

Forklift Robot Using Microcontroller

Shripad Desai¹, Prem Rajendra Vaidya²

¹Assistant professor, Department of Electrical Engineering, Bharati Vidhyapeeth Deemed to be University, College of engineering, Pune, India

²Student, Department of electrical engineering, Bharati Vidhyapeeth Deemed to be University, College of engineering, Pune, India

Abstract - In this paper I have concluded forklift robot using microcontroller.

1. INTRODUCTION

a. BACKGROUND INFORMATION

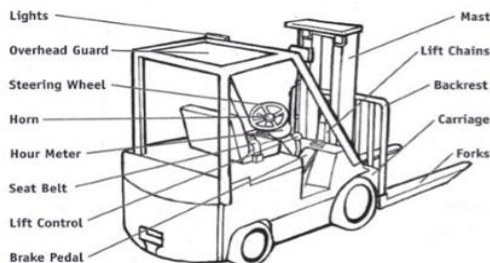
A forklift is one type of power industrial truck that comes in different shapes, sizes and forms. A forklift can be called a pallet truck, rider truck fork truck, or lift truck. Yet, the ultimate purpose of a forklift is the same to safely allow one person to lift and move large heavy loads with little effort.

1.1 BLOCK DIGRAM AND SPECIFICATIONS

The system architecture is shown schematically in Fig. 1.1. The robot communicates its data through an arduino board which is connected to the host computer.

Hardware Specifications

1. Arduino UNO
2. Motor Driver
3. DC Motor & Bluetooth Module



2. METHODOLOGY

2.1 Arduino UNO

It is a microcontroller board developed by Arduino.cc and based on Atmega328.

Electronic devices are becoming compact, flexible and cheap that are capable of doing more function as compared to their predecessors that happened to cover more space, turned out costly with the ability to perform fewer functions.

Microcontrollers are widely used in embedded systems and make devices work according to our needs and requirements. We have already discussed the controllers like 8051, Atmega16, Atmega328 and PIC16F877.

Arduino Uno is a very valuable addition in the electronics that consists of USB interface, 14 digital I/O pins, 6 analog pins, and Atmega328 microcontroller. It also supports serial communication using Tx and Rx pins. You should also have a look at this UNO for beginners.

Some people get confused between Microcontroller and Arduino. While former is just an on system 40 pin chip that comes with a built-in microprocessor and later is a board that comes with the microcontroller in the base of the board, bootloader and allows easy access to input-output pins and makes uploading or burning of the program very easy.

Introduction to Arduino Uno

- Arduino Uno is a microcontroller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328.
- The current version of Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output.
- It allows the designers to control and sense the external electronic devices in the real world.

Features of Arduino Uno Board

- Arduino Uno comes with USB interface i.e. USB port is added on the board to develop serial communication with the computer.
- Atmega328 microcontroller is placed on the board that comes with a number of features like timers, counters, interrupts, PWM, CPU, I/O pins and based on a 16MHz clock that helps in producing more frequency and number of instructions per cycle.

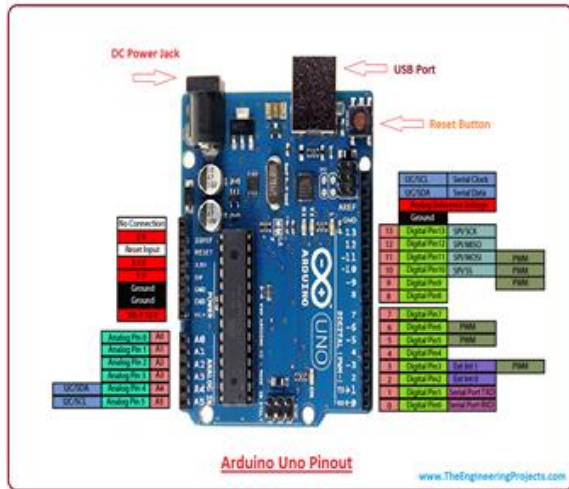


Fig 2 Arduino UNO Pin Out

Pin Description

There are several I/O digital and analog pins placed on the board which operates at 5V. These pins come with standard operating ratings ranging between 20mA to 40mA. Internal pull-up resistors are used in the board that limits the current exceeding from the given operating conditions. However, too much increase in current makes these resistors useless and damages the device.

LED. Arduino Uno comes with built-in LED which is connected through pin 13. Providing HIGH value to the pin will turn it ON and LOW will turn it OFF.

Vin. It is the input voltage provided to the Arduino Board. It is different than 5 V supplied through a USB port. This pin is used to supply voltage. If a voltage is provided through power jack, it can be accessed through this pin.

5V. This board comes with the ability to provide voltage regulation. 5V pin is used to provide output regulated voltage. The board is powered up using three ways i.e. USB, Vin pin of the board or DC power jack.

USB supports voltage around 5V while Vin and Power Jack support a voltage ranges between 7V to 20V. It is recommended to operate the board on 5V. It is important to note that, if a voltage is supplied through 5V or 3.3V pins, they result in bypassing the voltage regulation that can damage the board if voltage surpasses from its limit.

GND. These are ground pins. More than one ground pins are provided on the board which can be used as per requirement.

Reset. This pin is incorporated on the board which resets the program running on the board. Instead of physical reset on the board, IDE comes with a feature of resetting the board through programming.

IOREF. This pin is very useful for providing voltage reference to the board. A shield is used to read the voltage across this pin which then select the proper power source.

PWM. PWM is provided by 3,5,6,9,10, 11 pins. These pins are configured to provided 8-bit output PWM.

SPI. It is known as Serial Peripheral Interface. Four pins 10(SS), 11(MOSI), 12(MISO), 13(SCK) provide SPI communication with the help of SPI library.

AREF. It is called Analog Reference. This pin is used for providing a reference voltage to the analog inputs.

TWI. It is called Two-wire Interface. TWI communication is accessed through Wire Library. A4 and A5 pins are used for this purpose.

Serial Communication. Serial communication is carried out through two pins called Pin 0 (Rx) and Pin 1 (Tx).

Rx pin is used to receive data while Tx pin is used to transmit data.

External Interrupts. Pin 2 and 3 are used for providing external interrupts. An interrupt is called by providing LOW or changing value.

Communication and Programming

Arduino Uno comes with an ability of interfacing with other other Arduino boards, microcontrollers and computer. The Atmega328 placed on the board

provides serial communication using pins like Rx and Tx.

Arduino Uno is programmed using Arduino Software which is a cross-platform application called IDE written in Java.

Applications

Arduino Uno comes with a wide range of applications. A larger number of people are using Arduino boards for developing sensors and instruments that are used in scientific research. Following are some main applications of the board.

- Embedded System
- Security and Defense System
- Digital Electronics and Robotics
- Parking Lot Counter
- Weighing Machines
- Traffic Light Count Down Timer

Motor Driver



Fig3 L293D IC Pin Out

Features

- Can be used to run Two DC motors with the same IC.
- 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 5V and 24V)
- Automatic Thermal shutdown is available
- Available in 16-pin DIP, TSSOP, SOIC packages

How to use a L293D Motor Driver IC

Using this L293D motor driver IC is very simple. The IC works on the principle of Half H-Bridge, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a set up which is used to run motors both in clock wise and anti clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time, the circuit to achieve the same is shown below.

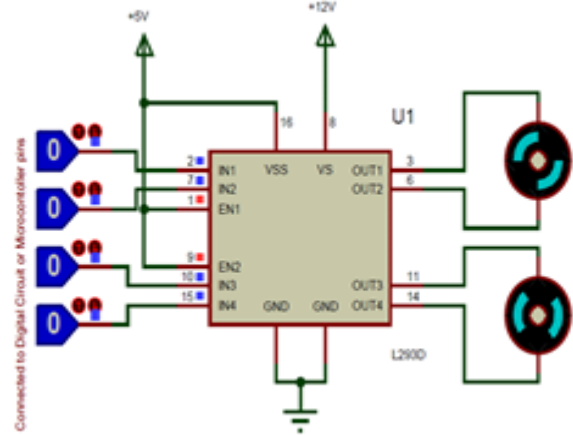


Fig 4 DC motor Connection with Motor Driver

Input 1 = HIGH(5v)	Output 1 = HIGH	Motor 1 rotates in Clockwise Direction
Input 2 = LOW(0v)	Output 2 = LOW	
Input 3 = HIGH(5v)	Output 1 = HIGH	Motor 2 rotates in Clockwise Direction
Input 4 = LOW(0v)	Output 2 = LOW	

Input 1 = LOW(0v)	Output 1 = LOW	Motor 1 rotates in Anti-Clockwise Direction
Input 2 = HIGH(5v)	Output 2 = HIGH	
Input 3 = LOW(0v)	Output 1 = LOW	Motor 2 rotates in Anti -Clockwise Direction
Input 4 = HIGH(5v)	Output 2 = HIGH	

Input 1 = HIGH(5v)	Output 1 = HIGH	Motor 1 stays still
Input 2 = HIGH(5v)	Output 2 = HIGH	

Input 3 = HIGH(5v)	Output 1 = LOW	Motor 2 stays still
Input 4 = HIGH(5v)	Output 2 = HIGH	

Applications

- Used to drive high current Motors using Digital Circuits
- Can be used to drive Stepper motors
- High current LED's can be driven
- Relay Driver module (Latching Relay is possible)

DC Motor



Fig 5 DC motor

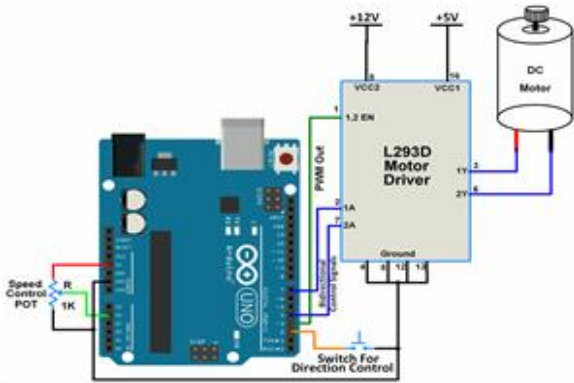
DC motor converts electrical energy in the form of Direct Current into mechanical energy in the form of rotational motion of the motor shaft.

The DC motor speed can be controlled by applying varying DC voltage; whereas the direction of rotation of the motor can be changed by reversing the direction of current through it.

For applying varying voltage, we can make use of PWM technique.

For reversing the current, we can make use of H-Bridge circuit or motor driver ICs that employ the H-Bridge technique

INTERFACING DIAGRAM



Here, we are going to control the speed and rotational direction of DC motor using Arduino Uno.

Here, a potentiometer is used as a means for speed control and an input from a tactile switch is used to change the direction of the motor.

L293D motor driver IC is used for controlling the direction of the motor.

PWM wave generated on the Arduino UNO is used to provide a variable voltage to the motor through L293D. In Arduino, analogWrite function is used to generate PWM wave.

Bluetooth Module



Fig 15 HC 05 Module

HC-05 Technical Specifications

- Serial Bluetooth module for Arduino and other microcontrollers
- Operating Voltage: 4V to 6V (Typically +5V)
- Operating Current: 30mA
- Range: <100m
- Works with Serial communication (USART) and TTL compatible
- Follows IEEE 802.15.1 standardized protocol
- Uses Frequency-Hopping Spread spectrum (FHSS)
- Can operate in Master, Slave or Master/Slave mode
- Can be easily interfaced with Laptop or Mobile phones with Bluetooth
- Supported baud rate: 9600,19200,38400,57600,115200,230400,460800.

How to Use the HC-05 Bluetooth module

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.

It is very easy to pair the HC-05 module with microcontrollers because it operates using the Serial Port Protocol (SPP). Simply power the module with +5V and connect the Rx pin of the module to the Tx of MCU and Tx pin of module to Rx of MCU as shown in the figure below

During power up the key pin can be grounded to enter into Command mode, if left free it will by default enter into the data mode. As soon as the module is powered you should be able to discover the Bluetooth device as “HC-05” then connect with it using the default password 1234 and start communicating with it. The name password and other default parameters can be changed by entering into the

Applications

1. Wireless communication between two microcontrollers
2. Communicate with Laptop, Desktops and mobile phones
3. Data Logging application
4. Consumer applications
5. Wireless Robots
6. Home Automation

3.HARDWARE DEVELOPMENT

DC GEAR MOTOR

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.

EXTERNAL STRUCTURE

At the first sight, the external structure of a DC geared motor looks as a straight expansion over the simple DC ones.

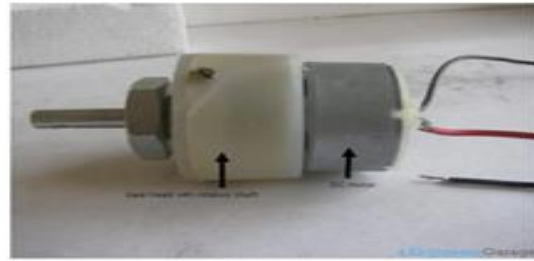


Fig 17 gear dc motor

The lateral view of the motor shows the outer protrudes of the gear head. A nut is placed near the shaft which helps in mounting the motor to the other parts of the assembly. behind this could be to lubricate gear head from time to time. The plastic body has a threading through which nut can be easily mounted and vice versa from the gear head.

4.RESULT AND DISCUSSION

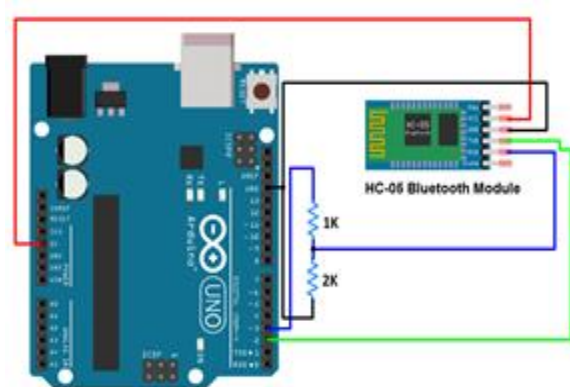


Fig 6 Interfacing HC-05 Bluetooth Module with

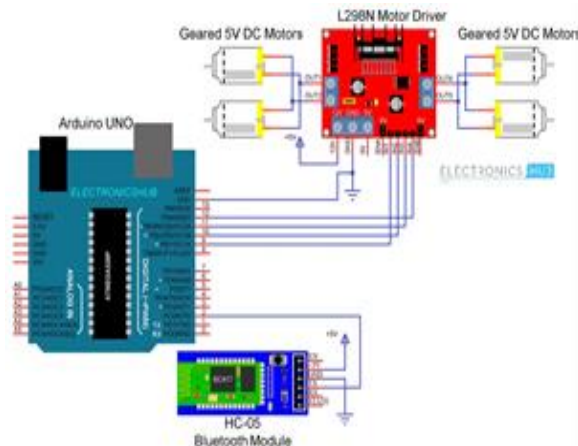


Fig 7 final circuit diagram

5.CONCLUSIONS & FUTURE SCOPE

5.1 Conclusions

1.Mature electronic prototyping methods and systems need to be established; so that ideas could be validated faster and products would come well in time in the market.

In this paper I have concluded

5.2 Future Scope

The digital revolution now has reached to a stage where we cannot conduct our normal modern daily lives without this technology.

REFERENCES

- [1] S. Berman, E. Schechtman and Y. Edan, Evaluation of automatic guided vehicle systems, Robotics and Computer-Integrated Manufacturing, 25(3), pp.522-528, 2009.
- [2] R. Bischoff, and G. Volker, Vision-guided intelligent robots for automating manufacturing, materials handling and services. WESIC'98 Workshop on European Scientific and Industrial Collaboration on Promoting Advanced Technologies in Manufacturing, 1998.
- [3] S. Datta, R. Ray, and D. Banerji, Development of autonomous mobile robot with manipulator for manufacturing environment, The International Journal of Advanced Manufacturing Technology, 38(5), pp.536-542, 2008.
- [4] M. Gamberi, R. Manzini and A. Regattieri, A new approach for the automatic analysis and control of material handling systems: Integrated layout flow analysis, The International Journal of Advanced Manufacturing Technology, 41(1), pp.156-167, 2009.
- [5] A. Kelly, B. Nagy, D. Stager and R. Unnikrishnan, Field and service applications, an infrastructure-free automated guided vehicle based on computer vision. Robotics and Automation Magazine, IEEE, 14(3), pp.24-34, 2007.
- [6] M. Kefer and W. Kubinger, Evaluation of Kinect depth sensor for use in mobile robotics, Proceedings of International DAAAM symposium 22(1), pp.147-148, Austria, 2011.