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Study Design of Electronic Trolley by Using Arduino

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Abstract: *Trolley is the mechanical device used for carrying load or to transport the material at various points. For different kind of applications, we have to select specific type of trolley. To overcome the problem of specific task trolley, one new trolley is designed which can be used for more than one field application. This paper contains based on geasture of trolley on the basis of creativity skills. The trolley designed is the integration of airport trolley and shopping mall trolley. The major areas of focus while designing are aesthetic ergonomics, function.*

Keywords: 4 Dc Motor, L289n Motor Driver, Ultrasonic Sensor**,** 2 IR Sensor, Servo Motor, 9v Battery

I. INTRODUCTION

The objective of this research is to design and fabricate a trolley using creativity techniques, which can be used at multiple fields. An innovative concept of two in one facility has been conceived and being implemented. New product development is an extremely challenging and complex process. Innovation is naturally uncertain, and firms may invest considerable time and money in new product ideas with no guarantee that they will ever become commercially feasible

Product development involves either improving an existing product or its presentation with some modifications, or developing a new product as per the requirements of a particular market segments. To keep up with changes and trends in the marketplace it is necessary for the companies to develop the product consistently to ensure their success and future profitability.

II. WORKING PRINCIPLE

1. The AVR microcontroller will perform the operation on the received command from android device through Bluetooth module HC-05. The DC motor driver IC-L293D is connected to port C of AVR microcontroller,
2. Which drives the DC motor as per command and controls the wheels of robot. The Port D of microcontroller are used for future use for wired communication by using MAX 232 IC for serial communication
3. Port B remaining pins are used for the ULN2803 IC for connected the in future the devices like Buzzer, LED etc.
4. ADC In Microcontroller Atmega32 the Port A has 8-bit ADC are inbuilt. The ADC are used for to convert the signals from analog to digital form. These digital signals are used for further processing by the digital processor. ADC is operated on 5v power supply
5. ULTRASONIC SENSOR We used HC-SR04 three ultrasonic sensors, which transmit & receive signals by emitting sound waves. Ultrasonic sensor has four pins Vcc, Echo, Trigger, Gnd three ultrasonic sensor are used to connect the right, left and front side of the robot for calculating the distance between person and robot.5v supply are required for each ultrasonic sensor and common ground will be connected. The first and second Ultrasonic Sensor are connected to Port B B0,B1,B2,B3 pins and third Ultrasonic Sensor is connected to the Port A A0,A1 pins.
6. DEVICE DRIVERS The AVR Microcontroller Port C, C0 to C3 pins are connected to the Driver IC L293D as a input and the four pins of Driver IC's two DC Motors are connected as a output of driver Ic.
7. It required 5V power supply. The 4.7k pull- up resistors connected between the microcontroller and Driver

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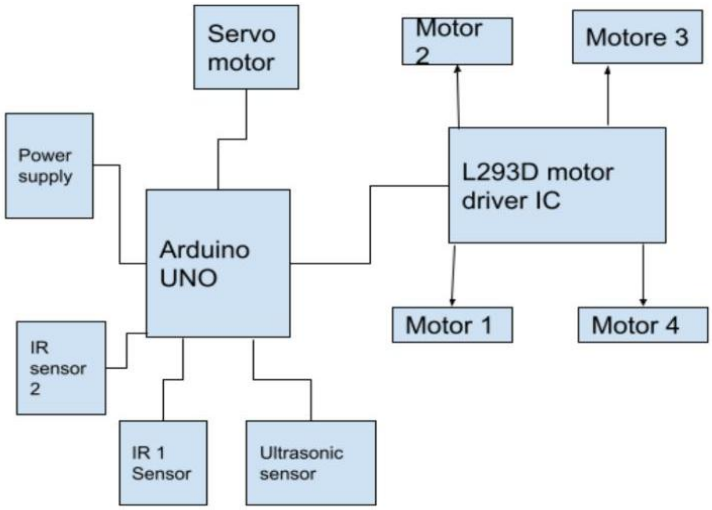
8. DC MOTOR We have used two 60 rpm DC motors for forward and reverse
9. Direction according to the microcontroller instruction. For the DC Motors we have used directly supply from charging and discharging lead acidic battery 12V , 1.3A/hrs

III. BLOCK DIAGRAM



IV. COMPONENT DETAILS

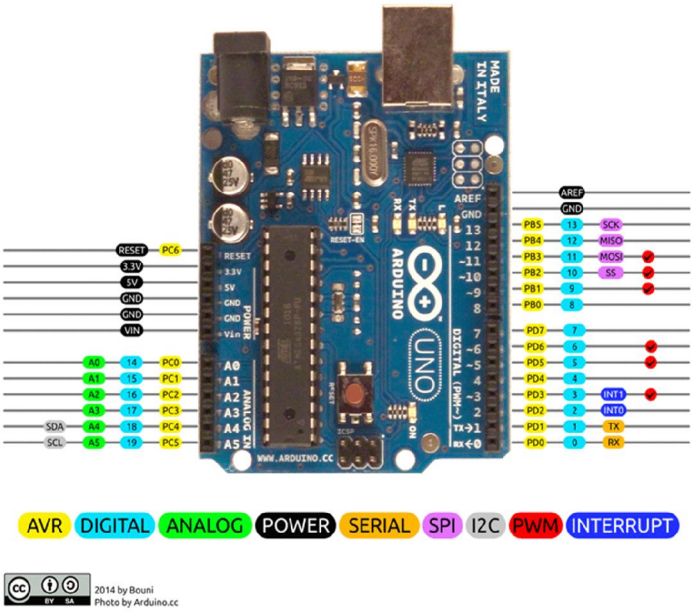


Figure: Arduino Uno Pinout

4.1 Arduino Uno

Arduino Uno is a popular microcontroller development board based on 8-bit ATmega328P microcontroller. Along with ATmega328P MCU IC, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller.

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4.2 Arduino Uno Pinout Configuration

- Vin: Input voltage to Arduino when using an external power source.
- 5V: Regulated power supply used to power microcontroller and other components on the board 3
- 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA.
- GND: ground pins.
- Reset pin : used to Resets the microcontrer
- Analog pin : A0 - A5 ; Used to provide analog input in the range of 0-5V

Input/Output Pins :

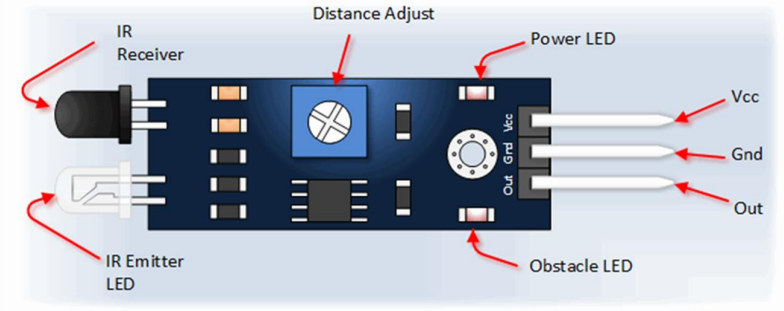
- Digital Pins 0 – 13 : Can be used as input or output pins.
- Serial : 0(Rx), 1(Tx) : Used to receive and transmit TTL serial data.
- External Interrupts : 2, 3 : To trigger an interrupt.
- PWM : 3, 5, 6, 9, 11 : Provides 8-bit PWM output.
- SPI : 10 (SS), 11 (MOSI), 12 (MISO) : Used for SPI communication.
- Inbuilt LED : 13 : To turn on the inbuilt LED.
- TWI : A4 (SDA), A5 (SCA) : Used for TWI communication.
- AREF : AREF : To provide reference voltage for input voltage

Arduino Uno Technical Specifications

Microcontroller:ATmega328P – 8 bit AVR family microcontroller
Operating Voltage : 5VRecommended
Input Voltage : 7-12V Input
Voltage Limits : Input Voltage Limits Analog
Input Pins : 6 (A0 – A5)
Digital I/O Pins : 14 (Out of which 6 provide PWM output) DC
Current on I/O Pins : 40 mA
DC Current on 3.3V Pin : 50 mA
Flash Memory : 32 KB (0.5 KB is used for Bootloader)
SRAM : 2 KBEEPROM : 1 KB
Frequency (Clock Speed) : 16 MHz

4.3 IR sensor

Infrared technology is found not just in industry, but also in every-day life. **Televisions**, for example, use an infrared detector to interpret the signals sent from a remote control. Passive Infrared sensors are used for motion detection systems, and LDR sensors are used for outdoor lighting systems.



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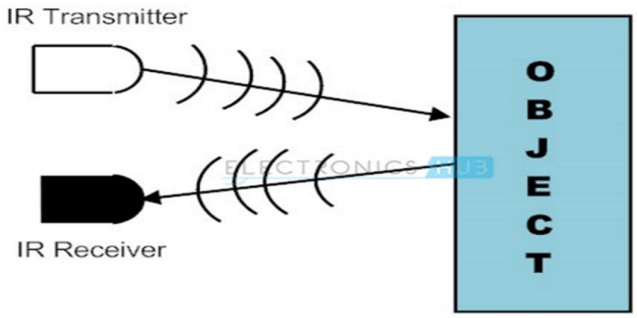

4.4 IR Sensor Transmitter and Receiver

The main specifications and features of the IR sensor module include the following. The operating voltage is 5VDC. I/O pins – 3.3V & 5V. Mounting hole. The range is up to 20 centimeter

V. L293D MOTOR DRIVER IC

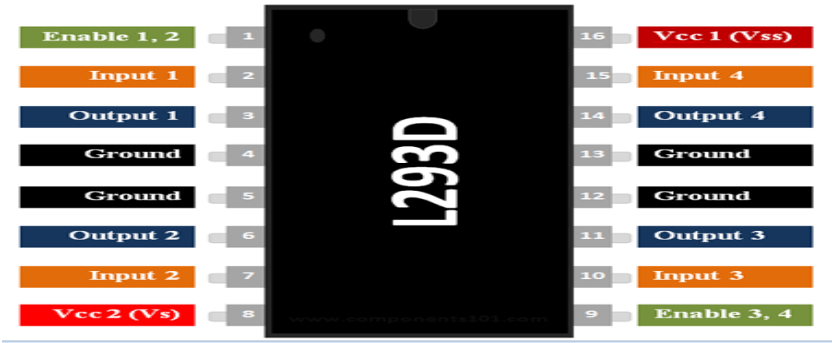

Figure: L293D Motor Driver IC

5.1 L293D Pin Configuration

Enable 1,2 : This pin enables the input pin Input 1(2) and Input 2(7)
Input 1 : Directly controls the Output 1 pin. Controlled by digital circuits
Output 1 : Connected to one end of Motor 1
Ground : Ground pins are connected to ground of circuit (0V)
Ground : Ground pins are connected to ground of circuit (0V)
output 2 : Connected to another end of Motor 1
Input 2 : Directly controls the Output 2 pin. Controlled by digital circuits
Vcc2 (Vs) :Connected to Voltage pin for running motors (4.5V to 36V)
Enable 3,4 :This pin enables the input pin Input 3(10) and Input 4(15)
input 3 : Directly controls the Output 3 pin. Controlled by digital circuits
output 3 : Connected to one end of Motor 2
Ground : Ground pins are connected to ground of circuit (0V)
Ground : Ground pins are connected to ground of circuit (0V)
output 4 : Connected to another end of Motor 2
input 4 : Directly controls the Output 4 pin. Controlled by digital circuits 16 : Vcc2 (Vss) : Connected to +5V to enable IC function

5.2 Features

- Can be used to run Two DC motors with the same IC.

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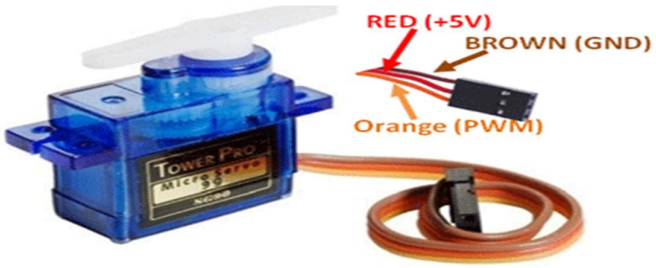
- Speed and Direction control is possible
- Motor voltage Vcc2 (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to Vcc1(vss): 4.5V to 7V
- Transition time: 300ns (at 5Vand 24V)
- Automatic Thermal shutdown is available
- Available in 16-pin DIP, TSSOP, SOIC packages

VI. SERVO MOTOR



Servo Motor Wire Configuration

A. Servo Motor Pinout (Wires)

1: Broun: Ground wire connected to the ground of system

2: Red: Powers the motor typically +5V is used

3: Orange: PWM signal is given in through this wire to drive the motor

TowerPro SG-90 Features

- Operating Voltage is +5V typically
- Torque: 2.5kg/cm
- Operating speed is 0.1s/60°
- Gear Type: Plastic
- Rotation : 0°-180°
- Weight of motor : 9gm
- Package includes gear horns and screws

VII. ULTRASONIC SENSOR

Figure: Ultrasonic Sensor

HC-SR04 Ultrasonic Sensor Pin

Ultrasonic Sensor Pinout Configuration

1: Vcc : TheVcc pin powers the sensor, typically with +5V

2: Trigger: Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.

3 : Echo :Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.

4 : Ground : This pin is connected to the Ground of the system.

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HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

VII. RESULT

Different experiments were conducted and the performance of the trolley was tested. Test was performed on the ultrasonic and infrared sensor. It was noted that the sensor was working accurately within a range of 4 meters. Then we performed the test to check whether the robot maintains a specific distance with the target object. Then we checked the serial communication between Arduino, motor shield and various motors. On the basis of results obtained from these tests and experiments, we made the necessary changes in the processing and control algorithm. After the completion, we observed that the results produced were very satisfying the robot was perfectly following the person wherever it goes. Hence the objective of implementing a good Human-Robot interaction was achieved

VIII. CONCLUSION

A successful implementation of a prototype of geasture trolley is illustrated in this paper. This trolley does not only have the detection capability but also the following ability as well. While making this prototype it was also kept in mind that the functioning of the trolley should be as efficient as possible. Tests were performed on the different conditions to pin point the mistakes in the algorithm and to correct them. The different sensors that were integrated with the trolley provided an additional advantage. The trolley is an automobile system that has ability to recognize obstacle, move and change the robot's position toward the subject in the best way to remain on its track. This project uses arduino, motors different types of sensors to achieve its goal. This project challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming.

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