ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 9| Issue: 4| April 2023|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2023: 8.224 || ISI Value: 1.188

A NOVEL TABLE TENNIS ROBOT USING ARDUINO

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ABSTRACT

In this work, a Smart Ping Pong Robot has been suggested. This robot is being used exclusively for table tennis applications so that the player can practise or play without an opponent. The ball is automatically thrown by the robot so that players can compete against it. In this system, the actuator, also known as the crank shaft piston, is powered by a power source. 12 volts DC are created by converting the power source (230V AC). The crank shaft piston moves mechanically as a result of the electrical energy.The ball is fed from the basket to the end effector using this piston (Ball delivery). When a DC wiper motor is activated, a DC wiper motor is fixed at the bottom of the disc, and the disc is turned 45 degrees to the left and 45 degrees to the right. in order for the ball to be delivered in the forehand and middle forehand directions. Moreover, the ball is given top, side, and reverse spin by this robot.Thge design of the work has one degree of flexibility, and it rotates to deliver balls in various directions. Thus, our robot plays a positive role in the robot table tennis development.

KEY WORDS-***DC wiper motor, Forehand, Forehand middle***

I.INTRODUCTION

A robot is an artificial mechanical or virtual entity that is typically an electro-mechanical device that is controlled by electronic circuitry or a computer programme. In addition to humanoids like Honda's Advanced Step in Innovative Mobility and thePing Pong Playing Robot, robots can also be autonomous or semi-autonomous. Other types of robots include industrial robots, swarm robots that are controlled by a group of robots, and even microscopic nanorobots. A robot may appear intelligent or have thoughts of its own by emulating a human appearance or automating movements.

However, the Robotics Industries Association (formerly the Robotics Institute of America) provided the definition that has been regarded as appropriate in the current state-of-the-art in November 1979. "A reprogrammable multipurpose manipulator designed to move material, parts, tools, or specialised devices via multiple programmed motions for the performance of a variety of tasks" is how an industrial robot is described.

Robots are recognised to reduce resource waste, increase quality, and improve working conditions. Robots are entering a new phase of adaptability and usability that will make them omnipresent helpers that will enhance our quality of life by providing effective services in our homes, workplaces, and public spaces. Robots can be categorised according on the purpose for which they are used. Robots in society, industrial robots, service robots, educational robots, general-purpose autonomous robots, etc.

Industrial robots typically have a multi-linked manipulator with jointed arms and a fixed-surface end effector. A gripper assembly is one of the most popular types of end effectors. A manipulating industrial robot is defined by the International Organization for Standardization in ISO 8373. For use in industrial automation applications, "an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or movable"

The International Federation of Robotics, the European Robotics Research Network and other national standards bodies all utilise this concept.

The most common types of industrial robots used in the production and delivery of goods are fixed robotic arms and manipulators. Less is known about what a "service robot" is. The International Federation of Robotics' suggested definition of a service robot is "a robot that runs semi- or fully autonomously to perform services useful to the well-being of humans and equipment, excluding manufacturing activities."

Teachers employ robots to assist them in the classroom. Beginning in the 1980s, turtle-shaped robots were employed in classrooms and were programmed in the Logo programming language.

Moreover, there have been robot-shaped gadgets such as Michael J. Freeman's Leachim teaching computer from 1974 and 2-XL, a robot-shaped game/teaching toy based on an 8-track tape player.

The general-purpose autonomous robots are capable of a wide range of tasks on their own. Generally speaking, general-purpose autonomous robots are able to move around autonomously in familiar environments, manage their own recharging requirements, interact with electronic doors and elevators, and carry out other simple duties. The general-purpose robots can connect to networks, software, and accessories to expand their utility, just like PCs can. They may be able to identify individuals or items, communicate, be a companion, keep an eye on the environment, react to alerts, gather supplies, and carry out other helpful functions.

The general-purpose robots can carry out a number of tasks at once or switch between duties throughout the course of the day. Some of these robots attempt to mimic humans and may even look somewhat human-like. A humanoid robot is one of this kind. Since no humanoid robot

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has been able to successfully explore a room it has never been in before, humanoid robot technology is currently in a very early stage. Consequently, despite their intelligent behaviours in their well-known surroundings, humanoid robots are actually extremely constrained.

II .DESCRIPTON OF TABLE TENNIS

Two or four players use a table tennis bat to strike a light ball back and forth in the game of table tennis, often known as ping pong. A net divides the hard table on which the game is played. Players must return a ball so that it bounces on the other side of the table after only one bounce on their side, with the exception of the first serve. When a player fails to return the ball in accordance with the rules, points are earned. Play is brisk and necessitates quick responses. The ball's altered trajectory and decreased alternatives due to spinning provide the hitter a significant edge. The hitter has a strong chance of scoring when doing so if the spin is successful.

A robot cannot successfully play table tennis or any other continuous interaction sport without quick and precise perception and control. Since it is a traditional real-time "eye-hand" platform, academics from around the world have been becoming increasingly interested in it. John Billingsley unveiled the first robot capable of playing table tennis in 1983. Since then, a number of robot systems for playing table tennis have been created. Industrial robotic arms were used to create numerous prototype systems.

a.Table Tennis Robot: Fig.1 shows the block diagram of the system

In order to play the game, each sport basically requires two players or two teams. Unfortunately, one participant may be interested in playing while the other may not. We created a robot specifically for the game of table tennis in order to get around this ambiguity. It only possesses one degree of freedom. When a player is battling this robot, the robot automatically throws the balls every second at a distance of one second. The current table tennis robot was created with the aid of a microcontroller and another programming device. But, utilising mechanical components, we created a Ping-Pong robot to lower the cost and complexity. Using a crank shaft piston as a manipulator, a 12 volt DC source is employed to excite or power it (actuator). An end-effector that rapidly launches the ball is a wheel. The ball will pitch towards the player as it lands on the table tennis board.

DC motor, PVC pipe, DC wiper motor, wheel, and basket are some of the main parts that went into our design. The crank shaft (Manipulator), which moves back and forth and propels the ball towards the end effector, is powered by a DC motor. This motor's specs are 12 volts, 1 amp, and 1000 revolutions per minute. The metal disc may rotate at an angle of 180 degrees thanks to the usage of a DC wiper motor. We achieve one degree of freedom with this mechanism. 12 volts, 40 watts, 1-1.5 amps, and 40 rpm are the motor's specifications.

The piston motion and the tubing used to feed the balls are made of PVC. Moreover, it serves as the pathway for the ball's delivery outside. The end effector of this mechanism, which turns the disc at a 180-degree angle, is made of mild steel with a 3 inch thickness and 225 inch diameter. The foundation that supports the entire body is made of mild steel with a 6mm thickness.

The piston arrangement's crank shaft is designed first. PVC pipe was used in the piston's construction. One ball at a time will be pushed by the piston because of the way it is constructed.

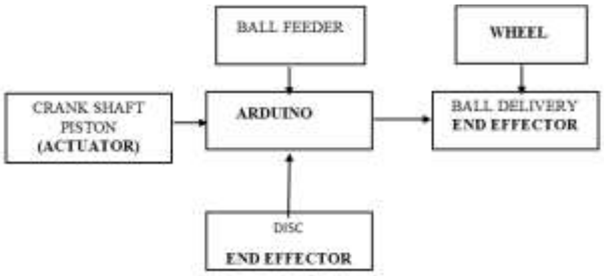

Fig.1.Block diagram of the Proposed system

The bolt is attached to the drill that has a 5 mm diameter hole in the disc. A bolt is welded onto the screw's top. The wiper motor shaft is fastened into the hole (bolt) after being inserted. The shaft moves back and forth when the motor is turned ON. This back-and-forth movement contacts the bolt, which causes the disc to rotate at a 45-degree angle to the left and the right.

The top of the manipulator is equipped with a basket that can accommodate 80 to 100 balls. A gear motor with a 60 rpm speed is kept at the bottom of the basket to push the balls one at a time to the manipulator. The motor's shaft is constructed so that it feeds only one ball at a time, one at a time, down to the manipulator. The ball is pushed or forced towards the end-effector by the piston.

The wheel, which is connected to the motor shaft and rotates when the motor is turned on, is fixed by a PVC pipe that has been carved into the end effector. At the side of the PVC pipe, a setup is constructed to hold the motor. The wheel is positioned so that it touches the ball's upper surface. The ball at the end-effector is delivered quickly towards the player when the motor is turned ON.

Fiog.2 shows the final table tennis Robot .

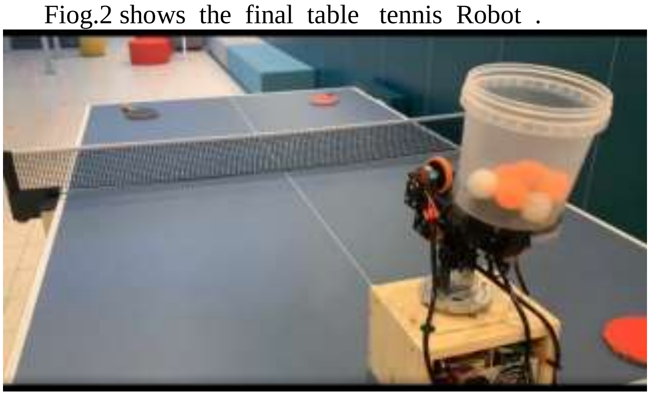

Fig.2.Table Tennis Robot

Depending on the position of the wheel, this robot may give the ball top, side, or reverse spin. The ball will spin top-down if the wheel is positioned as in picture 3. The ball will spin in the opposite direction if the wheel is locked at the bottom as indicated in figure 4. The side of the ball is revealed if the wheel is fixed at the side.

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Fig.3.Top Spin

Fig.4Side Spin

Fig.5.Reverse spin

III.CONCLUSION

Our research's main output is a clever ping pong robot that we designed. As a result, we created a smart ping pong robot that solves the issue that other robots created on an electrical platform had. Hence, by using this design, we have created a robot that performs well while costing less than previous robots. So, our robot will aid table tennis players in honing their talents. We can avoid the circuitry difficulty that could arise with an electrical platform because our design is for a mechanical platform.

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