An Alternate Approach for Implementation of Electric Long Board

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Abstract. In this paper a gesture control motorized skateboard is implemented. The operations like moving at constant speed, acceleration, regenerative breaking is performed by our model. The skateboard is controlled by gesture of hand in gloves via sensors. In recent decades skateboarding has expanded from recreation into a form of transportation. Skateboarders appear to use roadways much as other non-motorized modes do. The work is another leap in that direction where a simple, efficient and affordable way of transport for short-distance transportation has been developed.

Keywords: Electric Skateboard, DC Motor , Arduino.

1 Introduction

Gasoline was used by the first non-manual skateboard named “Motoboard “. It was constructed in 1975 [3]. Unfortunately, it was being banned by law because of excessive pollution and noise. It became the role model for other types that followed it. The modern electric skateboard was originated by Louie Finkle in 1996 and patented in 1999 [2]. The model was operated by lead-acid batteries and a remote controller. New models[5][6][9][11] of an electric skateboard are made by some companies[4]. Operations and Control achieved by them using the different method are achieved by us using different methods [8][10][12][13][14][15]. The electric skateboard is considered by many as a vehicle as it is motor powered and can move at great speeds [7]. The electric longboard is considered by European countries as a very common transport medium [1]. Compelling speed is provided by them which makes them so popular. The basic design is made by an electric motor(out- runner or hub), batteries, speed controller(designed by VESC) and wireless throttle on top of a regular skateboard.

2 Design of Electric Skateboard

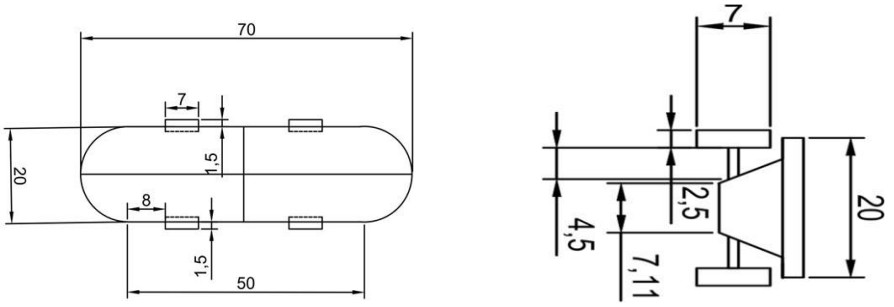

Fig. 1. Top View of Skateboard

Fig. 2. Front View of Skateboard

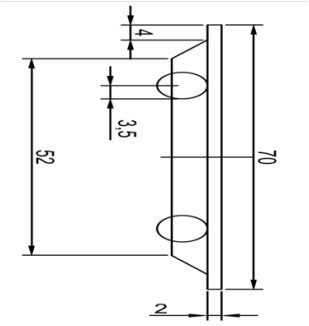

Fig. 3. Side View of Skateboard

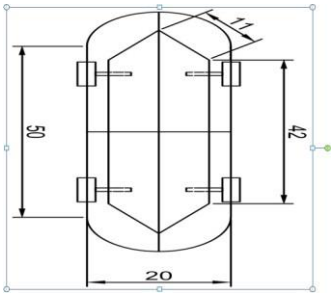

Fig. 4. Bottom View of Skateboard

3 Working Principle : Forward Boost Mode

Bi-directional Chopper is used by us in this project. Bi-directional power flow is allowed by these choppers. Bi-directional current flow is also allowed by four switches present in it. It is required by us as we are going to implement regenerative braking. Voltage and power direction is controlled by the PWM signal generated by Arduino. Two different modes are used by us in the project. By Forward Boost Mode speed control is done. Regenerative breaking is implemented by Backward Buck Mode.

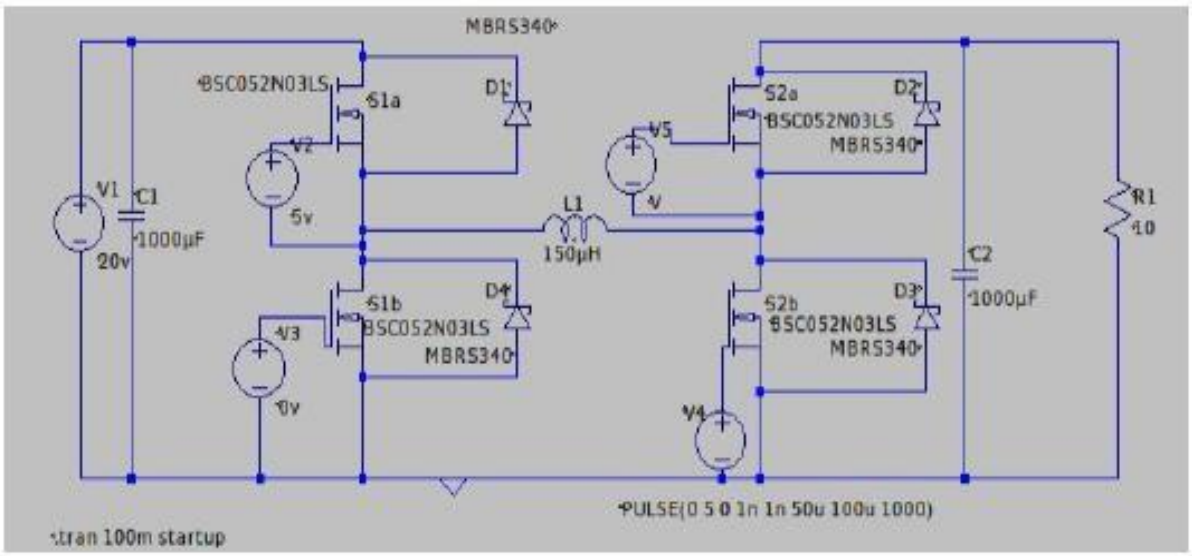

Fig. 5. Forward boost Mode Circuit

Fig. 6. Simulation for Forward boost Mode Circuit

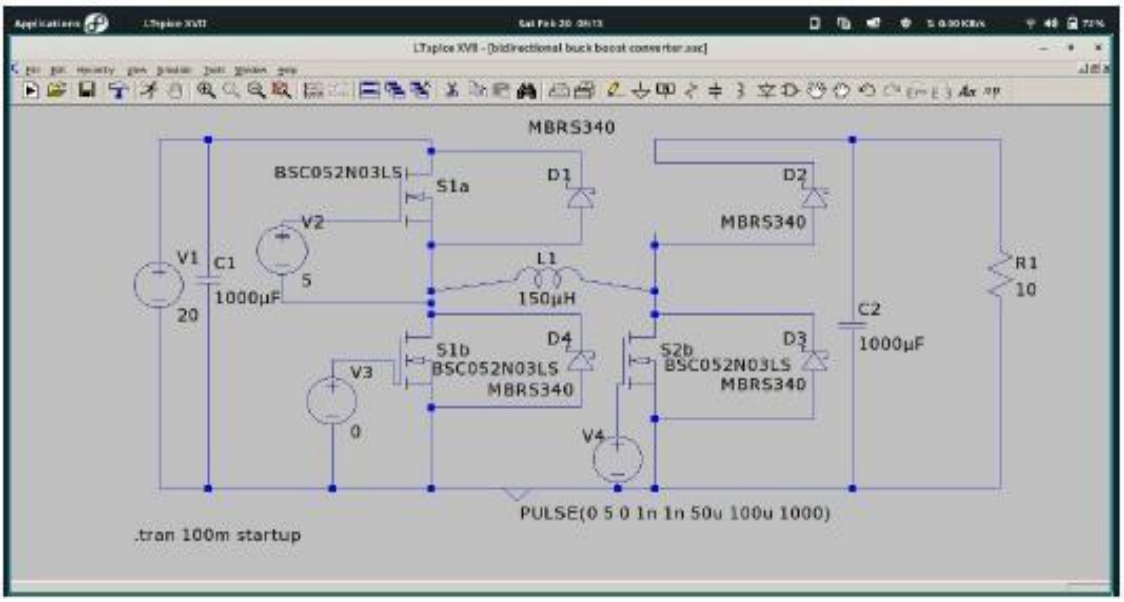

Fig. 7. Backward Buck Mode Circuit

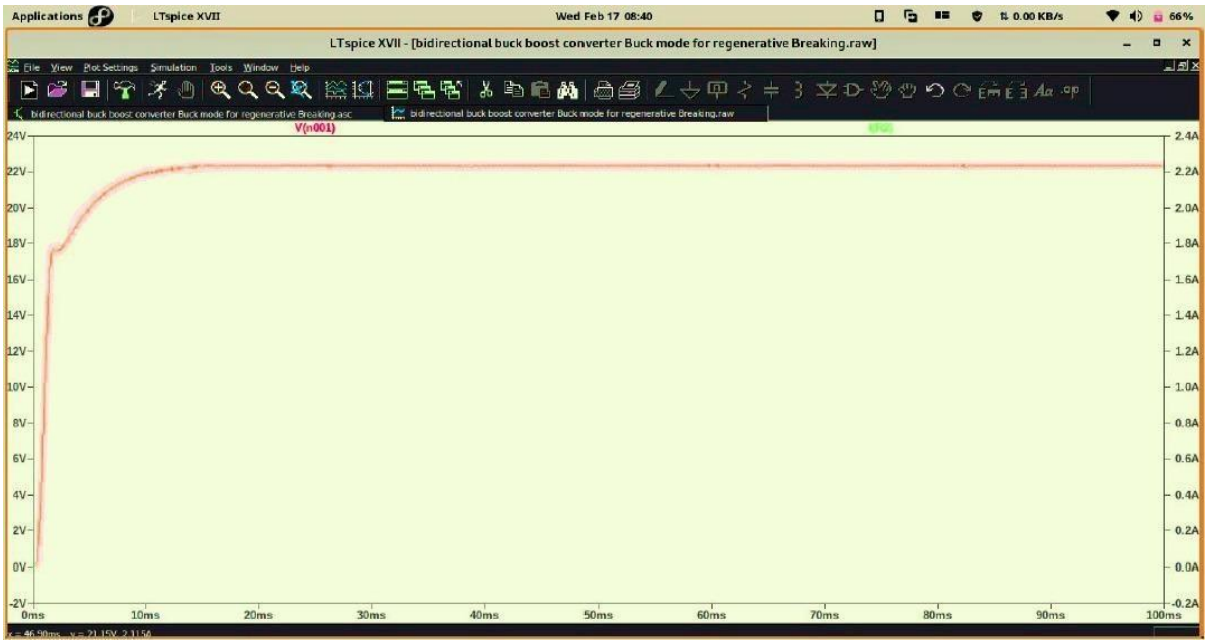

Fig. 8. Simulation of Backward Buck Mode Circuit

4 Control method

The Control System Block Diagram is given by fig. 9

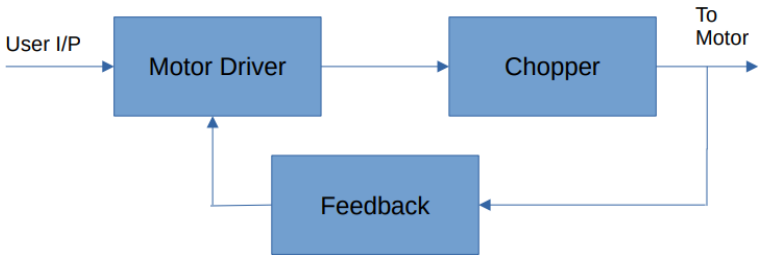

Fig. 9. Control system Block diagram

The speed of the motors is being controlled by a simple feedback loop type control. Above mentioned safety features are also implemented by the feedback network. Non-starting of the motor driver without the user is also ensured by it.
We use the terminal voltage control method as we are limited by our choice of motor. The DC series motor is controlled by the terminal voltage control.

4.1 Battery Bank And Battery Management System(BMS)

The required voltage and the capacity for the Battery Bank are provided by 18650 cells making up the battery bank. Battery Management Systems (BMS) has various protections like charging protection. The protections offered by it are over-charge protection, over-discharge protection, high current cutoff, thermal protection, balance charging. Fire hazards are prevented from LiPo batteries by connecting them in parallel as they will get the same voltage.

4.2 Arduino And Controller Code

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator. The PWM Pins are used in combination with AnalogWrite() function to output the required PWM control signal. Arduino Uno is being used by us as our main controller in the project. The following functions are performed by it are -
-Taking Data from The User using Bluetooth.
-Generating the PWM signal
-Monitoring the BMS output, etc.

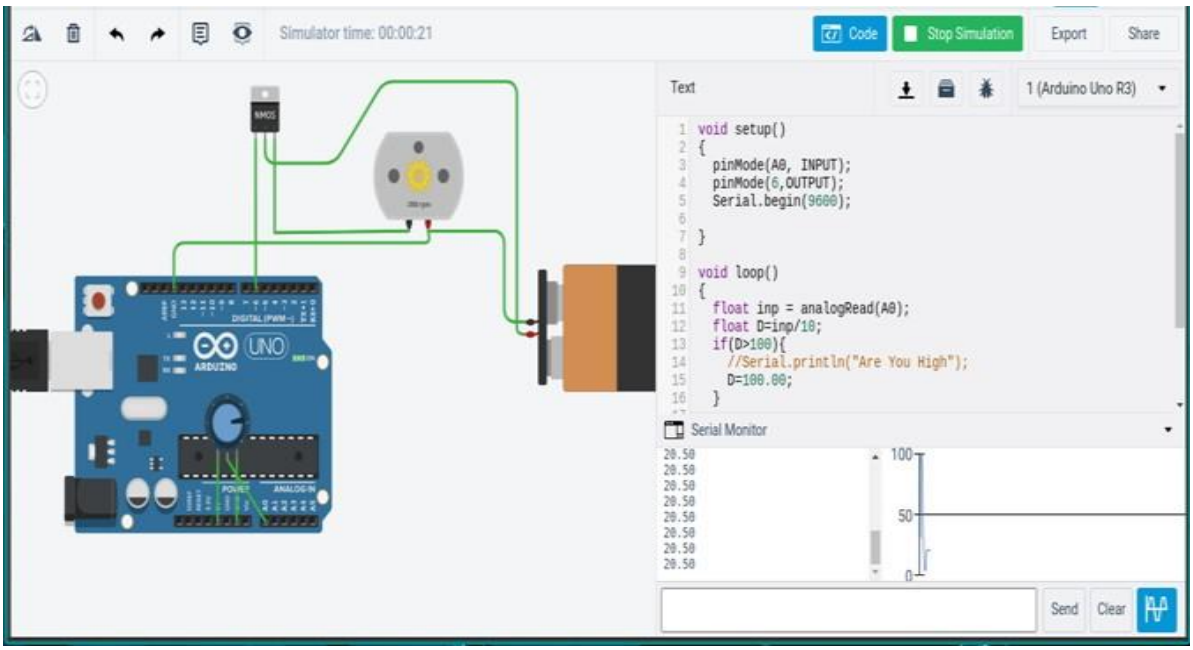

Fig. 10. A Sample PWM generation using Arduino

Safety features implemented by Arduino are as follows-Soft Start, User Detection, -User Fall Protection. The electric long board is made safer by the following features compared to electric bicycles.

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4.3 Gesture Sensing Gloves

Four main parts of Gesture Sensing Glove are -
-Battery with Charging And Protection Circuitry.
-Bluetooth module
-ATtiny84 microcontroller
-Three Flex sensors Mounted on a Glove.
Change in resistance is observed by us in Flex resistor whenever it is bent or flexed. Gestures made by the user are understood by the motion of the fingers. These change in resistances are processed by the ATtiny microcontroller which converts these readings into PWM output that are being transmitted by the Bluetooth module. ATtiny84 is a special microcontroller that is programmed by Arduino.

Fig. 11. Flex sensor

5 Conclusion

This mode of transport is very effective due to many reasons. These reasons are its weight is less than a bicycle, highly portable, a maximum speed of 30 km/hr is achieved by it, a battery range of 10 kilometers is achieved by it, perform uphill climbing can be performed by it, up to 20 times less energy for every kilometer compared to a conventional car is required by it. But one thing must be kept in mind that the design is a bit fragile and the design is meant to travel on smooth roads mainly. Travelers can be quite benefited by this initiative. High compatibility and High efficiency are provided by them compared to electric cycles as is clear from the discussion above. It can be implemented by people as a daily personal transporter for short-distance travel in cities and towns.

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