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## Presence of technology in sports

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### Abstract

Technology has spread its wings everywhere, sports is no exception. Technology in sports encompasses the use of gadgets and equipment's for availing advantage over the human performance. Participation in sports exhibits the strength and velour of the athlete but technology has brought sports to the next level. Use of technology has improvised the levels of performance beyond human body's capacity and excellence. The use of Hawkeye, electronic timers, force plates, motion sensors, simulation computing systems, and wearable gadgets are some of the examples of growing technology. Bio mechanical analysis, sports physiology and other field researches have evolved to create the human excellence at par. This paper will present few examples of technology and its advantages. But then the use of too much technology has raised the question of ethical use of technology against competition among equals. Participation and winning in sports is a matter of pride for countries. The hunger for winning more medals has made technology stronger and needed.

**Keywords:** Sports technology, biomechanics, sports physiology, wearable gadgets, ethics

### Introduction

Technology has made the better player even better. Technology is being used at every stage of sports performance starting from very talent identification, training and coaching, competition and performance, making and breaking new records, recording and broadcasting the live events etc. Technology not only support performance but also the research and development in sports including designing the training program, tactics and strategy, assessing opponents strength's and weakness, psychological training, decision making, assessment of physical and psychological factors of athletes etc. The role of technology has become integral part for the athlete and as well as the coach. Although the use of technology brought forward a question for ethical aspects of competition. Each and every sport is completely arrested with the use of technology. Various existing theories are there to support, analyses and criticize the use of technology and performance such as instrumentalist theory, substantive theory and critical theory. Although various technologies are being used in sports at different aspects, here in this paper we will be discussing only the technologies used to upgrade the performance, assessment of performance in sports and Injury prevention. These gadgets improve the standard of sports, athletes, referees and contempt free competition enabling higher participation. Loland, Sigmund categorized technologies for three obvious categories i.e. technology as a necessary condition for the sports to arise at all, secondly, technology for injury prevention and protections against any harm and thirdly, technology works as performance enhancing means. The performance enhancing technologies are further divided into body techniques, sports equipment technologies, training technologies and expert administered technologies. A few examples of technology being used in present day sports are presented here for the following objectives:

- To create awareness among masses.
- To understand the role of technology in sports at various stages.
- For understanding the role of increasing technology for the existence of sports, for performance monitoring and assessment technology and technology for injury prevention and rehabilitation.
- To learn about the technological advanced equipment for the purpose of increased

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participation with clean and clear judgement appraisals.

### For the Existence of Sports

Well-designed bats and balls, the centre of gravity of the well-designed bat is important for hitting the ball hardly and rightly. The material, the length, the weight, the color, the light, the ground, the cameras, the garment all are the highest examples of the technology being used. Application of Bio-mechanical principles for designing and manufacturing the sports goods like Rackets, balls, cycles, bats, skies, skates, shoes and costumes for participation and excellence in sports. Each equipment and basic unit of the sport is specifically designed as per the need of the sport; enhancing speed, strength and precision in sporting event. The running turf/surface are available in variety as per cost and geographical conditions for the best outcomes in terms of performances.

Use of prosthetics is like creating magic to one's life. Athletes have greater range for choosing the sport and performing to the next levels of excellence. The prosthetics for upper and lower limb broaden up the sphere for disabled athletes. The prosthetics for lower limb the running leg made up of carbon fiber. The carbon fiber is very lightweight, strong and durable. It also has the mechanical edge for spring like properties which helps like feeling the natural limb advantage. There are numerous types of activity-specific prostheses available, including: Prosthetic legs with specially designed feet. Running is an example of a high-impact sport; Prosthetic legs designed for rotational sports such as golf; Water-proof prostheses with component designed specifically for activities involving water sports such as swimming or scuba diving; and Upper limb terminal devices to allow for specific sport, work, and recreation activities.

Prosthetists <sup>[1]</sup> use their clinical and biomechanical knowledge, as well as their knowledge of current evidence, materials, and product developments, to help people who have lost limbs choose the most effective prosthetic solution to meet their personal goals. The <sup>[2]</sup> incredible advancement of prosthetic technology in the recent years has improved the lives of active citizens and competitive athletes. In addition, it has caused a huge debate in the international sports community. The development of highly effective energy-storing lower limb prosthetic devices, most importantly the Seattle Foot, "has allowed Paralympics' athletes to compete at levels that rival the able bodied,"

### Performance Monitoring and Assessment Technology

If we talk about Football latest technology is being used is called "Goal Line Technology" GLT. It is used to create the check if a ball has crossed the goal line, to support the referee. Now, currently VAR (Video Assistant Referee) Technology is being used, It was introduced in a friendly game between France and Italy, and after a successful trial, a pitch-side monitor was used in the FIFA Club World Cup. The A-league was the first professional league to use VAR. VAR was first seen in an FA Cup game in England, and La Liga adopted it for the 2018-19 season, with the Premier League and even the Champions League adopting it for what FIFA refers to as "game-changing decisions," such as goal validity, penalty kicks, red cards, and offside, beginning in the 2019/20 season.

Hawk eye is being used in Tennis to assess the ball movement 'in' and 'out' the court. Hawkeye technology uses a camera taking 600 frames a second on the goal line with information analyzed on computer, information sent to referee's headset or a device on his wrist as well.

Cricket is again a great example of highest technology being used. The video coverage plays a role of third empire and has an important role in decision making. Hawkeye technology is used to measure the trajectory of the ball in cricket was first used in 2001. It measures the speed direction, line and length of the ball. It presents the complete graph for statistical analysis after the bounce of the ball. The sensors are being placed below the surface of the play and are directly linked to the computers for simulation purpose. The Ultra Edge Technology is a more advanced version of Snickometer that is used for edge detection. Snickometer was invented by Allan Plaskett, a British computer scientist, and was first used by Channel 4 in 1999. It uses a sensitive stump microphone connected to an oscilloscope to measure sound waves. The sounds are then processed to eliminate background noise, synced with video streams, and replayed in slow motion for the third umpire to make a decision. *Smart Bails and Wickets*, The umpire had a difficult time judging this during close calls when one end of the bail left the stumps at a different time. When both ends of the bail lose contact with the wicket, the bails light up; This whole system is known as the Zing Wicket System. This system was first launched in 2013 by a firm named Zing Bails. A microprocessor in the Smart Bails recognizes when the bails lose contact with the stumps and lights up within 1/1000<sup>th</sup> of a second, which are powered by a low-voltage battery.

Electronic timers controlled by computers are used to record performance in milliseconds of athletes in as many sports as Athletics, cycling, skiing, etc. This also measures the reaction time while taking start from the blocks at the shot of the gun. The electronic timers are attached with video cameras as well. In athletics for record performances Photo finish mechanism are required to mark the performance for world record acceptance. Photo finish equipment captures 3000 pictures per second.

### Injury Prevention and Monitoring

Innovation and technology can aid in preventing and minimizing sports injuries, enhancing sports technique, and assessing performance. Smart wear ables (or gear) are commercially available for use in all major sports, including aquatics, athletics, boating, cycling, gymnastics, invasion games, net sports, winter sports, and many others, offering real-time analytical details on the subject's behavior and performance. Data can be recorded and analyzed later. It can also be sent in real-time to portable terminals (smartphones, tablets, smartwatches, or laptops) and displayed immediately. Wearable gadgets are being used to monitor heart Rate integrated with tracking technologies includes global positioning sensors (GPS), accelerometer and gyroscope sensors, used to describe the athletes movement and physical demands. Smart devices including pedometer helps analyzing daily step count. These gadgets help preventing injuries in athletes. Wearable technology is leading a sports revolution. It is changing the definition of sports and the level and efficacy of the game. It also decreases the rate of injury. The latest biometric technology means it is possible to turn our shirts, socks and bras in wearable smart devices that monitor heart rate, fitness, muscle performance and calorie intake. Eventually it becomes the part of the outfit. Smart

<sup>1</sup> <https://www.aopa.org.au/careers/what-is-an-orthotistprosthetist-2>

<sup>2</sup> Laura L. Smith, "Technology Aids Advances in Prosthetic Limb Development," Jacksonville Business Journal, (April 2, 1999): 9.

glasses/eyewear is there to assess brainwave sensing EEG, EOG and EMG technology to deliver cognitive training technology along with other features. There are well designed Smart watches featuring optical heart rate sensor. In swimming the highest techno intelligence is used to prepare body suits to control the friction in water and to increase the speed through water. Full body swim wear made of polyurethane. It laid an unforgettable mark in 2008. Olympics and banned a year later because of its two obvious results making remarkable difference in performance. The use of body suits in other sports like cycling and skiing allows maximizing aerodynamics and optimizing core body temperature. Sensors include inertial measurement units (IMUs) and microelectromechanical sensors (MEMS), which contain a combination of magnetometers, accelerometers, and gyroscopes. Flex sensors are capable of tracking joint motion via changes in resistance when a force is applied to the sensor. G. McLellan and L. Bailey suggested development of a position and motion monitoring system to quantify physical activity. One solution may be to use Global Positioning System (GPS) and accelerometer technology. Secondly, it is a frequently used tool in the field of sports and physical activity. The development of GPS in 1990 made it possible to collect human movement data in real-time and analyze sports performance more conveniently, efficiently, and accurately. Research on global positioning systems has progressed from estimating continuous motion to studying energy expenditure to estimating human locomotion in a sports context. The combination of GPS, accelerometer and heart rate measurement technologies, now referred to as 'integrated technologies' (IT), allows for a better understanding of energy expenditure and specific movement patterns in controlled situations. Yewade *et al.* [3]. A total of 33 articles with dynamic movements relating to performance monitored by wearable technologies were included for full-text analysis. Inertial measurement units, flex sensors, magnetic field, and angular rate sensors were among the devices used to quantify motion in over 15 sports. Wearable technology is still in its early stages, but it has the potential to positively influence coaching practice and athlete technique.

### Summary and Conclusion

Technology is revolutionizing sports training by live tracking performances, perfection in movement analysis, enhancing communication and eliminating injuries. Various research studies examines and presents the use of technology for excellence and achieving more biomechanical advantage with more intense and clear vision inside outside human body.

Since the early 2000s, sports performance analysis methods (including advanced statistical modeling and new analytical frameworks) and technologies (including GPS tracking, time-lapsed notational analysis software, and a wide range of tracking sensors and other tracking equipment) have been dramatically transformed. Data for post-match analysis can come from a variety of sources, including qualitative data, video sequences, and even measurements of athletes' exertion, heart rate, blood lactate levels, acceleration, speed, and location metrics collected via wearable devices. Drones and Moving Cameras: These devices have a 360-degree viewing

angle and are used to capture images from the ground to the skyline. Significant advantage of the wearable gadgets in sports to monitor athletes ability in real time sports environments and provide real time feedback. These gadgets are light in weight and wireless optimizing the transfer data risks signal loss during recording and interference from any other electronic device such as mobile phones and computers. Such sensors can be used in extreme sporting environments such as snow, mountains, water and air. However, they are not without limitations: the presence of ferromagnetic objects can cause inertial-based system measurements to be distorted [5, 6, 7, 8, 9], and precise positioning can have an impact on data accuracy as well as data integration, introducing errors when attempting to extrapolate positional data from acceleration measurements [10, 11].

New terminologies like sports engineering and techno dope are emerging. In 2006 WADA (World Anti-Doping Agency) also found a threat and considers prohibiting technologies if they are "performance enhancing" or "being against the spirit of the sport". Technology in sports could give athletes' an unfair advantage. In sports we organize a techno human combination. Olympics, which allows competing with the athlete's strength and intelligence, the innovative and creative higher technologies of their teams. The countries with better access to technologies are competing with cutting edges towards success and winning competition. We use technology at every aspect of sports:

- Basic learning of technique while introducing the specific sport.
- Psychological training.
- Physical and technical training.
- Physical and Physiological testing and Monitoring.
- Motion sensing.
- Planning and Periodization.
- Competition.
- Making results, decision making.
- Broadcasting the sporting event.
- Referee and umpiring the event.
- Research and Development.
- Injury prevention, diagnosis and treatment.
- Rehabilitation.

The technologically advanced programs and devices help to procure Accurate & Reliable Data, it provides Time Efficient Assessments, it also provides Objective, Evidence-Based Decisions, technology prepares devices for Tracking Progress and Monitor Rehabilitation, the devices could be Expandable and Customized as per individual needs. The technology is one of the integral parts of modern sports but also it should be limited to ethical boundaries for maintaining the spirit of sports.

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