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Design And Automation Of In- Line Forklift

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Abstract

Factories, industries and Storage godowns requires machines for transporting large goods which is a laborious task and difficult to be performed by humans for a long time. To fill this need there came into existence four wheel drive forklift to lift and transport such medium weight goods across factories & industrial warehouses with the help of a driver. But working of forklift can be automated so that it doesn't require any driver. This system is going to use line follower system for the forklift. It uses a colour tracker for the purpose of transportation. This system is the best solution for pick and place operation. Colour track can be made from one Location to the other location. It uses colour detecting line sensor. It is programmed by PICK IT 2 software. Instructions to the forklift can be coded by this software. More than one forklift can be used on one track by keeping a proper time gap. It can be used in mass production industries where laborious pick and place operations are taking place. It is more flexibility to move from one place to another place like moving from one department to other department . Human interference in the plant will be reduced and due to this cost reduction takes place. It also senses the path in front of it by a IR sensor. Nut and Bolt Mechanism is used for the lifting and lowering action of load by the forklift. Wheels used and bolt in the lifting mechanism are also driven by the DC motor.

Key Words: *Transportation, Automatic Forklift, Colour Track, Sensor, flexibility*

INTRODUCTION:

The forklift defines the concept of material handling as well as placing. The forklift uses screw and thread arrangement in order to lift the loads. Lifter is connected to 12V motor in order to lift weights and also consists of a counter weight in the back to maintain proper balance while lifting weights. The lifting mechanism is attached onto a four-wheel drive frame chassis.Forklift consists of four motors needed to control vehicle movement in all four directions. The system uses twoball bearing sliders in order to achieve smooth vertical movement of the lifter. Also, we use motor drive in order to drive the forklift with efficient strength. The system can be capable of moving in a defined path and collect the objects in the path. To achieve this task, we have used microcontroller and sensors. The sensors detect the line and send that information to the microcontroller. The microcontroller will change the motors direction with the help of motor driver. The microcontroller gives commands to the motor driver circuit to achieve the desired direction.To perform the fork lifting we are arranging two smaller lines besides the path. When both sensors detect that small path then robot will stop and it lift the object with the help of fork lift mechanism and moves forward. To drop the object, we create another two lines after some distance then again both sensors detects the similar path and it will place the lifted object and moves backward. To perform this task microcontroller was programmed in Embedded 'C' language. This program is compiled in PICK IT 2 software.

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WORKING:

Components Required:

1. **Regulated power supply (12V)**

The main components in the power supply assembly are 12V batteries, Bridge rectifier (DB107), capacitor, voltage regulator (IC 7805), resistor, led(light emitting diode)

2. **Micro Controller (PIC16F72)**

Important criteria for choosing microcontroller are Speed, Packaging (Ex. DIP, QFP Quad Flat Package) Power Consumption, Amount of RAM, ROM, I/O Pins, Final Cost of The product, How easy it is Upgraded.

The figure 1 shows the internal structure of a microcontroller. At times, a microcontroller can have external memory also (if there is no internal memory or extra memory interface is required). Early microcontrollers were manufactured using bipolar or NMOS technologies. Most modern microcontrollers are manufactured with CMOS technology, which leads to reduction in size and power loss. Current drawn by the IC is also reduced considerably from 10mA to a few micro Amperes in sleep mode (for a microcontroller running typically at a clock speed of 20MHz).

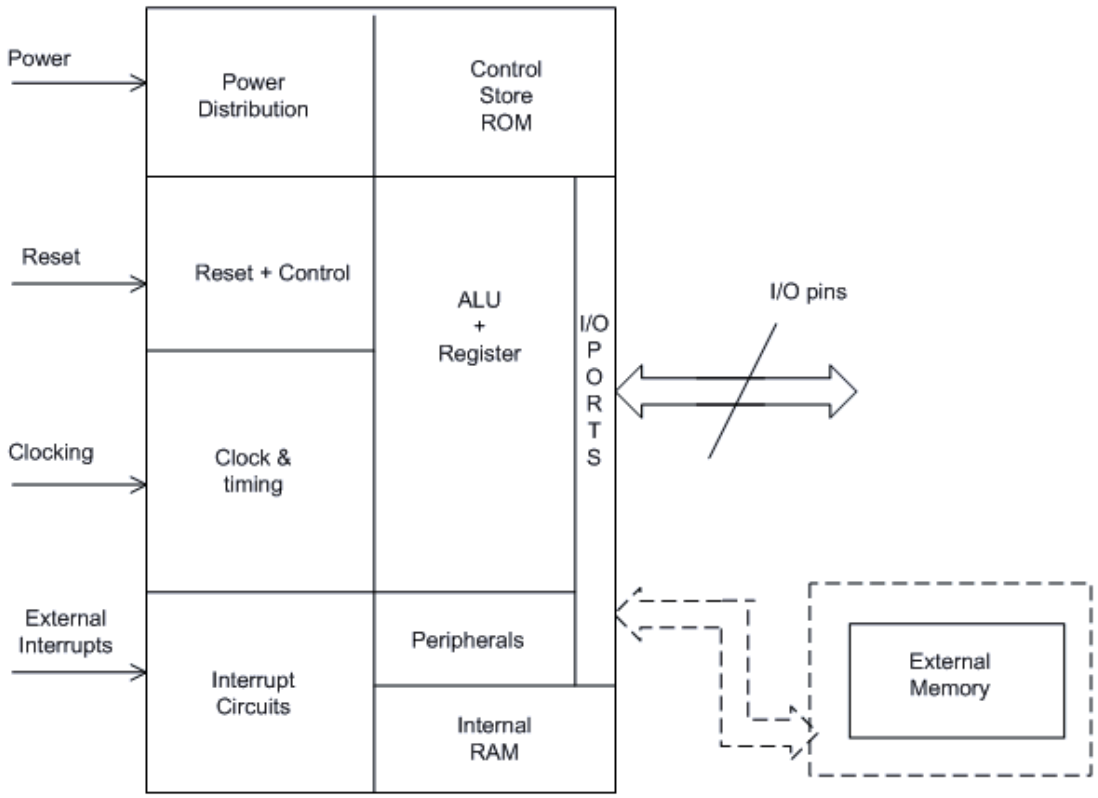

Figure 1: Internal Structure of Microcontroller

3. **Charging Circuit**

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Charging circuit consists of transformer, rectifier, capacitor, resistor, batteries. Main purpose of this charging circuit is to charge the batteries required for regulated power supply by taking the input from 220V AC power supply.

And the other important components include D**C Motors,** IR Sensors (line detection sensors), DC motor driver (L293D), Bolt & Nut mechanism, Relay Switches, Ball Bearing sliders, Limit Switches

Description of Working:

Three batteries are used for the power supply to main mother board circuit, L293D circuit and relay circuit. DC supply is given from battery supply. Microcontroller needs DC power for the working. So DB107 Rectifier is used convert AC current to pulsating DC. Capacitor is used to convert pulsating DC to pure DC supply. It acts as a filtering circuit. Voltage regulator gives required supply for the microcontroller (5v). Through 5-pin , program is fed into the microcontroller through programming kit. Crystal oscillator is used to run the microcontroller continuously. Connections are given to the L293D circuit and relay circuit from the parts of microcontroller. Limit switches are used to regulate the movement of the lifter. When the sensor detects the white surface. It gives information the microcontroller such that microcontroller gives the information to L293D motor driver.(high torque). L293D Motor gives information to the DC motor wheels to move. Speed of DC motor is 10 rpm. When both the sensors detect by black colour, then microcontroller gives the information to the forklifting motor (5v) such that there is a load in front and we have to lift it. Forklift lifts the object in front and carries it over the track. When the black colour is detected by both the sensors it understand that load is to be placed at that position. Forklift drops the load and goes back. Turning of forklift towards left and right is done by line sensors too. When tracks take a turn then one of the two sensor detect the colour. In this case set up is programmed such that inner wheels rotate in one direction and outer wheels rotate in opposite direction to that of the inner wheels to take the turn. This phenomenon occurs while the forklift is taking the turns. During the movement of the lifting , forklift must be in stationary sition. So limit switch connection is given to the microcontroller board, so this microcontroller gives information to the L293D circuit so that wheels are stationary upto the lifting action. After the lifting is stopped microcontroller gives information for the forklift to move.

Program code :

```
#include <16f72.h>
#fuses  HS,NOWDT,PROTECT,brownout,put
#use delay(clock=20000000)
void forklift_up()
{
output_low(pin_C6);
output_high(pin_C7);
output_high(pin_C4);
}
```


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```
void forklift_down()
{
output_high(pin_C6);
output_low(pin_C7);
output_high(pin_C4);
}

void forklift_stop()
{
output_high(pin_C6);
output_high(pin_C7);
}
void Robot_Forward()
{
output_low(pin_C0);
output_high(pin_C1);
output_low(pin_C2);
output_high(pin_C3);
}

void Robot_Backward()
{
output_high(pin_C0);
output_low(pin_C1);
output_high(pin_C2);
output_low(pin_C3);
}

void Robot_Left()
{
output_low(pin_C0);
output_high(pin_C1);
output_high(pin_C2);
output_low(pin_C3);
}
void Robot_Right()
{
output_high(pin_C0);
output_low(pin_C1);
output_low(pin_C2);
output_high(pin_C3);
}
```


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```
void Robot_Stop()
{
output_low(pin_C0);
output_low(pin_C1);
output_low(pin_C2);
output_low(pin_C3);
}

void main()
{
  int i = 0;
output_high(pin_C4);
delay_ms(1000);
output_low(pin_C4);
delay_ms(1000);
output_high(pin_C4);
delay_ms(1000);
output_low(pin_C4);
delay_ms(1000);

while(1)
  {
 if(!input(pin_B0) && input(pin_B1))  //up limit switch = 0 and down limit switch = 1
    {
output_high(pin_C6);
output_high(pin_C7);
output_low(PIN_C4);
       break;
    }
    else
    {
output_low(pin_C6);
output_high(pin_C7);
    }
 }

while(1)
  {

   if(input(pin_A0) && input(pin_A1) &&i == 0)    // IR SENSORS
     {
i = 1;
Robot_Stop();
delay_ms(2000);
```


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```
forklift_down();
delay_ms(50);
        while(input(pin_B1));
forklift_stop();
delay_ms(2000);
Robot_Forward();
delay_ms(2000);
Robot_Stop();
delay_ms(2000);
forklift_up();
delay_ms(50);
        while(input(pin_B0));
forklift_stop();
delay_ms(2000);
Robot_Forward();
delay_ms(2000);
      }

    else if(input(pin_A0) && input(pin_A1) &&i == 1)
      {
i = 0;
Robot_Stop();
forklift_down();
delay_ms(50);
        while(input(pin_B1));
forklift_stop();
delay_ms(2000);
Robot_Backward();
delay_ms(2000);
Robot_Stop();
delay_ms(2000);
forklift_up();
delay_ms(50);
        while(input(pin_B0));
forklift_stop();
delay_ms(2000);
while(1);
      }
    else if(!input(pin_A0) && !input(pin_A1))     //BOTH SENSORS DETECTING TRACK
      {
Robot_Forward();
delay_ms(100);
      }
```


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```
    else if(!input(pin_A0) && input(pin_A1))     //RIGHT SENSOR DETECTED
      {
Robot_Right();
delay_ms(50);
Robot_Stop();
delay_ms(50);
      }
    else if(input(pin_A0) && !input(pin_A1))    //LEFT SENSOR DETECTED
      {
Robot_Left();
delay_ms(50);
Robot_Stop();
delay_ms(50);
      }
  }
}
```

RESULT:

The fabrication of a Line following mini fork lifter has been taken up . The mini fork lifter defines the concepts of using forklifts for weights lifting as well as placing. This system allows for efficient implementation of material handling concept. The mini forklift uses screw and thread arrangement in order to lift the loads. It is connected to a powerful 12V motor in order to lift weight. Thelift mechanism is havingfour wheel drive which is also support the counterweight. It consists of four motors needed to give mobility to the forklift. The system uses two ball bearing sliders in order to achieve smooth vertical movement of the lift. Also motor drive is used in order to drive the forklift with efficient strength. The system can be capable of moving in a defined path and collect the objects in the path. To achieve this task we used microcontroller and sensors. The sensors detect the line and send that information to the microcontroller. The microcontroller will change the forklift direction with the help of motor driver. The microcontroller gives commands to the motor driver circuit to achieve the desired direction. To perform the fork lifting two smaller lines are arranged besides the path. When both sensors detect that small path then forklift will stop and it lift the object and moves forward. To drop the object we create another two lines after some distance then again both sensors detects the smaller path and it will place the lifted object and moves backward. To perform this task microcontroller was programmed in Embedded ‘C’ language.

CONCLUSION / SUMMARY:

The advancement of technolgy in the field of material handling has been quite remarkable in recent years. This project describes all steps and procedures that has been followed up a line follower forklift for the purpose of loading heavy loads from a fixed place, then, carrying goods to the destination where these goods to be unloaded by forlift itself. While carrying loads, the forklift is programmed to follow a pre-defined path on the floor from source to destination. This industrial forklift promises to be beneficial to the industry . In this project, fabrication of forklift is explained in detail is feasible based on the movement of the desired track.Integrating features of all the hardware components used have

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been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully tested.

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