IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)
e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 14, Issue 2 Ser. I (Mar – Apr 2019), PP 101-105
www.iosrjournals.org

Development of All Terrain Vehicle with Magnetic Heading Sensor

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Abstract: *In the recent days, due to pollution and issues in ozone layer the whole world slowly fads into greenhouse technology. A wide effort is done to palliate the awful environmental impinge and climatic change. One such methodology to adopt to this recurring change is the use of all terrain vehicles in grooves and timberland. This paper focuses on developing a hardware remote-controlled car using magnetic header sensor to control the vehicle. A remote control vehicle is defined as any mobile device that is controlled by a means that does not restrict its motion with an origin external to the device. This is often a radio control device, cable between control and vehicle or an infrared or blue tooth controller. A remote control vehicle (Also known as RCV) is always controlled by a human and takes no positive action autonomously. It is vital that a vehicle should be capable of proceeding accurately to a target area; maneuvering within that area to fulfil its mission and returning equally accurately and safely to base. This paper proposes blue tooth wireless technology to control our robot car. The user has to install an application on his/her mobile and turn on the blue tooth in the mobile phone. Users can perform various actions like moving forward, backward, move left and move right using commands that are sent from the android mobile; as the vehicle moves over uneven terrain, it is possible for the vehicle to lose its direction when it overcomes obstacles. This is overcome with a 3 axis magnetometer that corrects the vehicle's course by maintaining the magnetic heading. The blue tooth based technology gives a wider range of control and more efficiency. It also gives us the advantage of changing the remote anytime, meaning that we can use any android devices including phones, tablets, computers. Physical barriers like walls, doors, etc. do not affect controlling the car.*

Keywords: ***Blue tooth, terrain, remote control, magnetometer, direction***

I. Introduction

To develop a robotic platform that is capable of travelling on rough terrain to reach spaces for surveillance and reconnaissance. Since the vehicle is moving over uneven terrain, it is possible for the vehicle to lose its direction when it overcomes obstacles. This is overcome with a 3 axis magnetometer that corrects the vehicle's course by maintaining the magnetic heading. It is a very simple communication system. The remote control is an android device which has blue tooth feature built-in. Bluetooth is a serial communication medium through which we can connect two devices wirelessly. Here we have used a Bluetooth module in our robot tank which gets connected to the phone's Bluetooth, that allows us to communicate and allows us to take command over it. On the other hand, the magnetic field is not constant across the globe there are places where they warp or lose their strength based on the mineral deposits on theearth and the distribution of land and sea and even change over time. But considering a navigation method that does not rely on satellites for navigation it serves as a very reliable alternative [1-5].

There are other methods that use the earth's horizon to maintain orientation, but that is suitable for high altitude and requires expensive image sensors to navigate.The method of using a simple magnetic compass to navigate over short distances over uneven terrain is a feat in itself and it is an advancement over algorithms used by robots to follow a line on a track [6,7]. Our approach to help the bot maintain heading bust based on its magnetic heading is an attempt to find alternate methods of navigation from point A to point B without the need for an expensive sensor. The attempt made in this paper is it various iterations inthe future that could be used even to use a bot to draw the track lines in an openfield parallel to each other unaided.

II. Working Principle

The working of our remote-controlled vehicle can be understood easily by observing the block diagram as shown in figure 1 is shown below:

- Here, the whole system is divided into four principal blocks viz Bluetooth block, microcontroller block, and motor driver block.
- The Bluetooth block comprises the Bluetooth module present in the mobilephone used along with the Bluetooth module used in our robot tank. The mobile phone consists of an application that provides us with an interfaceto send ASCII characters.

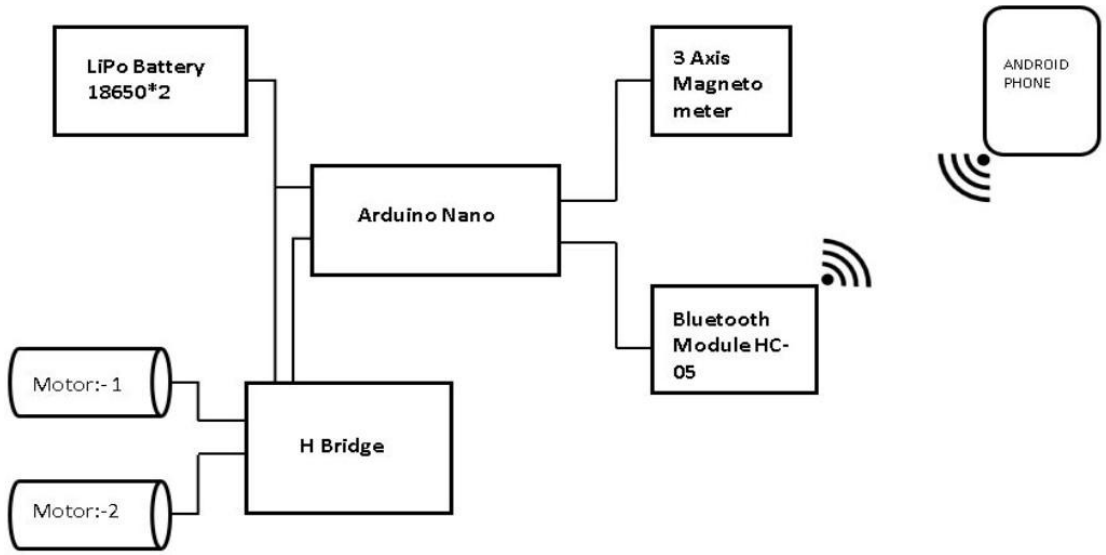

Fig 1: Block diagram of remote controlled vehicle for all terrain environment

- Bluetooth is then received by the Bluetooth module on the robot tank.
- The microcontroller then receives the data from the Bluetooth module and then manipulates the data received into a series of digital outputs which run the motor driver section. The data rate of communication is set to 9600 bauds per second. Two geared motors that run at 60 RPM are used to drive a tracked wheel to be able to give it traction over uneven terrain.
- The algorithm to maintain magnetic heading is planned to take over the bot only when the bot is traveling in a straight line. This could either be when it has been given a command to either move forward or backward.
- When the instruction is received to move forward it receives the input over serial and if there is no change in the input, then the bot is triggered to read the vehicle's magnetic heading and save it and compare it with the moving direction of the vehicle and correct its orientation based on the difference.
- In the event the direction of the vehicle is changed by the user or the input is stopped. The loop that maintains the magnetic heading is stopped and moves over to manual mode.
- Thus, a simple digital magnetic compass communicating over I2C can be used to maintain orientation of a vehicle [8-14].

III. Working Principle

This article proposes an implementation in breadboard and the breadboard itself is used as the chassis for the robot tank as shown in Fig.2 . The Bluetooth module HC05 is connected to the Arduino board through simple single strand wires. The transmission pin of the Bluetooth module is connected to the receiver pin of Arduino and the receiver pin of the Bluetooth module is connected to the transmission pin of the Arduino.

The Digital output pins 10,11,12 and 13 of Arduino board are connected to the pins IN4,IN3,IN2 and IN1 of the **L298N** motor driver ICrespectively.

Three rechargeable batteries as supply is used which are connected to the motor driver and Arduino respectively. When the circuit is energized, we will have to first pair the android phone with the Bluetooth module through the phones Bluetooth setting. The default password of the Bluetooth module will be 1234. Once the phone gets paired, open the application "Bluetooth Remote Controller" which we can download from Google play store. After connecting the mobile to HC05, four options will appear on the application-Controller mode, Switch mode, Dimmer mode and Terminal mode. We have to select the Controller mode from it. The controller mode will provide us with a joystick interface. We will send ASCIIvalues from the application to the Bluetooth module. As the user presses any control buttons, the controller will run programs move forward, backward, right, left, depending on the data sent by the mobile and the tank moves likewise. The task of controlling the tank is done by the Arduino UNO which houses the micro- controller ATMEGA32. Arduino has played a major role in the robotic section and has made it easier to convert digital and analog signals to physical movements. The Arduino also stores the program in its memory so it does not require re-uploadingof Program. The IN1, IN2, IN3 and IN4 are the inputs for the motor driver that receives command from the Arduino for the two motors respectively [15-18].

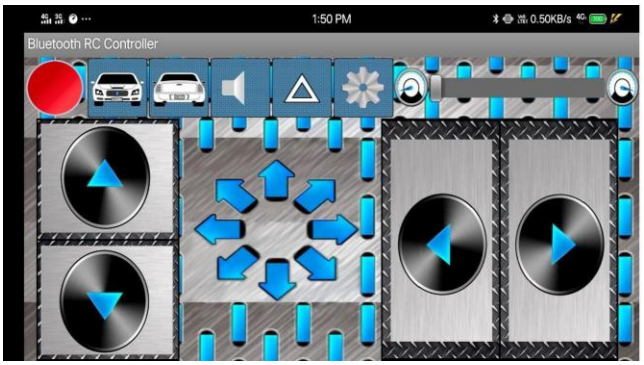

Fig 2: Chaises with Robot tank

The motor driver should be grounded with the Arduino ground pin(GND). The motor driver requires minimum of 6v and above to run, any voltage below 6v the motor remains off. The RXD pin of the Bluetooth module is for receiving commands from the Android devices and sends to Arduino through this pin and the TXD is for transmitting or sending data or information It is supplied with a 5vdc source from the arduino 5v pin. The main part of the above circuit diagram is arduino UNO. The power supply is selected carefully to provide constant voltage to the devices for the successful working. Fig 3: Shows the internal circuitry of the robot car.

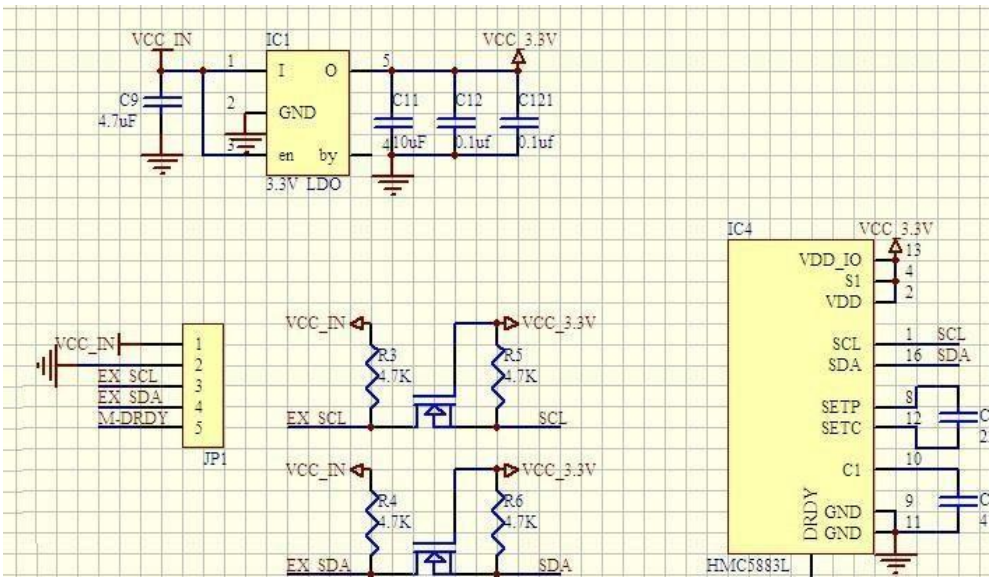

Fig 3: Internal circuitry of robot car

IV. Hardware Details

4.1 Battery

The Standard 18650 battery size is 18 * 65mm. The 18650 battery length is 65mm. The diameter of the 18650 battery is 18mm. A lithium ion cell is preferred to for adaptability. It has overcharge protection and short circuit protection circuit to prevent damage to the cell as well as device in which it is used.

4.2Motors

A Direct Current (DC) motor is a rotating electrical device that converts direct current, of electrical energy, into mechanical energy. An Inductor (coil) inside the DC motor produces a magnetic field that creates rotary motion as DC voltage is applied to its terminal. Inside the motor is an iron shaft, wrapped in a coil of wire. This shaft contains two fixed, North and South, magnets on both sides which causes both a repulsive and attractive force, in turn, producing torque. A gear head is used in combination with the motor to reduce the speed while increasing the torque output. The most important parameters in regards to gear motors are speed (rpm), torque (lb-in) and efficiency (%).

4.3 Gladiator

It is an agile tracked robot chassis, low noise, and easy to control, which could be a good partner for any tank-like robot. This tracked chassis employs high-strength aluminium alloy base with delicate appearance, higher stability and longer durability. The track is made of engineering plastic that basically assures the good elasticity, excellent damping effect and large road grip of the product. What' s more, it comes with two quality motors to provide high power and speed, which enables your DIY robot tank to widely suit all kinds of road surfaces. To explore more possibilities, you can use this tracked chassis with Arduino microcontrollers or add other electronic components on the base such as, IR sensor, ultrasonic sensor, camera, LED, display, WIFI module, etc.

4.4 Arduino & IDE

Arduino and Genuino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. An Arduino Bluetooth controller application provides a Nintendo joystick style interface which is highly convenient for controlling robot cars and similar projects that utilize Bluetooth as their communication Technology. The buttons can be assigned ASCII Characters that can be sent with the button pressed. The values are assigned to the different buttons on the joystick interface. When a button is pressed the respective ASCII character assigned to the button is sent by the mobile phone via Bluetooth. Fig 4,5 shows the top view and the side view of the all terrain vehicle.

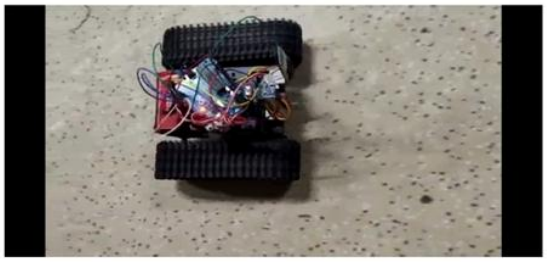

Fig 4: Top view of the all terrain vehicle

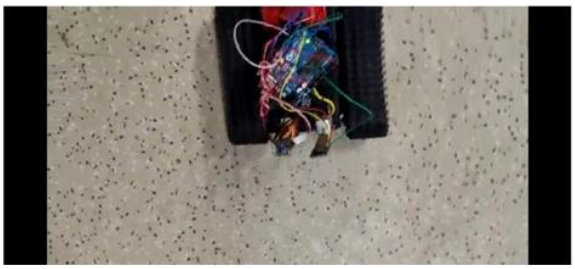

Fig 5: Side view of the all terrain vehicle

V. Conclusion

The final output implementation of the hardware model is that it can move on all terrain surfaces and uneven areas. It does not need human monitoring nearby to control it. Instead, it can be controlled from far distances without any human support.

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