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Impact of internet of everything technologies in sports

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Abstract
Internet of Things has been one of the hottest technology concepts of recent years. It started with the wearable devices and any digital device connected online and evolved to a web connected network linking everything from devices, sensors, machines, people, processes, companies, and so on, creating the Internet of Everything concept. There are many application areas, but one stands out due to its popularization and importance to industry, Sports and specifically Football. Football has been reinventing itself with the implementation of technology, recreating the formula used in the United States Major Sports, where technology helps to enhance the spectacle experience, expand game analysis by coaches, players, and media, provide live refereeing, and improve health recoveries and detection of injuries. This research is a state-of-situation regarding technology in football, recognizing the presently used technologies and what could be implemented, and ultimately measuring the impact of these devices in Football.

Keywords: internet of things, internet of everything, sports, football, devices

Introduction

At a time in which there are devices and apps for almost everything in a society's daily activities, it becomes pivotal to assess the impact in user's lives, as well as its growing development in a forecasted future even more advanced and connected than the present. Herein, we will approach the use of these monitoring devices in sports, more specifically, in football. First, it is mandatory to explain what Internet of Everything really is and to distinguish it from a similar and better-known concept that is Internet of Things. These "things" are real and physical objects that can be used, such as a Smartphone, smart watch or a computer, but must have the ability to become online and connected to the world (Morgan, 2014). But as we know, there is much more beyond these devices, being only a portion of the Internet. For instance, we can consider Google, which has no physical space; instead, it is an intelligent network that enables all smart devices to be connected in only one place, but also, people, users, data, processes, machines, transportation, environment, etc.

Ultimately, the "Everything" is a set of these interconnected elements, converging and designing a system able to create Internet of Everything. An example of this is to see "Internet of Things as a rail road line, including the tracks and the connections, whereas the Internet of Everything is all of that, and the trains, ticket machines, staff, customers, weather conditions, etc." (Simmons, 2015). Sports Technology is in constant expansion and development, as we witness greater involvement of science and technology in sports, more than we have ever seen till now. Nowadays, the best sporting results often lie in the details that can be noticed and forearmed with the use of any kind of technology or device that can make the difference. In the Big Data era, sports are also included in it, because, increasingly, there are large amounts of data collected that can be applied for analysis, thereby creating competitive advantages to be used either in real-time during a competition or during practice, preparation, or recruitment.

Internet of Everything can already be seen in some fields of sports. For instance, technology is being used in live refereeing of an event through sensors and high-definition cameras spread across the sports field (e.g. tennis, American football), monitoring each athlete's movement through inertial sensors (e.g. football, ballet, golf, race walking and swimming), simulating real competition using Virtual Reality Goggles/Helmets (e.g. boxing) and sensors in the balls for data analysis (e.g. basketball and tennis). Currently, the United States is in the forefront of the inclusion of technology in sports, enhancing the experience of millions of viewers and helping every single intervenient with detailed images and statistics, all thanks to partnerships with software companies (e.g. Microsoft and SAP) or sports television networks that help the television and internet broadcast.

Motivation/Justification

Internets of Things technologies have the power to make an impact on any aspect of our daily lives. We can no longer live without certain mobile apps, devices, or even concepts, as they are changing our behavior with the world around us. In sports, it is changing the interactions between spectator and spectacle, in which they are soon faced with attractive technology around the stadiums, thematic mobile apps, social media, fantasy sports, and much more, making everything part of the spectacle or competition.

Nowadays on our planet we have more devices than humans and they are multiplying five times faster than we are (Boren, 2014) [2]. It is expected that by the year of 2020, Internet of Things industry will reach the trillion-dollar margin and have approximately 26 billion connected devices (Macy, 2015). Sports will have its share, mainly football, by already being a billion-dollar industry through player transfers, advertising contracts, television audience, merchandising, infrastructures for events, and in by the increase of technology implementation that is being invested by international clubs. Undoubtedly, football is a worldwide phenomenon and the most famous sport, as we can see by the higher number of

members of FIFA (Federation International de Football Association) compared to the United Nations (Stein *et al*., 2016). Football success is all about winning games and titles and a club history is fed by the number of championships won. Therefore, scouts and coaches are always looking for new rising prospects outside or within their club or trying to develop young players inside their own football academies by watching hours and hours of tapes to compare and scrutinize new talent around the world. Monitoring players' performance has become a routine to video analysts being very close to the coaching staff, sometimes with its own department in which they can identify weaknesses and strengths of their teams and of their opponents and then help to adjust specific training situations or in game real time decisions. In terms of health and physical aspects, players can also be monitored through data collected in players' bodies to improve medical treatment in case of an injury or to even predict it or to improve any physical weakness such as endurance, speed, reaction capacity, strength, etc.

Associated Technologies

Internet is no longer a network of computers, we now have internet access and connectivity in multiple devices and platforms due to adaptations in our everyday objects, opening a tremendous range of opportunities that promise to revolutionize and improve the quality of life of the population (Xia *et al*., 2012). The network of devices that is talked about can be of different types and sizes, can be vehicles, smart phones, home appliances, toys, cameras, medical instruments, industrial systems, and so on (Vermesan & Friess, 2013).

Artifacts

Having described the main problems and challenges football faces and presented the Internet of Things/Everything concept and how it is fitting into sports and football, it is now time to explain what is the best way to answer those problems and challenges. This will be made through artifacts, which are no more than devices belonging to certain technologies and to the Internet of Things framework. There are four major technology groups. Image Acquisition, Wearable's, Video Refereeing and Simulation Technology. Image Acquisition has three artifacts: Video Cameras, Miniaturization Tablets and Statistics Analysis Software. Wearable's is made up of four artifacts: Movement Sensors,

Conclusion

The two main pillars of this work are Technology and Sports. Technology that we discuss has a concept behind it, Internet of Things, where all technological physical objects are a part. These devices are used by humans to extend the connectivity to the world anywhere, anytime, and with anything. We use them to collect data from the environment, access infinite data from the internet, monitor ourselves, and connect with each other. Each device has its use and goal but with the online interactivity, we can have a web of data with all these devices linked with each other and with the internet, improve the user experience, monitor our daily routines, and easily access knowledge and of data. With all this interactivity between devices, people, machines and environment, Internet of Things evolved to Internet of Everything, where this "Everything" represents every single intervenient in this web connected to each other and the ability to have access to everything.

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