

Miniaturizing a GNSS Device for Real Time Match Analysis

A Feasibility Study over the Integration of GNSS Device for Real Time Match Analysis

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Abstract: The GNSS devices for monitoring athletic performances are becoming more and more a common tool for football team, in order to better shape athletic training and have a more complete view of individual performances.

However, technological limits, but also legal ones, restricted the use of these devices only to training sessions and post-processing analysis.

This study wants to demonstrate the benefits and the change in match analysis with the introduction of a non-invasive GNSS device integrated into a shin-guard.

1 OBJECTIVES

1.1 Premises

The GNSS devices for monitoring athletic performances are becoming more and more a common tool for football team, in order to better shape athletic training and have a more complete view of individual performances.

However, technological limits, but also legal ones, restricted the use of these devices only to training sessions and post-processing analysis.

Match analysis instead have been done until now with video analysis and video tracking systems, which still present issues over data accuracy and have a limited set of data offered to the team.

Therefore there is a need to find a system capable of bringing the capacity of GNSS devices to give quantitative data in real-time and during official matches and integrate them with systems capable of, instead produce qualitative data.

The goal is to give a complete spectrum of players and team performances and enhance the possibilities of a more scientific and analytical approach to performance and training analysis in football.

The GNSS device have been installed inside a shin-guard (mandatory equipment for a football player) and delivers data to a receiving station

installed at the border of the field. Recently FIFA, through its official board committee the IFAB, issued an amendment (SEC/2015-C049/bru) over the use of GNSS technology during official matches, for health and performance monitoring purpose.

This news make this research even more important.

1.2 Goals

The overall goal of this study is to demonstrate the feasibility of a GNSS monitoring device, able to measure in real time players' athletic performances, and team.

Overall tactical results, during league official matches.

In order to achieve this overall goal some intermediate one have been set:

1. Miniaturizing a GNSS device to fit inside a shin-guard
2. Reaching a consistency and reliability in wireless transmission
3. Creating algorithms for high-precision in position
4. Real-time data processing
5. Consistency in data processed
6. Accuracy in speed measurement of a 10hz GPS compared to other systems with a faster update rate

2 METHOD

The method used by the author for reaching this goals have been different

In order to research and developed the system SpaceEXE took advantage of the expertise in aerospace industries of the authors of this abstract, especially related to satellite navigation and hardware engineering.

The first major challenge was to harmonize a GNSS receiver with the current rules over player's equipment.

In this case, the shin-guard proved to be the only gear in which, it was possible to achieve a satisfying quality in signal reception and overcoming any ground-effect issues.

For implementing a correct wireless transmission, the position of the antenna and the frequencies of transmission proved to be the crucial point in order to respect quality standards, especially in order to not be overwhelmed by more powerful devices such as television cameras.

For the consistency of data, it have been necessary to implement an extended round of test which used a number of other device, of already stated accuracy, in order to understand the consistency of the data produced by MESSI system.

For example for speed, testers used photocells and an HD camera and then applied some business analysis tools in order to understand the differences in measured speed.

3 RESULTS

The result of this development proved encouraging, especially related to the viability of the system and the consistency of data produced.

The photos below show the shin-guard with the GNSS integrated in it (figure 1), the second one shows instead how the shin-guard is seen by its user (figure 2).

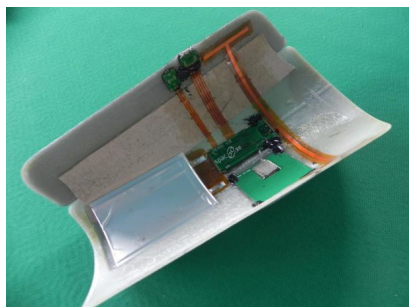


Figure 1.



Figure 2.

In the next pics instead to screenshot of the system at work are showed, with an example of real time tactical feature and a real time athletic performance feature (figure 3 and 4).

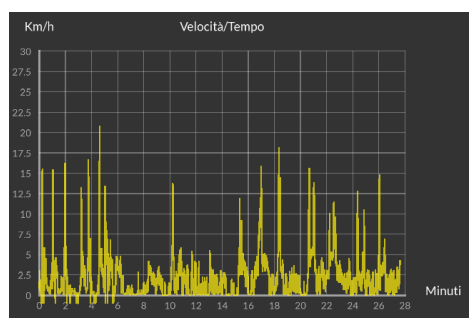


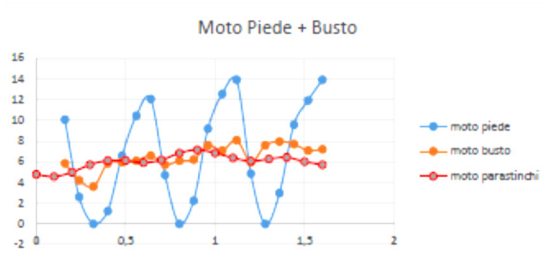
Figure 3.



Figure 4.

This graph instead shows the results obtained by the test over speed, with an indication of the speed measured by photocell and cameras.

The blue graph shows the speed of the foot registered by the camera, while the orange line shows the movement of the chest, recorded from the camera too; finally, the red line instead shows the speed recorded by the shin-guard.



4 DISCUSSION

The system have been tested and implemented with different Italian teams, like the young team of Lazio (figure 5) and proved its reliability and its impact on the possibility of managing tactics during a match and correct the positions of the player in order to achieve better results and a better efficiency in team management.

The capacity of the system of recording and storage data allows coaches and athletic trainers to have a ready- made path of players performance) and better shape training programs, but also to have a constant monitoring over the footballers' health in the scope of prevention.



Figure 5.

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