ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 8, March 2018

ROBOTIC ARM BOWLER USING MICROCONTROLLER

Sivapughalventhan.V[1],Suhith.S[2],Syed Ahamad Raza Saqqaf[3],Udhayakumar.S[4], Eazhisai Vallabi.M[5]

UG Scholar, Department of ICE, Saranathan College of Engineering, Trichy, India[1,2,3,4]
Assistant Professor, Department of ICE, Saranathan College of Engineering, Trichy, India[5]

Abstract: The previous work is all about the robotic arm which helps in the cricket bowling. It was designed and tested for the same. This paper is about the future advancements that could be done to the arm, and it also speaks about the improvement in the accuracy of the arm in bowling. This robotic bowling arm is accompanied with the ball conveyer. It continuously provides the ball to the arm. The current work has the ability to pitch the ball at various distances with a different mechanism. The mechanical structure of the arm is redesigned for this. Then the entire governing of the arm is done with the microcontroller.

Keywords: DC Motor, servo motor, relay, Microcontroller.

I. INTRODUCTION

The cricket training tools are widely used for training nowadays. The bowling arm is also aimed for such application. It has evolved the conventional approaches of improving batting technique through a new paradigm in cricket science. This bowling arm is featured with adjustable arm which is supported by a dc motor by means of the gears. This design was made under the principle that the distance that the ball travels depends upon the length of the arm from the center. The distance considered here is the distance from the place where the ball is hold to the center of the arm. The arm is with the conveyor that brings the ball ready for the continuousbowling. And the arm also detects the ball and grabs it. This is whatthe improvement made to the robotic arm for the bowling action.

II. LITERATURE REVIEW

D James - The aerodynamic mechanisms that produce swing, and reverse swing in cricket are well understood and the phenomenon has often been measured in wind tunnel tests. However, it is widely believed throughout the cricketing community that atmospheric conditions can have a dramatic effect on a bowler's ability to make the ball swing, and this has perplexed the minds of sports engineers for decades. A sophisticated trajectory model was developed to investigate how different atmospheric conditions affect the swing of a cricket ball, and similar to previous studies, humidity was found to have no effect.

Huda AhmedMaghrabi-Cricket bowling requires high level of skills in many ways (e.g. physically and mentally). The ball delivery technique is one of these important skills which can be optimised with advanced training methods. These training methods hinge on advanced performance parameters. Development of a low cost smart cricket ball will address the shortcomings of the existing systems and discover and explore cricket bowling kinematics and dynamics.

JegedeOlawale - Robotic arm has become popular in the world of robotics. The essential part of the robotic arm is a programmable microcontroller based brick capable of driving basically three stepper motors design to form an anthropomorphic structure. The first design was for experimental use on a human-size industrial robot arm called PUMA 560 used to explore issues in versatile object handling and compliance control in grasp actions (Bejczy&Jau, 1986). This paper explains the method of interfacing the robotic arm stepper motors with the programmed 8051-based microcontroller which are used to control the robot operations.

Mohammad JavedAnsar - Robotics has been a tremendous successful field of research in last few decades. Regarding the development of robotics, many developed robotic arm has been deployed in industrial purposes like automation, sophisticated fabrication etc.

L Justham- Bowling machines are used in cricket training to improve a batsman's technique and prevent injury or fatigue to the bowler through overuse; however, existing bowling machines do not provide a realistic training environment that compares to the experience of facing a real bowler. This paper presents the design process undertaken to specify a novel bowling machine which is capable of recreating all common types of technically correct bowling

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 8, March 2018

deliveries. The design was implemented based on the requirements and specifications outlined by cricket coaches and players.

III. DESIGN AND METHODOLOGY

A)Electrical Aspect

DC Motor- A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

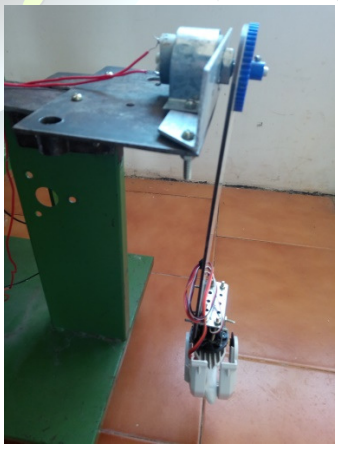
A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills.

Servo Motor- A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servomotors are used in applications such as robotics, CNC machinery or automated manufacturing. Servos are controlled by sending an electrical pulse of variable width, or pulse width modulation (PWM), through the control wire. There is a minimum pulse, a maximum pulse, and a repetition rate. A servo motor can usually only turn 90° in either direction for a total of 180° movement.

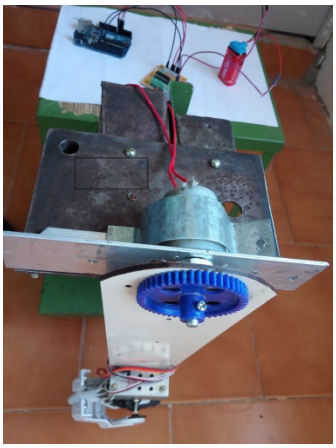
B) Working

The conveyor which is a cylindrical structure with a ball holder at the end is fitted at the point where the ball is to be picked. The ball is grabbed from a container with the motor driven conveyor. Once the ball reaches the grabbing point once the sensor detects the ball the arm is activated. The entire system is controlled and driven by the microcontroller which is pre-programed with the specific program. Now the palm of the arm which is supported by the servo motor picks the ball. Once this is done then the dc motor is activated by the dc power source. The position of the arm is also detected and the point at which the ball should be released is programed for different bowling styles. The bowling actionis also governed by varying the length of the arm. This is achieved by controlling the DC motor with the PWM signals. The adjustment for the bowling style is done while the rotation of the armso that the batsman could not predict the ball in advance. The programing is done with the arduinoIDE which is specialized for the arduinoboard. .All these actions are done at an interval so that the batsman could get ready for the next ball.

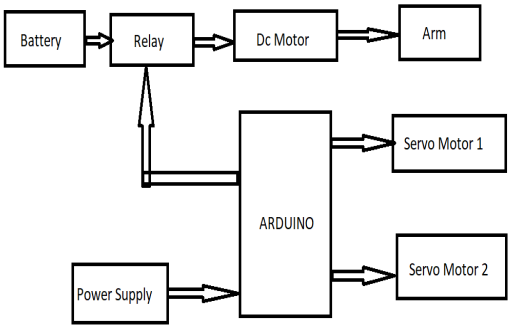


ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 8, March 2018



IV. BLOCK DIAGRAM



V. TORQU EQUATION

The equation for torque developed in a DC motor can be derived as follows:

The force on one coil of wire is

$F = I \times l \times B$, (1)

Torque equation;

$T = K I*a$ (2)

VI. ARDUINO

The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega 2560 board is compatible with most shields designed for the Uno and the former boards Duemilanove or Diecimila.

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Features

- ATmega2560 Microcontroller (MCU)
- 5V operating voltage
- 7-12V input voltage (recommended)
- 6-20V input voltage (limit)
- 54 digital input/output (I/O) pins
- 15 of which provide PWM output
- 16 analog input pins
- 20mA DC current per I/O pin
- 50mA DC current for 3.3V pin
- 256KB Flash memory
- 8KB used by boot loader

Power

- Can be powered via USB connection or with external power supply
- Power source selected automatically

Communication

- Features a number of facilities for communicating with a computer, another board, or other MCUs
- ATmega2560 provides four hardware UARTs for TTL (5V) serial communication
- An ATmega16U2 (AT mega on the revision 1 and revision 2 boards) on the board channels one of these over

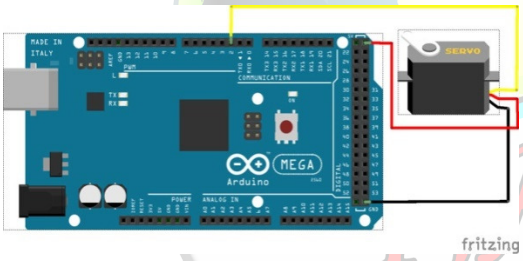
ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 8, March 2018

USB and provides a virtual com port to software on the computer.

Servo Interface with Arduino

Servo motor control using Arduino Uno R3 can be easily done by interfacing servo motor with Arduino. Servo have three input pins as shown in circuits below. Power supply pins and pulse signal pin. Interfacing diagram is shown below



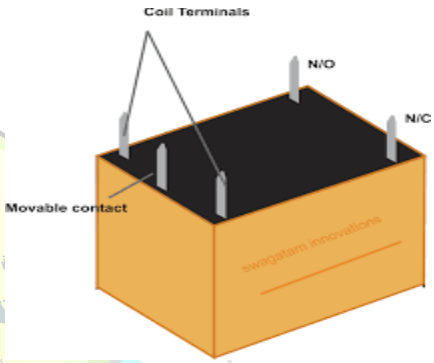
VII.RELAY

A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it).

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized.

Relay Switch Circuit .But while electrical relays can be used to allow low power electronic or computer type circuits to switch relatively high currents or voltages both "ON" or "OFF", some form ofrelay switch circuit is required to control it.

In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At no input state, the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO. Different relay configurations are available like SPST, SPDT, DPDT etc,



IX. Testing and Result

The results has tested and performed using a golf ball as a prototype dimpled ball and the basic speed measuring formula, with the distance being constant and the voltage being supplied to the motors being varied. 10 feet pitch has been taken as an analogy for this purpose.
The developed bowling arm offers greater mobility to pitch the ball at desired line & length, as well as spin in the required direction at speeds ranging between 60 to 90kmph. The machine was tested and found to deliver satisfactory results, in very close terms of the objectives enlisted. However, the performance of the arm can be improved.

X. ADVANTAGES OF THE ARM

Reduced bowler requirement, Compact size, cost is low, Batsman can adjust as per the requirement, it can delivered at various different speeds by using pulse width modulation, speed accuracy is good.

XI. FUTURE WORKS

By achieving these three different rotational movements, i.e. pitch, yaw and roll, ball can be bowled at an angel to the batsman, thus opening possibilities to a wide range of deliveries.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 8, March 2018

By making the electronic speed control of the motors automated, viz. remote-controlled, the machine can be made to bowl at any required speed with close accuracy. This can further enhance the ability of a coach to guide batsmen by being beside them during training, as the machine can be controlled by the hand-held remote.

An electronic display which shows the speed at which a ball is being bowled can be of great advantage to practicing batsmen. This can be achieved by using a digital signal processing and a LCD screen on the bowling machine.

An improved ball feeding mechanism which can hold suitable number of balls in it and bowl it onto the batsmen at his convenience is desirable. This ball throw-rate control can be added to the hand-held remote control, thus providing effective overall control.

XII. CONCLUSION

In this paper an automatic bowling arm has been designed. The batsman can design or programmed by an arduino software the bowling arm can rotate as per his/her requirement. The pulse width modulation used to controlling the speed of the dc motor. For 12V dc supply, it gives the speed from 65 Km/hr.

REFERENCES

[1]GLAZIER P, WHEAT J. An integrated approach to the biomechanics and motor control of cricket fast bowling techniques [J]. Sports Medicine, 2014, 44(1): 25–36.CrossRefGoogle Scholar

[2] AbhijitMahapatra, AvikChatterjee and ShibenduShekhar Roy' "Modeling and simulation of a ball throwing machine", 14thNational Conference on Machines and Mechanisms (NaCoMM09), NIT, Durgapur, India, pp. 416-422, December 17-18, 2009.

[3]RANA Z. Test cricket-top 10 fast bowlers of all time[EB/OL].[2013.10.26].http://www.cricketdawn.com/featured-articles/test-cricket-top-10-fast-bowlers-of-all-time.html

[4] FERDINANDS RENÉ E D, KERSTING UWE G., MARSHALL ROBERT N. A new taxonomic system for the sub-classification of cricket bowling actions [J]. Sports Technology, 2014: 1–13.

[5] P.R. Upadhyay, K.R. Rajgopal and B.P. Singh, "Design of a compact winding for an axial flux permanent magnet brushless DC motor used in an electric two wheeler", IEEE, Transactions on Magnetics, Vol. 40, Issue 4, pp. 2026-2028, July 2004.

[6] Zhe Li, Sridhar Kota, Virtual Prototyping and Motion Simulation with ADAMS, Journal of Computing and Information Science in Engineering, Transactions of the ASME, Vol. 1, 2001, pp. 276-279.

[7]JUSTHAM L, WEST A. Design and development of a novel, integrated bowling machine for cricket [J]. P I MechEng P-J SET, 2009, 223(4): 125–137.

[8] Raza Ali, Diegel Olaf and Arif Khalid Mahmood "Robowler: design and development of a cricket bowling machine ensuring ball seam position", Central South University Press and SpringerVerlag Berlin Heidelberg, Vol. 21, pp. 4142–4149, 2014.

[9] Rene´ E.D. Ferdinands, Uwe G. Kersting and Robert N. Marshall, "A new taxonomic system for the sub-classification of cricket bowling actions", Sports Technology, pp. 1-13, 2014.

[10] Paul S. Glazier and Jonathan S. Wheat, "An integrated approach to the biomechanics and motor control of cricket fast bowling techniques", Springer International Publishing, Switzerland, 2013.

[11]BAKER C. A unified framework for the prediction of cricket ball trajectories in spin and swing bowling [J]. Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology, 2013, 227(1): 31–38.

[12]SENGUPTA A. Alec Bedser: One of the greatest seam bowlers of all time [EB/OL].[2013-11-10]. http://www.cricketcountry.com/cricket-articles/Alec-Bedser-One-of-the-greatest-seam-bowlers-of-all-time/28577.

[13] A. Gung, IGAP Raka, S. Huda and I WA Wijaya, "Speed control of DC motor with pulse width modulation (PWM) method using infrared remote control based on AT mega 16-Microcontroller", IEEE, International Conference on Smart Grid Technology in Electrical and Information System (ICSGTEIS), pp. 108-112, 5-7 Nov. 2014.

[14] SCOBIE JAMES A, PICKERING SIMON G, ALMOND DARRYL P, LOCK GARY D. Fluid dynamics of cricket ball swing [J]. Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology, 2013, 227(3): 196–208.

[15] Y.S. .Ali, S.B.M. Noor, S.M. Uashi and M.K Hassan, "Microcontroller performance for DC motor speed control system", IEEE, National Power and Energy Conference (PECon), Bangi, Malaysia, pp. 104-109, 2003.

[16] CREWE H, CAMPBELL A, ELLIOTT B, ALDERSON J. Lumbo-pelvic loading during fast bowling in adolescent cricketers: The influence of bowling speed and technique [J]. Journal of Sports Sciences, 2013, 31(10): 1082–1090.

[17] DAVIS K H, BLANKSBY B. A cinematographic analysis of fast bowling in cricket [J]. Australian Journal of Health Phycical Education and Recreation, 1976, 71(Suppl): 9–15.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 5, Special Issue 8, March 2018

[18]CORK A, JUSTHAM L, WEST A. Three-dimensional vision analysis to measure the release characteristics of elite bowlers in cricket [J]. Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology, 2013, 227(2): 116–127.

[19] Caldwell, R. D., N. Ye and D. A. Urzi, Reengineering the product development cycle and future enhancements of the computer-integrated environment, International Journal of Computer Integrated Manufacturing, Vol. 8, No. 6, 1995, pp. 441-447.

[20] CarmadiMachbub, ArySetijadiPrihatmanto and YosephDwiCahaya, "Design and implementation of adaptive neural networks algorithm for DC motor speed control system using simple microcontroller", pp. 479-483, IEEE, 2001

[21] MANIKRAO A, DESHPANDE J, SANGOLE T, GOLE N. Simulation of aerodynamics of the cricket ball with soil conditions of the pitch [J]. International Journal of Engineering Research and Development, 2013, 6(12): 12–14.

[22] BOLA. Ball throwing machines for cricket, hockey and baseball [EB/OL].[2013-07-22].http://www.bola.co.uk/cricket.html

[23] G. Rajeshkanna, "Modern speed control of separately excited dc motor by boost converter fed field control method", IEEE, International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, Jan. 09 – 11, 2013.

[24]Leverage Sports Technologies. Leverage Yantra three wheel bowling machine [EB/OL].[2013.11.25]. http://www.bowlingmachine.co.in/threewheelcricketbowlingmachine.html

[25] JAMES D, MACDONALD D C, HART J. The effect of atmospheric conditions on the swing of a cricket ball [J].