both the clinics as well as the individual users.

➢ Security:

Patient details confidentiality and the data security are the major concerns while using the wearable devices. The security of the collected data is also a measure concern so proper encryption should be done to provide an authentication in the organization's trusted network. Since the direct access to the key and certificate can help anyone to gain the access to the details so key management is also important to increase the security.

➢ Big Data:

In the health care sector, the wearable devices generate a very large amount of user personal data. This large amount of data is stored in a data warehouse for further operations. This data can be used by the researchers for various studies and pattern discovery. Since the big data is complex an unorganized so proper data capturing and cleaning should be used. The data which is captured should be clean, accurate and complete as noisy or irrelevant data can be dangerous for clinical decisions, so proper data capturing techniques should be used.

➢ Battery Life:

Since the wearable devices are small in size and are almost all the time running when they are worn their battery life is not sufficient and require a frequent charging which is a bit inconvenient for the user. But main problem is that if the developer tries to increase the capacity of the battery the price of that device will increase as well as the weight would increase.

➢ Price:

Many wearable fitness devices come at a very less price where everyone can purchase doesn't offer the entire feature. Thus a wearable device which offers nearly all the features is still quite expensive and so everyone cannot afford it. For example, the Apple watch.

Conclusion:

The wearable technology is nowadays getting to be involved into the various aspects of the human life so applying it into the learning process can provide us a long term benefits. By implementing the wearable computing into education and involving the students the quality of learning can be improved and also can be made fun, the students can also perform development of these wearable systems in the future. Also the students who are disabled can use these wearable devices like Google glass, smart watches into learning.

The wearable devices like the smart watches and fitness trackers also help the people in improving their health by encouraging them to exercise and also keeping an eye on their health.

The usage of wearable technology in the existing education process and also the usage in the healthcare activities are discussed in this paper based on different examples.

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