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ijirset@gmail.com

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Arduino Based Skateboard Control by using Smartphone

Shraddha Jadhav¹, Veena Kadechkar², Nishant Yadav³, Mainsh Sonwane⁴, Prof. Shashi Prabha⁵

U.G. Student, Department of Electrical Engineering, Mahatma Gandhi Mission's College of Engineering & Technology, Kamothe, Navi Mumbai, Maharashtra, India^{1,2,3,4}

Assistant Professor, Department of Electrical Engineering, Mahatma Gandhi Mission's College of Engineering & Technology, Kamothe, Navi Mumbai, Maharashtra, India⁵

ABSTRACT: The aim of our project is to design a Smartphone Control Skateboard. The working is based on Android OS, Arduino micro-controller, Motor drivers, Bluetooth module. This paper presents the design and methodology utilized in the creation of an electric skateboard. This report will take us through the instructions to make our own powered skateboard, which we can make at our home or workshop. This is a very simple Smartphone control Skateboard, with an Arduino and Bluetooth module. The main objective of the skateboard is to transport a person from one point to another using a Planetary geared DC motor, powered by a rechargeable battery, which will be controlled wirelessly. Traveling with an Electric Skateboard is an ideal mode of transport for moving around the city.

We chose this for our major project, as in upcoming years electric vehicle is going to become a major part of our everyday lifestyle and also have a wide scope in the engineering field. It plays a vital role in the development of new technology. It provides fast transportation and easy portability. The skateboard will be motor-driven, smartphone controlled and with a controllable speed.

KEYWORDS: Bluetooth, Smart phone, App controlling skateboard, motors, Vehicle, batteries, Mobile controlling skateboard

I. INTRODUCTION

We'll be focusing more on the overview of the Hardware, how to get the board running including using Batteries, Motor and SmartPhone. More importantly, how to get them all connected. Ideally, an electric skateboard is a normal skateboard with a motor attached that propels the board forward. An android application usually controls this. Just like a normal skateboard, you can lean left or right like a normal skateboard to navigate your surroundings. The use of electric skateboards as small transport vehicles has gained in popularity during the latest years, and there are numerous manufacturers on the market. This report will go through the building of an electric skateboard and implementation of a motor control. This will be done using an Arduino UNO board. Android is a safe and secure operating system. All of its essential tools are combined in Software Development Kit. We know that all manual operations have been replaced by automated mechanical operations. Our main objective of writing this paper is to develop an Android app for controlling the skateboard using Bluetooth.

The aim of this project is to explore the concept of using mobile control on a small personal transportation vehicle, in this case an electric skateboard. An electric skateboard is a small personal transport vehicle, that practices the technique of riding a regular skateboard, but with the use of a motor to power the board forward. The user is able to control the motor and therefore the speed with a smartphone controller while riding on the board. The motor is supplied with power from a battery that also fits on the board. This will enable the user to travel at a constant speed even when riding in terrain with varying gradient. So when the user finds a comfortable speed there will be an option to stay at that speed without manually adjusting the motor and speed. Since the battery is a finite source of energy, the possible distance travelled depends on the energy consumed when riding on the skateboard.

II. RELATED WORK

Various researches have been made by different researchers in developing this project. However, they serve a different application and have different technologies implemented. Some of those papers are mentioned below stating their



technology and application. Jorge Kazacos Winter [2] has developed android controlled robot automation. Main aim of his project was the transfer of information wirelessly between a smartphone and the robot and developing the robot and its communication system underneath a low price and open source philosophy. He used 3D design technique to style the structure of the robot with the facilitation of parametrical modelling software. The style, when fed to the 3D printer can print the parts of the robot in a layered manner one by one and can then use these parts to assemble the robot simply. He has used Arduino micro-controller and Wi-Fi technology in this robot. M. Selvam [4] in his paper has projected design to develop a robotic system which has a wireless camera attached to it for surveillance. Bluetooth was implemented in his project for providing connection between robot and smartphone. Wireless night vision camera was used for providing remote surveillance. The video which is recorded by camera is then transmitted to TV unit through Radio Frequency signal. He used 8051 micro controller for the robotic unit. Vito M. Guardi [1] has evolved the method of Bluetooth technology by developing an android app for a robot which is driven by a microcontroller. The central idea of his work is to show that one android app can be operated using totally different electronic devices. Vito M. Guardi has invented a communication protocol for android smartphone and robotic platform over a Bluetooth. Ranjith Kumar Goud and B. Santhosh Kumar [3] have invented a pick and drop robot. They wanted it to be used for diffusing a bomb remotely with safety. For the robotic arm, they used a pair of motors and another pair as the wheels of the robot for controlling the movement. Connectivity is established using Bluetooth. The micro-controller used is LPC2148. They had also attached a wireless camera for remote surveillance. They have worked on this project mainly for industrial and military applications. Xiao Lu, Wenjun Liu, Haixia Wang, Qia Sun [8] have published a paper based on a project in which the smartphone is capable of IFLYTEK voice as well as handwritten input. The design is therefore robust, suitable, and practical for use and it also ensures the reliability of the full system. For connectivity between the smartphone and robot, wifi is used. Use of wifi makes it easy and absolutely convenient for controlling the robot so that it can act according to the commands. Arpit Sharma, Reetesh Verma, Saurabh Gupta, Sukhdeep Kaur Bhatia [9] have configured an android smartphone which can control a robot via Bluetooth technology. The phone uses motion sensors and records the gestures sent via an android mobile phone. It also has an inbuilt accelerometer and Bluetooth module for controlling the movements of a robot.

III. METHODOLOGY

The Block Diagram of our system consists of a Bluetooth module, an Arduino kit and a couple of motors for driving the skateboard.



Fig1. Block Diagram

The block diagram of the hardware which shows the connections between Arduino, Bluetooth and motors. It also shows a motor driver which is responsible for movement of the motors in either direction. Rx pin of the Arduino is connected to the Tx pin of Bluetooth and vice versa. Supply is provided to the motors through driver. The idea is to first code the entire working using knowledge of programming. The code will then be simulated on software and later be interfaced with the hardware. The controlling remote can be any smart device with android. All the controls of the skateboard will be on the app on that device. The system hardware consists of a controller equipped with Bluetooth communication module. It'll be connected to the motors and other alternative components of skateboard. When the mobile app is turned on and is connected with the current system via Bluetooth, one will operate the skateboard by giving wireless commands from the app using the functions already programmed in the app. The vehicle will move all four told directions: left, right, front and back. For forward movement, movement of both the motors will be in the same direction and for backward motion; movement of the motors will be in opposite direction. For left and right movements, either of the motors will rotate and to stop both the motors will stop. Instructions are given to the motors through the mobile app by the user.

About Project

Traveling with an Electric Skateboard is an ideal mode of transport for moving around the city - It's portable and powerful. In our current climate, things are changing and people are considering different ways of traveling short commutes. Which you may have seen an increase in e-scooters in your city. A bigger motor may provide more torque, which would be helpful for inclines but may not be the most ideal for traveling around faster on a flat surface. Likewise, a bigger battery would give you an increased range, but that may increase your board's weight.

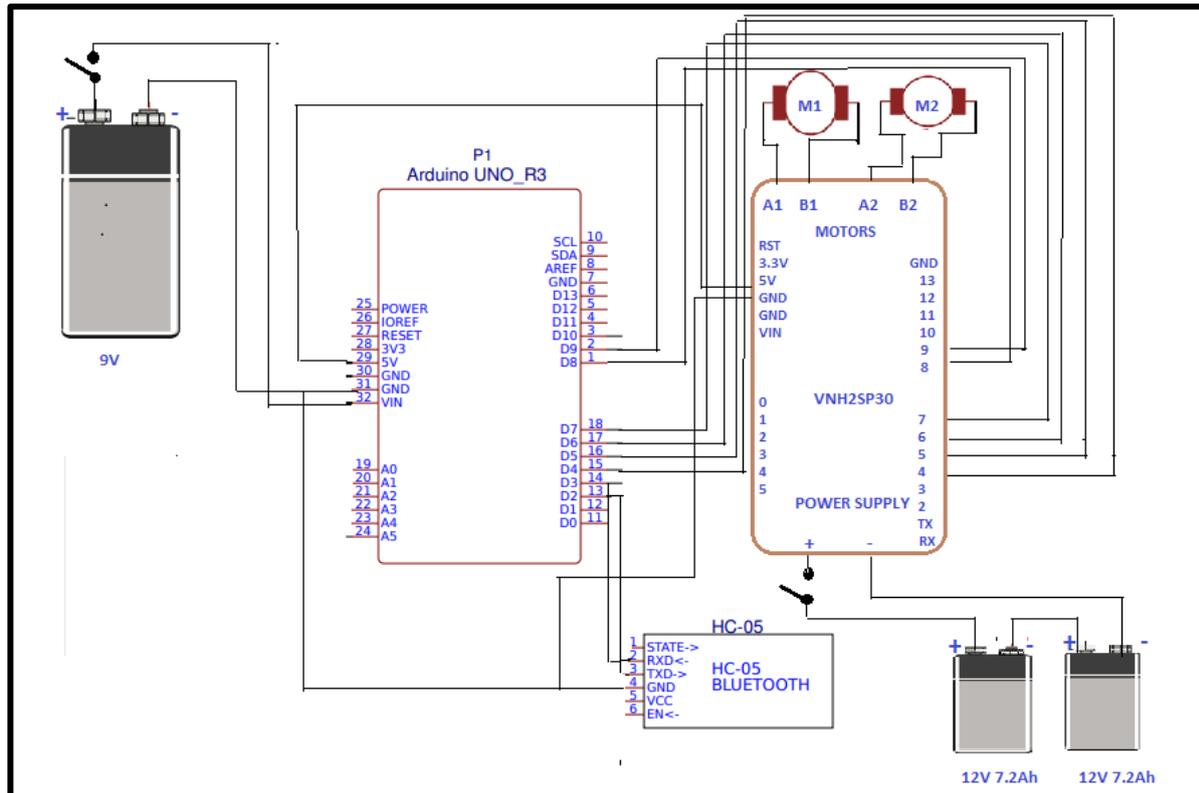


Fig 2. Circuit Diagram

The circuit diagram of the hardware which shows the connections between Arduino, Bluetooth and motors. It also shows a motor driver VN12SP30 which is responsible for movement of the motors in either direction. Supply of 12V each is provided to the motors and supply of 9V is provided to Arduino Uno.

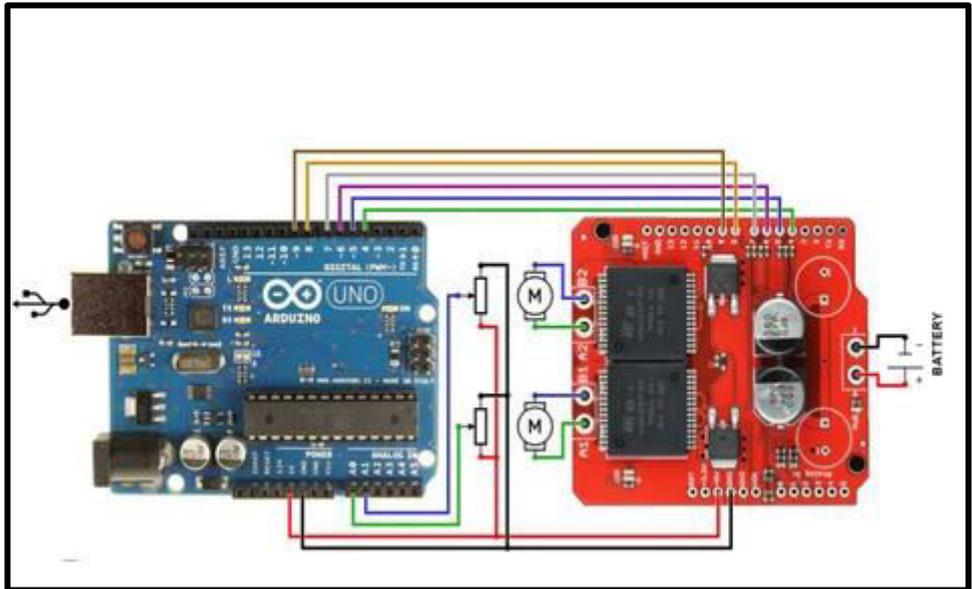


Fig 3.Arduino no & VN12SP30 motor driver connection

The componets used for our project are as follows:

- Arduino Uno
- HC-05 Bluetooth module
- VN12SP30 Motor Driver
- Planetary gear Motors
- Male to female jumper wires
- Male DC pin
- Female DC pin
- 4007 Diode
- 1k resistor
- LED
- Battery

1. Arduino Uno



The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer release

Fig 4. Arduino Uno

2. HC-05 Bluetooth Module

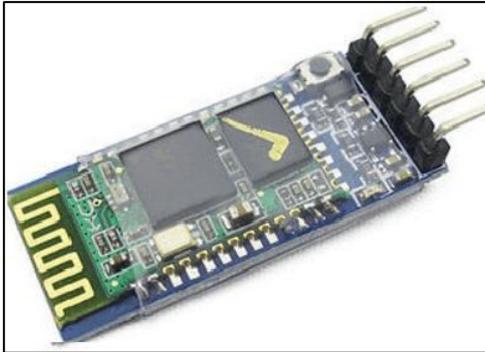


Fig 5. HC-Bluetooth Module

The HC-05 is a very cool module which can add two-way (full-duplex) wireless functionality. This module is to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. The HC-05 has two operating modes, one is the Data mode in which it can send and receive data from other Bluetooth devices and the other is the AT Command mode where the default device settings can be changed. We can operate the device in either of these two modes by using the key pin as explained in the pin description.

3. VN12SP30

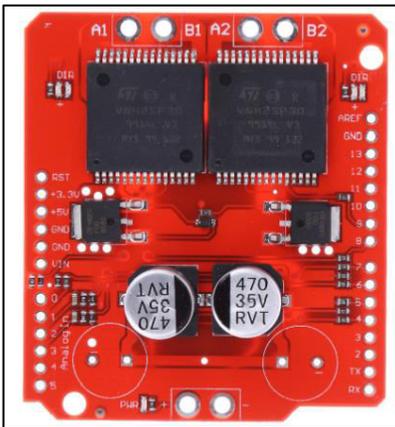


Fig 6.VN12SP30

VN12SP30 is a full bridge motor driver intended for a wide range of automotive applications. The device incorporates a dual monolithic high side driver and two low side switches. The high side driver switch is designed using the STMicroelectronics well known and proven proprietary VIPower M0 technology which permits efficient integration on the same die of a true Power MOSFET with an intelligent signal/protection circuitry. The VIN and motor out are pitched for 5mm screw terminals, making it easy to connect larger gauge wires. INA and INB control the direction of each motor, and the PWM pins turn the motors on or off. For the VN12SP30, the current sense (CS) pins will output approximately 0.13 volts per amp of output current.

4. Planetary gear Motors



Fig 7.Planetary gear Motor

The planetary geared motor is always well known for its low backlash and higher efficiency characteristic to meet your higher expectation. The HD Planetary DC Geared Motor 438 RPM 29.5N-CM 12V. This is 12V DC motor which has a gearbox of 36mm diameter. The planetary type gearbox of this motor has a reduction ratio of 13.7 which produces 438 RPM with the torque value of around 29.5 N-cm.

Features:

- Brushed permanent magnet DC motor
- Variable speed and reversible
- Planetary Gear Box

5. Battery



Fig 8. Battery

A battery is a device consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy.

IV. RESULTS



Fig 9. Skateboard

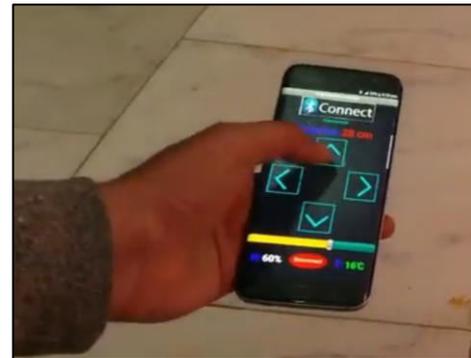


Fig 10. Smartphone as controller

After simulating the circuit connections, following result was observed. Connections were made as per the circuit diagram and hex file of the code of arduino was attached to the arduino uno.

V. CONCLUSION

We have implemented all the required components for building a electric skateboard and connected to each other, these all components are together mounted on a board accordingly. As we have used planetary geared dc motor which is driven by VNH2SP30 DC motor driver it's programing is done using Arduino Uno and the operation is done using mobile app for running a board. Our algorithm successfully runs the skateboard and controlles according to the programming done. We have applied our algorithm and found that it successfully excepting all the programming instruction and fluent control over the board.

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