

## PalArch's Journal of Archaeology of Egypt / Egyptology

### SIMULATION FOOTBALL PLAYER HEALTH MONITORING USING IOT (INTERNET OF THINGS) and IMAGE PROCESSING

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**Ahmad Syaifudin, Fikri Helmi Setiawan, Yopi Almarij, Muhammad Bima Pramadinata, Ari Purno Wahyu W. Simulation Football Player Health Monitoring Using Iot (Internet Of Things) And Image Processing--Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(10), 3708-3717. ISSN 1567-214x**

**Keywords: IOT, Football, Image Processing.**

#### **ABSTRACT:**

In football game need requires excellent physical condition and a long playing pattern, football is a game that is very popular both young and old in this game the players are strictly selected from their physical condition and stamina, at the level of playing football will make movements like running and sprinting for the attack and the dodge process, this game pattern causes injuries to and sometimes becomes fatal. in the modern era players use tools for monitoring with the help of IOT (*Internet of things*) tools which are integrated with E-health system, this system is used to monitor temperature and heart rate from player temperature, IOT tools can be used during training and during matches, this method able to use as a recommendation for players to compete, this IoT system can be juxtaposed with image processing techniques where this image system can monitor the player's movement pattern so the player's condition able to read with the system, an additional algorithm that can record and recognize the player's name clearly so that the analysis process Movement data and body condition become accurate, the IOT method and image processing techniques able to carried out simultaneously so that if a system has problems it will be resolved with another system.

#### **INTRODUCTION**

Football is included in a sport that has more than 5 players, this sport requires a large field of at least 15m x 25 meters, in this soccer or Football game a person is required to have excellent physical condition and stamina, players are required to do sprints. play tactics that are useful in setting attack patterns, sports require a high level of movement and can cause a player to become tired and sweat a lot in and sometimes football players ignore this and continue to push themselves, so that when body is tired and the most bad condition can cause death, a condition that can be avoided by football players

in order to avoid the risk of fatigue and death by doing changes of play and doing a health check before the game starts, the process is started in a way a system of selection on players or by minimizing the incidents when soccer starts, in the process of changing players it must be conditioned so the game patterns and strategies can still run and doesn't reduce game performance.

### ***Football Health Monitoring***

In some developed countries the sport of football has become a famous and is a sport that has quite a lot of fans compared to other sports, in this sport process of selecting players is very strict considering this sport has a high risk and rate of injury, experienced coach of course understand circumstances and conditions of the players at the time of the match, a process will be carried out to select so that the substitution process able to carried out, this replacement process is intended that game tactics and strategies aren't disturbed, manual monitoring is indeed very difficult to do in a match. but in the development of computer technology at this time has developed very rapidly and has an influence on the ways and methods of monitoring the situation of players [1].

A computerized method is used to record a player's track partner and the results will be analyzed by the computer, the computer itself will ensure that the player's condition is still fit for the match or must be rested so that he is replaced by a substitute player, when the game is running, sometimes the player experiences an injury caused by a pattern fast game, by avoiding and causing collisions with other players, the computer system can be integrated with the help of the IOT computer can work using different platforms [2].

Computer techniques will predict the condition of the body and analyze it with the help of a computer, while other health conditions can be monitored using a sensor that is connected to an IOT device. This technology only used during training but in competitive conditions, technology is able to monitor and record all the movement of players able to predict the condition of the body and environment [3].

### ***Internet Of Things***

In an IoT device, the sensor has a different role. Importantly, this tool is able to record and detect a magnetic condition caused by changes in three components, namely temperature, light and chemical changes, the sensor will convert a change into an electric current signal, where the conditions in the current can be monitored and measured with the help of reliable computerization. which is used to collect a data [4] [5].

The sensor that is most widely used in the field of sports is the heart rate sensor, this sensor works by firing a light signal in the blood circulation through the network that is connected to the pulse, then the sensor converts it into an impulse signal which converts into the form of BPM (beats per minute) [6].

A sensor device can be used in conjunction with a body temperature sensor, repeated with a working mechanism similar to electricity and the process of checking the heart with visually, the heart itself is often used by doctors to

measure and used as a parameter of a person's health because damage to heart health conditions will affect other organs. In the industrial era 4.0, the current IOT device plays a major role in integrating all electronic devices with a larger network, IOT itself is responsible for collecting data and integrating with a database, in that database there is information collected from all IOT sensors, data sensors can be displayed on a website and are able to work with the operating system and different platforms [7].

One of the IoT technologies used in the health sector is IoMT or also known as IOT medical things, this tool helps many medical personnel to diagnose disease and monitor patient health, this tool is very useful because it can monitor the patient's condition remotely and connected to a wearable device or a sensor device without cables [8].

In a previous study this device was used on a patient who has asthma, this device is installed and integrated with a GPS, this tool is able to provide information and patient health track records and provide a record of road conditions or places that are frequently passed by patients, the system will provide a responses and warnings if the location visited is dangerous and too risky and it is recommended to avoid that location, In everyday use this IOT device can be used to monitor the position and record a person's sleeping condition, even in further development this device is used to assist and treat a patient who has a history of diabetes, cardiac care, asthma, drug delivery [9].

Football player movement and speed became main keys, in a new method of monitoring this movement use a camera that is integrated with an IOT device and used in real time. The movement pattern of the players will be monitored using an image processing technique, this method monitors the movement with changes in the geometry of the ball game pattern, this algorithm will carry out the tracking process with several stages, namely object segmentation [10].

In this method an algorithm is able to read the player's movements without being influenced by circumstances and surrounding objects, the last method is the classification process, in this process the player's condition will be responded to by the system so that an algorithm will read the patient's condition in a running or falling state, this system can be called as the Maximum a Post theory Probability (MAP) and the research was carried out in several matches with different conditions and weather [11].

The fast movement of a soccer player needs to be done and analyzed, this condition is used to read and monitor a player's attitudes and habits, the monitoring method works in several ways, namely, first recognizing an object of an opposing player or friend, second, visually reading the player's condition. in the field and the last is a visual application that must be able to read and track more than one object, this object tracking capability will be the main part that will determine whether or not a reading is accurate.

$$\bar{\mu}^t = \alpha\mu^t + (1 - \alpha)\bar{\mu}^{t-1} \dots\dots(1)$$

$$\bar{\sigma}^t = \alpha|\mu^t - \bar{\mu}^t| + (1 - \alpha)\bar{\sigma}^{t-1} \dots\dots(2)$$

Only if the intensity value of that point is substantially unchanged with respect to the coarse background model, that is:

$$|I^t(x, y) - B_C(x, y)| < th \quad \dots(3)$$

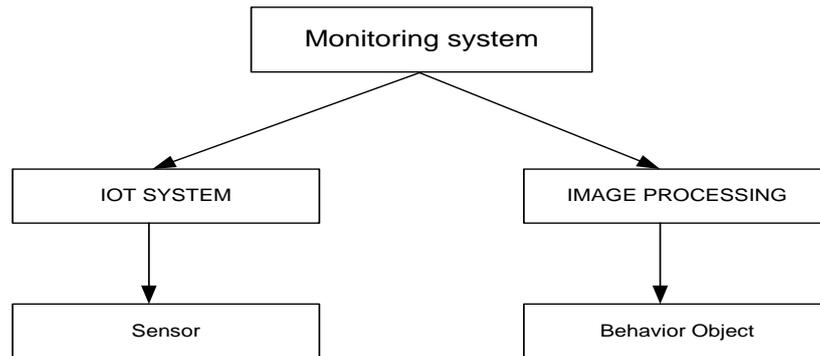
where  $\hat{A}$  is the empty set, and  $th(W)$  is a threshold that depends on the size  $W$  of the sliding window. The whole procedure is iterated on another sequence of  $W$  frames, starting from the frame  $W+1$ . The coarse model of the background is now the frame  $W+1$ , and the new statistical values Eq. 1, 2 and 3 are evaluated for each point, like as the new energy content 3. The relevant difference with 3 is that known the new statistical parameters are averaged with the previous values, if they are present; otherwise, they become the new statistical model values.

### ***Camera Position***

The most important process of detection is a background subtraction method, this method determines whether an algorithm is good or not for reading data that can be derived by the following formula, the method will be registered with a device or application to reduce the influence of the background or background with the value  $(x: y)$  which will be considered as an object in the background with a value of  $B(x: y)$  and has a value with twice the deviation of  $V(x: y)$ , this information is taken from the measurement of the lighting level of a pixel that is in the process of taking an image, this pixel value level will be used to distinguish a main background from the object being monitored, so that during the identification process the main object will not be too influenced [12].

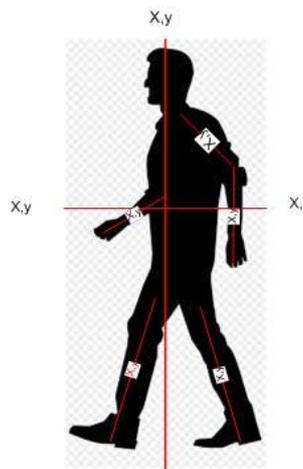
In realtime surveillance of soccer players, a camera is required to be installed at a certain point. This camera functions to provide a coordinate value for a soccer player. Cameras installed on a soccer field have at least two cameras, the first camera that will serve as a tool used to read an object by tracking and describing movement at each angle, the second camera will be used to read and track objects and distinguish the types of costumes used by soccer players, the costumes worn by soccer players have four possibilities, namely the main player's costume, the goalkeeper's costume and the referee's costume, in the previous experiment this tracking method was able to read 25 player movements with different either positions on opposing players or friends [13]

## **RESEARCH METHODS**



**Figure 1.1** Ball player detection system

In Figure 1 is the process of the results of the football player's health detection using IOT technology based on image processing, the IOT system to read the heart rate sensor and image processing techniques will be used to read the condition of the players, both stages can be described as follows.



**Figure 2.** Sensor placement and image processing detection

### ***Iot Sensor***

This tool is installed using an impulse sensor that is mounted on the chest close to the heart in the pulse section, this sensor is connected to a microprocessor and a GPS signal, the sensor will send a heart rate and body temperature data which will be read by a system in the form of a graph and analog data signal from each player.

### ***Image Processing***

The image processing-based football player monitoring system in this section has two cameras, both of which are installed between the corners of the field, the first camera detects colors and the second detects reading the player's movement.

- ***Image Input***

The source of the input image can be taken with an object from anywhere it can be from a body camera mounted on the body or taking pictures via CCTV, each object will be identified and converted into several different frame parts for easy identification

- ***Background Subtraction***

Obviously the use of weapons and their types vary and in different circumstances and environments, the function of this section is able to identify the types of weapons with modified conditions

### ***System Implementation And Testing***

In this test, a test simulation is carried out using two methods, the first method of testing is carried out by configuring the IOT device on the camera in the field, while the second method is to carry out the tracking process using images that are already available, the testing stage will go through several processes, namely, tracking. object, object input, pattern recognition, object classification and finally pattern recognition.

```
function [speedimage,speed] = calcSpeed(speedimage,fgBBox,tmhi)
%updating motion history image(speed)
speedimage = max(zeros(size(speedimage)),speedimage-1);
speedimage(fgBBox==true) = tmhi;

%co-effecient of mhi for speed
speed = sum(sum(speedimage))/(sum(sum(fgBBox))*speedimage);

end
```

***Figure 3. Calculation of object velocity***

### ***Information***

In Figure 3 is the system test source code used to read and adjust the speed of football players, the data is taken from two cameras installed in the field, the first frame records the player's running speed and the second camera records the color of the clothes and the players' requirements used, the data from the camera. then processed using image processing techniques, from the data an algorithm will recognize and read the name of the player.

```

% initialise the video reader
videoSource = vision.VideoFileReader('1.mp4',...
    'ImageColorSpace','rgb','VideoOutputDataType','uint8');
% declare the foreground detector using GMM
detector = vision.ForegroundDetector(...
    'NumTrainingFrames', 50, ...
    'InitialVariance', 'Auto');
% morphological operation
blob = vision.BlobAnalysis(...
    'CentroidOutputPort', false, 'AreaOutputPort', true, ...
    'BoundingBoxOutputPort', true, ...
    'MinimumBlobArea', 60, 'MaximumBlobArea', 600);
shapeInserter = vision.ShapeInserter('BorderColor','Custom',...
    'CustomBorderColor',[0 255 0]);
textInserter = vision.TextInserter('%s', 'Color', [255, 255, 255], ...
    'FontSize', 24, 'Location', [405, 705]);
    
```

Figure 4. Calculation of input on the camera

**Information**

In Figure 4 is a code that is used as a medium between the cameras as a hardware device so that player recording data stored in a database, recorded analyzed data directly in realtime or by observing the previous video

Original data	Object detection results
	

Figure 5. Pattern recognition of players with the right camera

**Information**

In Figure 5 is the process of testing the system on a ball player in the rear position, an algorithm displays data automatically with visual data, the data displays the player's name and is in a scenario in a competitive condition.

Original data	Object detection results



*Figure 6. Pattern recognition of players with left camera*

**Information:**

In Figure 6 is a system process that is screened on the back side of the camera, the process is screened, displaying data and player names on the back with a yellow visual display.



*Figure 7. Pattern recognition of players using image processing techniques*

**Information**

In Figure 7, an image processing technique for reading the movements of players in the field, the image processing method has the advantage of reading realtime data that is converted into several frames, in the process of forming data frames it will be easier to analyze, the analysis process is carried out on each change and movement of the player.

**CONCLUSION**

From the results of the above experiment we can take concluded that IoT-based image processing techniques can be used for monitoring players at football matches, IOT techniques able to analyze player health and player movements in the field. Image processing systems have a broad scope and analysis method compared to the usual IOT sensor method, but the IOT sensor itself has several advantages of being able to supervise and monitor players with more precision because the tools installed are used more personally, so that the players' heart rate and body temperature can be analyzed, image processing techniques themselves are very helpful in recognizing player names and differentiating opposing teams. Directly, for further research, a system improvement mechanism is needed, be it an IOT system or an Image processing system, the accuracy of data reading still depends on the type of sensor and the transmitter device used by the IoT system is very dependent.

The battery condition and sensor reading will experience weakness if the battery used is problematic or damaged, while the image processing system depends on the camera used, the system will accurately read an image data if the camera used uses a sharp resolution, while the image reading process will be reduced if the field conditions are foggy or rainy conditions.

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