www.ijaceeonline.com ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
Volume: 2, Issue: 7, July 2017, pp. 29–33

An Autonomous Two Wheel Based Self-Balancing Robot Using Arduino

Md. Abdullah Al Ahasan
Lecturer, Department of Computer Science and Engineering,
Bangladesh University of Business and Technology, Dhaka, Bangladesh
Email: ahasancse08@gmail.com

Abstract: *Modern technology and robotics has become a popular research filed in the recent time because robotics engineers have a dream to build a robot that would be substitute of human. For this purpose, stability control would be a basic mechanism. In this paper, we have proposed a technique of making self-balancing robot that reflect the stability control mechanism. We will use the basic mechanism of inverted pendulum to make the system stable. An accelerometer is used here for measuring angle and two DC motor with shielded with two wheel is used to maintain fixed cart position that is controlled by a motor driver.*

Keyword: *Self balancing robot; Inverted pendulum; Stability, Accelerometer,*

1. INTRODUCTION

Self-balancing robot means the robot that can keep balanced herself without falling. In this project, we follow basic mechanism of inverted pendulum. According to inverted pendulum mechanism a fixed cart position is set up initially and drive a reverse force when the cart is disappearing form the fixed position until the cart comeback his fixed position and that's helps the cart to remain constant in the fixed position. The basic rule of inverted Pendulum is followed here. We have tried to use simple technology to implement our balanced robot [1]. This simple and easy technology can be used for our further big project like as humanoid robot that can walk and balance itself easily

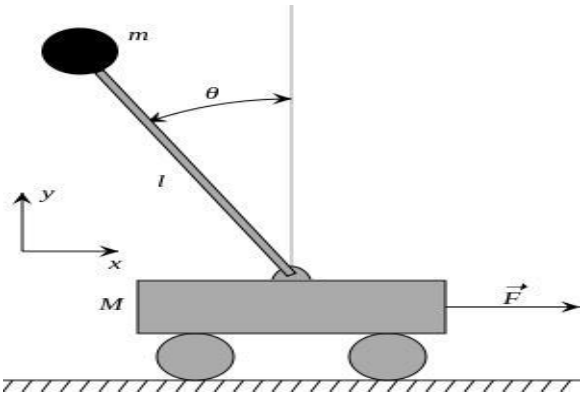


Figure 1 Inverted Pendulum on a cart

Cite this paper:

Md. Abdullah Al Ahasan, "An Autonomous Two Wheel Based Self-Balancing Robot Using Arduino", International Journal of Advances in Computer and Electronics Engineering, Vol. 2, No. 7, pp. 29-33, July 2017.

2. METHODOLOGY

The methodology of this project is divided into three parts namely the hardware, mechanical design and software design.

2.1 Hardware Description

2.1.1Arduino Uno

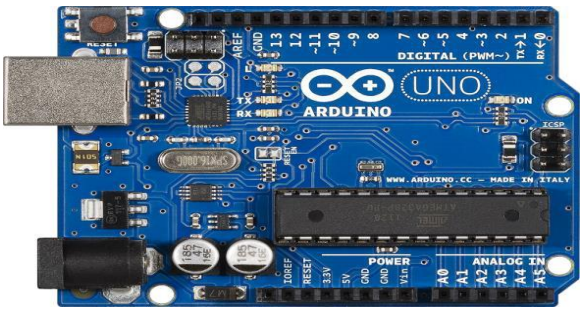


Figure 2 Arduino Uno

Arduino Uno is a microcontroller-based board and easily programmable that contains 14 digital input/output ports, 6 analog input, power jack and a reset button and other functions also. It also contains a USB plug with an AC to DC adapter [4] [8].

2.1.2 Motor driver L293d

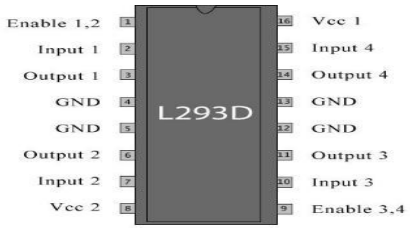


Figure 3 Motor driver L293d

ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
Volume: 2, Issue: 7, July 2017, pp. 29–33

L293d motor driver works as amplifier that takes a lower voltage and produce higher voltage that will drive the motor.

2.1.3 Adxl337

Figure 4 Adxl337

The ADXL337 is a complete 3-axis acceleration measurement system in the range of ±3 g minimum [3] [6].

2.1.4 Motor with Wheel

Figure 5 Motor with wheel

2.2 Mechanical Structure

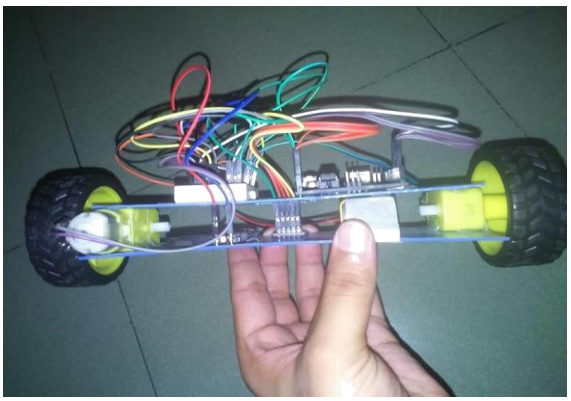


Figure 6 Front view

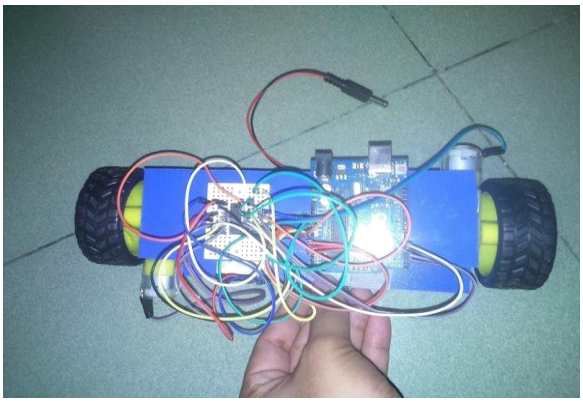
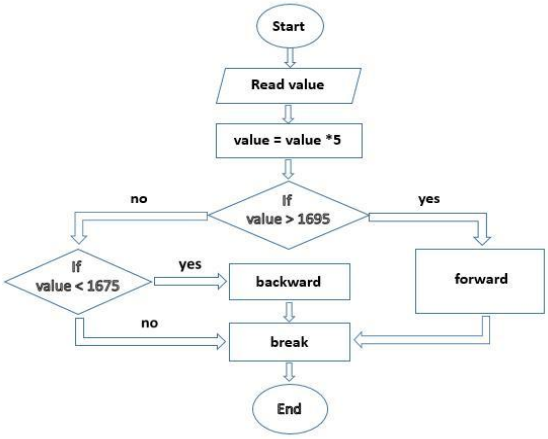


Figure 7 Top view

2.3 Software design

2.3.1 Flowchart



ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
Volume: 2, Issue: 7, July 2017, pp. 29–33

2.3.2 Pseudocode

Read the value of x axis

Multiply the value by 5

If value > 1695
Forward

Else if value < 1675

Backward

Else

Break

3. PROCESS DESCRIPTION

The primary task for controlling the system is the measurement of angle. We used adxl337 as angle measurement sensor. Basically it's provide the angle value for three axes like x, y, z but hare we will consider only the angle value of x.

Since it's provide the value between 0 to 360, so it's raise a problem in decision making when to go forward or backward because the difference between two consecutive values is very small. To overcome this situation, we multiply the angle value by a constant value (i.e. 5) that increase the difference between two consecutive values.

Next, task is maintaining the angle value on cart position. Hare, we used a range of values from 1675 to 1695 as our fixed cart position. If the angle value belongs to this range will considered as stable position. For this purpose, we used two DC motor shielded with two wheel that controlled by a motor driver called L293d [5] [7].

Our main processing unit is Arduino Uno. The angle measured by the adxl337sensor is compared as if angle value is less than 1675 than process to backward else if angle value is greater than 1695 than process to forward otherwise remain constant at the same angle position which we called hare as break. Hare, the motor driver called L293d processes forward, backward, and break operation.

2.4 Measurement Units

• Hare we measured angle in term of degree.

2.5 Equations

Hare,

Value = angle value of x axis

Hence,

Value = Value * 5

Within range of, 1675 >= Value <= 1695

4. EXPERIMENTAL RESULT

4.1 Output on Sirial Monitor

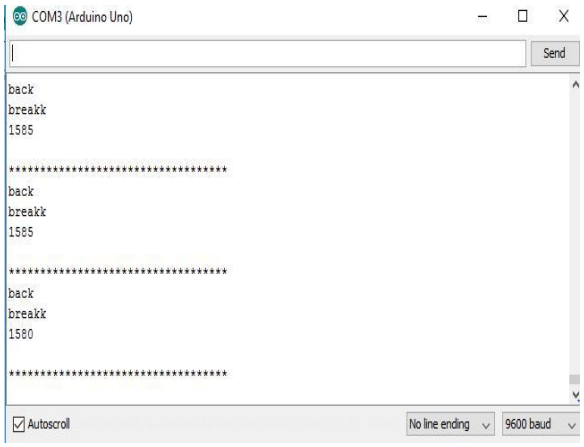


Figure 9 Backward

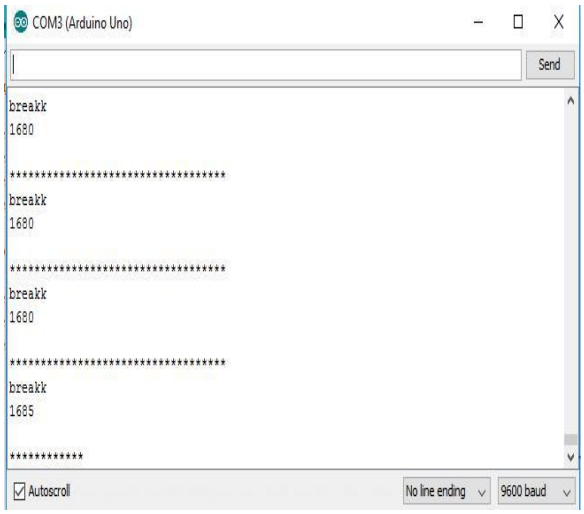


Figure.10 Break or Stable

ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
Volume: 2, Issue: 7, July 2017, pp. 29–33

4.2 Figures and Tables

TABLE 1 DATA FOR THE DIFFERENT POSITION OF THE SELF-BALANCED ROBOT

Table Head	Experimental Result		
	Backward	Break	Forward
1	1585	1677	1745
2	1582	1680	1740
3	1580	1685	1730
4	1590	1690	1705
5	1600	1694	1698

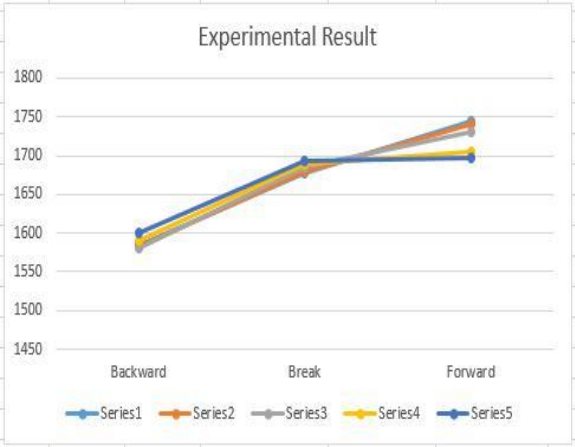


Figure 12 Graphical View of our Robot Balanced Diagram

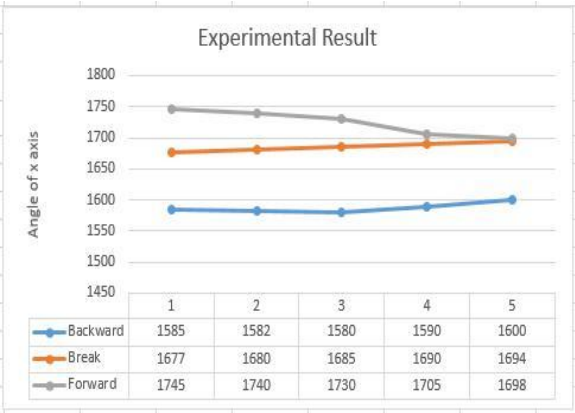


Figure 13 Graphical View of our Robot

5. LIMITATION AND FUTURE WORK

In this project, we implement the basic idea of making a system or robot stable but the produced result is not satisfying because we did not use any filtering method. Hence, the garbage values mitigate our experimental result. Therefore, we think there is a scope of working to produced error free result by using any filtering technique like PID controller or Kalman filter [2][9].

6. CONCLUSION

Throughout this project, our main goal was to implement the basic idea of making a system or robot stable. However, the experimental result is not satisfying as expected but we successfully implement the method of how to stable a system or robot.

REFERENCES

[1] Madhira, Kartik, Ammar Gandhi, and Aneesha Gujral. "Self balancing robot using complementary filter: Implementation and analysis of complementary filter on SBR." Electrical, Electronics, and Optimization Techniques (ICEEOT), International Conference on. IEEE, 2016.

[2] Krishna, Bsb Vamsi, And P. Mallikarjuna Rao. "Implementation of Two Wheeled Self Balancing Platform." (2016).

[3] Ooi, Rich Chi. "Balancing a two-wheeled autonomous robot." University of Western Australia 3 (2003).

[4] Hellman, Hanna, and Henrik Sunnerman. "Two-Wheeled Self-Balancing Robot: Design and control based on the concept of an inverted pendulum." (2015).".

[5] Ghani, Nor Maniha Abdul, Faradila Naim, and Tan Piow Yon. "Two wheels balancing robot with line following capability." World Academy of Science, Engineering and Technology 55 (2011): 634-638.

[6] Shankar Raja Sakthiya Ram, Dravidamani Dinesh Kumar "Designing of Optimization Techniques based PID controller for Self Balancing Bicycle", International Journal of Advances in Computer and Electronics Engineering, Vol.2, no.6, pp. 21-25, June 2017.

[7] Sun, Fengxin, Zhen Yu, and Haijiao Yang. "A design for two-wheeled self-balancing robot based on kalman filter and LQR." Mechatronics and Control (ICMC), 2014 International Conference on. IEEE, 2014.

[8] Juang, Hau-Shiue, and Kai-Yew Lurrr. "Design and control of a two-wheel self-balancing robot using the arduino microcontroller board." Control and Automation (ICCA), 2013 10th IEEE International Conference on. IEEE, 2013.

[9] Li, Jingtao, et al. "Controller design of a two-wheeled inverted pendulum mobile robot." Mechatronics and Automation, 2008. ICMA 2008. IEEE International Conference on. IEEE, 2008.

Authors Biography

Md. Abdullah Al Ahasan, is a Lecturer of the Computer Science and Engineering Department in Bangladesh University of Business & Technology and he is also Software developer and Embedded system developer. He completed his B.Sc.in department CSE at Khulna

ISSN: 2456 - 3935
International Journal of Advances in Computer and Electronics Engineering
Volume: 2, Issue: 7, July 2017, pp. 29–33

University. He is studying the M.Sc. Thesis in department of Information Technology at Jahangirnagar University. His research interests are artificial intelligence, electronic devices, communication systems, electrical machines, and transmission and switch gears.

Cite this paper:

Md. Abdullah Al Ahasan, "An Autonomous Two Wheel Based Self-Balancing Robot Using Arduino", International Journal of Advances in Computer and Electronics Engineering, Vol. 2, No. 7, pp. 29-33, July 2017.