Development of an Automatic Bottle Filling Device

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Course Title: Project and Thesis

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We here by declare that this thesis is our own work and to the best of our knowledge it contains no materials previously published or written by another person, or have been accepted for the award of any other degree or diploma at Sonargaon University or any other educational institution. We also declare that the intellectual content of this thesis is the product of our own work and any contribution made to the research by others, with whom I have worked at Sonargaon University or else where, is explicitly acknowledged.

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ABSTRACT

The field of automation has a notable impact in a wide range of industries beyond .manufacturing. Automation plays an increasingly important role in the world economy.Filling is a task carried out by a machine that packages liquid products such as cold drinks or water. In past, humans were the main method for controlling a system. More recently, electricity has been used for control and electrical control is based on microcontrollers for various purposes like medicines, pharmaceutical plants, chemical plants etc.There microcontrollers control the complete working of the system.It is common to use microcontrollers to make simple logical control decision. The automation in bottle filling industry comes with increased electrical components. Essential requirements of each component in the system is important to be studied in ordered to understand how each part works in coordination with other parts in the system.This study mainly includes design, fabrication and control system for automated bottle filling system. The main part is control system which includes C programming in pick microcontroller to control various composnents in system. A conveyor system with sensors and eclectromagnetic valve is fabricated for this purpose. The entire sequence of operation is controlled by pick microcontroller. In small industries bottle filling operation is done manually. The manual filling process has many short comings like spilling of water while filling it in a bottle, equal quantity of water may not be filled, delay due to natural activities of human etc. this problem faced by small industries.It aims to eliminate problem faced by small scale bottle filling system. With this system which operates automatically, every process can be smooth and the process of refilling can reduce worker cost and operation. The manual filling process has many problems like spilling water while filling it in a bottle, etc. This work generally emphasizes small industries and we aim to make these small-scale industries more efficient and to eliminate problems faced by small-scale bottle filling industries. With this technique that operates automatically, every process can be smooth and the process of refilling will cut back the hands price and operation time.

Contents

Chapter 1 Introduction

1.1 Over view

The Automation has a major impact in a wide range of industries and it plays a vital role in the development of various industries. The filling task is carried out by a machine to package liquid products. More recently, machines have taken over production of medicines, vaccines , chemical plants, etc. Micro controllers are now majorly used in many embedded systems to perform dedicated functions. The common use of micro-controllers is to make simple logical control decisions. The automation in the bottle filling industry comes with increasing demand currently and in the future. Each component in the system is important to be studied in ordered to comprehend how each part works in the system. This study mainly includes the designing and a control system for an automated bottle filling system which can be an alternative to or microcontroller in the market in an affordable price. The control system which includes C programming in pick micro-controller is used to control various components in the system. For this purpose a conveyor system with sensors and an electromagnetic valve is fabricated. This system is meant for small scale industries. It aims to eliminate problems faced by small scale industries which involve filling of bottles. With the help of this system that is automated every process can be done effortlessly and the cost be reduced and the production will be more efficient. Automatic bottle filling is the simplest project that we have seen nowadays. In industries that have a project like this are microcontroller-based projects and it is very expensive. The price of one microcontroller is around 1 to 2 lakh, and it is very expensive for the general people. So we have made a project on the automatic bottle filling system using pick microcontroller. The objective of this project, automatic bottle filling system using a pick microcontroller, to provide easy access to the company which cannot afford microcontroller and are in need of an alternative which they can afford. This type of project is mainly used in the sanitizer and medicine manufacturing company in which liquid is Automatically Filled in the Bottle.

Objectives:

The objectives of the project are-

i. To implement an an automatic bottle filling machine.

ii. To reduce the man power.

iii. To reduce interrupt in production system of industry.

iv. To Safe time than manual time.

v. To safe place with this device.

vi. To safe costing amount.

Chapter 2 Hardware Requirement

2.1Pick-12F675 Model microcontroller PIC**:** (usually pronounced as [pʰɪk]) is a family of microcontrollers made by Microchip Technology, derived from the PIC12F675[1][2] originally developed by General Instrument's Microelectronics Division. The name microcontroller initially referred to Peripheral Interface Controller,[3] and is currently expanded as Programmable Intelligent Computer.[4] The first parts of the family were available in 1976; by 2013 the company had shipped more than twelve billion individual parts, used in a wide variety of embedded systems.

The PIC was originally intended to be used with the General Instrument CP1600, the first commercially available single-chip 16-bit microprocessor. The CP1600 had a complex bus that made it difficult to interface with, and the microcontroller was introduced as a companion device offering ROM for program storage, RAM for temporary data handling,

Figure:2.1 pic 12F675 microcontroller

2.2 Gear motor:-The gear motor is a dc motor used for rotation it is an important equipment. It is 100rpm. Nowadays, gear systems are used widely in industrial applications

Figure:2.2 Gear motor.

2.3 Pump:- It is used for supply water.It is 12volt, flow rate-10L/min,Max H-5meter

Figure:2.3 pump

2.4 IR sensor: The IR sensor module consists mainly of the IR Transmitter and Receiver, pump, Variable Resistor (Trimmer pot), output LED IR sensor is an electronic gadget which is utilized to detect certain qualities of its surroundings by either transmitting or recognizing infrared radiation with no contact.

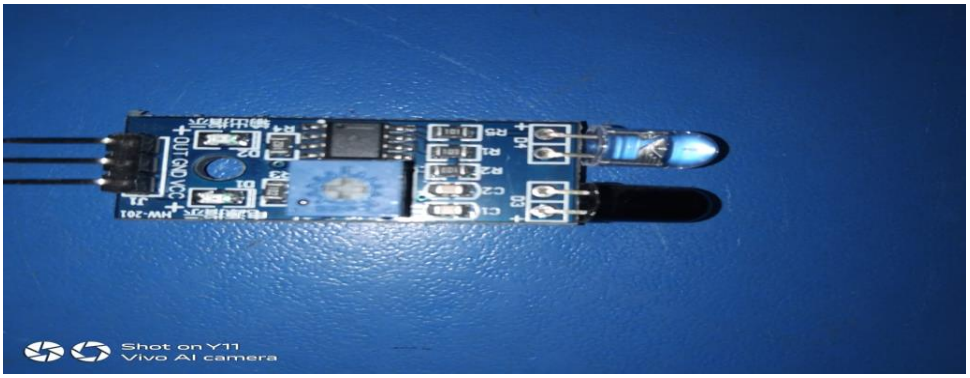


Figure:2.4 IR Sensor

2.5 Conveyor belt: A conveyor belt is the carrying medium of a belt conveyor system (often shortened to belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with a closed loop of carrying medium—the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley.

Figure:2.5 conveyor belt

2.6. 7805 transistor: IC 7805 is a linear voltage regulator and it includes three terminals including 5V of the fixed output voltage. This voltage is used in a variety of applications. At present, the manufacturing of this voltage regulator can be done by different manufacturing companies like STMicroelectronics, ON Semiconductor, Texas Instruments, Infineon Technologies, Diodes incorporated, etc

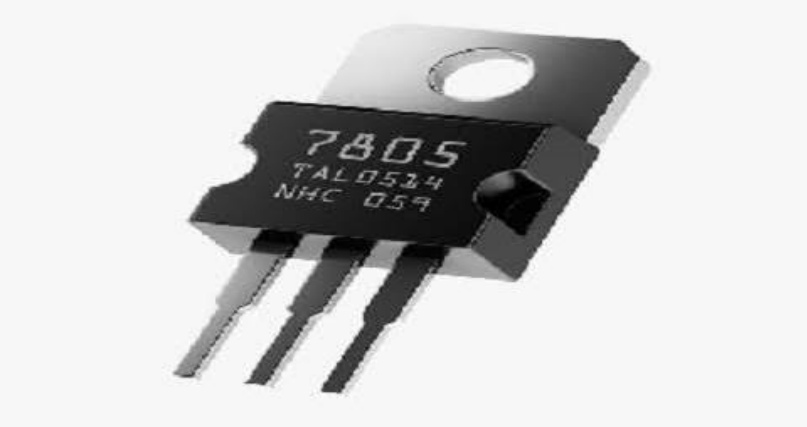


Figure:2.6 7805 Transistor

2.7.water storage tank: A water tank is a container for storing water. They are used to provide storage of water for use in many applications, drinking water, irrigation agriculture, fire suppression, agricultural farming, both for plants and livestock, chemical manufacturing, food preparation as well as many other uses. Water tank parameters include the general design of the tank, and choice of construction materials, linings.

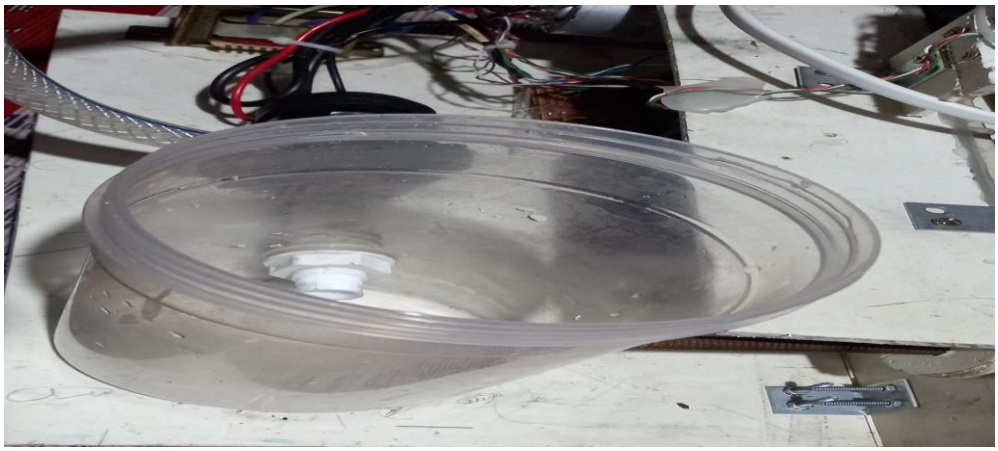


Figure:2.7 water storage tank

2.8. Transformer 220 volt to 18volt: A transformer is a passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits. A varying current in any coil of the transformer produces a varying magnetic flux in the transformer's core, which induces a varying electromotive force (EMF) across any other coils wound around the same core. describes the induced voltage effect in any coil due to a changing magnetic flux encircled by the coil.

Figure:2.8 Transformer

2.9 Bearing: A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races.The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads.Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were sliding against each other.This 6203 model bearing.

Figure:2.9 Bearing

2.10 Three bottle cup:This bottle cup is made of plastic

Figure:2.10 Three bottle cup

2.11Pipe: To achieve a better pressure resistance, hoses can be reinforced with fibers or a steel cord. Commonly used reinforcement methods are braiding, spiraling, knitting and wrapping of fabric plies. The reinforcement increases the pressure resistance but also the stiffness. To obtain flexibility, corrugations or bellows are used. Usually, circumferential or helical reinforcement rings are applied to maintain these corrugated or bellowed structures under internal pressure.

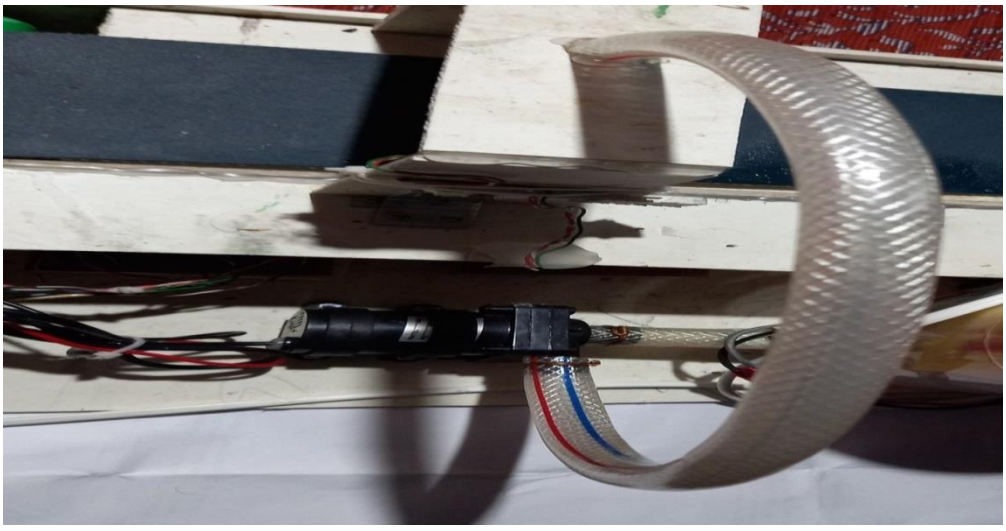


Figure:2.11 pipe

2.12 Rotor:The rotor is a moving component of an electromagnetic system in the electric motor, electric generator, or alternator. Its rotation is due to the interaction between the windings and magnetic fields which produces a torque around the rotor's axis. Induction (asynchronous) motors, generators and alternators (synchronous) have an electromagnetic system consisting of a stator and rotor. There are two designs for the rotor in an induction motor: squirrel cage and wound. In generators and alternators, the rotor designs are salient pole or cylindrical.

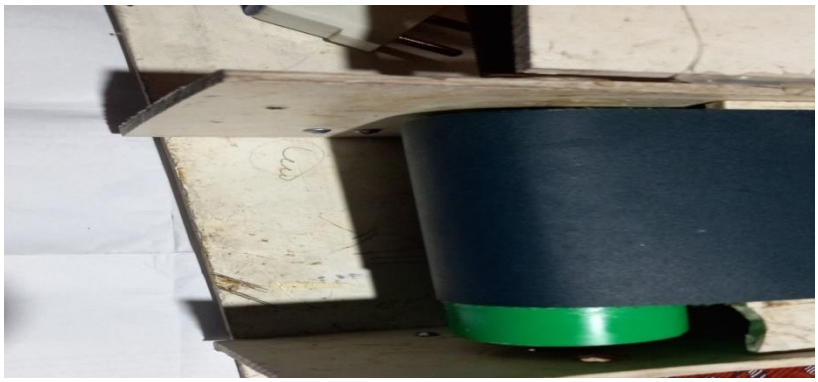


Figure:2.12 Rotor

CHAPTER 3
Design Of Bottle Filling Device

3.1 Automatic bottle fill up system:

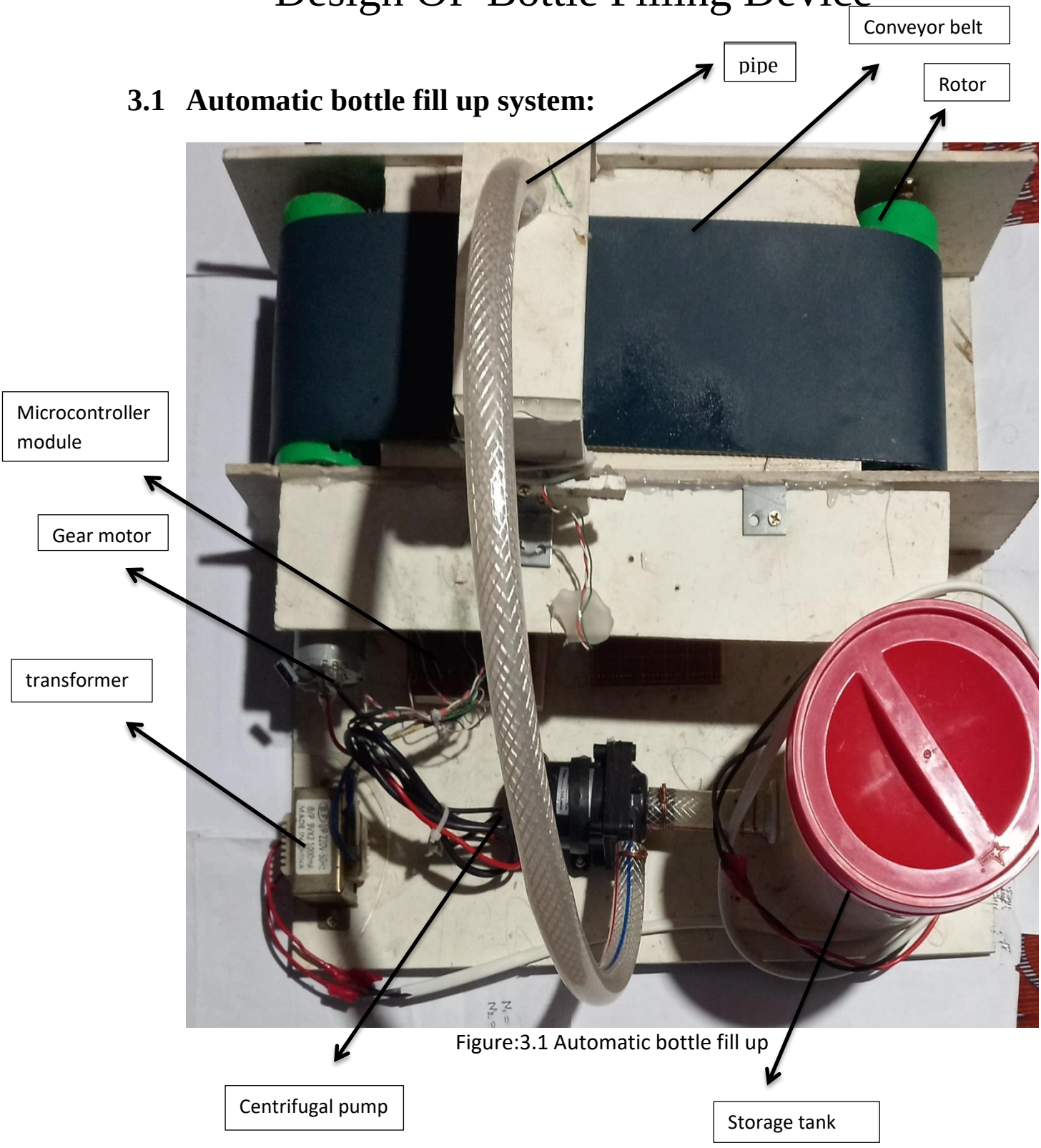


Figure:3.1 Automatic bottle fill up

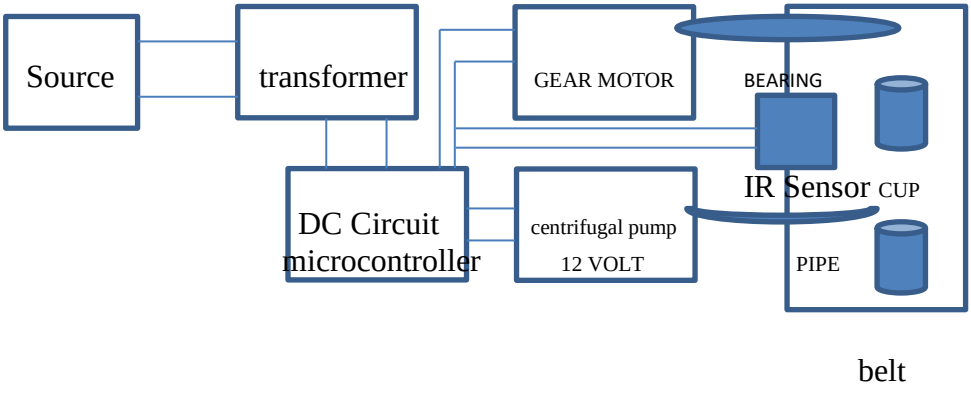
3.2 Programming concepts

Complete code and demonstration are given below.

Code

```
 * File:   newmain.c
 * Author: Nadim */
// PIC12F675 Configuration Bit Settings
// 'C' source line config statements

// CONFIG
#pragma config FOSC = INTRCIO   // Oscillator Selection
bits (INTOSC oscillator: I/O function on
GP4/OSC2/CLKOUT pin, I/O function on
GP5/OSC1/CLKIN)
#pragma config WDTE = OFF       // Watchdog Timer
Enable bit (WDT disabled)
#pragma config PWRTE = ON       // Power-Up Timer
Enable bit (PWRT enabled)
#pragma config MCLRE = ON       // GP3/MCLR pin
function select (GP3/MCLR pin function is MCLR)
#pragma config BOREN = ON       // Brown-out Detect
Enable bit (BOD enabled)
#pragma config CP = OFF         // Code Protection bit
(Program Memory code protection is disabled)
#pragma config CPD = OFF        // Data Code Protection
bit (Data memory code protection is disabled)

// #pragma config statements should precede project file
includes.
// Use project enums instead of #define for ON and OFF.

#include <xc.h>
#define _XTAL_FREQ   4000000

unsigned char pwm;
void Init_timer(void);

void main(void) {

   ANSEL  = 0x00;       // Set ports as digital I/O, not
analog input
        ADCON0 = 0x00;                  // Shut off the
A/D Converter
        CMCON  = 0x07;                  // Shut off the
Comparator
        VRCON  = 0x00;              // Shut off the Voltage
Reference
        TRISIO =0b111100;       // GP3 input, rest all
output
        GPIO   = 0x00;       // Make all
pins 0
          //GP0=1;
   Init_timer();
   __delay_ms(3000);
   while(1)
   {
     if(GP2==0{
           pwm=0;
           __delay_ms(50);
           GP1=1;
           __delay_ms(2500);
           GP1=0;
           __delay_ms(2000);
           pwm=70;
           __delay_ms(500);
           while(GP2==0);

        }
        else
        {
          pwm=70;
          GP1=0;

   return;}

void Init_timer(void)
{
   OPTION_REG&=0xc0;
   T0IE=1;
   GIE=1;
}

void __interrupt() ISR(void)
{
          if(T0IF)  //If Timer1 Interrupt
           {
      if(GP0)
      {
         TMR0=pwm;
         GP0=0;
      }
      else
      {
         TMR0=255-pwm;
         GP0=1}

                  T0IF = 0;    // clear the
interrupt}
```

3.3 Connection Diagram



3.4 Methology:

Diameter of rollers,

d =55mm or 0.055m.

 RPM of motor,

N = 100.

 Belt Speed,

V = (π×d×N)/60 = (π×0.055×100)/60 = 0.288 m/s

 Sectional Area,

A = L×H = 0.150×0.0127 = 0.001905m2.

 Material Density,

ρ = 30 kg/m3.

 Belt Capacity,

B.C. = 3.6×A× ρ ×V = 3.6×0.001905×30×0.288 =

0.0637 kg/s.

 The mass of Material Mm (live load) per metre

loaded on a belt conveyor is given by,

Mm = BC/ (3.6×V) = 0.0637/ (3.6×0.288) = 0.0614

kg/m.

 Length of the Belt,

L = (πd) + (2×centre distance)

= (π×0.055) + (2×0.1905)

= 0.554 m.

 Velocity of fluid through pipe,

V1 = Q/A =0.00017/0.001905 = 0.0874 lit/s

 Time required to fill a One Litre bottle,

In one second discharge is 0.0874lit/s.

CHAPTER:4 Result & Discussion

The results from numerical analysis show that the time required to fill a 0.0874 litre bottle moving on the conveyor belt is 1.5 seconds.This is applicable when the conveyor belt is moving at a speed of 0.287 m/s. The length of the belt is 0.389 m. The discharge or volume of water which comes out of the pipe unit time is assumed to be 0.0874 litres/second. Thus, the velocity of the water flowing through the pipe becomes 0.287 m/s.The time required to fill a single cup bottle, i.e., 1.5 seconds feed into the pick code as time-delay of the motor. This is the time for the motor driving the conveyor belt stops for the bottle to fill.The final construction of the filling mac. If the button of the power supply is pressed, the conveyor motor will start to move. When the infrared sensor detects the bottle, the conveyor motor stops to move and the dc pump will start to flow the water to fill the bottle. After completing the filling operation, the dc pump stops. Hence the conveyor motor starts to move and the bottle goes away from the dc

CHAPTER:5 Conclusion

i. In this project, an automatic bottle filling machine is designed and constructed. All the components are performing well.

ii. It can fill 0.0874 lit bottle in 2.5 second. It is a time based control system and it can fill 0.0874 lit bottle in 2.5 second.

iii. This filling machine is cost effective. It saves human effort and time. It can be used in small scale bottle filling systems such as coffee shops, juice shops and other beverage industries.

iv. The system offers advantages like portability, low power consumption, flexibility.

v. The careful selection of sensors and their mounting reduces the costof system. The moderate liquid filling speed found its use in many cottages Industries.

vi. The designed system with certain modifications can be made usefulin the beverage industries, dairy plant, chemical industries and paint industriesDue to less human intervention and automation it is possible to maintain Hygienic environment during liquid filling

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