

CONTROLLING OF PERSONAL TRANSPORT VEHICLE

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Abstract—This paper presents the idea of the "Controlling Of personal Transport Vehicle". As the price of petroleum products shoots up, there is an imminent need for cheaper and more efficient form of transport. Even major industries and factories that span over large areas restrict the use of transport by their employees within their premises to avoid the risk of contamination due to emissions. Manufacturers have a great need for competence in the field of hybrid vehicle technology or even fully electrical vehicle technology as a step towards fulfilling these goals. These new vehicles are complex machines and require engineering competence in many fields; mechanics, vehicle dynamics, automatic control, power electronics, battery technology, software engineering, network and communication engineering to name a few.

The above problem and that of space constraints is overcome with the concept of personal transport vehicle.

Key Words: (Arduino uno board, dc motors, motor drivers, batteries, accelerator, limit switches)

1 INTRODUCTION

In our daily life when we have to travel a small distance i.e. about 20 Km we use two wheeler vehicle which is not economical as well as creates pollution in the environment which is dangerous to human life. It has also harmful effects on animals. So, someone needs to take care of humans as well as animals. So to overcome above problems we are going to design a self-balancing vehicle for Personal Transport as well as it can be used in shopping malls, in non-polluting zone, in the industry for material transport. If we are able to replace 10% of 900 million 3 mile car trips with an eco-friendly personal transport. There would be 6.2 million fewer gallons of gas consumed 286 million fewer pounds of CO₂ emitted every day. It does draw electric power during recharge, but that electricity causes 14 times less greenhouse gas emission

than driving a car. After one year on your segway personal transport you would have literally saved a ton of CO₂ released into the atmosphere. The Personal Transport (PT) Vehicle is a vehicle which has two coaxial wheels driven independently by a motor. If the rider accelerates the accelerator, the speed of motor increases and if rider reaccelerated the accelerator, then speed of motor decreases to obtain balancing. Turning is done with the help of limit switches which are connected to the handle bar of PTV. It is robust enough to accept riders of different weights and responsive enough to provide adequate balancing for different riders and riding styles.

1.1 Proposed Work

To overcome the disadvantage of present methods of personal transporting, we are going to develop a controlling system of a personal transport vehicle which will reduce the use of fossil fuel vehicles.

For controlling purpose we are using arduino uno board. The arduino receives inputs from the accelerator and two limit switches. Out of the two limit switches, one limit switch is connected at right side and one is connected at the left side. The accelerator is used for changing the speed and limit switches are used for turning purpose. According to the signals which are given to the arduino board from the accelerator or limit switches, the arduino uno controls the vehicle. The controlled output signals from the arduino uno are given to the motor drivers of the vehicle. The motor drivers receive the signals from the arduino board and according to that signals the motor driver controls the speed of the motor.

2 SYSTEM DEVELOPMENT

System development will consist of following parts:

1. Arduino Uno Board(ATMega 328)
2. Two DC motors
3. Two motor drivers
4. Accelerator
5. Two limit switches

6. Two 12 volt batteries
7. One 5 volt power supply

2.1 Arduino Uno Board (ATMega 328)

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5Vpin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

1. Atmel Atmega 328P is the heart of UNO version Arduino.
2. This 28 pin microcontroller features 20 MIPS throughput capability at 20 MHZ.
3. Input/Output:
 - Three Port: PORT B, PORT C, PORT D of total 23 I/o pins.
 - ADC pins: A0 to A5
 - USART: PD0(RXD) PDI(TXD)
 - PWM: OC0A, OC1A, OC1B, OC2A, OC2B
4. Chip operates in between 1.8V to 5.5V
5. Port features:
 - 6 channel 10 bit Analog to Digital
 - Master/slave SPI serial interface
 - Six PWM Channels
 - Byte-oriented 2 Wire serial interface
 - Programmable watchdog timer
 - Programmable serial USART/UART

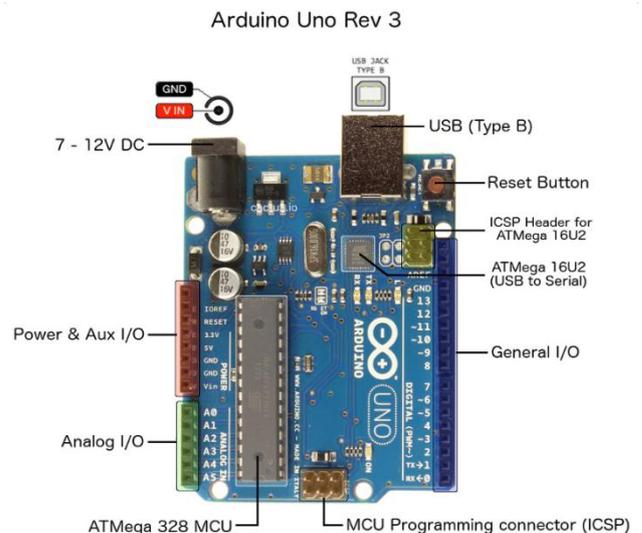


Fig-1: Arduino Uno Controller

2.2 DC motors

A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor.

Requirements:

- Bidirectional
- Rotate at low speeds
- Low backlash
- Mounting points present
- Both motors need similar operating specification.

2.3 Motor Driver

Motor is an electrical machine which converts electrical energy into mechanical energy. The principle of working of DC motor is that “whenever a current carrying conductor is placed in a magnetic field”, it experiences a mechanical force.

DC drivers are DC motor speed control systems. Since the speed of DC motor is directly proportional to the armature voltage and inversely proportional to the motor flux(which is the function of field current),either armature voltage or field current can be used to control speed. Separate Motor drivers are used for separate DC motor

Motor drivers were required to turn the control signal from the microcontroller into an appropriate varying power level to drive the motors. Pulse Width Modulation

(PWM) is one method of communicating between a microcontroller and a motor driver. By sending a train of pulses at regular intervals and varying the width of the pulses, the motor controller is able to interpret this pulse width as a requested motor duty level.

Requirements:

- Either be one driver per motor or one driver that controls both the motors.
- Be able to drive motors bi-directionally.
- PWM preferred over current or voltage limiting drive modes.
- Accept inputs from microcontroller.

2.4 Accelerator

Accelerator is used to accelerate (increases the speed). In PTV accelerator is placed on the handle bar. When the user starts the vehicle and accelerates the accelerator PTV start running in forward direction. The accelerator is connected to the controller and controller takes the power supply from the battery and controls both the motors at the same speed.

Requirements:

- Quick and accurate response.
- Controlling the speed is easy.
- Minimum motion required.

2.5 Limit Switch

A limit switch regulates the operation of machines that are equipped with moving parts connected to a switching action mechanism. A wide range of industrial machinery uses the limit switches to control the movement of devices performing on a production line, but these switches are also found in non-industrial applications, such as electrical motor operation and garage door opener, units. In the case of garage door opener, a limit switch is responsible for turning off the motor that lift the door. Common types of limit switches used in industrial application are:

1. Heavy-duty precision oil-tight and foundry
2. Heavy-duty precision oil-tight
3. Miniature enclosed reed
4. Rotary switches
5. Linear switches
6. Gravity return
7. Snap switches

There are two limit switches are placed at bottom side of handle bar, one at right side and another is placed at left side of bar and they are normally open so current is flowing in circuit. When the user move the handle bar towards right or left resistance difference are occurred. For example user wants to take a turn to left side they moves handle bar to left side so that limit switch is goes off condition and current supply is

stopped to the left wheel. But current flowing right side circuit so that vehicle take the turn

Requirements:

- High sensitivity.
- Support to the controller for turning.
- Quick and accurate response.
- Less cost.

2.6 Battery

Three categories of energy storage technologies have been used in commercial electric vehicles: batteries, combustion-powered generators (as in hybrid vehicles), and fuel cells. Generator-powered hybrids and fuel cells are not commercially viable for personal electric vehicles at this time. Therefore, batteries of various types are the principal means of energy storage available to the personal electric vehicle designer.

The runtime of PTV is dependent on the capacity of the on-board power supply. Batteries were quickly determined to be the simplest way to provide on-board power.

Requirements:

- As compact as possible
- As light as practical
- Fast charge rate (minimum recharging time)
- Low cost
- Provide sufficient power to PTV for 1 hour

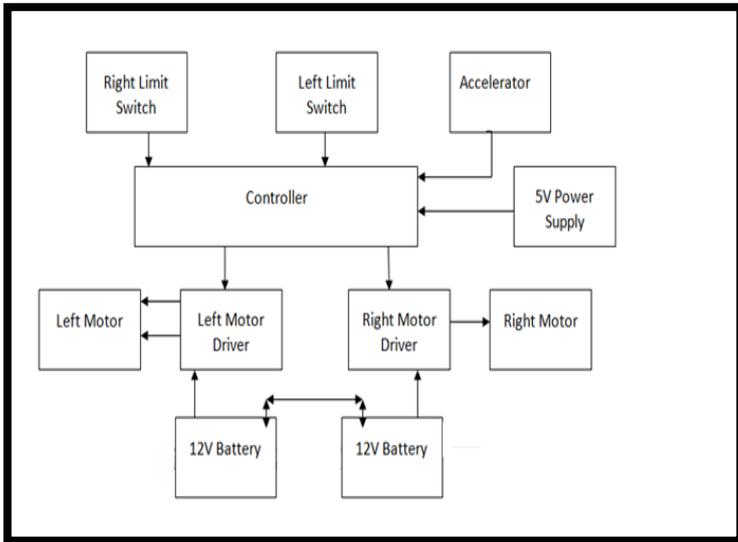
2.7 5 Volt Power Supply

One 5 volt power supply is used for the arduino uno board. As the arduino uno board is working on the 5 volt power supply, separate 5 volt battery is used for it.

3 SYSTEM BLOCK DIAGRAM

The Personal Transport Vehicle (PTV) is a vehicle which has two coaxial wheels driven independently by the motors that balances the vehicle. We are using accelerator, two limit switches, two dc motors, two motor drivers, arduino uno board, two 12 V batteries and one 5 V battery. When the rider gives command to the PTV then that command is given to the Arduino Uno board and according to that command the controller takes action. Then processor gives signal to motor driver which controls the speed of the motor i.e. it take action according to the situation.

If the rider accelerate the accelerator, the speed of the motor increases. If the rider reaccelerated the accelerator, then the speed of the motor decreases to obtain balancing. Turning is done with the help of limit switches which are



Connected to the handle bar of the PTV. One limit switch

Fig-1: Block Diagram

is connected at the left side and one limit switch is connected at the right side. When the rider wants to turn at the left side, then the rider moves the handle bar of the PTV to the left side. Then the signal from the left limit switch goes low and then the left motor goes off and the turning gets happen. When the rider wants to turn at the right side, then the rider moves the handle bar of the PTV to the right side. Then the signal from the right limit switch goes low and then the right motor goes off and the turning gets happen.

4 CONCLUSIONS

By implementing this project we can able to control the personal transport vehicle. By using personal transport vehicle we can reduce the use of fossile fuel based vehicles. The personal transport vehicle provides the pollution free environment.

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