

# Table Tennis Training Automotion

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## ABSTRACT

In this study; The fact that the table tennis sports activities are in an active position has been created in order to provide a working field where some technological innovations can be applied in order to attract interest and to attract an increasing international demand. With the aluminum mechanism placed on the fixed playground, the data obtained by the sensor devices are processed by microcontroller by subjecting the image processing methods by PC to the software interface via arduino mega. At the last stage, the robot arm is controlled by moving the servo motor. When the study test and working times are considered, it is seen that the racket on the robot arm moves and meets the position of the ball depending on the direction of travel of the ball. The study is expected to improve the necessary hardware and provide an efficiency of 80% or more depending on features such as speed and instant data communication when it is used with advanced technical devices such as industry 4.0.

**KEYWORDS:** *Arduino, PC, microcontroller, servo motor*

## 1. INTRODUCTION

One of the most important elements in sports activities is the best preparation of the person for the game system to be played. At the same time, it meets the workload of time and the player needs another partner during the preparation phase; It also brings along situations such as loss of efficiency, inability to prepare fully and completely (Asan, 2011; Bardak & Topaç, 2019).

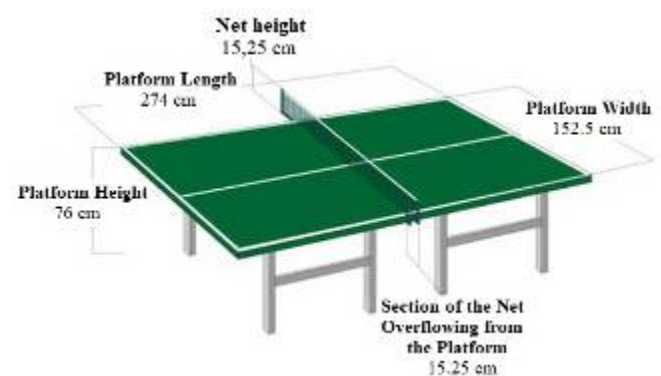
The main defect encountered in this working situation is that the sent ball bounces off the wall and returns to the player following the angle from which it was sent in general. This situation prevents the player from being prepared for many different angles (Anonymous, 2018; Sofuoğlu, 2017).

With the developed robot arm design application, it has been carried out in order to provide optimum, error-free, high-efficiency preliminary work individually and against all possible functions, without the need for a second person (Sevim, Gürler, & Arınmış, 2014). For example, if you want to use While the shortcomings of the player, assuming that he is working with the coach, have negative consequences for the development of the player,

**How to cite this paper:** Abdülkadir Çakir | Sultan Selim Yağiz "Table Tennis Training Automotion" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-6 | Issue-1, December 2021, pp.219-224, URL: [www.ijtsrd.com/papers/ijtsrd47761.pdf](http://www.ijtsrd.com/papers/ijtsrd47761.pdf)



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**Figure 1: Table tennis playground and dimensions**

After examining all these situations and analyzing the data obtained, our response to technological studies for a positive development of the player during training in the field of table tennis was HandBot - Training partner robot arm. As a result of this study, it

was carried out by considering that a table tennis player will have the opportunity to make any preparation in any way he wants at any time and within the time period without the need of any coach or second person (Vurgun, Vurgun, Aldırmaz, & Mutlutürk, 2020).

In this study, researches were carried out and applied to the study to have various knowledge about the mechanics and software during the operations carried out in the realization of the robot arm designed to perform the task determined in accordance with the predetermined commands (Figure 2).



**Figure 2: Table tennis training robot representation**

In the robot arm work designed, Arduino, the instant data obtained and converted with Visual Studio interfaces were moved with servo motors and prepared with the working software C# language. The working status of the design is controlled by doing it in the order described below (Figure 3):

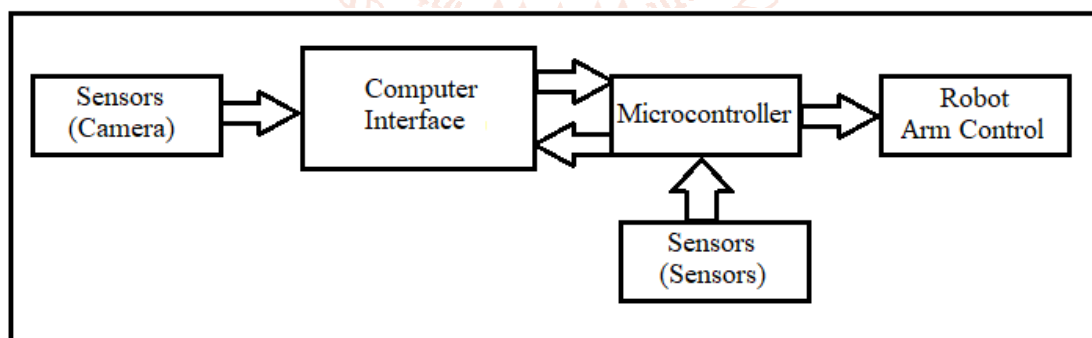
The data received from the cameras unit is transferred to a computer and processed in the interface program designed on the computer.

These rendered images are subjected to image processing methods.

The resulting data is sent to the microcontroller accordingly.

The data received in the microcontroller is transferred and collated via PC and the microcontroller is also processed.

The data obtained in the final stage are sent to the robot arm control mechanisms unit to control the relevant mechanism of the robot arm.



**Figure 3: Table tennis training robot application block diagram**

The basic principle taken in the study of table tennis training robot is image processing and the method of applying the processed data. Images taken with cameras are processed through software interface programs on the computer and transferred to the microcontroller, and this information is converted into a suitable format in the microcontroller and controls the motors that will activate the relevant mechanism (Figure 3).

Saygılı and Çayıroğlu (2015), by making application of robot arm design with servo motors and control of 2-axis robot arm, explaining detailed working situations about the use, features and equipment of Arduino and servo motors; presented an example of an applied robot arm.

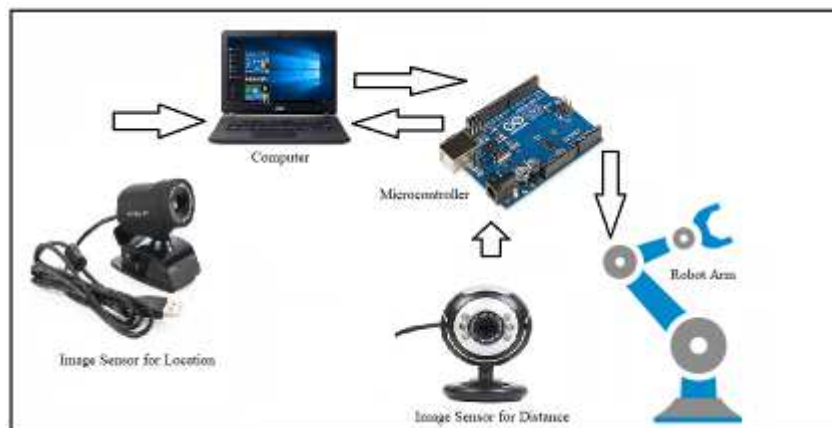
Erdoğan (2016), comparing the physical parameters of the students playing table tennis and court tennis, revealing the motoric characteristics of the athletes, determining the differences between the variables, created information and data on the dominant characteristics.

The analysis of the prepared data was prepared with the SPSS 22.0 package program; As a percentage, he made descriptive statistics with Frequency, Average value, Standard deviation techniques, Independent Samples t-test applications and tested the developments. It revealed the effects on the physical and mental development of table tennis players.

## 2. TABLE TENNIS TRAINING AUTOMATION

In this study, the software was made with Arduino and Visual Studio programs, the images obtained over the internet with the DroidCam program were sent to the microcontroller, and the system controlling the robot arm mechanism to be moved with servo motors was realized.

The system interface can also be viewed visually on the PC, facilitating the analysis of the processed data, aesthetic modernity and ease of use for the user (Figure 4).



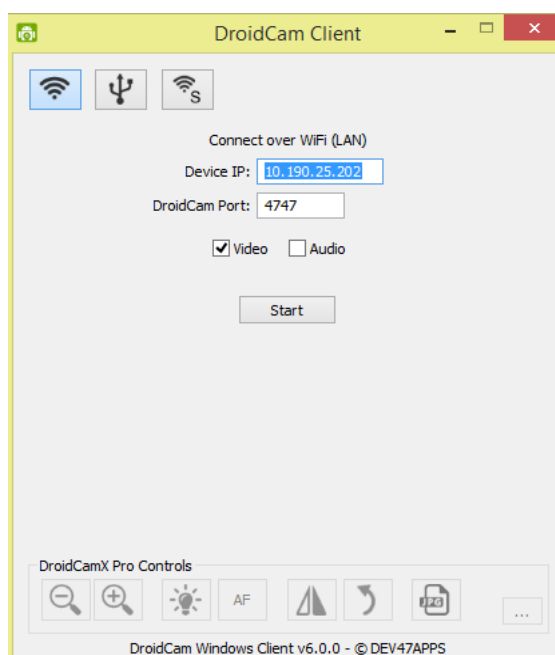
**Figure 4: Table Tennis Training Robot hierarchy**

The pathways and programs that the system follows during the operating stages are transferred schematically in Figure 4. In the system where the image processing method is basic, the digital data/images obtained through the cameras are processed and transferred to the microprocessor with the software interface (Visual Studio C#, Arduino) designed in a computer environment and this information is transferred through certain processes in the microprocessor and moved by the relevant mechanisms of the robot arm (Servo motors).

### 2.1. Image Sensors and Image Acquisition (DroidCam)

During the operation of the system, the DroidCam application enables the camera images obtained over the internet to be transferred to the C# interface and sent to the image processing unit (Figure 5).

DroidCam is an application that enables the use of snapshots, wirelessly, and sending data to a computer over the internet. Depending on the internet speed used in the system, the moving robot arm is faster and controlled in advance.



**Figure 5: DroidCam Application Interface**

The DroidCam application functions to send data received from digital cameras via wired or wireless connections such as Wifi and USB. The application is connected to the PC with the IP location.

In the developed system, two webcams are used for the image detection unit in order to observe the distance and determine the location. It has been used wired in terms of processing quality, the image resolution is 1280x720 pixels, and the movement of the ping pong ball is instantly sent to the PC and processed in the computer interface created.

## 2.2. Control of Robot Arm with Arduino and Pc

After the connections and inputs and outputs described in the materials and methods section of the Arduino program were made, the coding part and the determination of the relevant values were carried out.

After the images obtained in this system are processed and compiled in the C# interface, the Arduino program is used for moving and playing the robot arm mechanism after filtering and image processing techniques.

With the computer procedure, which is in constant communication with the microcontroller, both the values can be seen and the working status of the mechanism can be seen.

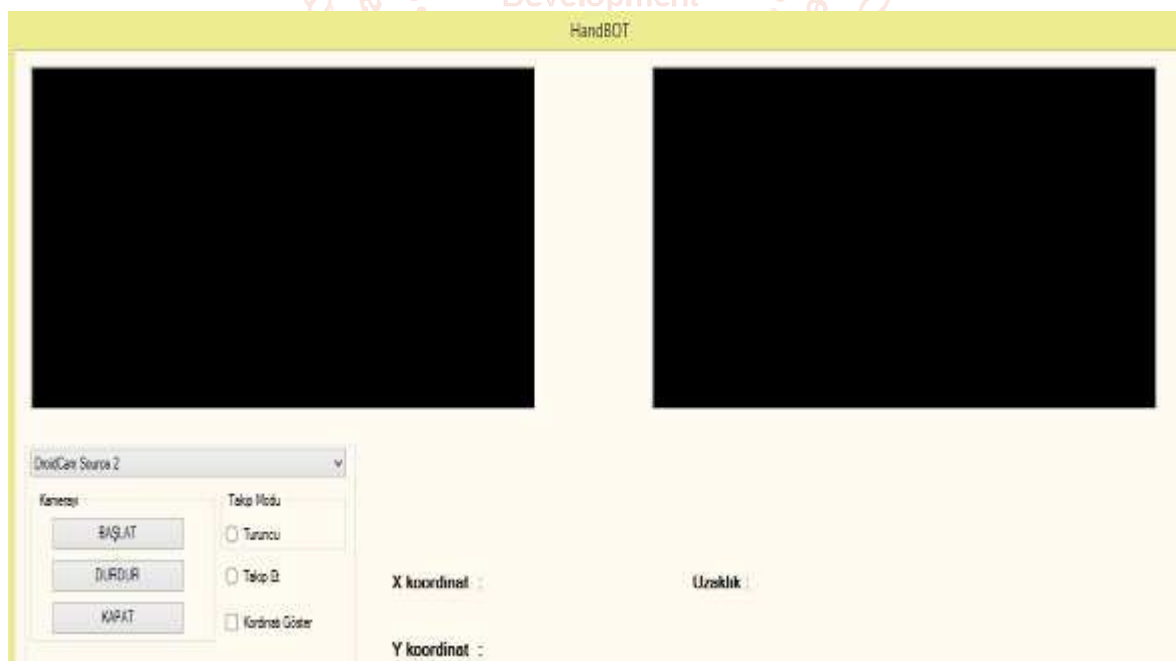
Servo motor connections, values, movement, serial communication relation data for the robot arm mechanism used in the design are controlled on Arduino. In the stages of the Arduino software, the necessary angle values, robot kinematic values and mathematical calculations were created and programmed, taking into account the characteristics of the servo motors, and the robot arm was moved with the PC via Arduino and the desired backstroke was achieved.

## 2.3. Visual Interface

The analysis of the images obtained in the table tennis training robot, the software of which was designed with Visual Studio 2017 C# language, was made using the Visual Studio interface, the image processing system and the data preparation for the movement of the robot arm.

Image processing, detection, image capture and control were performed using the Visual Studio interface in Figure 6.

In the design phase of the program, camera selection processes, on-off commands, color determination, distance control, and determination of the point on the coordinate axis were carried out by using appropriate boxes.



**Figure 6: Interface of the implemented system**

The most important point in moving the robot arm is the Visual Studio interface, the part of the system that provides real-time operation by sending the data in the most healthy way with image processing and filtering processes. It is used in the processes of transforming data for Arduino, connecting between programs, preparing data from cameras, transferring the coordinate axis to the relevant area and related parts on the robot arm. In addition, being able to monitor the interface visually provided convenience in terms of viewing and examining the process stages and it was controlled.

### 3. CONCLUSIONS

Considering the technological developments in current competitions, tournaments and games, the use of artificial intelligence and the decision-making ability of today's technology is increasing instead of managing with human power and mind. These stages are currently producing temporary solutions or manual use continues. Considering the continuation of results such as inability to use the time factor correctly, high errors, and inefficiency, the robot arm application we developed became an example for not sticking to table tennis activities, but also for starting to use it in terms of fairness in terms of other sports branches.

With the designed system, it is mechanically light, easy to use and offers portability; In terms of hardware and software, it responded to the demands of the player by showing full-time and instant active movement, precision, high speed and optimum performance (Figure 7).



**Figure 7: Robot Arm Design and Arrangement of Materials**

As a result of the study, a system designed with software and hardware features that can meet the needs of table tennis players in this regard, prepared for possible moves that may be encountered in a competition, individually, at any time and by adhering to the game rules, has been prepared without looking for a partner.

As the system is technological, developable and renewable, it has kept together different topics such as image processing, programming, data analysis, robot arm design, which have become widespread recently, and offered observation and testing opportunities for future applications.

When we look at the literature studies, it is expected that similar applications are not mostly semi-

professional, sedentary and full-time, and that the ease of examining the system will be carried forward in other studies.

In order to further reduce the waste of time and achieve high speed, a fully professional robot counter player can be created by using digital tools and equipment within the scope of industry 4.0. It is seen that artificial intelligence applications are open to development with technology, and fully productive applications can be put forward in the industrial sense with the prediction of all functions that may occur in more forward-looking designs, high quality and thinking ability.

Depending on its development and the development of industry and industrialization, it is seen that it is open

to innovation at a level that can be used in organizations and can be involved in individual or group games with similar systems, not depending on amateur sports branches.

#### 4. REFERENCES

- [1] Anonymous. (2018). Table Tennis. Retrieved from [https://en.wikipedia.org/wiki/Table\\_tennis](https://en.wikipedia.org/wiki/Table_tennis)
- [2] Asan, R. (2011). *Sekiz haftalık masa tenisi egzersizinin 9-13 yaş arası çocuklarda dikkat üzerine etkisi*. Selcuk University Institute of Health Sciences Department of Physical Education and Sports, Konya in Turkey.
- [3] Bardak, M., & Topaç, N. (2019). *Oyun Ve Oyun Materyalleri*. Istanbul University Open and Distance Education Faculty Child Development Undergraduate Program, İstanbul in Turkey.
- [4] Erdoğan, R. (2016). *Comparison of some selected physical parameters of the students who plays at Firat University table tennis and court tennis teams*. Firat University, Institute of Health Sciences, Department of Physical Education and Sports, Elazığ in Turkey.
- [5] Saygılı, E., & Çayiroğlu, İ. (2015). Two Axis Robot Arm Control using Servo Motor. *Science and Technology Information Sharing*, 7, 5.
- [6] Sevim, G., Gürler, U., & Arınmış, S. (2014). *Arduino ile Robot Kol Kontrolü*. Karadeniz Technical University, Faculty of Engineering, Department of Electrical and Electronics Engineering, Trabzon in Turkey.
- [7] Sofuoğlu, G. (2017). *Masa Tenisi 2.Kademe Antrenör Eğitimi*.
- [8] Vurgun, N., Vurgun, H., Aldırmaz, C., & Mutlutürk, N. (2020). The Effects of Table Tennis Training on Children's Self-Efficacy and Problem Solving Skill Perceptions. *Celal Bayar University Journal of Institute of Health Science*, 7(4), 427-433.

