Partners Universal Innovative Research Publication (PUIRP)
Volume: 02 Issue: 06 | November-December 2024 | ISSN: 3048-586X | www.puirp.com

Analysis of Manufacturing Automated Batting Machines With Economic Materials and the Foreign Trade in a Sports Industry of the Northwest of Mexico

Gustavo López Badilla[1], África Casillas Higuera[2], Verónica Arredondo Robledo[3], Juan Gabriel López Hernandez[4], Leslli Viridiana Pérez García[5], Estefany Chantal Castro González[6], David Isaías Romero Lucero[6], Lorena Jazmín Rodríguez Martínez[6], Rosa María Duque Sevilla[7], María del Carmen Corral Nuñez[8], José Manuel Alejandro Gómez Castillo[8], Eladio Naveja Farias[8,9], Luis Andrés Mondragón Chavero[10], Perla Rocío Hernández Navarro[11]

[1]Departamento de Ciencias Avanzadas, Universidad Vasconcelos, Campus Murua, Tijuana, Baja California, México.
[2]Departamento de Ciencias Básicas, Universidad Autónoma de Baja California, Mexicali, Baja California, México.
[3]Departamento de Ingeniería Industrial, Universidad Autónoma de Baja California, Mexicali, Baja California, México.
[4]Departamento de Ciencias Básicas, Centro Tecnológico Agropecuario No. 146, San Quintín, Baja California, México.
[5]Departamento de Ciencias Básicas, Instituto Metropolitano de Tijuana, Tijuana, Baja California, México.
[6]Departamento de Ciencias Básicas, Secundaria General Emiliano Zapata, Valle Las Palmas, Tijuana, California, México.
[7]Departamento de Contabilidad y Administración, Universidad Autónoma de Baja California, Tijuana, California, México.
[8]Departamento de Ciencias Avanzadas, Instituto Internacional para el Desarrollo Empresarial, Tijuana, California, México.
[9]Departamento de Ciencias Básicas, Colegio Alemán Cuauhtémoc Hank, Tijuana, Baja California, México.
[10]Departamento de Ciencias Básicas, CETYS Universidad, Tijuana, Baja California, México.
[11]Departamento de Ingeniería Industrial, Tecnológico Nacional de México, Instituto Tecnológico de Ensenada, Ensenada, Baja California, México.

Abstract - The industries that manufacture sport instruments, materials and objects are very relevant in the sport industry at worldwide, where exists a lot sport activities in each place of the world, being important in the relation of families, friends and communities to an adequate convivence between persons. For this reason, was made an evaluation in a sport industry located in the northwest of the Mexican Republic, specifically in the Tijuana city. In this scientific study was an analysis of the use of batting machines is very important to learn to play baseball or softball, as well as to increase the ability to obtain the best results to contact the bat and generate a good play that supports a team to win. These practice systems are manufactured for different levels of capacity and skills of people where the basic ones at low speeds are included with which care must be taken even at this type of capacity, then there are those of intermediate level at a moderate speed that also the safety of the batter must be recommended and those of high capacity with which extreme safety was for the people who practice, to be able to have the

ability to dodge if necessary that the ball has the direction towards the body and has higher speeds sometimes from 60 km/hour to 100 km/hour. Also, was made an evaluation of the foreign trade in this important city of the northwest of Mexico, about the buy of economic materials utilized in this sport industry, analyzing the taxes on materials and the economic design of the automatic batting control system to not generate economic losses in this company, where the research was made. This investigation was made in relation of a sport industry of Tijuana and a university of Tijuana (Universidad Vasconcelos, Campus Murua) with students, researches and specialists of sports activities, especially in the baseball actions.

Keywords: Automatic and economic electronic system, batting control system, foreign trade.

1.INTRODUCTION

1.1 Batting Practice Systems

This batting practice equipment are indispensable in improving the abilities of the batters. Baseball being a sport of great interest in our country along with soccer, and in Baja California being considered as the most practiced sport by young people and adults, a project is being carried out with which automated and specialized systems are replaced at average costs of over $1,000 Mexican pesos (López-Badilla et al, 2014). The project includes motion control equipment with a detection system with lamps and a small electronic device to control the ignition of the batting machine. In addition, an adaptation of a piston was made with the objective of having the balls on a rail and each one of them being delayed, so that when a batter wants to be ready in the appropriate position, he receives a ball to be part of the practice process (Arnold, 2016). The equipment consists of a base with three supports to have the appropriate backing to support sending the balls in the correct direction and not to the batter's body which can cause an accident. In addition, there are two types of levelers in the motion and light detector, one of them being a rotating one where the sensitivity of the movements to be detected is controlled. The other control device is the ignition time of the motor that contains the batting machine to indicate when it is in operation and achieve the maximum necessary energy savings, which is so sought after by companies in the Mexicali region, which is where high costs of electricity use are generated. Another control system that is electrically connected to the batting machine is the ignition of a piston where it is contemplated that the batter can control the moment in which he will receive the ball to be connected and have the most appropriate position for a good contact and thus achieve the necessary goals of being an excellent batter (Christopher, 2015).

1.2 Relationship of Batting Practice With Industrial Operations

The batting practice process, related to manufacturing processes, is part of the development of activities that lead to being more efficient day by day and thus having the maximum performance for companies (Balakrishnan et al,2023). Having the appropriate positions at the operational levels, in the professionalization and management functions, in addition to having the organization and work methods, which indicate the appropriate strategies, leads to having the required capacities that obtain the best results always in the industrial plants that are part of the success of the companies and the personnel that work in them (Tan et al, 2021). This is part of the project that is presented where knowledge of batting practice was required, as well as control systems with detection devices and indicators that show the desired operations (Batista et al, 2017), mainly motion sensors, in addition to the strategies that lead to improving at every moment both in batting practice and in the functions of the companies. The way to hit

Partners Universal Innovative Research Publication (PUIRP)
Volume: 02 Issue: 06 | November-December 2024 | ISSN: 3048-586X | www.puirp.com

the ball depends on each player and the style he takes in the position to hit the ball, being known as batting techniques, as shown by the two fundamental principles of the following figures (García et al, 2020):

a) Principle 1. It is known as weight transfer, which does not mean that it is a way of hitting, but a factor to properly hit the ball. The main aspect is the movement from back to front in order to have consistency and power (Figure 1).

Fig -1: Preparation of the back to front movement of the batter

b) Principle 2. It refers to the position of the hips and the center of the body, where the hip turn is an important part to be able to properly hit the ball (Figure 2) (Gutierrez et al, 2022).

Fig -2: Movement of the hip and center of the body of the batter

2. THEORETICAL ANALYSIS

In the Mexican Republic, baseball stands out as one of the sports that is most practiced in conjunction with soccer and Mexico has stood out in international competitions with considerable results. Having ball-throwing machines for batting practice is of great importance, to avoid first of all a hit to a person who would be throwing the balls to be hit by a batter (xxx). And secondly, the importance of being able to practice alone is considered, to obtain a better concentration in the practice (Lee et al, 2022).

2.1 Strategies in Baseball

The development of sports activities requires methods with specific activities to obtain the desired goals. One of the sports of great relevance is baseball where operations such as batting practice are presented. To carry out this activity, the various types of speed of the ball to be hit, shape and place where the person who will hit the ball is, are analyzed, in order to obtain a good result in the process of hitting the ball (Hernandez et al, 2021). This is part of the efficiency that a baseball player must have when hitting the ball, because based on this, the appropriate plays for the teams are presented (xxx). The situation that occurs in the batting process of a player is a fundamental part and similar to the activities carried out in industrial plants, where the efficiency of the personnel working in them, as well as the work methods, are essential to be able to obtain the desired objectives (Balakrishnan et al,2023).

2.2 Foreign Trade in the Border Zone of México

This topic is very relevant in the commercial and industrial activities, because can evaluate the import and export taxes, and tariffs of the materials utilized in the manufacturing operations of any type of industry in each place of the world (López-Badilla et al, 2014). This situation is evaluated every time in industrial operations, where in this investigation is focused in a sport industry that manufacture batting control systems, to sport activities as baseball to familiar, friends and community activities. Also, with this event is necessary develop some specialized systems with economic operations and materials to compensate this situation (xxx), as is showed in figure 3 (Zheng et al, 2020).

Fig -3: Foreign trade to commercial and industrial activities

2.3 Skills and Abilities in Sports

There are important aspects in every activity, where both the abilities and skills of each person represent the operational performance both at the sports level and for industrial operations. Experience is also part of the development of any activity and can be used to perform complex plays, the same occurring for industrial functions. The way of holding the object (bat) with which the ball is hit is a factor that indicates the force with which the hit is made and with it the type of objective in each play (Batista et al, 2017). This is also shown in companies where it is necessary to take the necessary tools and with the appropriate position in any operation. Another aspect of interest is the way of carrying out operations based on strategies to make the plays in a baseball game and the same can happen in a company where there are various proposals for solutions and improvement of the development opportunities that are presented and having the skills and abilities to solve them. Each player has his style from how to hold the bat to the way

of hitting the ball, just as workers carry out activities from the operational to management level (Christopher, 2015). One of the objectives of a batter is to feel how he hits the ball in order to send the ball as far as possible and if possible, beyond the field of play indicating that he has achieved a home run, which represents a run and if there were others in the game on the bases, more runs are scored. Any player likes to have the feelings of having good contact with the ball and being able to cooperate so that they serve so that the team he participates with wins. But the most basic skill since the origin of baseball is what we know as a single, which is a simple connection somewhere on the field that served to reach first base (Arnold, 2016). There are various types of systems with which you can practice how to hit a ball with a bat with automated equipment, only that they have a high cost, one of them being the one shown in figure 4.

Fig -4: Batting practice ball launching system.

2.3 Operation of Batting Practice Machines

Nowadays, there are great hitters from the amateur to the professional field, being athletes, with skills that surpass the extraordinary when making contact with the ball, while their style is concentrated in their own world, where discipline and honor for physical activity are the foundations (Gutierrez et al, 2022). This is achieved with batting practice through specialized equipment for this activity. To learn more about the batting process, an explanation of the system that operates as follows is shown (García et al, 2020):

1. The balls are introduced into a rail where they remain until the machine is turned on, where there are different speed levels to launch the balls and different times to launch one ball or another.

2. There is a motor that is turned on by means of a switch and once turned on it has a speed leveler and another as a waiting time.

3. The switches on the batting machine generate electrical conductivity and are connected to 12 volts of direct current energy levels coming from 120 volts of alternating current.

4. The machine must be installed on a base with either three or four supports and oriented towards where the batter will be.

5. Once the machine is turned on and finished its work, specialized electronic control systems that are expensive or sometimes one person or several people collect the balls and feed them back to the batting machine.

This is the most important thing in a batting practice machine, in order to have the appropriate skills and abilities to be an excellent hitter, being supported by coaches based on their experience and strategies (García et al, 2020). The relationship of the above-mentioned tamping machine with activities carried out in industrial plants, in such a way that there are various types of specialized equipment, as well as courses for the training of personnel who will carry out the operations, being indicated by experts of the functions to be performed, the appropriate methods and strategies to always obtain the desired objectives (Gutierrez et al, 2022).

2.4 Operation of Pistons

A piston is a component of engines, piston pumps, gas compressors and pneumatic cylinders, among other similar mechanisms. It is the mobile component that is contained in a cylinder and has up and down movements (López-Badilla et al, 2014). In an engine, its purpose is to transfer the force of gas expansion in the cylinder to the crankshaft through a piston rod and/or connecting rod. In a pump, the function is reversed and the force is transferred from the crankshaft to the piston in order to compress or expel the fluid in the cylinder. In some engines, the piston also acts as a valve by covering and uncovering the ports in the cylinder wall (Christopher, 2015).

2.5 Electronic Control Systems

In the area of electronics applied to any type of activity, there are electronic control systems (ECS) that greatly support low and high-power operations. Control systems can be of the electrical and electronic type where low or high-power levels are applied accordingly (Arnold, 2016). According to the type of ECS, there are their operating characteristics and they generate the energy necessary for the operation of mechanisms mainly from high levels of alternating current. These control devices are part of control engineering or engineering control systems, which is the engineering discipline that applies control theory to design systems with desired behaviors. The practice uses sensors to measure the output performance of the controlled device (of any operation) and the measurements can be used to give feedback to input actuators that can make corrections towards the desired performance. When a device is designed to perform without the need for human input for correction it is called automatic control (e.g. cruise control for regulating the speed of a car). Control systems engineering activities can focus on the application of control systems, mainly derived by mathematical modeling of systems of a wide variety (Batista et al, 2017).

3. EXPERIMENTAL DEVELOPMENT

The project includes carrying out analysis operations, electrical connection and testing of the electronic control devices in conjunction with the high-power activation systems that generate the required functions. The development of the activities was carried out with the appropriate requirements to activate the mechanisms that operate in the batting machine. The electronic diagrams of the low-power activation systems are shown below in figures 5 and 6, both for the activation of the batting machine and for the control of the balls to be connected:

Partners Universal Innovative Research Publication (PUIRP)
Volume: 02 Issue: 06 | November-December 2024 | ISSN: 3048-586X | www.puirp.com

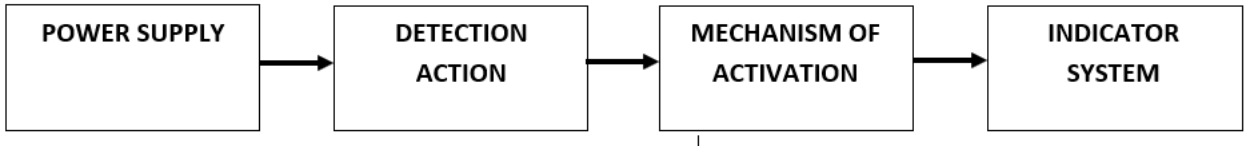

Fig -5: Electrical control system (ECS) for automated activations of the piston installed in the tamping machine

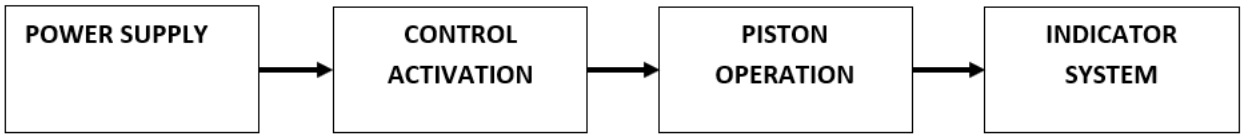

Fig -6: Electronic control system (ECS) for automated activations in the batting machine

The assembly process of the batting machine consisted of several stages, as shown and explained below:

Step 1. The machine is assembled with its supports according to the orientation of the batter who will have the batting practice. This is developed according to the distance that the batter will be, the type of ball (soft or hard), the angle at which the balls are required to be thrown, as well as the speed at which the machine will be used. All of these factors are key to achieving the main objective, which is to hit the ball with consistency and power and to be a good batter. In addition, the assembly of a protective mesh for the batting process is included, to prevent harm to any person (Figure 7).

Fig -7: Process of assembling the machine and net manually

Step 2. A variety of electronic devices and systems were analyzed to determine which of them could be suitable for the batting machine, where the on and off can be controlled, as well as the launching process with a piston that is activated and allows only one ball to pass at the desired time and subsequently allows the launch of another ball (Figure 8 and 9).

Partners Universal Innovative Research Publication (PUIRP)
Volume: 02 Issue: 06 | November-December 2024 | ISSN: 3048-586X | www.puirp.com

Fig -8:Control system used to turn on and off the piston before connecting it to the batting machine

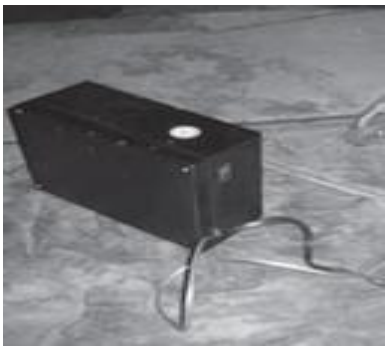

Fig -9: Control system used to turn on and off the piston before connecting it to the batting machine

Step 3. Once the control systems were determined, the assembly process was carried out, where the operation of the control that activates the two mechanisms was observed, such as the on and off process and the piston controller, which is the one that allows a ball to pass through and be launched by the machine (Figures 10 and 11).

Fig -10: Control system used for turning on and off once connected to the batting machine

Fig -11: Control system used to turn on and off the piston when connected to the batting machine

This investigation contemplates the use of low-cost electrical and electronic control systems where a great diversity of designs was developed and different electrical and electronic devices were evaluated, such as resistors, capacitors, coils, relays, integrated circuits, diodes, transistors and others of low and high power where both direct and alternating current are used. The electrical conductivity devices were analyzed based on their properties, where their power capacities and response speed were observed in figure 12.

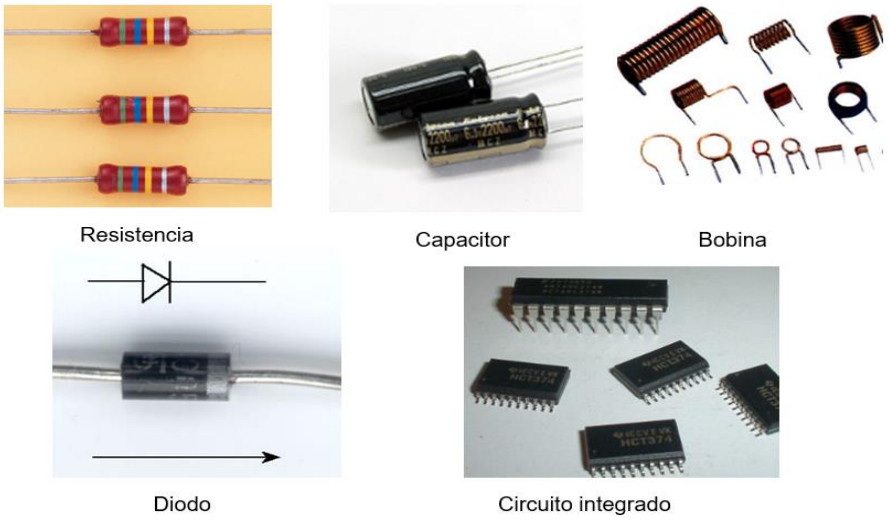

Fig -12: Electrical and electronic devices of the control system

4. RESULTS

This section is a fundamental part where the objectives achieved by the research are shown. It is here where the achievements of the operation tests of each stage mentioned above are indicated and an evaluation of its operation is made (Figure 13). It is worth mentioning that the cost of the shutdown system was adapted from a motion-detecting equipment and with a low cost of around 200 pesos, which is installed in homes, businesses and industries, with the appropriate requirements for the research project.

In addition, the piston control system has a cost of less than 100 pesos, being specifically designed for this activity. The batting practice lasts 1 minute for each ball that is thrown, and according to the tests carried out, some strategies were taken into account to be able to connect with consistency and power, to have great connections with the balls. In an adequate training process, it is necessary for the batter to be between half an hour and an hour, making the necessary attempts to have the adequate capacity, according to the skills of each person. The placement of the hands and arms were factors that supported having a better contact. The height of the batter is also essential as a support base for a good batting operation.

Fig -13: Evaluation of the batting tests with automated control systems

In the evaluations, several types of strategies were observed, where the players who participated in the test thought that batting practice improved not only the sports field but also the coordination of their movements. Several test players showed their gazes focused on the batting machine and mainly where the ball was thrown. An important aspect that the players indicated was that a batting practice does not make them one hundred percent skilled in the game, because the pitchers throw the balls sometimes with some movement called curves, which the batting machine does not do, it only throws at low, medium and high speed in a straight line. As with any other sport and activity, it is always necessary to be part of the game or operation to be aware of the requirements of continuous practice to improve the styles of the batting technique. Batting experts consider it very important to have this type of tests, but also being in the game gives the experience to be the best hitter. Batting experts can also affect the way the ball is hit in a game, because they do not have the idea of what the game will show, but it greatly supports people who do not have the experience and takes the appropriate confidence to be able to have the best contact with the ball. Different opinions from what is discussed in the previous paragraphs, the evaluated players showed great interest in having better orientation in the game and others as part of a relaxation process that supported being part of their normal life such as sports activities considerably such as being with the family. The players showed that having good contact made them have good feelings where confidence was mainly shown to perform any type of activity. This research represents the use of prototypes of this type of functions as part of recreational and family activities. In batting practice, usually a coach is behind an L-shaped screen located halfway between the mound and the plate. The objective is to throw consecutive pitches and be able to hit, simulating speed fields as theoretical analyses. The real work for hitters is done on and off the batting practice machines, and against low-, medium-, and high-speed pitches. When players did not get proper batting practice, they were observed to lose their fear of various distracting situations. Among the many things that divide pitchers and hitters, there are few sources of friction more contentious than batting practice.

5. CONCLUSIONS

Because baseball is a sport defined by routines and traditions, and few have more ingrained batting practice, there is always a pregame ritual that is one of the main ancient traditions that most teams develop to make their players better every day. For two hours before almost every game, each team dutifully extends the batting cage and slowly hits balls pitched to fields outside the baseball fields. In this research project, it was observed that in certain cases the skills were coordinated and the opportunity to obtain the necessary qualities and skills was much greater. Unless they are working in the bullpen, pitchers wait for the moment to challenge batters. The developed project is of great interest to the sports field, since it can be applied to other types of sports activities such as tennis. The main objective of the study was to evaluate the various types of electrical and electronic devices and systems that will support the control operations in the batting machine, indicating that these areas of engineering are widely applied in the sports field. The use of safety cage nets is of great importance to avoid any harm to people who observe the batting practice process and to be able to take photographs that are part of the choreographic operation of how batting techniques are evaluated. This is why the use of low-cost electronic and electrical devices can perform the functions in any type of activity. The analysis of batting practice is closely related to the operations carried out in companies and therefore, they can be correlated in such a way that similar strategies are generated with which great objectives are achieved in manufacturing processes. For many people, batting practice is just for hitters to see how far they can hit the ball to hit home runs. However, for baseball strategists, this activity is an integral part of preparation for the game.

REFERENCES

[1] Arnold Z. (2016). "Milestones in Automation using transistors to digital industries". Wiley-VCH Ed., 7(2), 76-88.
[2] Balakrishnan K., Dhanalakshmi R., Sinha B., Gopalakrishnan R. (2023). "Clock synchronization in industrial Internet of Things and potential works in precision time protocol: review, challenges and future directions", Int. J. Cognitive Comput. Eng. 4, 205–219. doi: 10.1016/j.ijcce.2023.06.001.
[3] Batista A., Capellà L., Neto A., Hall S., Naylor G., Stephen A. (2017). "F4E prototype of a chopper digital integrator for the ITER magnetics", Fusion Eng. Des. 123, 1025–1028. doi: 10.1016/j.fusengdes.2017.02.024.
[4] Christopher K. (2015). Modern Control Technology. Thompson Delmar Learning.
[5] García M., Serrano H., McDowell Y. (2020). "Specialized strategies to play baseball, Sporting Actions Journal, 9 (5), 65- 79.7.
[6] Gutiérrez E., Barrington H., Hendrikson A. (2022). "Analysis of batting practices to baseball activities", Sports Industry Journal, 4(1), 12-19.
[7] Hernández R., Michell A., Frank G. (2021). "New techniques to save money in the acquisition of industrial materials", Industrial Operations for Experimentation Journal, Vol. 6 (3), 13-26.
[8] Li Y., Lee G., Yang H. (2022). "Control system with basic electronic components the industry", International Journal of Automation and Computing, 1(1). pp.76-88. ISSN 1751-8520.
[9] López-Badilla G., Romero-Samaniego E., Toledo-Perea S.L., García-Castrellón M. M., Gamero-Ríos L. A. (2014). "Electronic system to save water due to their decrease in Mexicali by the coating of the All-American canal in USA", Revista Científica, vol. 18, Num. 1, enero-marzo, 2014, pp. 39-44 Instituto Politécnico Nacional Distrito Federal, México.
[10] Tan K., Li Y. (2021) Performance-based control system design automation via evolutionary computing. Engineering Applications of Artificial Intelligence, 14 (4). pp. 473-486. ISSN 0952-1976.
[11] Zheng Y., Tong Q., Freeman H. (2020). "Analysis of foreign trade between countries", International Journal of Commerce, 5(4), 45-60.