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Design and Implementation of A Self Balancing Mobile Robo

[1]R. Supreem, [2]V. Karthik Kumar
[1]M.Tech, Balaji Institute of Technology & Science,Telanagana, India
[2]Assistant Professor,Dept. of ECE, Balaji Institute of Technology & Science, Telanagana, India

ABSTRACT: This paper deals with the development of a low cost self-balancing vehicle. To demonstrate the techniques involved in balancing a platform. To work on precise movements and accurate control of platform. Establishing lines of communication with the correct hardware pin addresses will allow for easy identification on how each individual piece of hardware will transmit and process data to and from the MU. Interface and then control DC geared motors using its PWM pins and the frequency of operation of motors can be made synonymous with that of MU.The platform can be used for daily short journeys, handling everyday objects, carry professional photographic equipment, realize the smooth track shoot.

IndexTerms:Microcontroller, PWM,Bluetooth,self balacing

I. INTRODUCTION

The study on a two-wheel inverted pendulum, which is probably known as the self-balancing mobile robot,has received momentum over the final decade in a number of robotic laboratories world wide. That is shownby means of a quick increase within the number of journal papers, study tasks and theses on the field, which had beendealing with equivalent initiatives. The concepts of operation of one of these robotic are additionally utilized in a commercial electrictransportation automobile referred to as Segway. The self-balancing mobile robo on two wheels, known as Tilter, works on theprecept of an inverted pendulum. The robotic is inherently unstable and with out external manage it will rollaround the wheels' rotation axis and eventually fall. Riding the motors in the proper direction returns the robotic tothe upward role. Even though the robotic is inherently unstable, it has several advantages over the staticallysteady multi-wheeled robots – considering the fact that it has only two wheels (two elements touching the ground) it requires much lessarea; given that it is situated on dynamic balance (it continuously needs to right its tilt perspective to remain stable) itreveals elevated dynamic behaviour and mobility. This further manoeuvrability permits handy navigation onvarious terrains, turning sharp corners (it could possibly turn instant) and traversing small steps or curbs.To make small dimension robot with less components that is only 2 wheel instead of 3 or 4 wheel. Efficient development on twowheeled balancing robots are situated on inverted pendulum configuration by using designing code and implementing aself-balancing manipulate algorithm utilizing the PID controller. The proposed model implements self-balancing roboticwith lowered hardware and multiplied vigor efficiency. Also the mission simple two-wheeled balanced robotic canbecome the ideal academic and hobbyist tool to discover the electronics and programming field.

II. PROPOSED FRAMEWORK

It will be prevented from falling by giving acceleration to the wheels according to its inclination from the vertical. If the bot gets tilts by an angle, than in the frame of the wheels, the centre of mass of the bot will experience a pseudo force which will apply a torque opposite to the direction of tilt.

A. Mechanical Structure:

The bot consists of three platforms which have arduino, IMU, motor driver based on it. On the lower part of the bottom platform, the two high torque motors (300 rpm) are clamped. The whole bot gets balanced on two wheels having the required grip supplying sufficient friction (as there are large chances for wheels to skid).

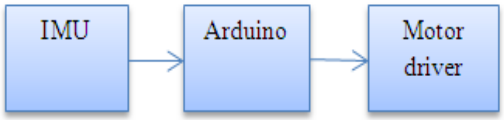

Fig.1 Hardware Block diagram of system

B. Arduino ATMega328

The Arduino Uno is a microcontroller board based on the ATmega328. It has a 16 MHz ceramic resonator, 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, an ICSP header, and a reset button. This board is very simple and can be easily used, everything you need to support the microcontroller is in this board, just plug it in a computer via USB cable and power using an AC-to-DC adapter or battery to get started.

Fig.2 Snapshot of Arduino Mega 2560

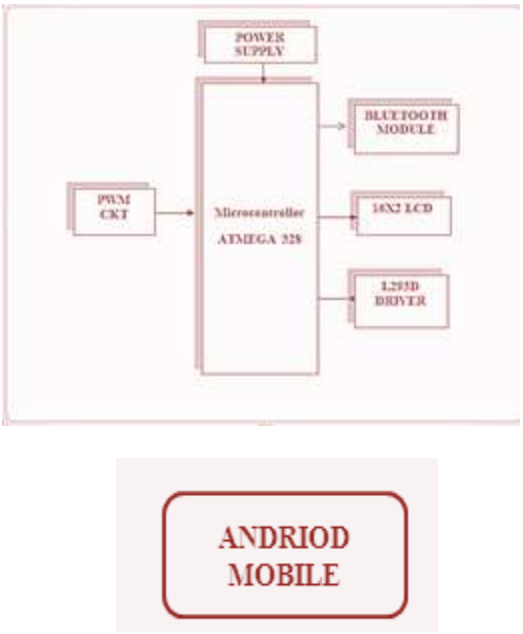

Fig.2 Block diagram of functional unit

C. DC Gear motor

A geared DC Motor has a gear assembly devoted to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and dropping the speed. Using the correct arrangement of gears in a gear motor, its speed can be reduced to any required figure. This concept of reducing the speed with the help of gears and increasing the torque is known as gear reduction. Reducing the speed put out by the motor while increasing the quantity of applied torque is a important feature of the reduction gear trains found in a gear motor. The decrease in speed is inversely relative to the increase in torque.DC Geared motors with robust metal gear box for heavy duty applications, available in wide RPM range and ideally suited for robotics and industrial applications. Very easy to use and available in standard size. Nut and threads on shaft to easily connect and internal threaded shaft for easily connecting it to wheel.

Specifications:

•100 RPM 12V DC motors with metal Gearbox.
• Same size motor available in various rpm.
•Shaft diameter : 6mm
•weight :122 gm
•Torque : 2 Kg-cm
•No-load current :- 70mA (Max)

I2C Interface: Inter-integrated Circuit (I^2C pronounced I- Squared- C) is a 2 wire serial bus generally used to communicate with sensors and other small accessories. The 2 lines of the I2C bus are SDA (knowledge) and SLC (clock) which can be run in parallel to communicate with a couple of instruments at once. I2C enables up to 112 "slave" (similar to a sensor) contraptions to be controlled by a single "master" (such as Arduino, in our case). Every slave device on the bus ought to have it is own special deal with so the master can keep up a correspondence immediately with the supposed device.This enables more than one of the same device to be on the same bus with out conflicting addresses.

I2C is ordinarily known as TWI or 2-wire-serial.
I2C Tutorial : I2C basic command sequence.

- 1. Send the start bit (S).
- 2. Send the slave address with (ADDR).
- 3. Send the read(R)-1 / Write(W)-0 bit.
- 4. Wait up for/send an acknowledgebit (A).
- 5. Send//Receive the data byte (eight bits) (information).
- 6. Expect/sendacknowledgebit (A).
- 7. Send the STOP bit (P).

D. Android Platform

Android devices are powerful mobile computers and they become more and more popular smart phones used worldwide. They becomes more and more popular for software developers because of its powerful capabilities and open architecture, also it's based on the java programming language.For the communication of the robot with the cell phone

or a mobile we are using the Bluetooth device. The Bluetooth device (HC-05) is attached to the robot that receives the data from the mobile and also can transmit the data.

III. RESULTS AND DISCUSSIONS

This is part of my "Building Robots using Arduino" tutorial series, explaining how you can create robots using Arduino. In this article we will see how we can control the speed of the DC motor using Arduino. This section explain how we can control the speed of the motor as well using the IC. Also We will talk about how we can encapsulate the entire logic into an Arduino Library.

Analog Write

Before we go ahead, we need to know about analogWrite function in Arduino. In Arduino, the analogWrite function allows you to generate a PWM wave in a pin. If we have tried out the LED fade example in Arduino, then we already know how to use it. If not, then checkout the PWM tutorial from Arduino reference. This function takes a value between 0 and 255 and doesn't work on all pins in Arduino. In Arduino Uno, it works on pins 3, 5, 6, 9, 10 and 11.

Controlling Speed of DC Motors

To control the speed of the motor, all we need to do is to replace digitalWrite function on L293D enable pins to analogWrite. The speed of the motor depends on value that was passed to the analog Write function. Remember the value can be between 0 and 255. If we pass 0, then the motor will stop and if you pass 255 then it will run at full speed. If we pass a value between 1 and 254, then the speed of the motor will vary accordingly.

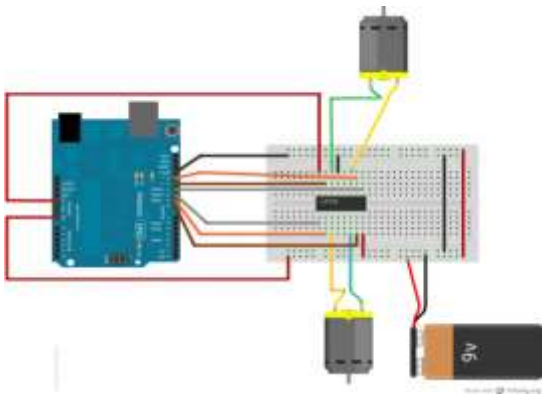

Fig.3 Mobile platform is flexible and convenient, itcan enter the elevator and run on the small slope.

Remember, we connect the enable pins of H-bridge to pins 10 and 11 of Arduino. This is because pins 10 and 11 are PWM pins.

PWM motor output calculation functions. Accordingto the polarity of the left and right electrodesÿ outputcontrol amount, superposition of a small dead zonevalue to overcome the mechanical static friction forceof platform. Function calling period is 10milliseconds.PWM output function: Calculate value of the PWMcontrol register according to the two motorsÿ output.Set the value of the four PWM control register.Function calling period is 1 milliseconds.

IV. CONCLUSION

In this paper, a self-balancing mobile platform was once introduced in terms of the platform meeting,hardware design, working principle, purposes discipline. This mission has resulted in building a working self-balancing mobile robot. The robotic is effectively balanced and pushed making use of a computer or a mobile phone. Various controlprocedures have been designed and verified.As mentioned earlier, multifunctional self-balancing mobile platform has the advantages of stable, reliable, flexible and convenient, simple manipulation, clean environmental protection, so it has a wide application prospectes.

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