

DESIGN AND FABRICATION OF COIN OPERATED PORTABLE SANITIZER VENDING MACHINE

Submitted in partial fulfillment of the requirements
for the award of
Bachelor of Engineering degree in Mechanical Engineering

by

R. BOSCO AGNALD (37150038)

A. ANSON ASRATH (37150013)



**DEPARTMENT OF MECHANICAL ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

**JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
CHENNAI - 600 119**

APRIL – 2021



SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with "A" grade by NAAC

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119

www.sathyabama.ac.in



DEPARTMENT OF MECHANICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **R. BOSCO AGNALD (37150038)**, **A. ANSON ASRATH (37150013)** who carried out the project entitled **"DESIGN AND FABRICATION OF COIN OPERATED PORTABLE SANITIZER VENDING MACHINE"** under our supervision from September 2020 to April 2021.

Internal Guide

Mr. R. KAJA BANDHA NAVAS, M.E.,

Head of the Department

Dr.G. ARUNKUMAR, M.E., Ph.D.,

Submitted for Viva voice Examination held on _____

Internal Examiner

External Examiner

DECLARATION

We **R. BOSCO AGNALD (37150038)**, **A. ANSON ASRATH (37150013)** hereby declare that the Project Report entitled “**DESIGN AND FABRICATION OF COIN OPERATED PORTABLE SANITIZER VENDING MACHINE**” done by me under the guidance of **Mr. R. KAJA BANDHA NAVAS, M.E.**, is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Mechanical Engineering.

DATE:

SIGNATURE OF THE CANDIDATE

PLACE: CHENNAI

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my sincere thanks to **Dr.S. Prakash, M.E., Ph.D.**, Dean, School of Mechanical Engineering and **Dr.G.ArunKumar, M.E., Ph.D.**, Head of the Department, Dept. of Mechanical Engineering for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Mr. R.Kaja Bandha Navas, M.E.**, for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I also express my thanks to all Teaching and Non-teaching staff members of the Department of Mechanical Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

Hand sanitizer dispensing machine is automated, non-contact, alcohol-based hand sanitizer dispenser, which finds its use in hospital, workplace, office, dispenser, which finds its use in hospitals, work places, offices, schools and much more. Alcohol is basically a solvent, and also a very good disinfectant when compared to liquid soap or solid soap, also it does not need water to wash off since it is volatile and vaporizes instantly after application to hands. It is also proven that a concentration of >70% alcohol can kill Coronavirus in hands. Thus, this project put forward to propose a low cost and user-friendly sanitizer dispensing vending machine. In this project, a prototype is developed using mild steel for the mechanical structure, where PIC16F877A is utilized as the main controller. In addition, the prototype includes a coin acceptor which is program to accept only 1 rupee as payment per product. The experimental results show that the system performance is good with coin recognition accuracy up to 99%, In addition, the real-time quantity monitoring performance is measured in terms of accuracy and reliability is up to 100%. In conclusion, the proposed design shows good performance as well as low power consumption compared to conventional vending machine of similar features.

TABLE OF CONTENTS

CHAPTER No.	TITLE	PAGE No.
	ABSTRACT	V
	LIST OF FIGURES	IX
	LIST OF TABLES	X
1	INTRODUCTION	1
	1.1 FOREWORD	1
	1.2 EXISTING SYSTEMS	2
	1.3 PROPOSED SYSTEMS	2
	1.4 VENDING MACHINES IN INDIA	3
	1.5 BLOCK DIAGRAM	4
	1.6 OPERATION	5
	1.6.1 Coin Detection	5
	1.6.2 Circuit Diagram	5
	1.7 RESULT	6
2	LITERATURE SURVEY	7
	2.1 LITERATURE REVIEW	7
3	AIM, OBJECTIVES AND METHODOLOGY	10
	3.1 AIM	10
	3.2 PROJECT OBJECTIVES	10
	3.3 METHODOLOGY	10
4	TYPES OF VENDING MACHINE	12
	4.1 COFFEE VENDING MACHINE	12
	4.2 MILK VENDING MACHINE	13
	4.3 SNACK VENDING MACHINE	14
	4.4 COIN OPERATED VENDING MACHINE	15
	4.5 SODA VENDING MACHINE	16
5	DESIGN MODELLING AND RENDERING	17
	5.1 2d DRAFT	17
	5.2 3d DRAFT	18
	5.3 RENDERING	20
6	FABRICATION	21
	6.1 ELECTRONIC COMPONENTS	21
	6.1.1 Coin Acceptor – DG600F	21
	6.1.2 Relay	22
	6.1.3 Relay Design	23
	6.1.4 Working of Relay	23

6.1.5 Pole and Throw	24
6.1.6 Relay Applications	25
6.1.7 Relay Interfacing with Drivers	25
6.1.8 Solenoid Valve	26
6.1.9 Technical Specifications of Solenoid Valve	26
6.2 COMPONENTS USED IN THE BLOCK	27
6.2.1 Circuit Diagram	27
6.2.2 Description	27
6.2.3 Step-Down Transformer	27
6.2.4 Rectifier Unit	27
6.2.5 Filtering Unit	28
6.2.6 Voltage Regulator	28
6.3 PIC16F877A	28
6.3.1 PIC Description	29
6.3.2 Pin Diagram	30
6.3.3 Pin Description	30
6.3.4 Features	38
6.3.5 Special Microcontroller Features	38
6.3.6 Peripheral Features	39
6.3.7 Analog Features	39
6.3.8 PIC Features	40
6.3.9 Advantages of PIC	41
6.3.10 Limitations of PIC	41
6.3.11 Architecture of PIC 16F877A	42
6.3.12 Memory Organization of PIC16F877	43
6.3.13 program Memory	43
6.3.14 PIC16F87XA Data Memory Organization	44
6.3.15 Data EEPROM and Flash	44
6.4 OSCILLATOR & CLOCK	45
6.5 RESET	46
6.6 SWITCH	47
6.7 RESISTOR	49
6.8 CAPACITOR	50
6.9 DIODE	51
7	PROGRAMMING TOOLS
7.1 PROTEUS	52
7.2 SCHEMATIC ENTRY	53
7.3 CIRCUIT SIMULATATION	53
7.4 MCU SIMULATATION OVERVIEW	54
7.5 SOURCE LEVEL DEBUGGING	54
7.6 MP LAB	54
7.7 CODING	55
8	RESULT AND DISCUSIONS
8.1 CONCLUSION	60
8.2 PATENT	61

8.3 COST ESTIMATION	62
8.4 ADVANTAGES	63
8.5 APPLICATIONS	63
8.6 SCOPE FOR FUTURE WORK	64
8.7 REFERENCES	65

LIST OF FIGURES

FIGURE NO.	FIGURE NAME	PAGE NO.
1.1	BLOCK DIAGRAM	4
1.2	CIRCUIT DIAGRAM	5
4.1	COFFEE VENDING MACHINE	12
4.2	MILK VENDING MACHINE	13
4.3	SNACK VENDING MACHINE	14
4.4	WATER VENDING MACHINE	15
4.5	SODA VENDING MACHINE	16
5.1	ISOMETRIC VIEW AND FRONT VIEW	17
5.2	PERPECTIVE VIEW	18
5.3	FRONT VIEW, SIDE VIEW, TOP VIEW AND BACK VIEW	19
5.4	RENDERING WITH SUITABLE BACKGROUND	20
6.1	COIN ACCEPTOR – DG600F	21
6.2	RELAY	22
6.3	WORKING OF RELAY	24
6.4	RELAY INERFACING WITH DRIVER	25
6.5	SOLENOID VALVE	26
6.6	POWER SUPPLY DIAGRAM	27
6.7	PIC16F877A	28
6.8	PIN DIAGRAM	30
6.9	ARCHITECTURE OF PIC 16F877A	42
6.10	OSCILLATOR & CLOCK	45
6.11	5V DIRCT CURRENT CONNECTION TO MCLR PIN	46
6.12	SWITCH AND A PULL UP RESISTOR IN BETWEEN 5V & RESET PIN	47
6.13	SWITCH DIAGRAM	47
6.14	RESISTOR	49
6.15	CAPACITOR	50
6.16	DIODE	51
7.1	INFORMATION ABOUT PRETEUS – PROGRAMMING SOFTWARE	52
8.1	PATENT FILED RECEIPT	61

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
1.1	EFFICIENCY OF COIN USED	6
6.1	PIN DECSRIPTION – 1	30
6.2	PIN DECSRIPTION – 2	35
6.3	PIC FEATURES	40
6.4	A BIT OF RP1 &RP0 OF THE STATUS REGISTER SELECT THE BANK ACCESS	44
6.5	VALUE OF CAPACITOR	46
8.1	COST ESTIMATION	61

CHAPTER 1

INTRODUCTION

1.1 FOREWORD

The corona disease is a major problem future world. Presently there is no medicine or vaccine found in the resent world. As there is a severe attack in this world, the people are suffering from the corona disease. The corona disease is not a simple virus attack, it makes severe to the human by infecting the respiratory system. The virus disease is heavily spreading in the world, as the nations are trying to monitor and maintain the spread of corona in the nation and other nations. The world is suffering a lot due to this corona virus. There is a strict evaluation everywhere to control the corona disease and spread to the nation. The hospital and the nurse people are suffering to cure the affected people and stop spreading the virus to the neighboring people.

As there is an impact in using the hand wash sanitation by foot or by pressing the sanitizer bottle used to have a spread of the virus disease from one human to another. A long press is made with the footer, such that the mechanical forced to spray out the Sanitizer liquid. The human at aged people is unable to use this system as there is mechanical stress and there the corona virus disease is a major problem in the future is a sudden liquid force coming from the sanitizer bottle.

The Easy Non-Contact Automatic coin based vending Sanitizer Dispenser; it has the PIC microcontroller to control the sanitizer liquid with the help of a Solenoid.

The mask and sanitizers provided anywhere to protect the people from spreading the virus and to kill the virus from the human hand. The virus is spreading from the human hand and mouth saliva. The mouth spread is controlled with the mask cloth and the human hand is controlled by the hand wash sanitizer. The hand touch while pressing the dispenser usage also spreads from human to human. There should be an automatic hand wash sanitizer dispenser, to control and maintain the spread from human to human.

1.2 EXISTING SYSTEMS

The patients were also given about 4.25-ounce containers of hand sanitizer alongside their beds. It also says that hand washing is important and also effective with proper hand washing steps, but washing with soap and water is time consuming for peak hours in hospitals. This seminar also showed the effectiveness of the alcohol-based hand sanitizers, which reduced infection rates by whopping 30%. In the seminar mainly says about the hospital grasped infections, which is about 2 Million Patients per year and That also says that it is 8 leading cause for deaths annually in USA. The paper says about the injection caused by drug resistant microorganisms which causes death rate and also complications, the multi drugs resistant pseudomonas aeruginosa MDRP which are very common worldwide. Several antibiotics have increasing multidrug bacteria isolation rate, even personal protection equipment (PPE) can't be left in isolation rate of MSRA. They used hand sanitizers with 60 to 70 percent ethanol or isopropanol for reducing significant number of pathogens.

Hence, they emphasis about the alcohol-based hand sanitizer since the alcohol-based hand sanitizer had negative association with MRSA isolation rate which, means that hand hygiene is very important in hospital. The seminar says about emergence of the normal corona virus (SARS-CoV-2) which has causes unexpected challenge to health of the people of this world.

1.3 PROPOSED SYSTEM

The main motive of this project is to design a low-cost effective vending machine, which can provide liquid Sanitizer dispenser. The most important component of vending machine is the detection of the coin that accepts and determines the value of inserted coin. This is a microcontroller-based vending machine. It mainly consists of 3 parts, the first part is coin insertion, second is coin detection that is basically programming which is implemented through microcontroller and the last stage is giving out the product according to the amount inserted. The purpose of this paper and project is to make a vending machine which can provide a sanitizer for hand wash at an outlet and also make it user-friendly.

The principle is simple: Now days the way of spreading corona virus so difficult for human life, need to prevent from corona the only option is wearing the mask and washing hands in sanitizer.

In this project, a prototype is developed using mild steel for the mechanical structure, where pic Microcontroller is utilized as the main controller. In addition, the prototype includes a coin acceptor which is program to accept only all type of 1 rupee as payment per product. The prototype is design to dispense sanitizer. The experimental results show that the system performance is good with coin recognition accuracy up to 95%, and dispensing accuracy up to 99%. In conclusion, the proposed design shows good performance as well as low power consumption compared to conventional vending machine of similar features.

1.4 VENDING MACHINES IN INDIA

Vending machines are not very common in India and are usually found only in major cities or along some national highways. Seaga India, a 100% subsidiary of the Seaga Group of USA, is the pioneer for bringing the concept of vending machines to India. Seaga India's machines are being used by the Delhi Metro, the state government, IT parks, factories, BPO, etc... Vending machines are used to sell snacks, beverages, condoms, public transit tickets, jewellery, and change for currency notes. Several reasons have been attributed to the lack of success of vending machines in India. The availability of cheap labour makes operating stores or kiosks economical; customers lack of technical knowledge and feel uneasy using vending machines; a lack of machines that accept a wide variety of payment methods; vandalism, rough use, and poor maintenance of the machines. However, vending machines are relatively new in India and analysts believe that usage will rise.

1.5 BLOCK DIAGRAM

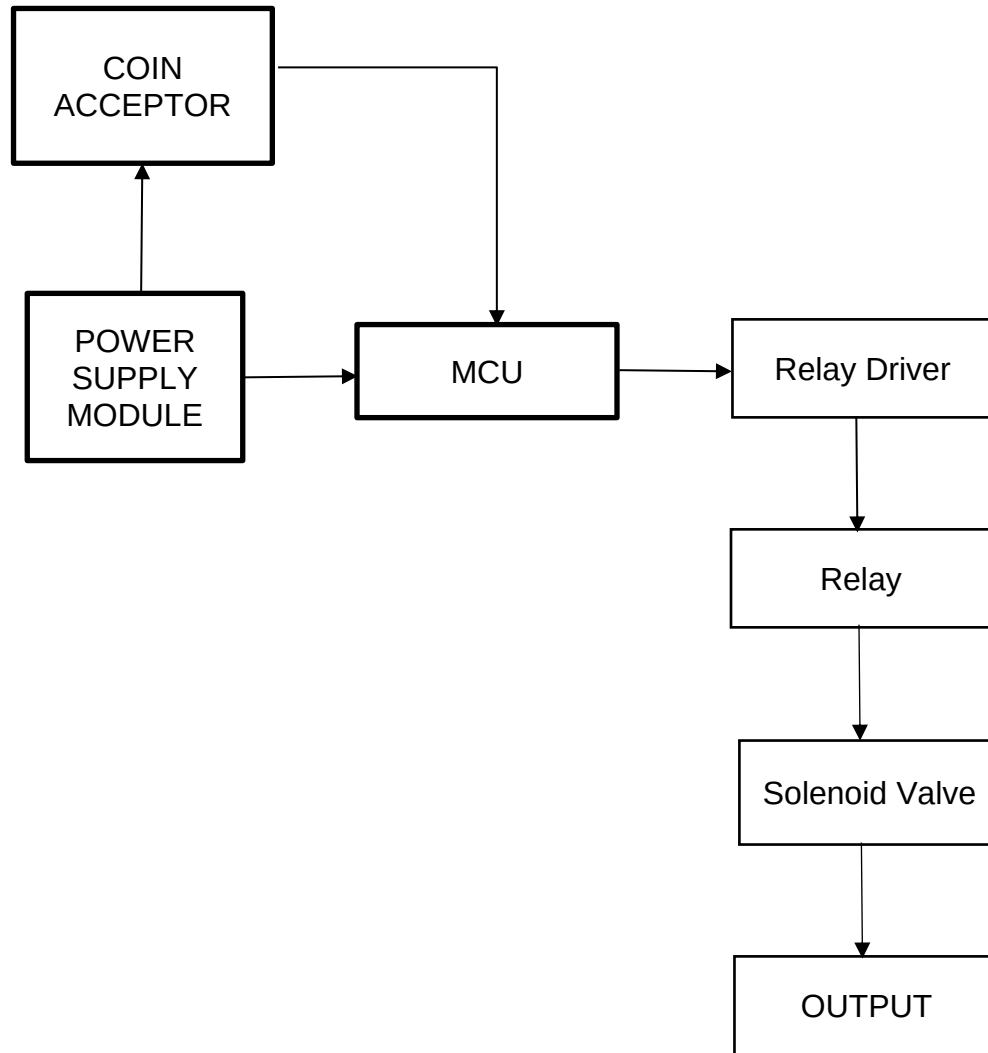


Fig:1.1: Block Diagram

The machine will accept one rupee coin. There is a slot for coin, which is connected to the microcontroller. User Interface is used for coin dispense and product dispense. Relay is used to control the Solenoid valve for product dispatch. The program is written on PIC16F877A micro controller and downloaded using PICKIT2 software for selecting product, coin checking and controlling of relay for product dispense. After supplying the AC voltage, the rectifier converts it into DC voltage and the voltage regulator is used for smooth voltage of a particular value. After the coin is inserted a pulse is received at the microcontroller which is already being supplied with a fixed DC voltage, the microcontroller then drives the relay through relay driver and the relay drives the Solenoid.

1.6 OPERATION

1.6.1 COIN DETECTION

When a 1-rupee coin is entered into the vending machine, the coin sensor will scan the coin and checks its authenticity by checking its diameter, thickness and fall-time. If the coin is authentic then the coin detector will accept the coin, but if coin is different from that which is been trained, then it will be returned back to the customer.

1.6.2 CIRCUIT DIAGRAM

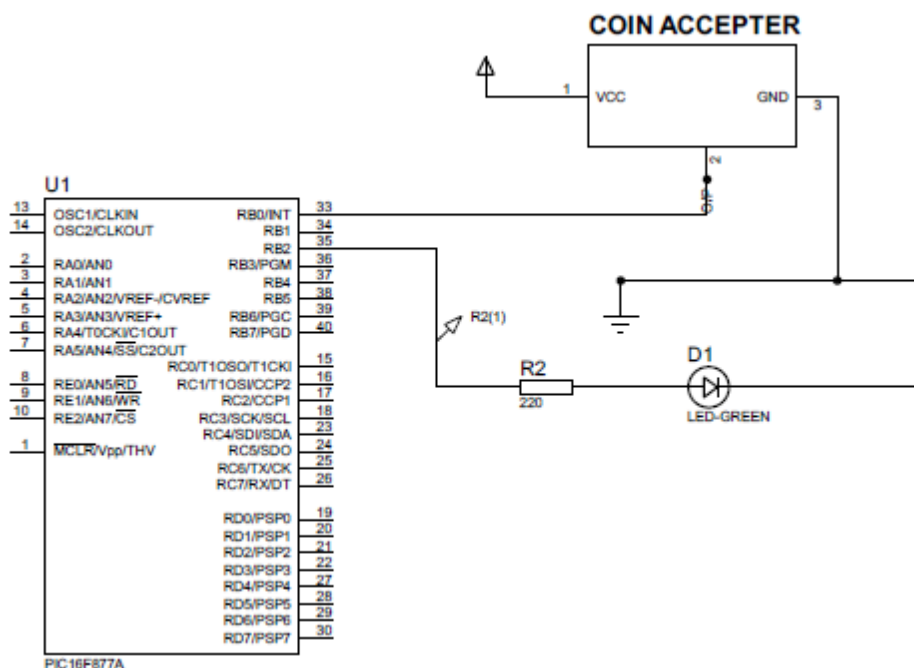


Fig:1.2: Circuit Diagram

From the main supply the AC voltage is continuously supplied to the vending machine. There is a diode rectifier in the circuit, which converts the AC voltage into DC, and this voltage is supplied to a voltage regulator (7805 IC) through an electrolytic capacitor present at the rectifier. The capacitor stores some voltage and provides the smooth voltage to the regulator. The regulator converts the voltage supplied to a constant voltage of 5V. An LED is present in the circuit to indicate the working, with a resistor to drop the voltage because an LED needs very less voltage to operate. Port B 0th pin connected to the input from the output of Coin

Acceptor. Port B 2nd pin Connected to the Relay driver for activating solenoid Value for output. The relay switch acts as a driver and a protector. The 12V generated at the voltage regulator is then supplied to the common of the relay, which is used to drive the Solenoid valve required. When the product required is selected and the coin is inserted and if accepted by the coin collector a pulse is given to the controller and the respective relay is driven which in-turn on the Solenoid attached to it. The solenoid makes flow of sanitizer to outlet valve.

1.7 RESULT

Various kinds of 1-rupee coin were trained in the coin box and following results were recorded of these different kinds of 1-rupee coins by testing them on the vending machine and this table produces information of, for how many insertions of the coin, the coin was accepted which is also showed in terms of its efficiency.

Table 1.1: Efficiency of Coin Used

COIN	Number of Times Coin Tested	Number of Times Coin Accepted	Efficiency
	20	20	100%
	20	19	95%
	20	20	100%

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE REVIEW

In the nineteenth century, the first vending machine to be successfully commercialized by Thomas Adams was used for the sale of their chewing gum in underground stations of New York. Only in 1902 the first company of vending machines emerged, Horn & Hardart Baking Company in Philadelphia. In turn, the Committee Definitions of the American Marketing Association define vending machines as “retail sales of products or services by operating machines that are used by end consumers” (STEIN, 1964).

Market developed via automatic vending machines has grown quickly since it is convenient, faster and cheaper (KIM, YOO, 2012). According to history, the coffee vending machines emerged in the 50s since profits decreased and managers needed to reduce costs. They concluded that could save money by using coffee automatic machines (STEIN 1964). The vending machine also had an important role in the new economy of America, being a generator of Employment (WEEK, 1999; Apud LEE, 2003). Yet there is some vulnerability in this kind of business. When the economy is in recession, sales of this business also decreased (LEE, 2003). For example, the consumption of products from vending machines decreased by 5% in 2001 due to the economic downturn (National Automatic Merchandising Association, 2002; Apud LEE, 2003). Nowadays, vending services include a large number of products such as coffee, drinks, snacks, books, toys and other products located in stations, schools, universities, companies and hospitals (KIM, YOO 2012). However, STEIN (1964) pointed out a limitation, clearly stating that is not possible to serve a “full meal” in a vending machine.

Vending machines were developed further, which led to a focus on installation, training and / or existence of effective instruction, maintenance and repair, being essential to achieve customer needs and satisfaction in different markets.

Services firms acquired vending machine to self-service businesses. However, these machines are a complex mix of mechanical and electronic technologies, security and display. Due to the wear and tear of a number of components, maintenance and repair are required. In these terminals, communication channels (links, machine to machine) may exist via modem to a central computer showing performance data, sales activities and stock levels in the chain of vending machines. With the updating of these channels of communication in services, companies of vending machines had good management practices reflected in a maintenance management and in an efficient and effective supply planning in record time. If there is a problem, the customer may contact the vending company and a compensation will be given. In order to achieve a better services quality, vending machine services companies normally have a department that is responsible for repairing any identified damage. All repairs are carried out in the place where the machine is located. Technicians make regular visits to carry out periodic inspections and preventive maintenance during times that do not have to make repairs (KIM, YOO, 2012). According to the authors, KIM and YOO (2012), vending machines can be distinguished by two types of failure mechanisms. The mechanism I group which includes transaction currency, delivery mechanism(s) of product(s) -, and the mechanism II group - which includes the electronic part. According to statistics, most faults relate to this group. The group of mechanisms II are related with the engine cooler in the case of ice creams or beverages refrigerator vending machines. This mechanism includes the compressor, control of ice and refrigerant charge. For this group, the repair mechanisms are necessarily more expensive because of technical resources as well as heavier equipment needed. According to different breakdowns of the two groups of mechanisms I and II, it is important to distinguish two types of technicians

for the manpower planning and repair process to be effective. After contact with the technicians, they move to repair the mechanisms of group I. If the detected failure is part of the mechanisms of group II, they contact colleagues to conduct the visit and repair. The probability of failure decreases and vending machines in the near future may witness a reduction of costs and an increased level of customer satisfaction (KIM, YOO, 2012).

Vending machine market in India is still at a nascent stage and is expected to witness dynamic growth in the near future. The market will be boosted by the increasing consumerism coupled with changing lifestyle, resulting in increased demand for vending machines. A market analysis studies the attractiveness and the dynamics of a special market within a special industry. In most of the developed countries the vending machines are situated at public places. These machines dispense the snacks, cold drinks, coffee, tea, etc. to the people. Also, in developing countries the vending machines are used to provide these things. The invention of coin operated vending machine is done in London. Initially it was used to dispense the post cards. As time passes the vending machines become much popular because of its numerous advantages. Coin operated vending machines are most popular in all the vending machines. The customer is able to get required quantity of product by inserting coins in vending machine through coin discriminator. The basic idea of proposed system is originated from these existing systems. Majorly we are developing a system in container which is set to provide sanitizers to the customer. Sanitizers had become the most commercial products of the century. This may sound bizarre, but true. The stress on sanitizing is a result of many factors. On the one hand, the rapidly rising population and changing lifestyles. It is highly important to sanitize ourselves and it is one priority before any other work. Our project aims on satisfying the public with its need for sanitizing at any random places like bus stops, shopping centres or even street side by designing and fabricating a **“Coin Operated Portable Sanitizing Vending Machine”**.

CHAPTER 3

AIM, OBJECTIVES AND METHODOLOGY

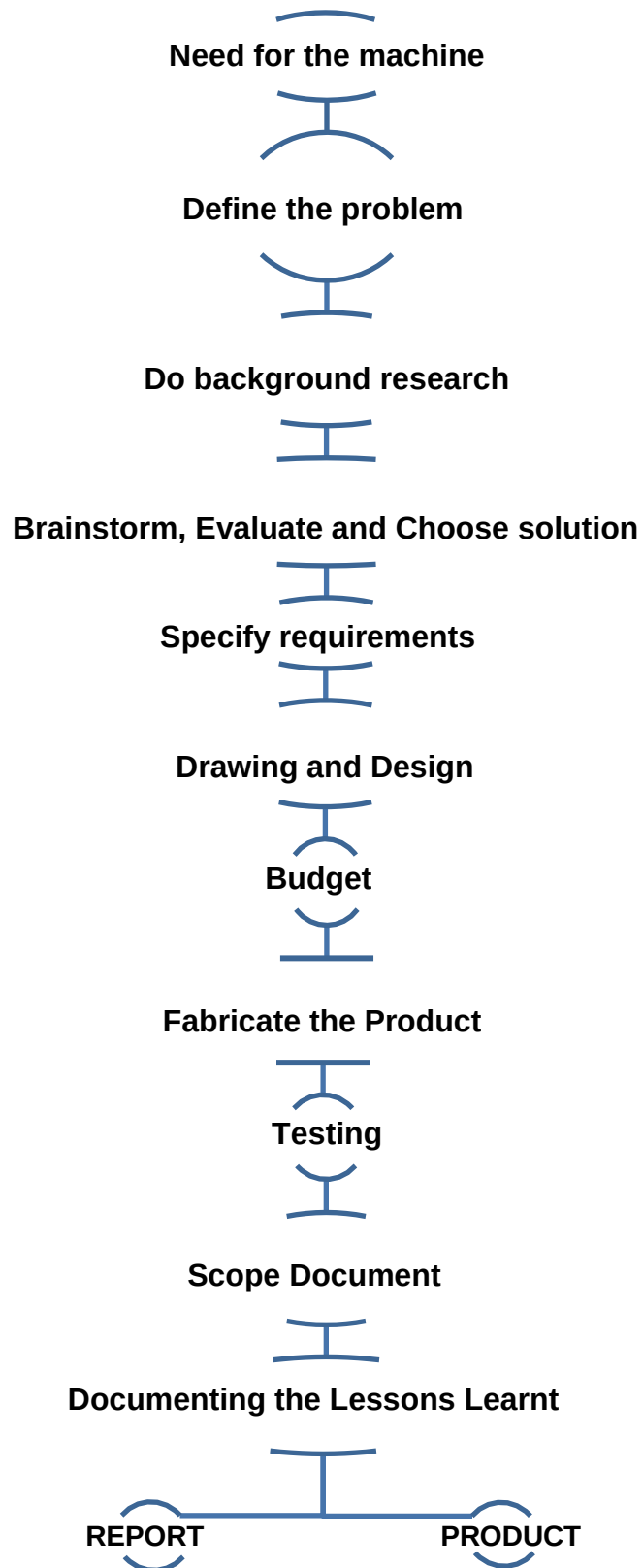
3.1 AIM

On the basis of we found that the present coin operated vending machines are huge and occupy more space and cannot be utilized in all the required places. Hence, we choose our project and its titled as 'Design and Fabrication of Coin Operated Portable Sanitizer Vending Machine'.

3.2 PROJECT OBJECTIVES

1. To provide sanitizing.
2. To provide economical cost.
3. To develop modelling and simulation.
4. To design and fabricate a portable machine using simple techniques.
5. To adopt simple design mechanism that can be easily maintained.
6. To make use of existing sanitizing cans as refills for vending machine.
7. To encourage local Entrepreneurs.
8. To extend sanitizing facility for common public.

3.3 METHODOLOGY



CHAPTER 4

TYPES OF VENDING MACHINE

4.1 COFFEE VENDING MACHINE



Fig:4.1: Coffee vending machine

PRODUCT DESCRIPTION:

It's a unique entity in the industry, actively committed towards offering an optimum quality range of Automatic Coffee Vending Machine. In accordance with the set industry standards, this machine is manufactured by skilled professionals using high grade components and latest technology. Owing to its smooth operation and long service life, the offered machine is highly demanded among clients. Moreover, to ensure optimum performance, this machine is stringently tested by quality experts on various quality parameters. This machine gives coffee when inserted coin. Price of this vending machine: ₹1 LAKH

4.2 MILK VENDING MACHINE



Fig:4.2: Milk vending machine

PRODUCT DESCRIPTION:

Automatic Milk Vending Machine, which is developed by accomplished professionals who employ the industry-accepted material and superior techniques. These products are existing in the market in numerous specifications that meet on clientele demand. In addition, quality checkers also examine these products in order to offer fault-free series to the clientele. Features: Easy installation Hassle free operation Temperature Resistance Descriptions: SS 304 Construction Refrigerated tank for maintaining the temperature at 4 C. Single delivery with SS float balance tank 20 liters. Float balance tank fitted with 3 port valve and 500 ml beaker used as an extension to main tank. Electronic push button /remote control operated panel with separate buttons for dispensing 250 ml, 500 ml and 1000 ml Optional buttons are available on request for bulk sale of 2000 ml and 4000 ml. Multiple Vending Options Operation: Manual & with Remote Battery Backup 2X16 Character crystal display with light Wheels/fix type arrangement

4.3 SNACK VENDING MACHINE

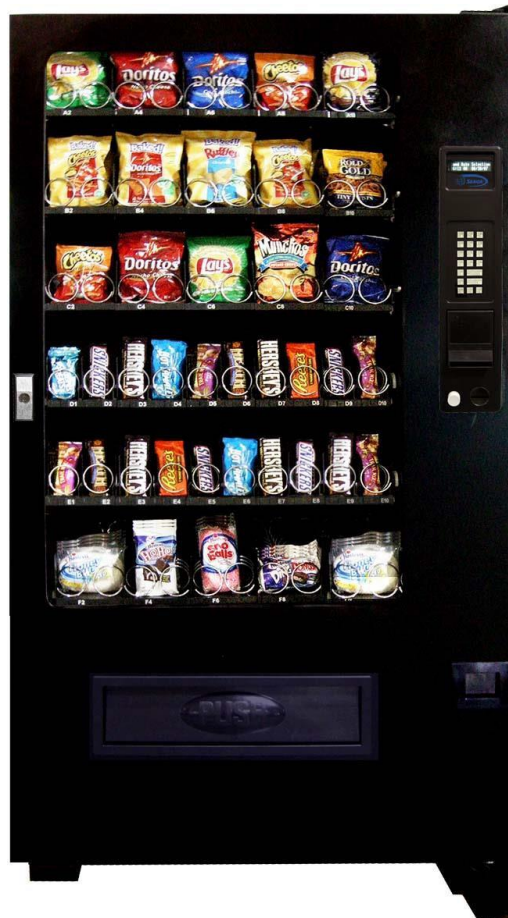


Fig:4.3: Snack vending machine

PRODUCT DESCRIPTION:

To meet variegated demands of clients, they are engaged in manufacturing, exporting and supplying an exclusive range of Automatic Snack Vending Machine. Specifications: (Dimensions H X W X D mm): 1845 X 810 X 905 Axial levering Port at optimum setting (Weight: 275 Kg). Electrical: 230 V. 50 Hz. 0.12 Amps. Selections: 26 as standard, 42 maximum Factory Configuration: 9 Snacks. 10 small sized Snacks. 7 Candy. 200- 400 ferns Styling: Clam Front Application: Suitable for Potato Chips, Cheese Puffs and Crackers. Cookies, Cupcakes and Biscuits. Partition and Height Product Vend Sensor Fast and Easy Product Loading. Price = ₹2.75 lakhs

4.4 COIN OPERATED WATER VENDING MACHINE



Fig:4.4: Water Vending Machine

PRODUCT DESCRIPTION:

Item: Water ATM/Purified Water Vending Machine
Water Source: Municipal Tap Water/Raw Water Power Supply: AC220V 50Hz / AC110V 60Hz. Production Capacity (GPD): 400,600,800,1300,1600 and 3000
Water Tank Capacity: 200L UV Power: 20w Ozone Capacity: 1000mg Filling Flow Rate: 8L/min Size of Filling Bottle: 200ml,500ml,1L,2L,20Ltr. Filtration Step: 9 Steps
Size: L80cmxW68cmxH200cm Packing: Carton for FCL or Poly Wood case for LCL
LCD Panel: 19inch for advertisement Technology: Pre-Filtration (German Technology) + Reverse Osmosis (RO)+Ultra Violet (UV) Technology +Ozonating
Price = ₹5 lakh.

4.5 SODA VENDING MACHINE



Fig:4.5: Soda vending machine

PRODUCT DESCRIPTION:

Soda vending Machine with high efficiency. Under the stern supervision of nimble professionals, the offered machine is developed using quality checked components and innovative technology. The provided machine is broadly used for making several types of beverages and cold drinks in bars, restaurants, clubs and many other places. Moreover, the offered soda machine is obtainable for our patrons at pocket friendly rates.

Features:

- Superior quality
- Fine finishing
- Reliable

Approximate Price = ₹1.6 Lakh

CHAPTER 5

DESIGN, MODELLING AND RENDERING

5.1 2d DRAFT

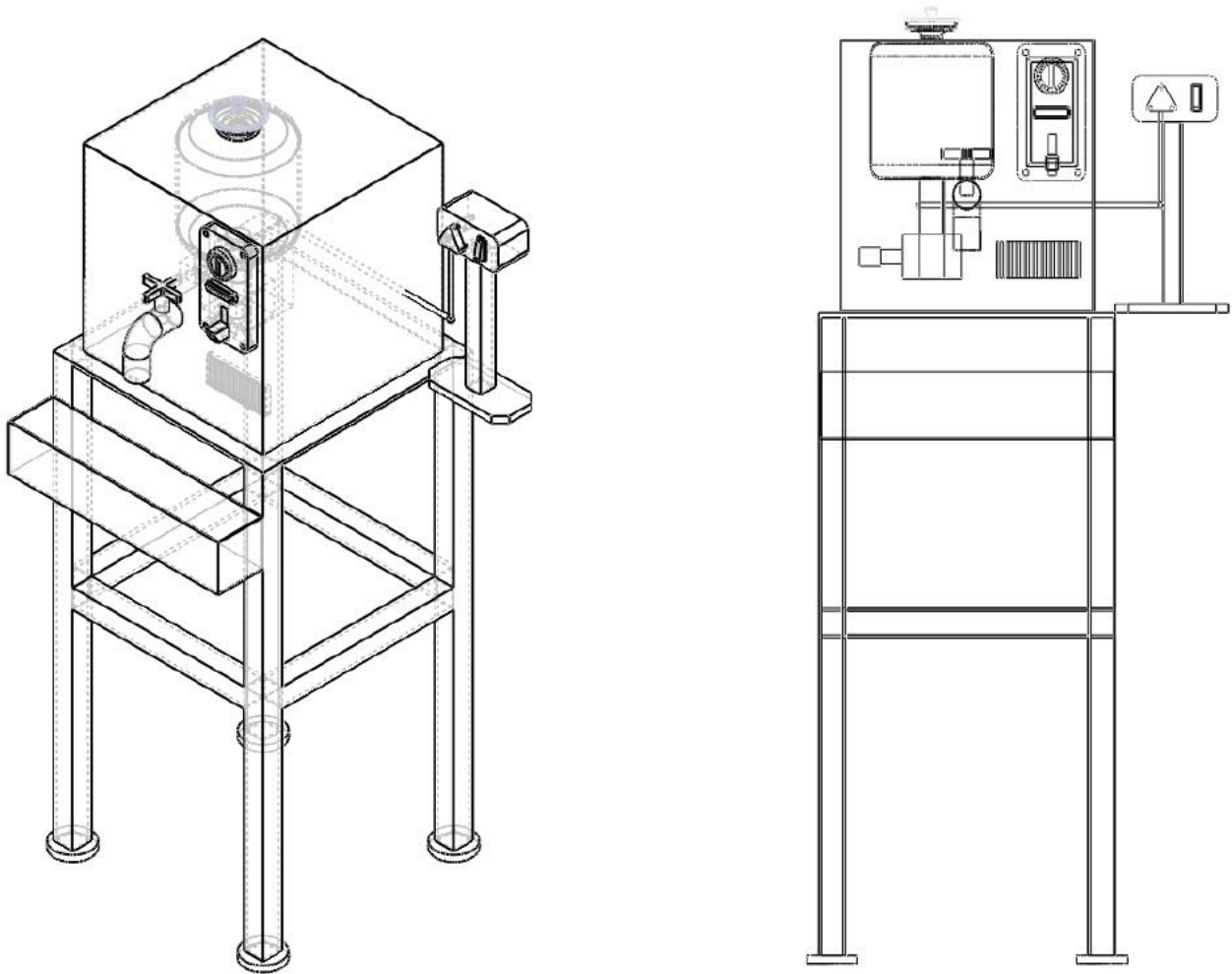


Fig:5.1: Isometric View and Front View

5.2 3d DRAFT

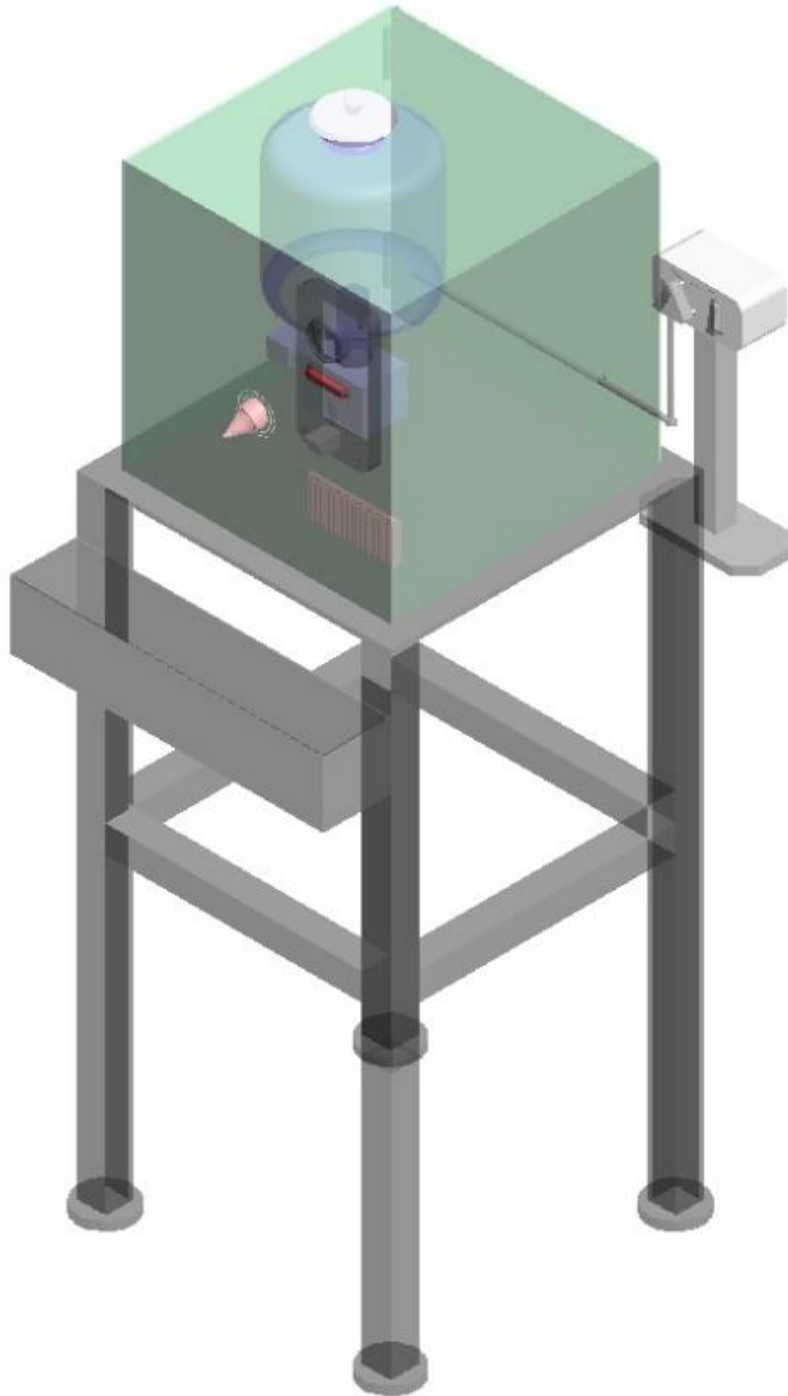


Fig:5.2: Perspective View

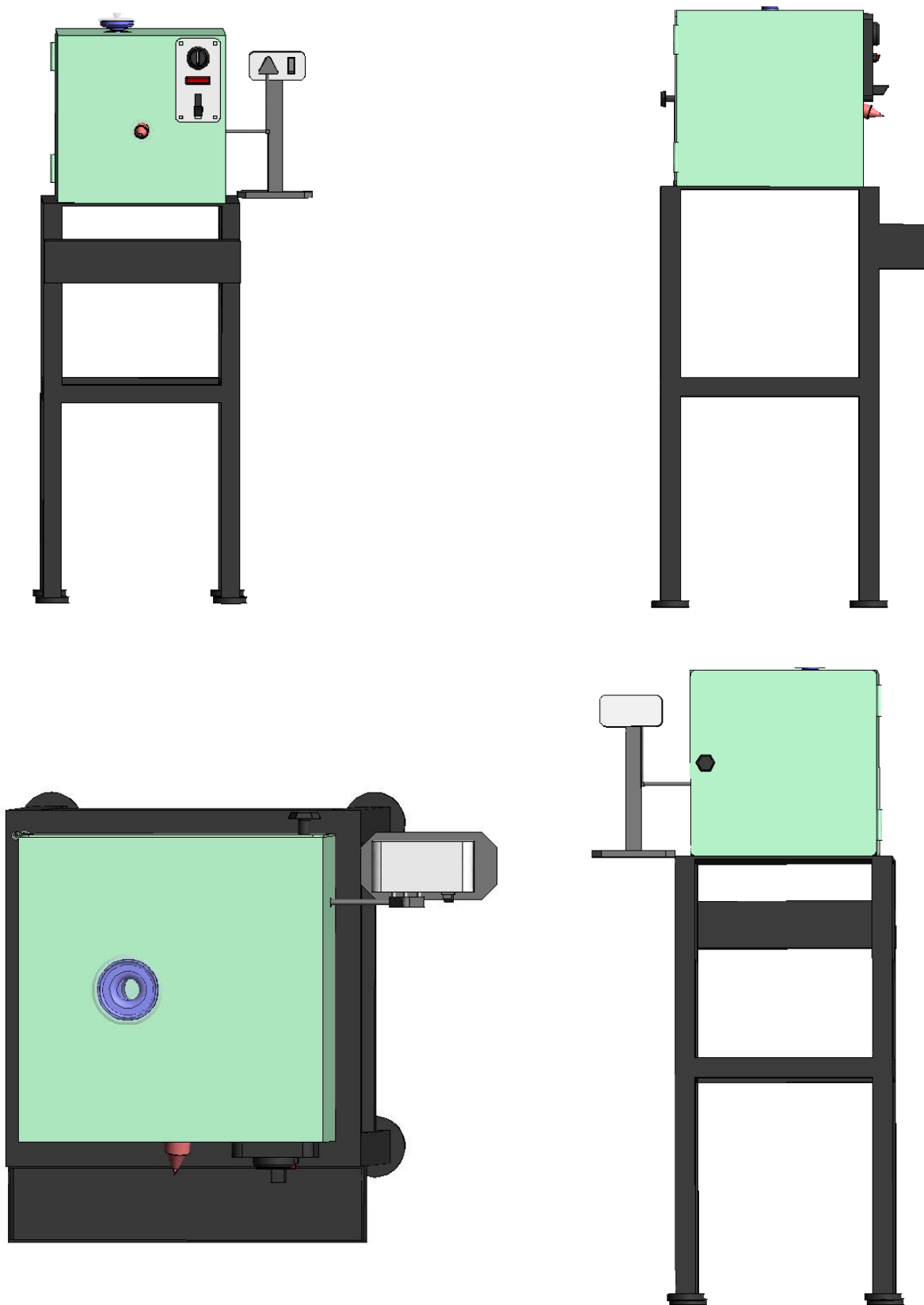


Fig:5.3: Front View, Side View, Top View and Back View

5.3 RENDERING



Fig:5.4: Rendering with Suitable Background

CHAPTER 6

FABRICATION

6.1 ELECTRONIC COMPONENTS

6.1.1 Coin Acceptor – DG600F



Fig:6.1: Coin Acceptor – DG600F

DG600F Series of coin acceptor is an electronic coin acceptor with high reliability, which is widely used in amusement facilities, vending machines and so on.

a) Main Features :

- Enable to recognize 6 groups of coins in different denomination.
- Enable to forbid accepting all coins.
- Industrial standard connector ---10Pin Parallel port.
- Special connector ---5Pin Serial port.
- Enable to release coins in jam.

- Enable to self-diagnose.

b) Specification :

- Coin Size

Diameter : 17 – 30.5mm

Thickness : 1.25 – 3.2mm

- Working Environment

Working Temperature : 0°C to 50°C

Storage Temperature : -30°C to 55°C

Ambient Humidity : Up to 95% RH non-condensing

Working Voltage : Normal 12VDC (Min 10VDC - Max 15VDC)

Working Current : Standby 50mA Max 450mA (At the instant of collecting coin)

Communication Interface Standard parallel port -- 10Pin

Special serial port -- 5Pin

Installation Position : On any plane, the angle can't be more than 2 degrees between coin acceptor and vertical

6.1.2 Relay

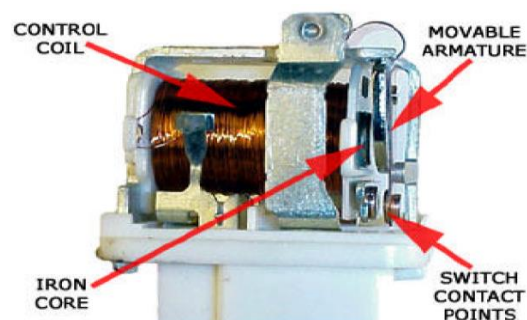


Fig:6.2: Relay

Relays are simple switches which are operated both electrically and

mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones. They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination.

6.1.3 Relay Design

There are only four main parts in a relay. They are

- Electromagnet
- Movable Armature
- Switch point contacts
- Spring

It is an electro-magnetic relay with a wire coil, surrounded by an iron core. A path of very low reluctance for the magnetic flux is provided for the movable armature and also the switch point contacts. The movable armature is connected to the yoke which is mechanically connected to the switch point contacts. These parts are safely held with the help of a spring. The spring is used so as to produce an air gap in the circuit when the relay becomes de-energized.

6.1.4 Working of Relay

The working of a relay can be better understood by explaining the following diagram given below.

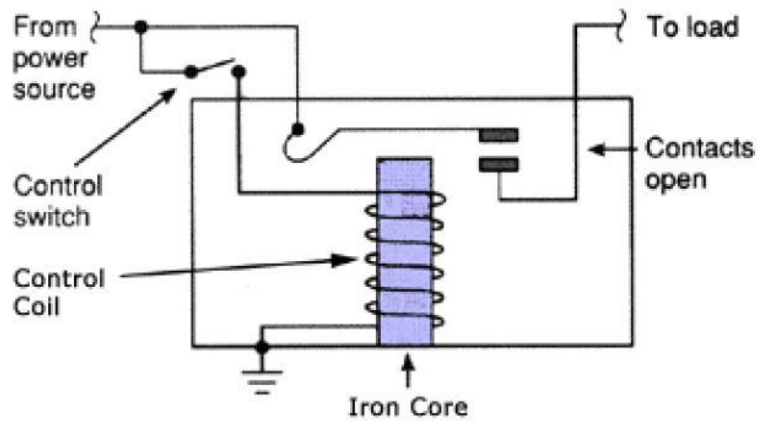


Fig:6.3: Working of Relay

An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus, the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit.

As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity.

In simple, when a voltage is applied to pin 1, the electromagnet activates, causing a magnetic field to be developed, which goes on to close the pins 2 and 4 causing a closed circuit. When there is no voltage on pin 1, there will be no electromagnetic force and thus no magnetic field. Thus, the switches remain open.

6.1.5 Pole and Throw

Relays have the exact working of a switch. So, the same concept is also applied. A relay is said to switch one or more poles. Each pole has contacts that can be thrown in mainly three ways. They are

- **Normally Open Contact (NO)** – NO contact is also called a make contact. It closes the circuit when the relay is activated. It disconnects the circuit when the relay is inactive.

- **Normally Closed Contact (NC)** – NC contact is also known as break contact. This is opposite to the NO contact. When the relay is activated, the circuit disconnects. When the relay is deactivated, the circuit connects.
- **Change-over (CO) / Double-throw (DT) Contacts** – This type of contacts is used to control two types of circuits. They are used to control a NO contact and also a NC contact with a common terminal. According to their type they are called by the names break before make and make before break contacts.

6.1.6 Relay Applications

- Relays are used to realize logic functions. They play a very important role in providing safety critical logic.
- Relays are used to provide time delay functions. They are used to time the delay open and delay close of contacts.
- Relays are used to control high voltage circuits with the help of low voltage signals. Similarly, they are used to control high current circuits with the help of low current signals.
- They are also used as protective relays. By this function all the faults during transmission and reception can be detected and isolated.

6.1.7 Relay Interfacing with Drivers

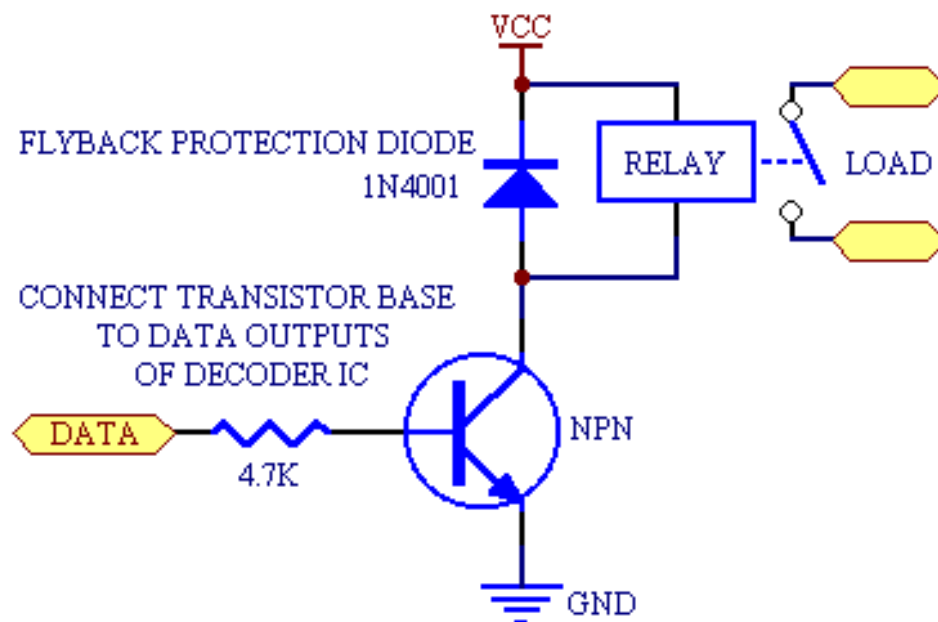


Fig:6.4: Relay Interfacing with Driver

6.1.8 Solenoid Valve



Fig:6.5: Solenoid Valve

RO Water Filter System Shut off Solenoid Valve 12- 24V, 1/4" valve Normally Close orifice opens when electrically energized. It is 24v DC and is designed to work within 0 – 120 PSI. The switch is "Normally closed". (Automatic flush and shut -off, auto power cut -off when filling, extends pump duration) when you connect it with high pressure switch. It shuts off the liquid flow when they got trigger pulse. Normally controlled in the RO system by the booster pump High pressure switch.

6.1.9 Technical Specifications of Solenoid Valve

Medium: Water, Air, Vacuum

- Temperature: 0÷100°C
- Function type: Normally Closed(N/C)
- Mode of action: Direct acting type
- Body material: PP + Fiberglass
- Sealing material: EPDM
- Protection class: IP54

6.2 COMPONENTS USED IN THE BLOCK

6.2.1 Circuit Diagram

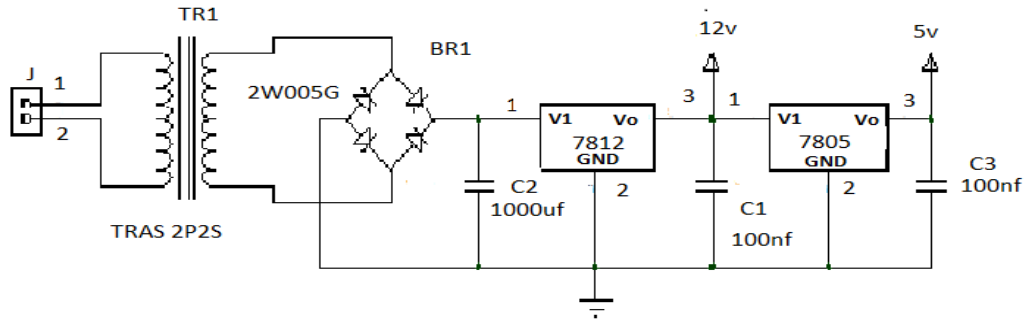


Fig:6.6: Power Supply Diagram

6.2.2 Description

- All the electronic components starting from diode to IC's only work with a DC supply ranging from $_+5v$ to $_+12$
- we are utilizing for the same, the cheapest and commonly available energy source of 230v-50Hz and stepping down, rectifying, filtering and regulating the voltage

6.2.3 Step-Down Transformer

When AC is applied to the primary winding of the power transformer it can either be stepped down or up depending on the value of DC needed.

In our circuit the transformer of 230v/15-0-15v is used to perform the step-down operation where a 230V AC appears as 15V AC across the secondary winding. The current rating of the transformer used in our project is 2A.

6.2.4 Rectifier Unit

The voltage regulators play an important role in any power supply unit. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device.

Power supplies without regulators have an inherent problem of changing DC voltage values due to variations in the load or due to fluctuations in the AC liner voltage.

6.2.5 Filtering Unit

Filter circuit which is usually capacitor acting as a surge arrester always follow the rectifier unit.

This capacitor is also called as a decoupling capacitor or a bypassing capacitor, is used not only to 'short' the ripple with frequency of 120Hz to ground but also to leave the frequency of the DC to appear at the output.

6.2.6 Voltage Regulator

The voltage regulators play an important role in any power supply unit. The primary purpose of a regulator is to aid the rectifier and filter circuit in providing a constant DC voltage to the device.

Power supplies without regulators have an inherent problem of changing DC voltage values due to variations in the load or due to fluctuations in the AC liner voltage.

With a regulator connected to the DC output, the voltage can be maintained within a close tolerant region of the desired output. IC7812 and 7805is used in this project for providing 12V and 5V DC supply.

6.3 PIC16F877A



Fig:6.7: PIC16F877A

6.3.1 PIC Description:

A PIC microcontroller is a processor with built in memory and RAM and you can use it to control, it saves you building a circuit that has separate external RAM, ROM and peripheral chips. The 40 pins make it easier to use the peripherals as the functions are spread out over the pins.

It is generally thought that PIC stands for Peripheral Interface Controller, although General Instruments' original acronym for the initial PIC1640 and PIC1650 devices was "Programmable Interface Controller" The acronym was quickly replaced with "Programmable Intelligent Computer"

PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

The Microchip 16C84 (PIC16x84), introduced in 1993 was the first microchip CPU with on-chip EEPROM memory. This electrically erasable memory made it cost less than CPUs that required quartz "erase window" for erasing EPROM. PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller"

6.3.2 Pin Diagram

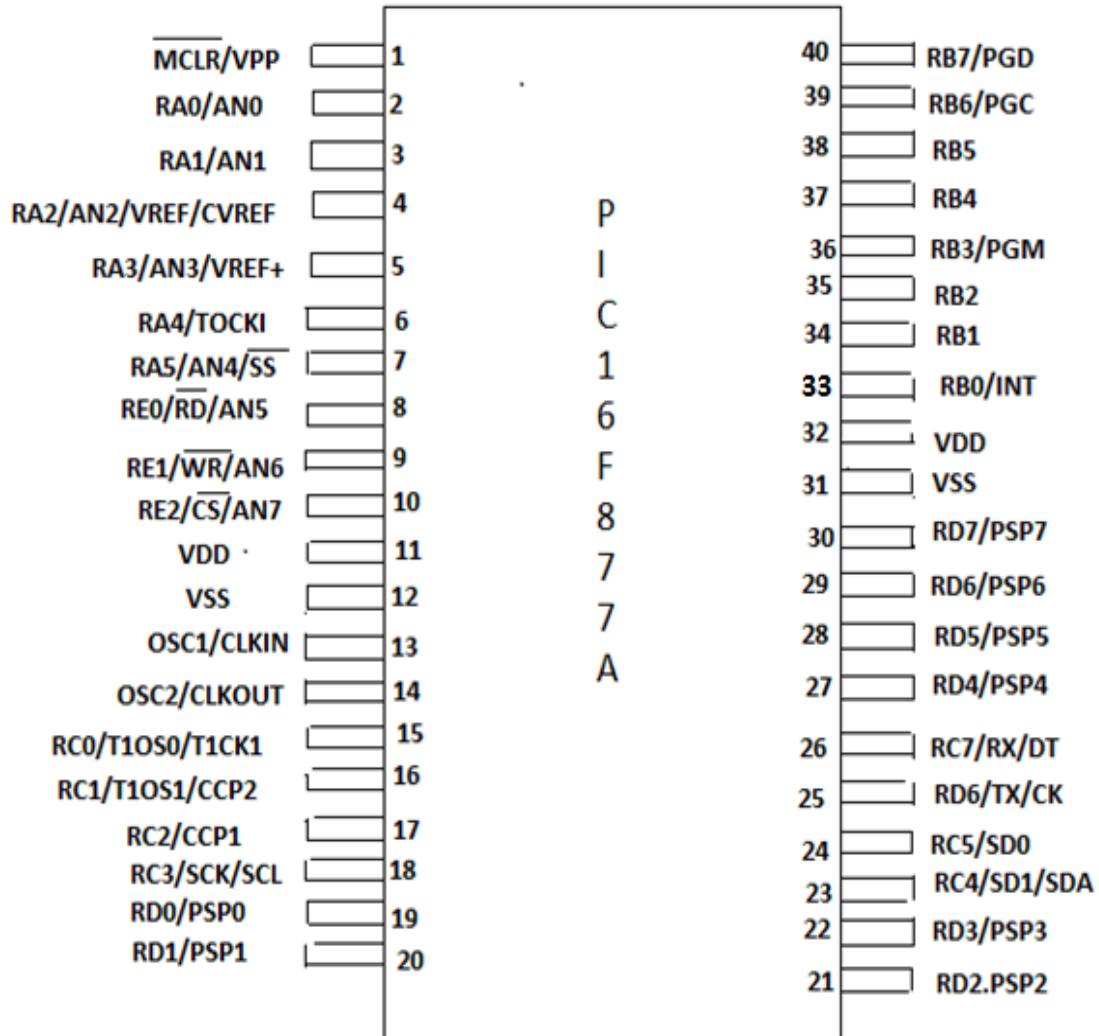


Fig:6.8: Pin Diagram

6.3.3 Pin Description

Table 6.1 : Pin Description 1

Pin name	PDIP Pin#	PLCC Pin#	TQFP Pin#	QFN Pin#	I/O/P Type	Buffer type	Description
OSC1/CLK1	13	14	30	32		ST/CMOS ⁽⁴⁾	Oscillator crystal or external clock input

OSC1					I		Oscillator crystal or external clock source input. ST buffer when configured in RC mode; otherwise, CMOS
CLK1					I		Ext clock source input. always associated with pin function OSC1(see OSC 1/CLK1, OSC2/CLK0pins)
OSC2/CLK0	14	15	31	33		-	Oscillator crystal or clock output
OSC2					O		Oscillator crystal output Connects to crystal or resonator in crystal OSC mode
CLK0					O		In RC mode, OSC2 pin outputs CLK0, which has $\frac{1}{4}$ frequency OSC1&denotes the instruction cycle rate
MCLR/VPP	1	2	18	18		ST	Master clear(input)or programming voltage(output)
$\overline{\text{MCLR}}$					I		Master clear (reset) input. This pin is an active low reset to the device

VPP					P		Programming voltage input
RA1/AN1 RA1 AN1	3	4	20	20	I/O I	TTL	Digital I/O Analog input 1
RA2/AN2/ V _{REF-} /CV _{REF} RA2 AN2 V _{REF-} CV _{REF} RA3/AN3/ V _{REF+} RA3 AN3 V _{REF+}	4 5	5 6	21 22	21 22	I/O I I O I/O I I	TTL TTL	Digital I/O Analog input 2 A/D reference voltage (low)input. Comparator V _{REF} output Digital I/O Analog input 3 A/D reference voltage (high)input

RA4/T0CLKI/ C1OUT	6	7	23	23		ST	
RA4					I/O		Digital I/O –Open –drain when configured as output
T0CK1					I		Timer0 external clock input
C1OUT					O		Comparator output

							PORT B is a bidirectional I/O port. PORT b can be software programmed for internal weak pull-up on all inputs.
RB0/INT	33	36	8	9		TTL/ST ⁽¹⁾	
RB0					I/O		Digital I/O
INT					I		External interrupt
RB 1	34	37	9	10	I/O	TTL	Digital I/O
RB 2	35	38	10	11	I/O	TTL	Digital I/O
RB 3/PGM	36	39	11	12		TTL	
RB 3					I/O		Digital I/O
PGM					I		Low – voltage ICSP programming enable pin

RB 4	37	41	14	14	I/O	TTL	Digital I/O
RB 5	38	42	15	15	I/O	TTL	Digital I/O
RB 6/PGC	39	43	16	16		TTL/ST ⁽²⁾	
RB 6					I/O		Digital I/O
PGC					I		
RB 7/PGD	40	44	17	17		TTL/ST ⁽²⁾	In – circuit debugger and ICSP programming clock
RB 7					I/O		
PGD					I/O		Digital I/O In – circuit debugger and ICSP programming clock

Table : 6.2 Pin Decsription 2

Pin name	PDIP Pin#	PLCC Pin#	TQFP Pin#	QFN Pin#	I/O/P Type	Buffer type	Description
RD0/PSP0 RD0 PSP0	19	21	38	38	I/O I/O	ST/TTL ⁽³⁾	PORT D is a bidirectional I/O port or Parallel slave port when interfacing to a microprocessor bus. Digital I/O Parallel slave port data
RD1/PSP1 RD1 PSP1	20	22	39	39	I/O I/O	ST/TTL ⁽³⁾	Digital I/O Parallel slave port data
RD2/PSP2 RD2 PSP2	21	23	40	40	I/O I/O	ST/TTL ⁽³⁾	Digital I/O Parallel slave port data

RD3/PSP3	22	24	41	41		ST/TTL ⁽³⁾	Digital I/O Parallel slave port data
RD3					I/O		
PSP3					I/O		
RD4/PSP4	27	30	2	2		ST/TTL ⁽³⁾	Digital I/O Parallel slave port data
RD4					I/O		
PSP4					I/O		
RD5/PSP5	28	31	3	3		ST/TTL ⁽³⁾	Digital I/O Parallel slave port data
RD5					I/O		
PSP5					I/O		
RD6/PSP6	29	32	4	4		ST/TTL ⁽³⁾	Digital I/O Parallel slave port data
RD6					I/O		
PSP6					I/O		
RD7/PSP7	30	33	5	5		ST/TTL ⁽³⁾	Digital I/O Parallel slave port data
RD7					I/O		
PSP7					I/O		

							PORT E is a bidirectional I/O port
RE0/RD/AN5	8	9	25	25		ST/TTL ⁽³⁾	
RE0					I/O		Digital I/O
RD					I		Read control for parallel slave port
AN5					I		Analog input 5
RE1/RW/AN6	9	10	26	26		ST/TTL ⁽³⁾	
RE1					I/O		Digital I/O
RW					I		Write control for parallel slave port
AN6					I		Analog input 6
RECSRD/AN7	10	11	27	27		ST/TTL ⁽³⁾	
RE3					I/O		Digital I/O
CS					I		Chip select control for parallel slave port
AN7					I		Analog input 7
V _{SS}	12,31	13,34	6,29	6,30,31	P	-	Ground reference for logic and I/O pins
V _{DD}	11,32	12,34	7,28	7,8,28,29	P	-	Positive supply for logic and I/O pins
NC	-	1,17,	1,13,	13	-	-	These pins are not internally connected.

		28,40	33,34				These pins should be left unconnected.
--	--	-------	-------	--	--	--	---

Legend: **I** = Input **O** = Output **I/O** = Input/Output **P** = Power

_ = Not used **TTL** = TTL Input **ST** = Schmitt trigger input

6.3.4 Features

- Operating speed: 20 MHz, 200 ns instruction cycle
- Operating voltage: 4.0-5.5V
- Industrial temperature range (-40° to +85°C)
- 15 Interrupt Sources
- 35 single-word instructions
- All single-cycle instructions except for program branches (two-cycle)

6.3.5 Special Microcontroller Features

- Flash Memory: 14.3 Kbytes (8192 words)
- Data SRAM: 368 bytes
- Data EEPROM: 256 bytes
- Self-reprogrammable under software control
- In-Circuit Serial Programming via two pins (5V)
- Watchdog Timer with on-chip RC oscillator
- Programmable code protection
- Power-saving Sleep mode
- Selectable oscillator options
- In-Circuit Debug via two pins

6.3.6 Peripheral Features

- 33 I/O pins; 5 I/O ports
- Timer0: 8-bit timer/counter with 8-bit pre scaler
- Timer1: 16-bit timer/counter with pre scaler
 - Can be incremented during Sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, pre scaler and post scaler
- Two Capture, Compare, PWM modules
 - 16-bit Capture input; max resolution 12.5 ns
 - 16-bit Compare; max resolution 200 ns
 - 10-bit PWM
- Synchronous Serial Port with two modes:
 - SPI Master
 - I2C Master and Slave
- USART/SCI with 9-bit address detection
- Parallel Slave Port (PSP)
 - 8 bits wide with external RD, WR and CS controls
- Brown-out detection circuitry for Brown-Out Reset

6.3.7 Analog Features

- 10-bit, 8-channel A/D Converter
- Brown-Out Reset
- Analog Comparator module
 - 2 analog comparators
 - Programmable on-chip voltage reference module
 - Programmable input multiplexing from device inputs and internal VREF
 - Comparator outputs are externally accessible

6.3.8 PIC Features:

Table 6.3: PIC Features

PIC microcontroller Feature	PIC microcontroller feature description
Flash memory	Re-programmable program storage.
RAM	Memory storage for variables.
EEPROM	Long term stable memory: Electrically Erasable Programmable Read Only Memory.
I/O ports	High current Input/output ports (with pin direction change).
Timers/Counters	Typically, 3.
USART	Built in RS232 protocol (only needs level translator chip).
CCP	Capture/Compare/PWM module.
SSP	I2C and SPI Interfaces.
Comparator	An analogue comparator and internal voltage reference.
ADC	Analogue to digital converter.
PSP	Parallel Slave Port (for 8-bit microprocessor systems).
LCD	LCD interface.
Special features	ICSP, WDT, BOR, POR, PWRT, OST, SLEP
ICSP	Simple programming using In Circuit Serial Programming.

6.3.9 Advantages of PIC

The PIC architectures have these advantages:

- Small instruction set to learn
- RISC architecture
- Built in oscillator with selectable speeds
- Easy entry level, in circuit programming plus in circuit debugging PIC Kit units available from Microchip.com for less than \$50
- Inexpensive microcontrollers
- Wide range of interfaces including I²C, SPI, USB, USART, A/D, programmable comparators, PWM, LIN, CAN, PSP, and Ethernet

6.3.10 Limitations of PIC

The PIC architectures have these limitations:

- One accumulator
- Register-bank switching is required to access the entire RAM of many devices
- Operations and registers are not orthogonal; some instructions can address RAM and/or immediate constants, while others can only use the accumulator

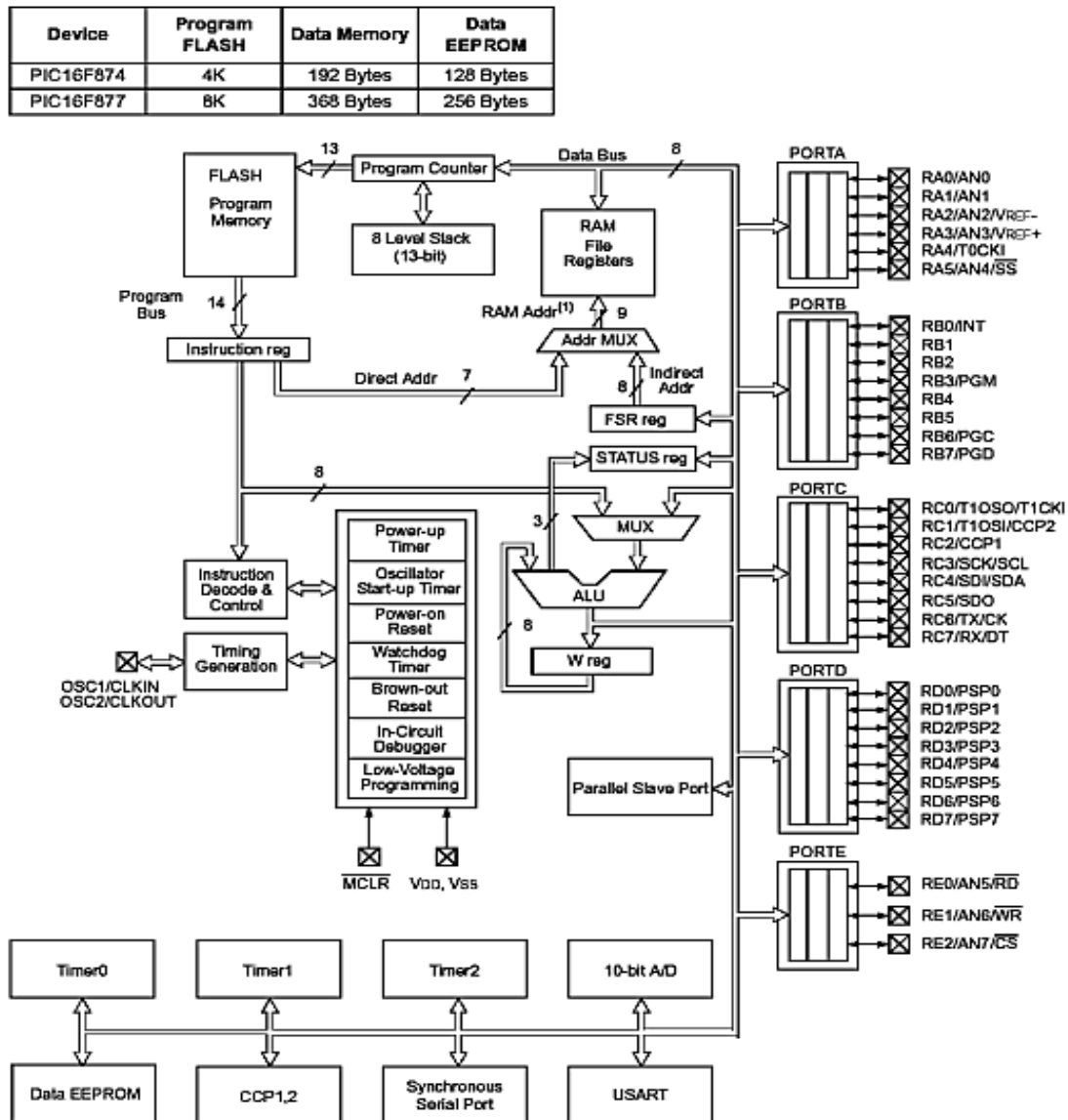
The following stack limitations have been addressed in the PIC18 series, but still apply to earlier cores:

- The hardware call stack is not addressable, so preemptive task switching cannot be implemented
- Software-implemented stacks are not efficient, so it is difficult to generate reentrant code and support local variables

With paged program memory, there are two-page sizes to worry about: one for CALL and GOTO and another for computed GOTO (typically used for table lookups). For example, on PIC16, CALL and GOTO have 11 bits of addressing, so the page size is 2048 instruction words. For computed GOTOs, where you add to PCL, the page size is 256 instruction words. In both cases, the upper address bits are provided by the PCLATH register. This register must be changed every

time control transfers between pages. PCLATH must also be preserved by any interrupt handle.

6.3.11 ARCHITECTURE OF PIC 16F877A



Note 1: Higher order bits are from the STATUS register.

Fig:6.9 Architecture of PIC 16F877A

6.3.12 Memory Organization of PIC16F877

The memory of a PIC 16F877 chip is divided into 3 sections. They are

1. Program memory
2. Data memory and
3. Data EEPROM

6.3.13 Program memory

Program memory contains the programs that are written by the user. The program counter (PC) executes these stored commands one by one. Usually, PIC16F877 devices have a 13-bit wide program counter that is capable of addressing $8K \times 14$ -bit program memory space. This memory is primarily used for storing the programs that are written (burned) to be used by the PIC. These devices also have $8K \times 14$ bits of flash memory that can be electrically erasable /reprogrammed. Each time we write a new program to the controller, we must delete the old one at that time. The figure below shows the program memory map and stack.

Program counters (PC) is used to keep the track of the program execution by holding the address of the current instruction. The counter is automatically incremented to the next instruction during the current instruction execution.

The PIC16F87XA family has an 8-level deep x 13-bit wide hardware stack. The stack space is not a part of either program or data space and the stack pointers are not readable or writable. In the PIC microcontrollers, this is a special block of RAM memory used only for this purpose.

Each time the main program execution starts at address 0000 – Reset Vector. The address 0004 is “reserved” for the “interrupt service routine” (ISR).

6.3.14 PIC16F87XA Data Memory Organization

The data memory of PIC16F877 is separated into multiple banks which contain the

general-purpose registers (GPR) and special function registers (SPR). According to the type of the microcontroller, these banks may vary. The PIC16F877 chip only has four banks (BANK 0, BANK 1, BANK 2, and BANK4). Each bank holds 128 bytes of addressable memory.

The banked arrangement is necessary because there are only 7 bits are available in the instruction word for the addressing of a register, which gives only 128 addresses. The selection of the banks is determined by control bits RP1, RP0 in the STATUS registers Together the RP1, RP0 and the specified 7 bits effectively form a 9 bit address. The first 32 locations of Banks 1 and 2, and the first 16 locations of Banks2 and 3 are reserved for the mapping of the Special Function Registers (SFR's).

Table 6.4: A bit of RP1 & RP0 of the STATUS register selects the bank access)

BANK	RP0	RP1
0	0	0
1	1	0
2	0	1
3	1	1

6.3.15 Data EEPROM and FLASH

The data EEPROM and Flash program memory is readable and writable during normal operation (over the full VDD range). This memory is not directly mapped in the register file space. Instead, it is indirectly addressed through the Special Function Registers. There are six SFRs used to read and write this memory:

- EECON1
- EECON2
- EEDATA
- EEDATH
- EEADR

- EEADRH

The EEPROM data memory allows single-byte read and writes. The Flash program memory allows single-word reads and four-word block writes. Program memory write operations automatically perform an erase-before write on blocks of four words. A byte write in data EEPROM memory automatically erases the location and writes the new data (erase-before-write). The write time is controlled by an on-chip timer. The write/erase voltages are generated by an on-chip charge pump, rated to operate over the voltage range of the device for byte or word operations.

6.4 OSCILLATOR & CLOCK:

Pin was named as OSC1 and OSC2. It can be connected to the crystal oscillator from various frequencies. Pulse generated from the oscillator will some time have the noise. To reduce

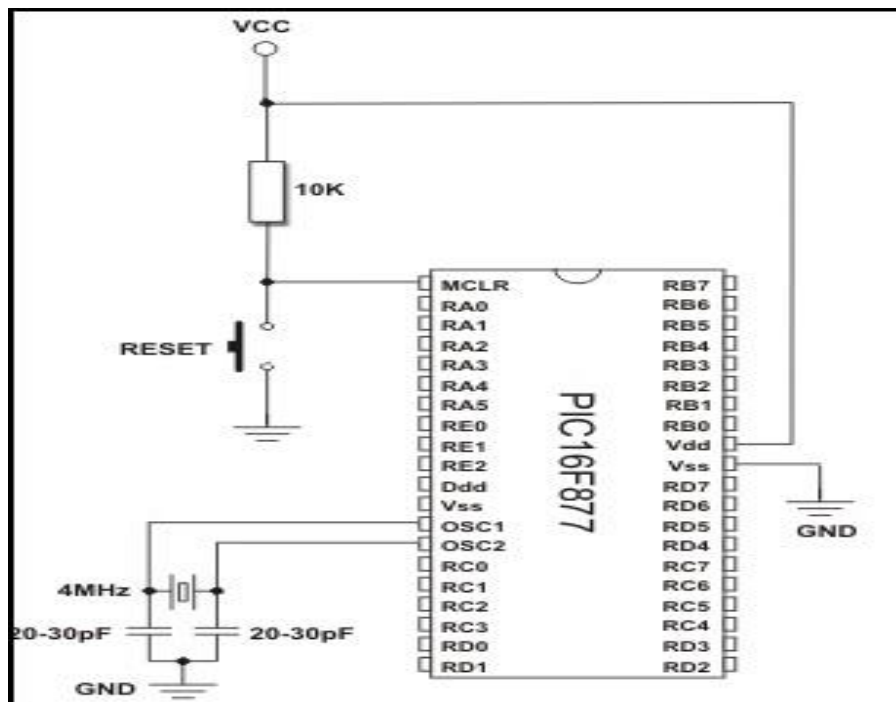


Fig:6.10: Oscillator and Clock

the noise, two capacitors in Picofarad value are needed. The value of capacitor is depending on the speed of oscillator that you use

Table 6.5: Value of Capacitor

Osc Type	Crystal Freq.	Cap. Range C1	Cap. Range C2
LP	32 kHz	33 pF	33 pF
	200 kHz	15 pF	15 pF
XT	200 kHz	47-68 pF	47-68 pF
	1 MHz	15 pF	15 pF
	4 MHz	15 pF	15 pF
HS	4 MHz	15 pF	15 pF
	8 MHz	15-33 pF	15-33 pF
	20 MHz	15-33 pF	15-33 pF

6.5 RESET:

If the PIC read 0V at the MCLR pin, it will reset the program and if the MCLR pin read 5V, the PIC will execute the program. The MCLR can be directly connect with 5V (series with resistor like picture below) but it will unable to reset if something goes wrong with the system.

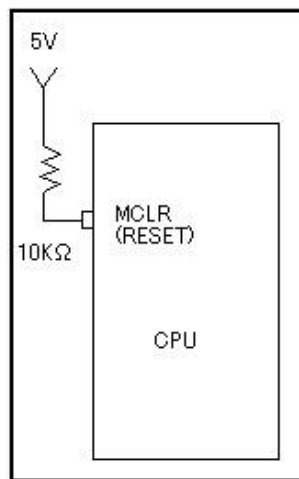


Fig:6.11: 5V direct current connection to MCLR pin

To solve this problem, a switch and a pull up resistor can be added in between 5V and the reset pin so it can create logic condition which is 1 and 0 to reset the pin.

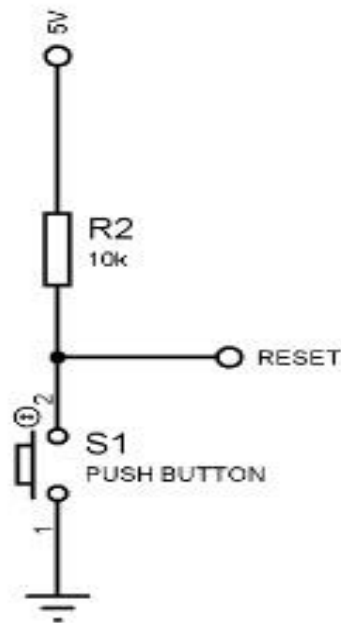


Fig:6.12: Switch and a Pull up Resistor in-between 5V and Reset Pin

6.6 SWITCH

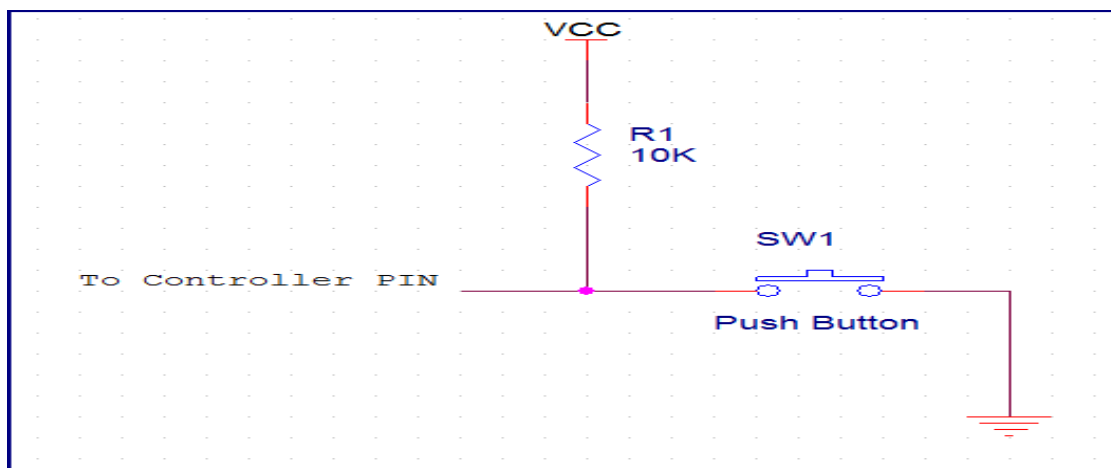


Fig:6.13: Switch Diagram

The simplest input is a switch or push button. This can operate with just one additional support component, a pull-up resistor, but there are still some significant issues to consider, such as input loading and debouncing. Let us make sure we understand how this works when the switch is open, the output voltage of the circuit is pulled up to 5 V via the resistor. Another way to look at it is that there is no current in the resistor (assuming there is no load on the output), so there is no volt drop, and the output voltage must be the same as the supply (5 V).

When the switch is closed the output is connected direct to 0 V; the resistor prevents the supply being shorted to ground. If a PIC input is open circuit, it is pulled up to Vdd (normally 5 V) internally, that is, it floats high. On some ports (Port B), weak pull-ups can be enabled to eliminate the need for external pull-up resistors.

The switch symbol assumes toggle mode operation the switch remains in the set position until changed. Push buttons normally assumed to be closed only when held the toggle operation can be implemented in software if required, to obtain a Push on, push off operation.

The resistor value is not critical, but if there is any load on the output, the pull-up must be significantly lower in value than the load, for the digital voltage levels to be valid. On the other hand, its value should be as high as possible to minimize wasted power, especially if the circuit is battery-powered.

Let us say the load on the output (R_i) was equivalent to 400k (100 A with a 5 V supply), the pull-up resistor (R_p) should be 100k or less, so that the output voltage with the switch open would be at least 4 V.

The minimum voltage which will be reliably recognized as logic 1 at a PIC input is 2.0 V, and the maximum voltage recognized as a logic 0 is 0.8 V, assuming a 5 V supply. The input leakage current is actually only about 1 A. If power conservation is not critical, a 10k resistor is a reasonable choice.

6.7 RESISTOR



Fig:6.14: Resistor

$$I = \frac{V}{R}$$

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances, such as those found in thermistors, varistors, trimmers, photoresistors and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law: where I is the current through the conductor in units of amperes, V is the potential difference measured across the conductor in units of volts, and R is the resistance of the conductor in units of ohms (symbol: Ω).

The ratio of the voltage applied across a resistor's terminals to the intensity of current in the circuit is called its resistance, and this can be assumed to be a constant (independent of the voltage) for ordinary resistors working within their ratings.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors can be composed of various compounds and films, as well as resistance wires (wire made of a high-resistivity alloy, such as nickel-chrome). Resistors are also implemented within integrated circuits, particularly analog devices, and can also be integrated into hybrid and printed circuits.

6.8 CAPACITOR



Fig:6.15: Capacitor

A **capacitor** (originally known as a **condenser**) is a passive two-terminal electrical component used to store energy electro statically in an electric field. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, a capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic field between its plates.

When there is a potential difference across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge (+Q) to collect on one plate and negative charge (-Q) to collect on the other plate. If a battery has been attached to a capacitor for a sufficient amount of time, no current can flow through the capacitor. However, if an accelerating or alternating voltage is applied across the leads of the capacitor, a displacement current can flow.

An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge (Q) on each conductor to the potential difference (V) between them. The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF (10^{-12} F) to about 1 mF (10^{-3} F).

Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power

supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow.

6.9 DIODE

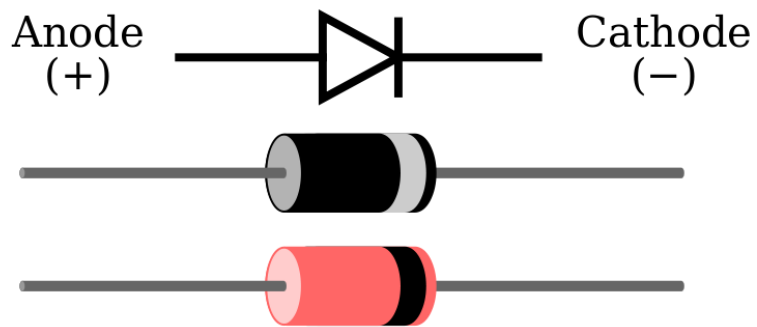


Fig:6.16: Diode

In electronics, a diode is a two-terminal electronic component with asymmetric conductance; it has low (ideally zero) resistance to current in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals.

CHAPTER 7

PROGRAMMING TOOLS

7.1 PROTEUS

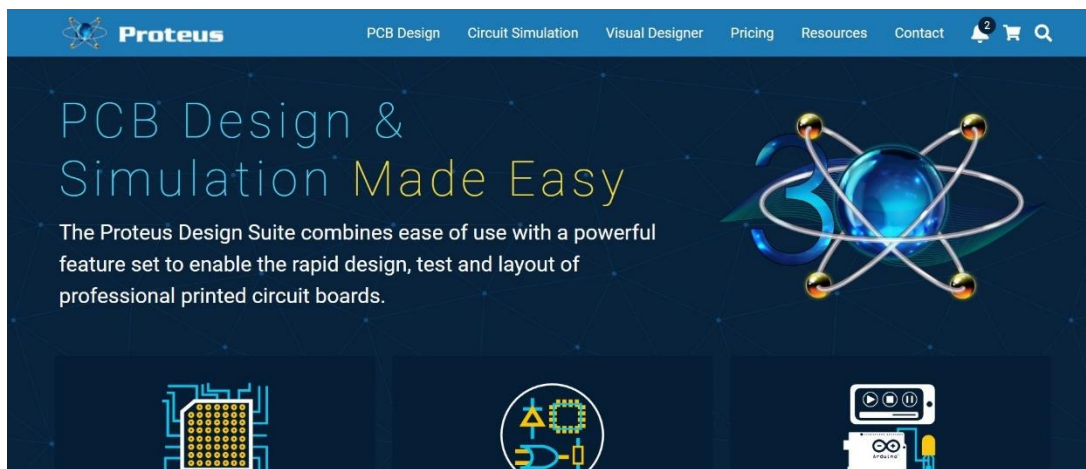


Fig:7.1: Information About Proteus – Programming Software

The Proteus Design Suite is wholly unique in offering the ability to co-simulate both high and low-level micro-controller code in the context of a mixed-mode SPICE circuit simulation. With this Virtual System Modeling facility, you can transform your product design cycle, reaping huge rewards in terms of reduced time to market and lower costs of development.

If one person designs both the hardware and the software then that person benefits as the hardware design may be changed just as easily as the software design. In larger organizations where the two roles are separated, the software designers can begin work as soon as the schematic is completed; there is no need for them to wait until a physical prototype exists. In short, Proteus VSM improves efficiency, quality and flexibility throughout the design process

Proteus Virtual System Modeling (VSM) combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete

microcontroller-based designs. For the first time ever, it is possible to develop and test such designs before a physical prototype is constructed.

This is possible because you can interact with the design using on screen indicators such as LED and LCD displays and actuators such as switches and buttons. The simulation takes place in real time (or near enough to it): a 1GMHz Pentium III can simulate a basic 8051 system clocking at over 12MHz. Proteus VSM also provides extensive debugging facilities including breakpoints, single stepping and variable display for both assembly code and high-level language source.

7.2 SCHEMATIC ENTRY

Proteus VSM uses our proven Schematic Capture software to provide the environment for design entry and development. ISIS is a long-established product and combines ease of use with powerful editing tools. It is capable of supporting schematic capture for both simulation and PCB design.

Designs entered in to Proteus VSM for testing can be net listed for PCB layout either with our own PCB Design products or with third party PCB layout tools. ISIS also provides a very high degree of control over the drawing appearance, in terms of line widths, fill styles, fonts, etc. These capabilities are used to the full in providing the graphics necessary for circuit animation.

7.3 CIRCUIT SIMULATION

At the heart of Proteus VSM is Pro SPICE. This is an established product that combines uses a SPICE3f5 analogue simulator kernel with a fast event-driven digital simulator to provide seamless mixed-mode simulation. The use of a SPICE kernel lets you utilize any of the numerous manufacturer-supplied SPICE models now available and around 6000 of these is included with the package.

Proteus VSM includes a number of virtual instruments including an Oscilloscope, Logic Analyzer, Function Generator, Pattern Generator, Counter Timer and Virtual Terminal as well as simple voltmeters and ammeters.

In addition, we provide dedicated Master/Slave/Monitor mode protocol analyzers for SPI and I2C - simply wire them onto the serial lines to interact with the data live during simulation.

7.4 MCU SIMULATION OVERVIEW

The most exciting and important feature of Proteus VSM is its ability to simulate the interaction between software running on a microcontroller and any analog or digital electronics connected to it.

The micro-controller model sits on the schematic along with the other elements of your product design. It simulates the execution of your object code (machine code), just like a real chip. If the program code writes to a port, the logic levels in circuit change accordingly, and if the circuit changes the state of the processor's pins, this will be seen by your program code, just as in real life.

The VSM CPU models fully simulate I/O ports, interrupts, timers, USARTs and all other peripherals present on each supported processor. It is anything but a simple software simulator since the interaction of all these peripherals with the external circuit is fully modeled down to waveform level and the entire system is therefore simulated.

VSM can even simulate designs containing multiple CPUs, since it is a simple enough matter to place two or more processors on a schematic and wire them together.

7.5 SOURCE LEVEL DEBUGGING

Whilst Proteus VSM is already unique in its capability to run near real time simulations of complete micro-controller systems, its real power comes from its ability to perform these simulations in single step mode. This works just like your favorite software debugger, except that as you single step the code, you can observe the effect on the entire design - including all the electronics external to the microcontroller.

7.6 MPLAB

Integrated Development Environment (IDE) is an application that has multiple functions for software development. MPLAB IDE is an executable program that integrates a compiler, an assembler, a project manager, an editor, a debugger, simulator, and an assortment of other tools

within one Windows Application.

A user developing an application should be able to write code, compile, debug and test and application without leaving the MPLAB IDE desktop. Bundled with MPLAB IDE software are several code generations tools. MPASM assembler is a full-featured universal macro assembler for all PIC microcontroller MCUs. It can produce absolute code directly in the form of HEX files for device programmers, or it can generate relocatable objects for MPLINK linker. MPLINK linker links relocatable objects from assembly or C source files along with pre-compiled libraries using directives from a linker script, and supports MPASM, MPLAB C17, and MPLAB C18. MPLIB librarian is a librarian for pre-compiled code to be used with MPLINK linker.

When a routine from a library is called from another source file, only the modules that contain that routine will be linked in with the application. This allows large libraries to be used efficiently in many different applications.

The latest versions of MPASM, MPLINK, and MPLIB are bundled with MPLAB and can be downloaded separately by choosing the web install and selecting only the MPASM, MPLINK and/or MPLIB. MPLAB allows you to write, debug, and optimize the PIC microcontroller MCU applications for firmware product designs.

7.7 CODING

Coding is completely carried out by using keil MDK software which is easy to learn and used for solving the complex problems faced by embedded software programs. The Code used in the project is attached below:

```
#include<reg51.h>
sbit RS=P2^0;
sbit EN=P2^1;
sfr lcd =0x90;
sbit s1=P2^2;
sbit s2=P2^3;
```

```

sbit s3=P2^4;
sbit s4=P2^5;
sbit m1=P2^6;
sbit led=P3^0;
sbit led1=P3^1;
sbit led2=P3^2;
void INTLCD();
void delay (unsigned int a)
{
    unsigned int b,c;
    for(b=0; b<a; b++)
        for(c=0; c<1000; c++);
}
void cmd(unsigned char e)
{
    lcd=e;
    RS=0;
    EN=1;
    delay(1);
    EN=0;
}
void Data(unsigned char *f)
{
    while(*f!=0)
    {
        lcd=*f;
        RS=1;
        EN=1;
        delay(1);
        EN=0;
        f++;
    }
}

```

```

}
void main()
{
    m1=led=led1=led2=0;
    INTLCD();
    //cmd(0x38);
    //cmd(0x0E);
    //cmd(0x01);
    //cmd(0x06);
    //cmd(0x80);
    Data("Welcome To The");
    cmd(0xc0);
    Data("  Project");
    delay(200);
    cmd(0x01);
    cmd(0x0c);
    while(1)
    {
        if((s1==0)&&(s2==1))
        {
            //while(s1==0);
            led=1;
            led1=0;
            cmd(0x01);
            cmd(0x80);
            Data("  Auto Mode");
            //while(1)
            //{
            //cmd(0x01);
            cmd(0xc0);
            Data("Motor On");
            m1=1;

```

```

        delay(1000);
        m1=0;
        cmd(0xc0);
        Data("Motor Off");
        delay(500);
        cmd(0x01);
        //}
    }
    else
    {
        led=led1=m1=0;
        //cmd(0x01);
        cmd(0x80);
        Data(" Systems OFF");
    }

    if((s2==0)&&(s1==1))
    {
        cmd(0x01);
        cmd(0x80);
        Data(" Manual Mode");
        led=0;
        led1=1;
        led2=0;
        m1=0;
        if(s3==1)
        {
            while(s3==1);
            //cmd(0x01);
            cmd(0xc0);
            Data(" Motor On");
            led1=1;
            m1=1;

```

```

        delay(1000);
        m1=0;
        led2=1;
        delay(500);
    }
}
/*if((s4==1)||(s1==0)||(s2==0))
{
    while(s4==1);
    led=led1=led2=0;
    m1=0;
    cmd(0x80);
    Data("  Systems OFF");
}*/
}

}

void INTLCD()
{
    cmd(0x38);
    cmd(0x0e);
    cmd(0x01);
    cmd(0x80);
    cmd(0x06);
}

```

CHAPTER 8

RESULTS AND DISCUSIONS

8.1 CONCLUSION

Implementing of Contactless Automatic vending Hand Wash Dispenser for Sanitation is efficient and the cost price is minimized. It works like the normal contactless automatic machine. The human gets the limited sanitizer liquid for sanitation in hand, to wash the hands and to protect themselves from the corona disease. This system can be utilized in malls, high populated areas. The economic cost of the seminar, it will be better quality when considering the life of the system. The most goal of this project was to use current advanced technologies to develop an Automatic vending hand sanitizing machine to improve hygiene and prevent the infectious viruses entering our body. At the same time, it is environment friendly as because the disposable wastage is very minimal, since it can be refilled easily without any technical assistance. These automatic vending hand sanitizer machines are developed keeping in mind about its affordability by underprivileged sections of the society as it can be purchased by lower income groups in pursuit of their wellbeing and also, they are easily available and can be used by everyone without any hassle.

8.2 PATENT

A Patent Has been Filed on the following Project.

4/1/2021

Design CBR

PATENT OFFICE
INTELLECTUAL PROPERTY BUILDING
G.S.T. Road, Guindy, Chennai-600032
Tel No. (091)(044) 22502081-84 Fax No. 044 22502066
E-mail : Chennai-patent@nic.in
Web Site : www.ipindia.gov.in



C.B.R. NO : 200041

Date/Time :
31/03/2021
16:18:43

To

MR. R. KAJA BANTHA NAVAS

SCHOOL OF MECHANICAL ENGINEERING, SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, JEPPIAAR
NAGAR, RAJIV GANDHI ROAD, CHENNAI - 600 119. 9952699572 sumai244@gmail.com

Sr No.	Reference Number	Application Number	Name of Article	Amount Paid	Amount Computed
1	341700-001	---	SANITIZER VENDING MACHINE/23-02	1000	1000

Received a sum of Rs. 1000 (Rupees One Thousand only) through

Payment Mode	Bank Name	Cheque/Draft Number	Cheque/Draft Date	Amount in Rs.
Draft	Indian Bank	348848	29/03/2021	1000

Note: This is electronically generated receipt hence no signature required.

Fig:8.1: Patent Filed Receipt

8.3 COST ESTIMATION

Table 8.1: Cost Estimation

SI.NO	PARTICULARS	COST (₹)
1	Multi-Channel Coin Acceptor	5000
2	Microcontroller and Electronic Configuration	3500
3	Development Board Module	250
4	Total Body Frame – Mild Steel	6000
5	Dispenser, Bottle and Adapter	250
6	Miscellaneous	2000
	TOTAL	17000

8.4 ADVANTAGES

1. The overall cost of the machine is very low in comparison with other machines in the market.
2. The product occupies very less space
3. The machine is portable as it is small in size and will work on battery power.
4. Availability of sanitizing methods increases when installed around the places.
5. The machine uses safe components. Hence it is safe for sanitizing purposes.
6. The machine consumes less power.
7. You don't have to apply physical pressure on the dispenser, just place your hands under the nozzle, and it provides the right amount.

8.5 APPLICATIONS

1. The Vending Machine can be used for other fluids i.e., Beverages and Juices and even drinking water.
2. Can be used in small shops as an additional income to the shopkeeper.

8.6 SCOPE FOR FUTURE WORK

1. Multiple coin detection can be enabled and utilized. Since the coin acceptor (DG600F) is a 6-type coin detection system, multiple coin mode can be easily achieved.
2. Increase in diameter of the Solenoid Valve and pipes would increase the flow rate.
3. The whole product can be redesigned for it to be aesthetically pleasing and for its better usability.
4. Can be used for other liquid items example – beverages, drinks and water also.
5. RFID tag identification and reading can be developed to accept the Money cards

8.7 REFERENCES

1. Real Time Embedded Vending Machine - Asian Journal of Science and Technology. 5, Issue 12, Pg.804-809, December 2014.
2. The Commodity of Vending Machines - Susanne GRUBER, Renate BUBER, Bernhart RUSO, Johannes GADNER
https://www.researchgate.net/publication/265079551_THE_COMMODITY_VENDING_MACHINE
3. Zhang Wen and Xin Long Zhang, "Design and Implementation of automatic vending machine Based on the short message payment", 6th International Conference on Wireless Communications Networking and Mobile Computing (WiCOM), IEEE, 2010
4. ZHU, J.C., WANG, K.Z., YANG, B. and Wu, Y.M., 2016. The Design of Control System for the Vending Machine. Equipment Manufacturing Technology, (7), p.26.
5. Increasing Vending Profitability with More Intelligent Machines
<https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/ref-design-for-intelligent-vending-product-brief.pdf>
6. Coin acceptor DG600F Tutorial - <https://www.youtube.com/watch?v=HbFekeW2mT4>
7. PIC16F877A Microcontroller - <https://components101.com/microcontrollers/pic16f877a-pin-diagram-description-features-datasheet>
8. Proteus – eBook – Proteus Manual
https://www.ele.uva.es/~jesman/BigSeti/ftp/Cajon_Desastre/Software-Manuales/EBook%20-%20Proteus%20Manual.pdf