RESEARCH ARTICLE OPEN ACCESS

DESIGN AND FABRICATION OF SELF BALANCING ROBOT

Ajith.H[1],Dr.Sengottuvel.P[2]
1*Student, Department of Mechatronics Engineering*
Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.
Email: 0809rdhanasekar@gmail.com)

2*HOD, Department of Mechatronics Engineering*
Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India.
Email- hodmechatronics@bharathuniv.ac.in

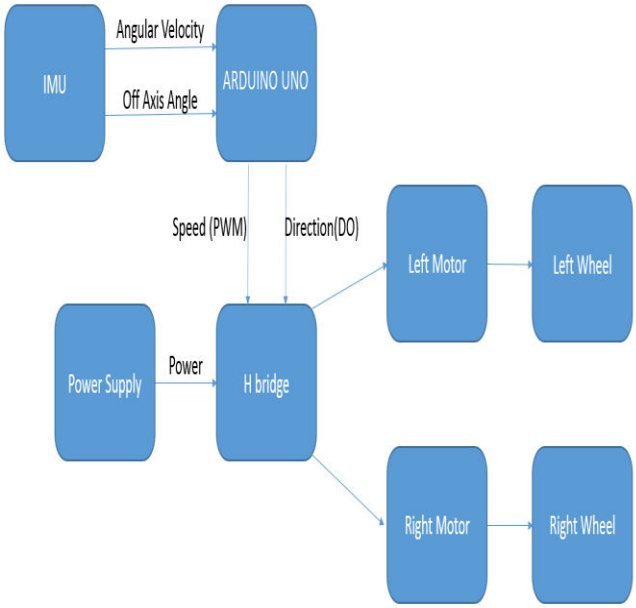
Abstract:
This work describes the design and implementation of a self-balancing two-wheeled robot. The system is similar to the classical unstable, non-linear mechanical control problem of an inverted pendulum on a cart.
This project derives the linearized system dynamics equations and approaches the control problem, of stabilizing the robot, using a Arduino system and driving motors. The controller manages to reject disturbances and stabilize the system using only a gyroscope and an accelerometer.
***Keywords* —pid controller,sensor imu board,arduinouno board,l293d driver.**

I. INTRODUCTION

Planning a self-offsetting robot with exceptional capacities has turned into a pattern nowadays for an assortment of all inclusive human utilization. It likewise fits well with the necessities and nature of the human way of life. Various structures and uses, self-adjusting robots have been planned and are currently in the market around the world.

A self-adjusting robot contains three principle parts including sensors, legitimate handling unit and actuator. In this task, a robot that can keep up an upstanding and adjusted situation on a stage is structured and created. The robot comprises of Inertial microchip and engines.

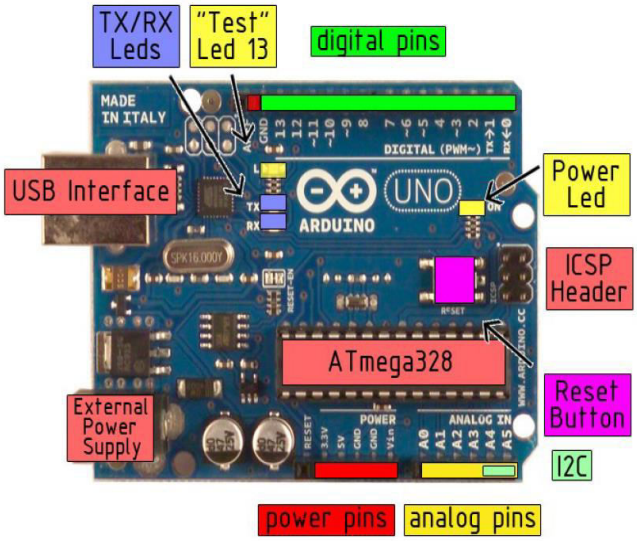
II. BLOCK DIAGRAM



The way toward executing this venture is very testing since it includes a few stages which incorporate understanding the fundamental hypotheses, planning the robot just as the PID controller. To make the procedure efficient, a Gantt Chart has been defined. Gantt Chart is significant so as to finish this undertaking on schedule. It begins with talking about with chiefs on the subject for the undertaking, goals, scopes and related things. Concentrate on the writing is additionally arranged in the Gantt Chart. Before continue the to the PID controller configuration stage, it is critical to figure out how to utilize the Simulink Matlab, which is additionally expressed in the outline.

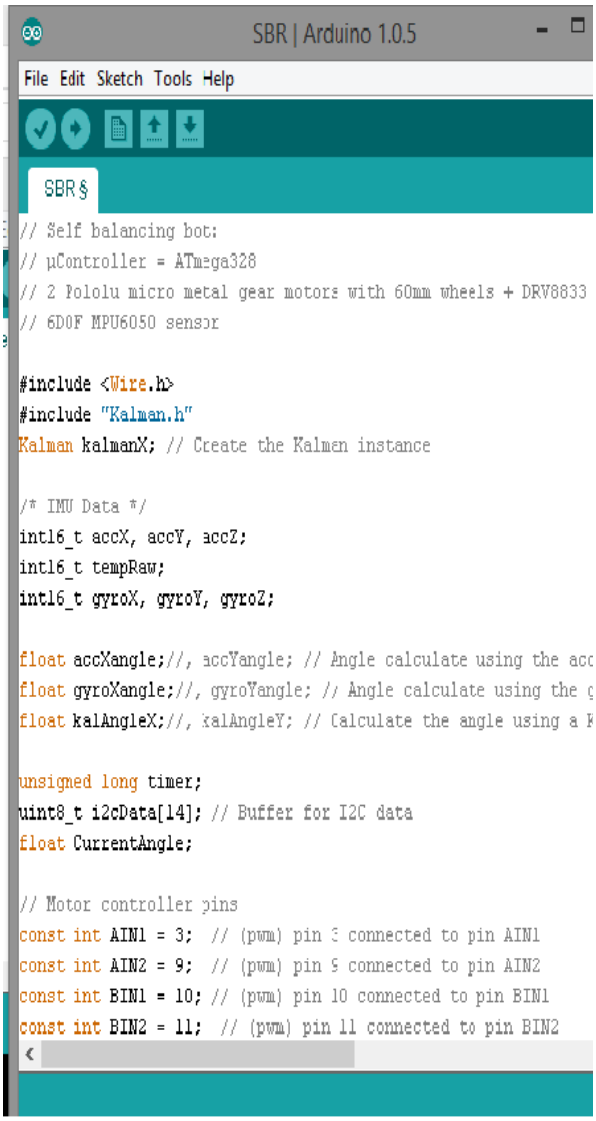
III. ARDUINO UNO BOARD

The main controller for this project is Arduino Uno which uses Atmel At mega 328 microcontroller as it combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 universally useful I/O lines, 32 broadly useful working registers, three adaptable clock/counters with look at modes, inner and outer intrudes on, sequential programmable USART, a byte-situated 2-wire sequential interface, SPI sequential port, 6-channel 10-piece A/D converter (8-directs in TQFP and QFN/MLF bundles), programmable guard dog clock with inside oscillator, and five programming selectable power sparing modes.



Arduino is an open-source gadgets prototyping stage dependent on adaptable, simple to-utilize equipment and programming. It's proposed for specialists, fashioners, specialists, and anybody keen on making intuitive items or situations.

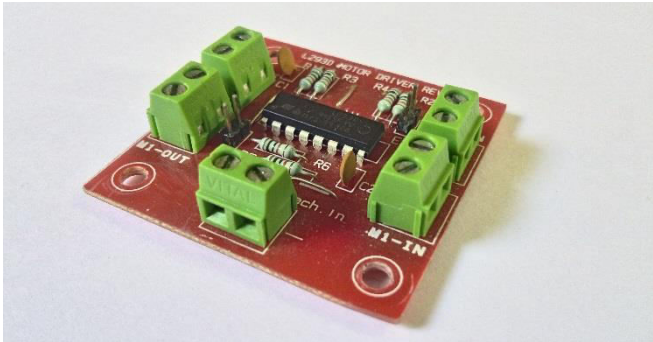
The open-source Arduino condition as appeared in Figure 3.10 makes it simple to compose code and transfer it to the I/O board. It keeps running on Windows, Mac OS X, and Linux. The earth is written in Java and dependent on Processing, avr-gcc, and other open source programming.



IV.L293D DRIVER

The Device is a solid incorporated high voltage, high ebb and flow four channel driver intended to acknowledge standard DTL or TTL rationale levels and drive inductive burdens, (for example, transfers solenoids, DC and venturing engines) and exchanging power transistors.

To rearrange use as two scaffolds each pair of channels is furnished with an empower input. A different inventory info is accommodated the rationale, permitting activity at a lower voltage and inner cinch diodes are incorporated. This gadget is appropriate for use in exchanging applications at frequencies up to 5 kHz.



The L293D is collected in a 16 lead plastic bundle which has 4 focus pins associated together and utilized for warmth sinking

The L293DD is collected in a 20 lead surface mount which has 8 focus pins associated together and utilized for warmth sinking.

V. PID CONTROL ANALYSIS

The IMU sensor gives the data and target directions as sources of info and makes, in outcome, yield sign to drive the Robot actuators (the engines in our model) so as to control the framework. We are utilizing a PID controller (Proportional + Derivative + Integral). This kind of control has 3 constants to modify kP,kD,kI.

The PID what to quantify (the "Info") ,where you need that estimation to be (the "Setpoint",) and the variable you wish to acclimate to get that going (the "Yield".) The PID at that point changes the yield attempting to make the information equivalent the setpoint.

kP is the Proportional part and is the primary piece of the control, this part is relative to the blunder.

kD is the Derivative part and is applied to the derivative of the error. This part depends on the dynamics of the system (depends on the robot,´s weight motors, inertias…).

The last one, kI is applied to the necessary of the blunder and is utilized to decrease consistent mistakes, it resembles a trim on the last yield (think in the trim fastens on a RC vehicle directing wheel to cause the vehicle to go absolutely straight, kI evacuates the balance between the objective required and the real worth).

On B-ROBOT the guiding order from the client is added to the engines yield (one engine with a positive sign and the other with a negative sign). For instance if the client sends the directing order 6 to go to one side (from - 10 to 10) we have to add 6 to one side engine esteem and subtract 6 from the correct engine. On the off chance that the robot isn't pushing ahead or in reverse, the consequence of the guiding direction is a turn of the robot.

Here we can tune the estimations of kP ,kI, kD in Arduino software.In results we can make a bot adjusted position.

VI. RESULT AND CONCLUSION

Controlling of self-balancing robot using PID is not an easy one also the parameter and sensor taken into an account. Small tuning of these parameters makes a wide range of deviation in movement.

Mechanical design plays a major role. A previous equation problem , flatness problem and in tuning the parameters has been solved and verified.

VII. REFERENCES

[1] R.S.Meena,VikasKumawat(2011) .*Controller Design For Servo Motor Using MATLAB* .In Proceeding of National Conferences on Advances & Research in Electrical System Technology (AREST 2011).

[2] Popescu, Cristina; Paraschiv, Nicolae; Cangea, Otilia.(2011*) Comparison Between Pid And Fuzzy Controllers Used In Mobile Robot Control*
annals of daaam& proceedings;jan2011, p223

[3] Kotaki, Masakazu; Yamakawa, Yuji; Yamazaki, Takanori; Kamimura, A
Tuning Method for PID Controller That Considers Changes in System Characteristics. ASHRAE Transactions. 2005, Vol. 111 Issue 2, p13-22. 10p.

[4] ArpitGoel., et al. (2012) *Performance Comparison Of PID And Fuzzy Logic Controller Using Different Defuzzification Techniques For Positioning Control Of DC Motors*. Journal of Information Systems and Communication
ISSN: 0976-8742 & E-ISSN: 0976-8750, Volume 3, Issue 1, pp.-235-238.

[5] Young Soo Suh.(2003) .*Attitude Estimation Using Low Cost Accelerometer And Gyroscope*.Proceedings KORUS 2003. The 7th Korea-Russia
International Symposium on Volume: 2 Page(s): 423 - 427 vol.2

[6] Andrea Demetlika, TomislavTomašić, MladenCrneković (2012)
Selfbalancing Mobile Robot Tilter.FAMENA issue 3, volume 36, Zagreb

[7] Hany Ferdinando, HeriSaptonoWarpindyasmoro, Stanley Kardinal Jusuf.
(2001) *Developing Mathematical Model of DC Servo Motor Using Bond Graph* 1st Kentingan Physics Forum ,Surakata

[8] V.J. VanDoren, "*PID: Still The One*," Control Engineering, October 2003.
Retrieved

[9] D. Simon, *Kalman Filtering With State Constraints: A Survey Of Linear And Nonlinear Algorithms*, IET Proceediings in Control Theory & Applications,
vol. 4, no. 8, pp. 1303-1318, 2010.

[10] Braun,T.,Sutherland ,and Alistair (2002).An Experimental Platform for Researching Robot Balance.Department of Electrical & Electronic Engineering .University of Western Australia.

[11] A. Warnasch, and A. Killen, *Low cost, high G, micro electro-mechanical systems (MEMS), inertial measurements unit (IMU) program*, IEEE
Position Location and Navigation Symposium, 2002, pp. 299-305.