A Project report on

ROBOTIC VENDING DISPENSER

in fulfilment of the Requirements for the award of degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted BY

K.Penchalanarasaiah	1610225
S.Swamy Naik	1610249
K.Ganga Lakshmi	1610226
K.Sreevani	1610264
A.Vyshnavi	1610202

Under the esteemed guidance of

Sri. D.PURUSHOTHAM REDDY, M.Tech.,

Lecturer, Department of ECE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SKU COLLEGE OF ENGINEERING AND TECHNOLOGY

SRI KRISHNADEVARAYA UNIVERSITY

ANANTHAPURAMU-515003

SRI KRISHNADEVARAYA UNIVERSITY

COLLEGE OF ENGINEERING AND TECHNOLOGY

ANANTAPURAMU-515003

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

This is to certify that the project entitled "**ROBOTIC VENDING DISPENSER**" is a bonafied work of **K.Penchalanarasaiah** (1610225), **S.Swamy Naik** (1610249), **K.GangaLakshmi**(1610226), **K.Sreevani**(1610264), **A.Vyshnavi**(1610202) submitted to the department of Electronics and Communication Engineering in partial fulfilment of the requirements for the award of degree of BACHELOR OF TECHNOLOGY in the branch of Electronics and Communication Engineering from SKU College of Engineering and Technology, SK University, Ananthapuramu.

Signature of the guide   Signature of Head of the Department

D.PURUSHOTHAM REDDY,M.Tech.,   K.KULDEEP SHAMGAR, M.Tech.,

Lecturer, Dept of ECE,   Lecturer, Dept of ECE,

SKU College of Engg. & Tech.,   SKU College of Engg. & Tech.,

Ananthapuramu.   Ananthapuramu.

DECLARATION

We Students studying final year B.Tech., Dept. of **ELECTRONICS AND COMMUNICATION ENGINEERING, SRI KRISHNADEVARAYA UNIVERSITY COLLEGE OF ENGINEERING AND TECHNOLOGY**. We have registered for the final year Main Project entitled "**ROBOTIC VENDING DISPENSER**" submitted for the B.Tech. under the guidance of Mr. **D.PURUSHOTHAM REDDY, M.Tech.,** and we promise to meet all the mandatory requirements as a specified by the project review committee. We declare that we will not hold the college, the department and the lecturers responsible for the out come of our project result.

Place: **Anantapur**   **Signature of the students:**

Date: 1.

                                                                        2.

                                                                        3.

                                                                        4.

                                                                        5.

ACKNOWLEDGEMENT

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We wish to express our deep sense of gratitude to our guide **Mr.D.PURUSHOTHAM REDDY,M.Tech.,** Lecturer, Dept of ECE for giving us the opportunity of doing the project and for providing a great support in completing our project work. We feel elated to thank her for inspiring us all the way by providing good lab facilities and helping us in providing such good environment.

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K.Penchalanarasaiah	1610225
S.Swamy Naik	1610249
K.GangaLakshmi	1610226
K.Sreevani	1610264
A.Vyshnavi	1610202

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ABSTRACT

Robotic Vending Dispenser is a machine which can dispense different types of juices without using manpower. This machine takes the input from the customer through graphical user interface, after the completion of online transaction it will give control to the hardware part. The machine will prepare customer required juice within 30sec. This is due to modern life style people want Fresh and healthy juices in less time. The intention of this project is to define a new way of distributing juices. Important statistical information collected in the machine will be shown to the manager via mobile app. We placed Temperature sensor for monitoring the temperature present inside the dispenser. Because for protecting the fruit pieces we have to maintain certain temperature level inside the dispenser. Here we are using POS machine for online transaction using credit/debit card. Not only juices we can dispense many food items in future by modifying the commands used in the program.

LIST OF FIGURES

LIST OF TABLES

Pin description of Raspberry pi:

Pin No	Description	Function
1	VCC	3V3
2	VCC	5V
3	SDA	Serial data
4	VCC	5V
5	SCL	Serial block
6	GND	Ground
7	GPCLK	General purpose clock
8	TxD	Transmit data
9	GND	Ground
10	RxD	Receive data
11	GPIO	General purpose input/output
12	PCM_CLK	Pulse code modulation clock
13	GPIO	General purpose input/output
14	GND	Ground
15	GPIO	General purpose input/output
16	GPIO	General purpose input/output
17	VCC	3V3
18	GPIO	General purpose input/output
19	MOSI	Master out save in
20	GND	Ground
21	MISO	Master in save out
22	GPIO	General purpose input/output
23	SCLK	Serial clock
24	CE0	Chip enable
25	GND	Ground
26	CE1	Chip enable
27	ID_SD	Reversed for ID EEPROM
28	ID_SC	Reversed for ID EEPROM
29	GPIO	General purpose input/output
30	GND	Ground
31	GPIO	General purpose input/output
32	PWM0	Pulse width modulation
33	PWM1	Pulse width modulation
34	GND	Ground
35	PCM_FS	Pulse code modulation
36	GPIO	General purpose input/output

37	GPIO	General purpose input/output
38	PCM_Din	Pulse code modulation data in
39	GND	Ground
40	PCM_Dout	Pulse code modulation data out

Table No. 1: Raspberry pi pins

Pin description of PCA9685:

Pin no	Description	function
1	GND	Ground
2	OE	Output enable
3	SCL	Serial clock
4	SDA	Serial data
5	VCC	3v3
6	V+	5V

Table No.2: PCA 9685 servo driver pins

LIST OF ABBREVIATIONS

GPIO   General purpose input/output pins

LCD   Liquid Crystal Display

IDLE   Integrated Development and Learning Environment

GUI   Graphical User Interface

HDMI   High definition multimedia interface

RPI   Raspberry pi 4

NOOBS   New Out-Of-Box software

VGA   Video graphics array cable

POS   Point of sale

RPM   Rotation per minute

SCL   Serial clock

SDA   Serial data

ROM   Read only memory

MOSI   Master out slave in

MISO   Master in save out

CHAPTER-1

1.1 INTRODUCTION

Firstly, let you know what exactly vending dispenser is, it is an automatic juice dispenser, which can dispense different types of flavored juices. The dispenser includes containers to hold fruit pieces. we created graphical User Interface to select the juices and making online payment. We provided the complete description of the juice in the graphical user interface. After the completion of online payment, the control goes to the hardware part. We used Razor pay payment gateway service for online transaction. The objective here is to design vending machine which accepts money through digital payment and delivers the customer required juice. This whole process is done by using the inputs given by the customer in the graphical user interface and it is the collected work of Software(FrontEnd) and Hardware(BackEnd) part. Which is a hygienic machine providing Cold Pressed juice to the customer.
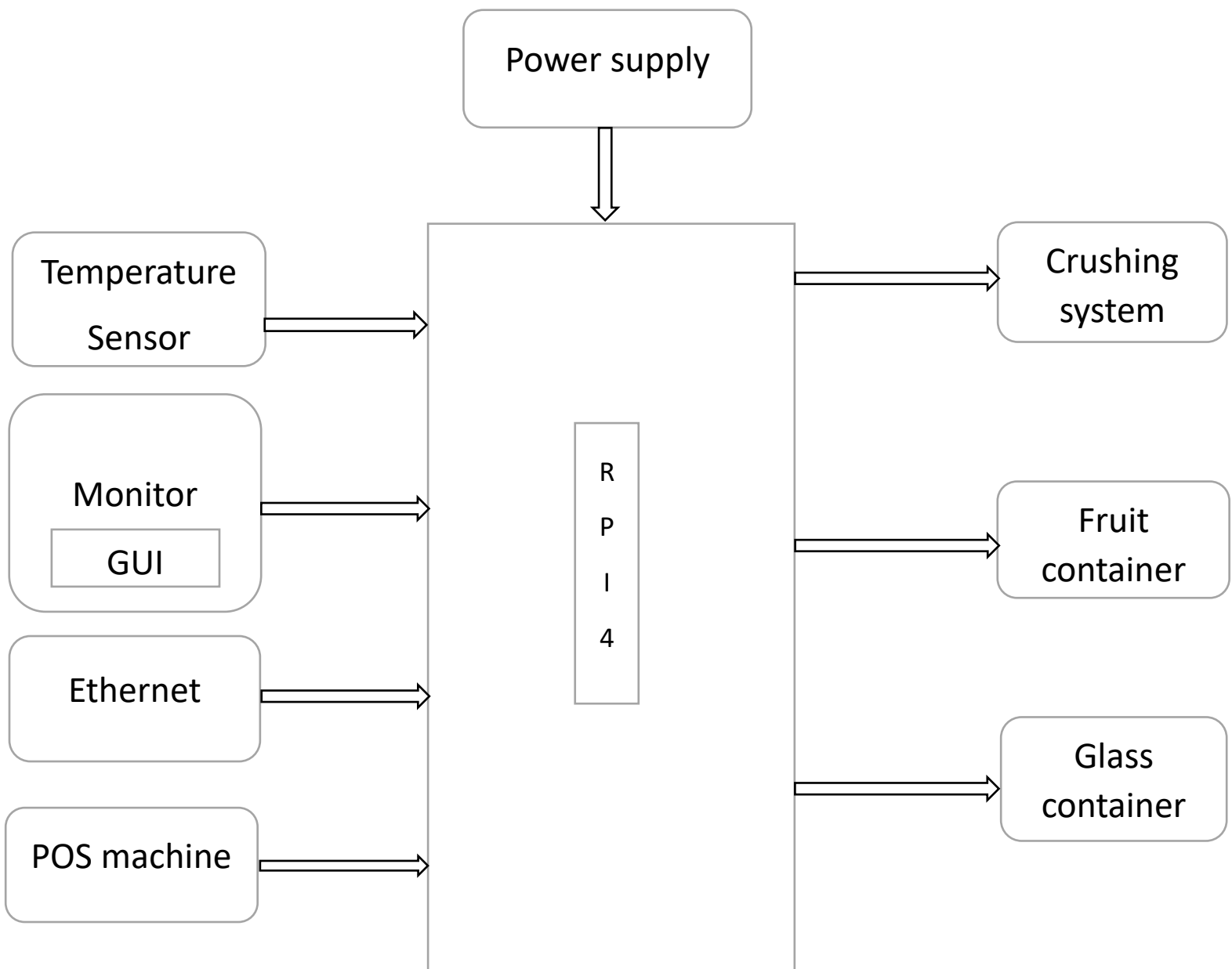
1.2 BLOCK DIAGRAM

Fig.1.2 Block diagram

1.2.1 Crushing System:

Crushing system is the main section in the whole Hardware part. DC Motor is used for crushing the fruit pieces. This motor runs at low RPM, for collecting Cold Pressed Juice.

1.2.2 Fruit Container:

This machine includes containers for placing different types of fruit pieces in it. This container is made up of high-quality steel and it has a servomotor used to fall down the fruit pieces into the glass.

1.2.3 Monitor:

Monitor is used for displaying the Graphical User Interface (GUI). Actually, it is an interface between customer and the Raspberrypi4 and also it allows the customer to select the juice and online transaction.

1.2.4 Glass Container:

Glass Container is used to place all the glasses in an order. The Servomotor placed at the glass container dispense the glasses one by one.

1.2.5 POS Machine:

POS Machine is a Point of sale Transaction, it is used for collecting money through credit/ debit card.

1.2.6 Ethernet:

Ethernet is used for providing internet connection to the Raspberry pi for doing online transaction using Razor pay Payment gateway. We can use ethernet or Wi-Fi but, Ethernet is secure for online transaction.

1.2.7 Temperature Sensor:

Temperature Sensor is used for monitoring the temperature present inside the dispenser. By using this sensor, we can protect fruit pieces from bacteria.

1.2.8 Power supply:

We are using 5.5V and 2mAh current to the Raspberry pi. We are using DC Power adopter for better performance.

CHAPTER-2

CIRCUIT DIAGRAMS:
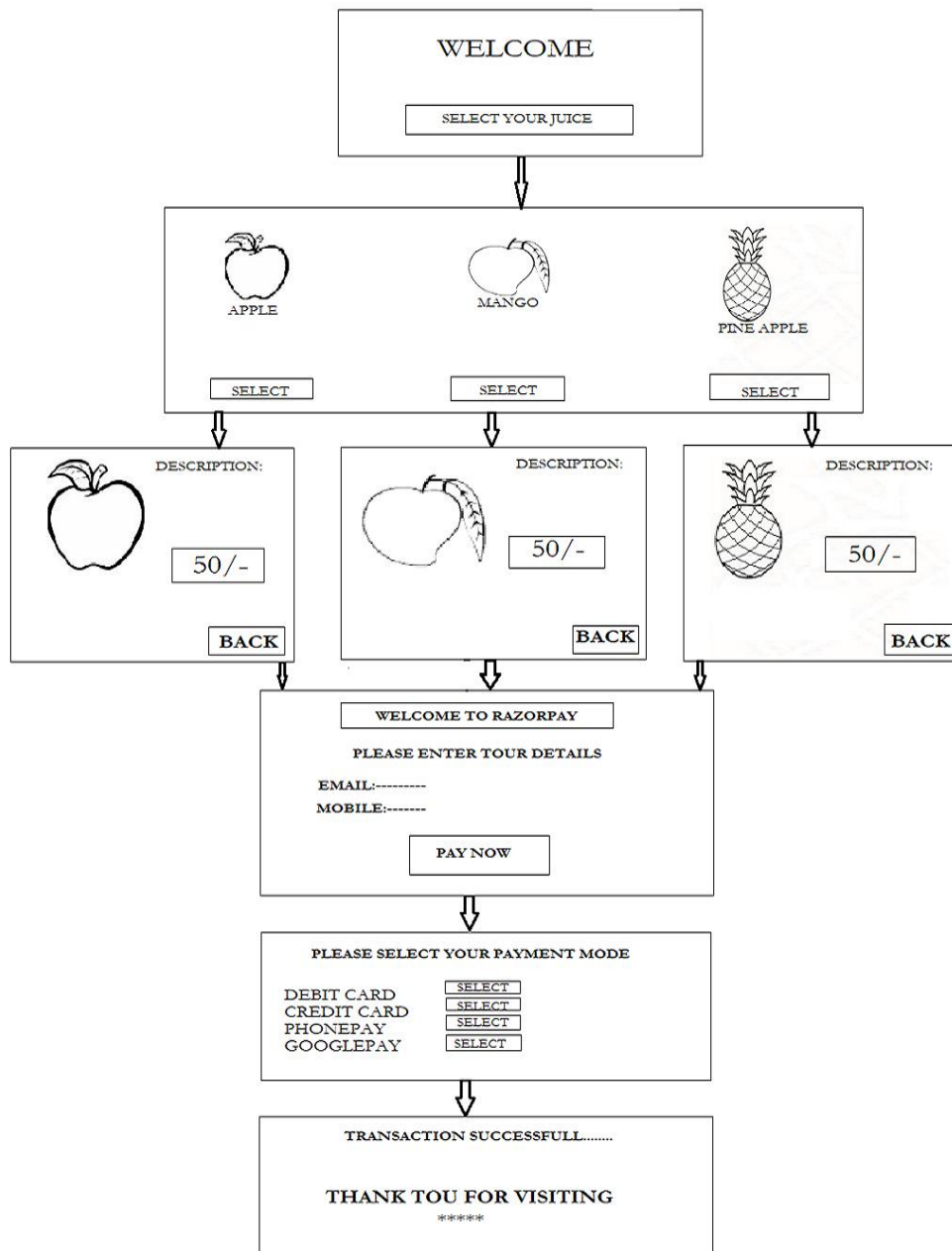
2.1 Software part(Front End)

WELCOME

SELECT YOUR JUICE

APPLE   MANGO   PINE APPLE

SELECT   SELECT   SELECT

DESCRIPTION: DESCRIPTION: DESCRIPTION:

50/-   50/-   50/-

BACK   BACK   BACK

WELCOME TO RAZORPAY

PLEASE ENTER TOUR DETAILS

EMAIL:---------
MOBILE:-------

PAY NOW

PLEASE SELECT YOUR PAYMENT MODE

DEBIT CARD   SELECT
CREDIT CARD   SELECT
PHONEPAY   SELECT
GOOGLEPAY   SELECT

TRANSACTION SUCCESSFULL........

THANK TOU FOR VISITING
*****

Fig.2.1 Graphical user interface

2.1.1 Welcome Window:

   Welcome window is the first window of graphical user interface. All the customers start selecting the juice from welcome window.

Fig.2.1.1 Welcome window

2.1.2 Selection Window:

   Selection window contains different flavored juices with their pictures. Customer can select the juice here.

Fig.2.1.2 Selection window

2.1.3 Description Window:

In the description window we provided all the information like minerals, proteins present in the juice. Customer can get complete idea about the juice by reading this description.

Fig.2.1.3 Description window

2.1.4 Payment gateway window:

We are using Razor pay payment gateway for the purpose of online transaction. It functions both online and offline. The platform is compatible with many digital payment options and it is secure one.
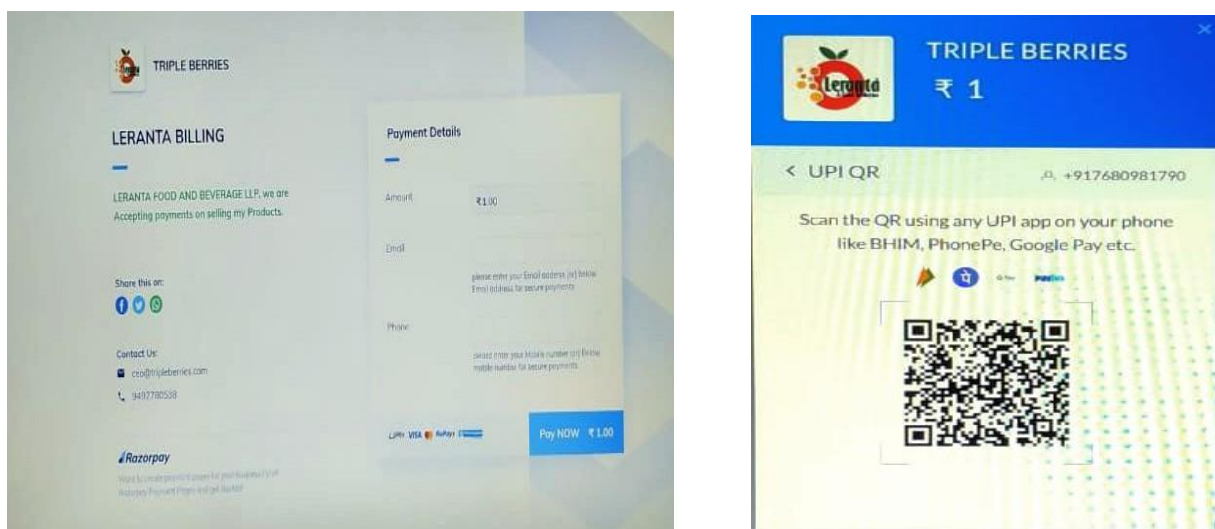

Fig.2.1.4 Payment gateway window

2.1.5 Redirecting window:

        After the completion of online transaction, it redirects to a webpage (Thank you page) and after that it goes to Welcome Window again.
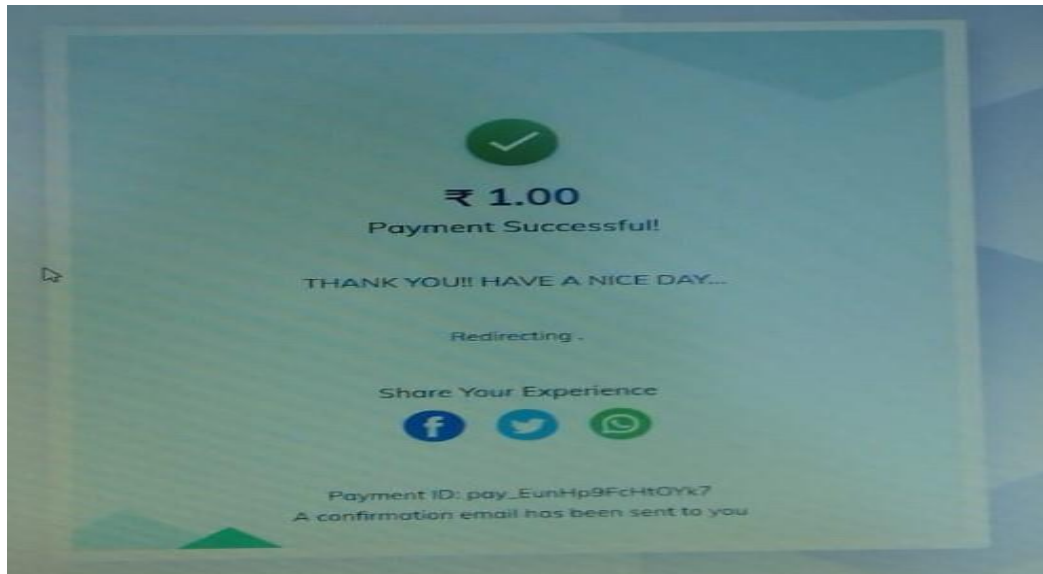

Fig.2.1.5 Redirecting window
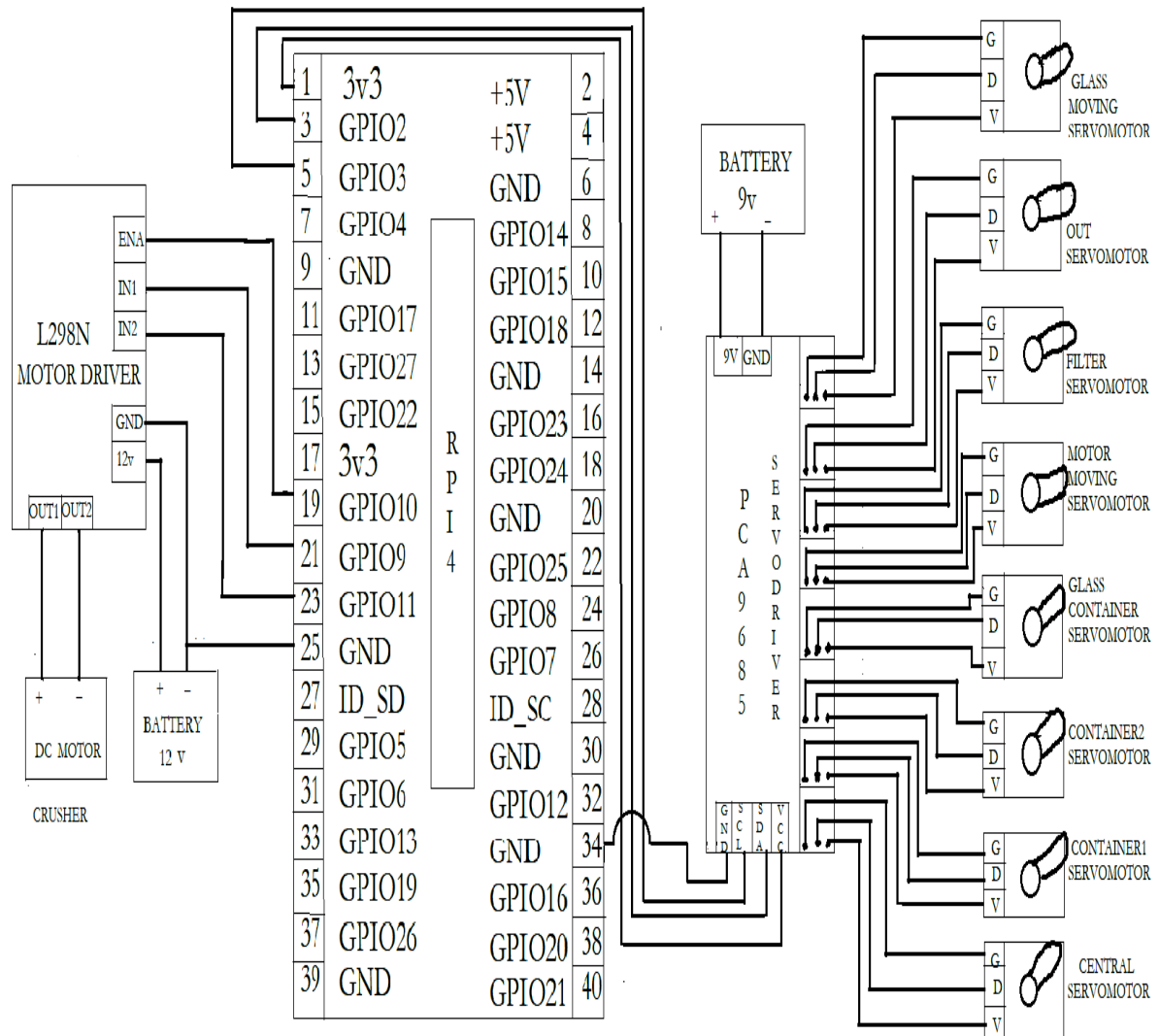
2.2 Hardware part(BackEnd)

Fig.2.2 Circuit diagram

2.2.1 Raspberry pi 4:

Raspberry pi 4 model B is the latest version of the low-cost Raspberry pi computer and is simply a credit-card sized electronic board. You also need a power supply, a Monitor, a micro HDMI cable and a mouse and keyboard. Once u hooked up all the cables, the easiest way for users to get up and running on the pi is to download the NOOBS(New Out- Of-Box software). Pi supports various operating systems, although a good choice for users is the official OS, which is called Raspbian.

2.2.2 Servomotor:

A Servomotor is an electrical device which can push or rotate an object with great precision. It is made up of simple motor which run through **SERVO MECHANISM.** If motor used is DC powered then it is called DC servomotor, and if it is AC Powered motor then it is called AC servomotor. We can get a very high torque servo motor in a small and light weight packages. Due to these features they are being used in many applications like robotics, machines etc. The MG995 servo motor has 3 wire interface and the connections should made as follows

Red wire – 5V

Black wire – ground

White wire – data pin

2.2.3 PCA9685 Servo driver:

The PCA9685 is a 16-channel I2C-bus controlled LED controller optimized for Red/Green/Blue/Amber (RGBA) color backlighting applications. Each LED output has individual 12-bit resolution (4096 steps) PWM controller with a fixed frequency. The controller operates at a programmable frequency from a typical 24 Hz to 1526 Hz with a duty cycle that is adjustable from 0% to 100% so the LED can be set to output a specific brightness.

2.2.4 DC Motor:

A DC motor is an electrical motor that converts direct current electrical energy into mechanical energy. DC motors were the first form of motor widely used, as they could be powered from existing direct current lighting power distribution systems. A Dc motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

2.2.5 L298N motor driver:

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A. The module has an onboard 5V regulator which is either enabled or disabled using a jumper.

2.2.6 Glass moving servo motor:

We placed a container, filled with high quality plastic glasses in the machine. The servo motor placed at the container will drop the glasses one by one.

2.2.7 Central servo motor:

The Central servo motor is connected to the steel glass. This Central servomotor will plays an important role in the machine after completion of online transaction.

2.2.8 Container servo motor:

Container servo motor will fall down certain amount of fruit pieces into the glass. Central servomotor will place the steel glass at the bottom of the container.

2.2.9 Filter servomotor:

After crushing the fruit pieces present in the glass filter servo motor will filter the juice and pour the juices into the high- quality plastic glass.

2.2.10 Out servomotor:

After filtering the juice Out servomotor will serve the juice to the customer.

2.3 Pin diagrams:

Fig.2.3.1 Raspberry pi pin diagram

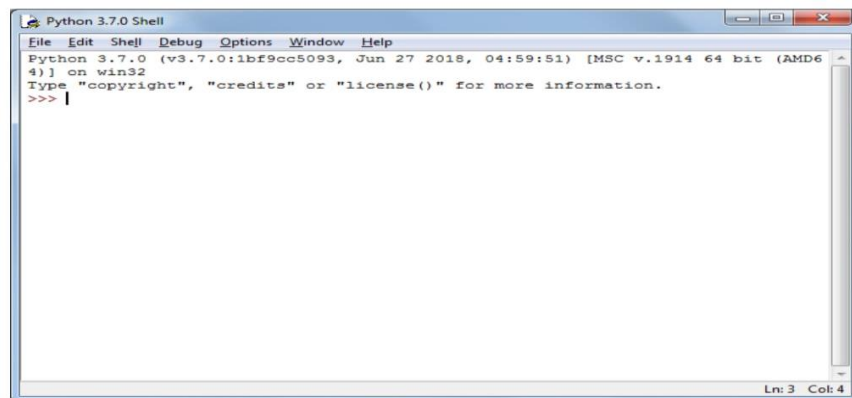
Fig.2.3.2 PCA9685 Pin diagram

CHAPTER-3

COMPONENTS

3.1 Software components

3.1.1 Python IDLE:

IDLE can be used to execute a single statement just like python shell and also to create, modify and execute python scripts. IDLE provides a fully featured text editor to create python scripts that includes features like syntax highlighting, autocompletion and smart indent. It also has a debugger with stepping and break point features.

Installation: $ sudo apt-get install idle

Fig.3.1.1 Python IDLE

3.1.2 PyQt5 module:

PyQt5 is a comprehensive set of python bindings for Qtv5. It is implemented as more than 35 extension modules and enables python to be used as an alternative application development language to C++ on all supported platforms including iOS and android. PyQt5 may also be embedded in C++ based applications to allow users of those applications to configure or enhance the functionality of those applications.

The GPL version of PyQt5 can be installed from PyPL:

Pip install PyQt5

The wheels include a copy of required parts of the LGPL version of Qt

Pip will also build and install the bindings from the sdist package but Qt's **qmake** tool must be on **PATH.**

3.1.3 Qt designer software tool:

   Qt designer is the Qt tool for designing and building graphical user interfaces(GUIs)with Qt widgets. You can compose and customize your windows or dialogs in a what-you-see-is-what-you-get manner, and test them using different styles and resolutions. Widgets and forms created with Qt Designer integrate seamlessly with programmed code, using Qt's signals and slots mechanism, so that we can easily assign behavior to graphical elements. All properties set in Qt Designer can be changed dynamically within the code. Furthermore, features like widget promotion and custom plugin allow you to use your own components with Qt Designer.
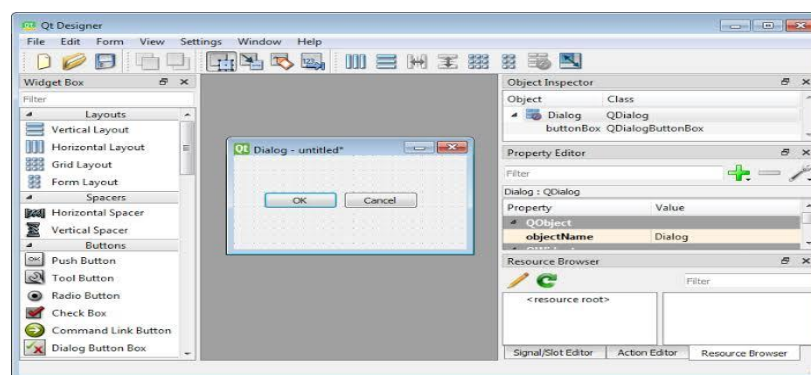
Fig.3.1.3 Qt designer software tool

3.1.4 Sublime text editor:

   Sublime text is a shareware cross platform source code editor with a python application programming interface (API). It natively supports many programming languages and markup languages, and functions can be added by users with plugins, typically community built and maintain under free software license.
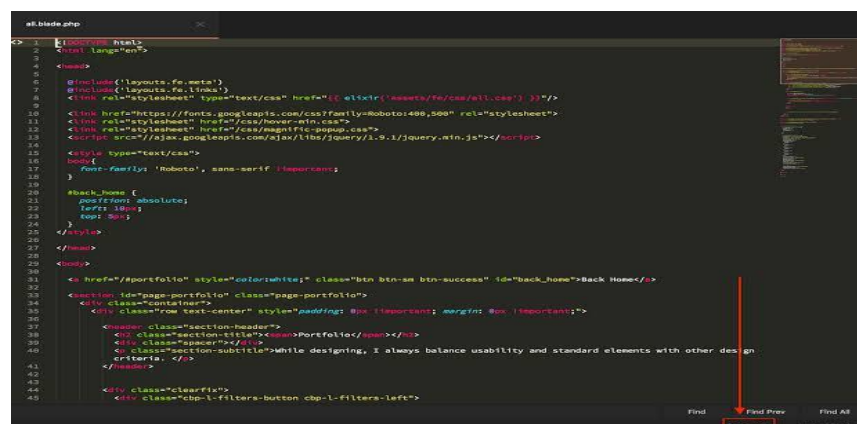

Fig.3.1.4 Sublime text editor

3.1.5 Raspberry pi NOOBS:

      NOOB is a way to make setting up a raspberry pi for the first time much easier. You won't need network access, and you won't need to download any special imaging software. Just head to the downloads page, grab a copy of the NOOBS zip file, and unpack it onto a freshly formatted 4 GB SD card. When you boot up for the first time, you will see a menu promoting you to install one of several operating systems into the free space on the card. The choice means you can boot the Pi with a regular operating system like Raspbian, or with a media-centre specific OS like RaspBMC.
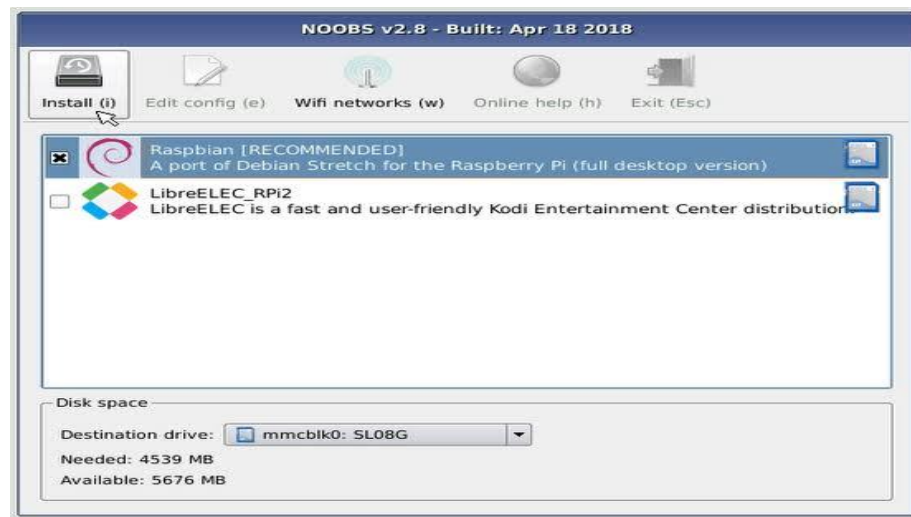
Fig.3.1.5 Raspberry pi NOOBS

3.2 Hardware components

3.2.1 Raspberry pi 4:

- The Raspberry pi 4 Model B+ is the first of the fourth generation of Raspberry pi computers.

- The latest model brings with it a more powerful Broadcom BCM2711B0 quad-core ARM processor.

- Operated at a frequency of 1.4GHz.

- Raspbian operating system is used.

Raspberry pi Spec :

1. CPU-Broadcom BCM2711, Quadcore cortex-A72(ARM v8) 64-bit SoC@1.5GHz
2. RAM-1GB, 2GB, 4GB LPDDR4-2400 SDRAM(depending on model)
3. Wi-Fi- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
4. Ethernet- Gigabit
5. USB- 2 USB 3.0 ports; 2 USB 2.0 ports
6. GPIO header- Raspberry pi standard 40 pin
7. HDMI-2* micro-HDMI ports (up to 4 kp60 supported)
8. Display port-2-lane MIPI DSI
9. Camera port-2-lane MIPI CSI
10. Audio- 4- pole stereo audio and composite video port
11. Storage-Micro-SD card slot for loading operating system and data storage
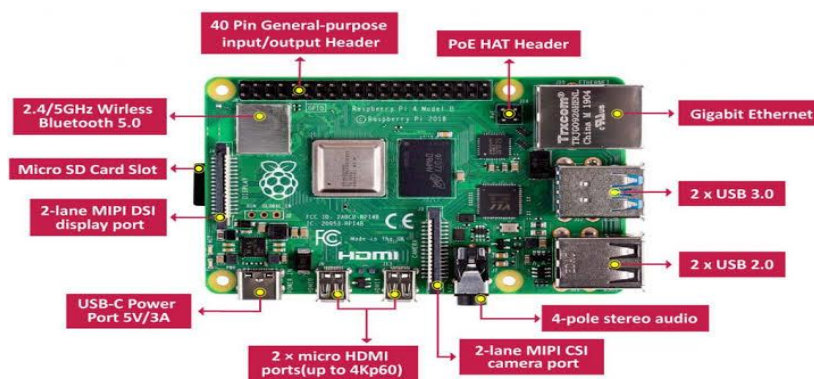12. Misc-H.265(4kp60 decode), H264(1080p60 decode, 1080p30 encode), OpenGL ES 3.0 graphics

Fig.3.2.1 Raspberry pi 4

3.2.1 Servo motor:

- Servomotor is a rotary actuator that allows for precise control of angular or linear position, Velocity and Acceleration.

- A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position.

- The input to its control is a signal (either analogue or digital) representing the analogue commanded for the output shaft.

- The MG995 servo motor has 3 wire interface and the connections should made as follows

    Red wire – 5V

    Black wire – ground

    White wire – data pin
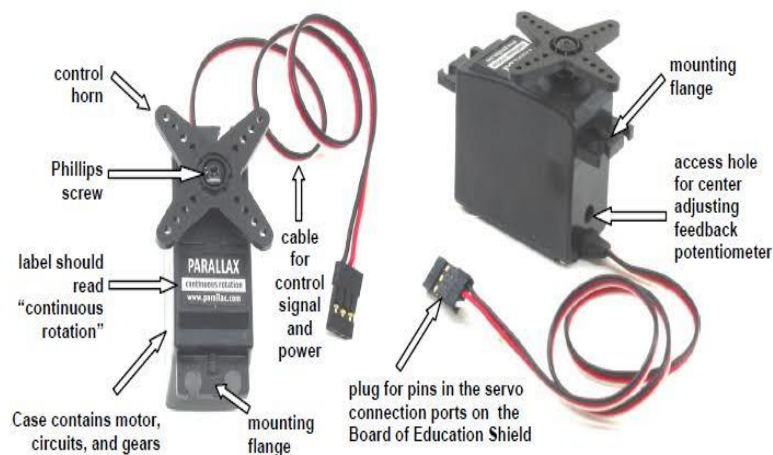
Fig.3.2.2 Servomotor

3.2.3 PCA 9685 servo driver:

- The module applies the PCA9685 chip as the controller.

- It can control the output of the 16-channel PWM values.

- The servo works like this: The PWM signal captured by the receiving channel is transmitted to the signal demodulated circuit, and a DC offset voltage is generated.

Specifications:

Item	Value
MCU operating system	3.3v 0r 5v
PWM supply voltage	2.3v to 5.5v
Tolerant inputs	5.5v
Output current on pin LED n	25mA
Ground supply current	400mA
Operating temperature	-40~85C
Interface	I2C
I2C Address Range	0*40 ~ 0*7f(default)
Size	L:60mm W:40mm H:18mm
Weight	14.3g
Package size	L:135mm W:85mm H:19mm
Gross Weight	21g
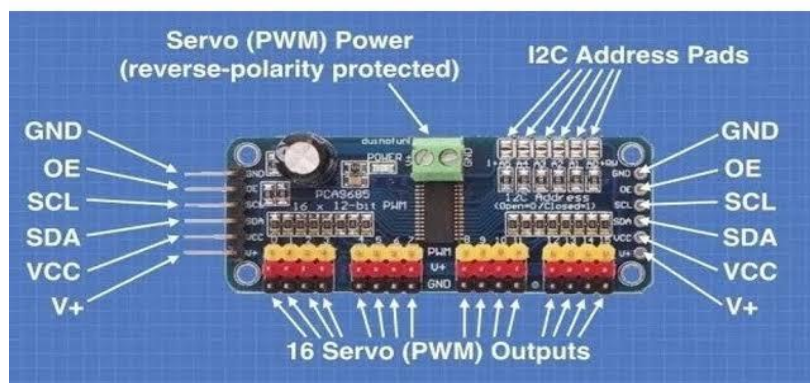
Fig.3.2.3 PCA9685 servo driver

3.2.4 DC motor:

- "775'' is a motor class. Any motor in that class will have similar size and case, but can have slightly different specs based on the internals.

- Similarly, a 775volt motor might consume 2 amps and produce 1550 watts of power.

- Specifications:

  Motor height:66.3mm

  Motor diameter:42.3mm

  Output shaft length:10mm

  Voltage:24v
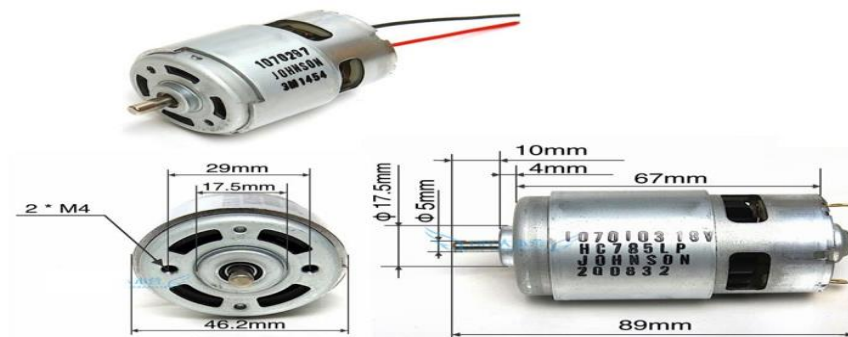
  Current:2.5A

  Speed:21000RPM

Fig.3.2.4 DC motor

3.2.5 L298N motor driver:

- The L298N is an integrated monolithic circuit in a 15- lead multi watt and power SO20
- It is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time.
- The module can drive DC motors that have voltages between 5 and 35V, with peak current up to 2A.
- **Features:**
  High operating voltage
  Large output current
  25 watt rated power

Specifications:

Driver model: L298N 2A

Driver chip: Double H-bridge L298N

Motor supply voltage(max):46v

Motor supply current(Max):2A

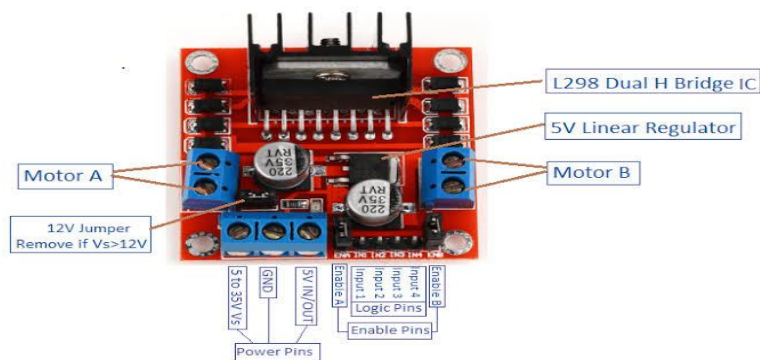Logic voltage:5V

Driver Voltage:5-35V

Driver current: 2A

Fig.3.2.5 L298N motor driver

3.2.6 LCD display:

- The ISP HDMI display with high resolution and ultrawide viewing angles.

- Specifically, the 5 inch and 7inch displays have a resolution of 720*1280 and a viewing angle up to double 178 degrees.

- They are small and light, easy to carry and compatible with most platforms with an HDMI interface.

- This is a 5inch LCD capacitive touch screen with multitouch support and has a resolution of 800*480.

- The panel is TN, which means it has a very low power consumption with short response time and a high refresh rate

- Single DSI interface is required for both power supply and data transmission.

- It is very easy to setup this LCD with raspberry pi without using any additional drivers, making it truly a plug-and-play display.

Specifications:

800*480 RGB LCD display

24-bit color

Industrial quality, 140 degree viewing angle

Horizontal, 130 degree vertical

10point multi touch - touchscreen

PWM backlight control and power control I2C interface

Backlight lifetime: 20000 hours

Fig. 3.2.6 LCD display

4.Result:

1. Welcome window

2. Selection window

3. Discription window

4. Paymet gateway window

5. Redirecting window

WORKING:

4.2 Software (FrontEnd) working:

In the software part we created Graphical User Interface(GUI) for the selection purpose. In the Graphical User Interface(GUI) we have a button named **Select your Juice** in the welcome window. After selecting the button different types of juices will be displayed in the second window. Customer can select any one of the juices in the second window. After that the description of that particular juice will be displayed in the third window. The description contains the minerals and proteins present in the juice. Then the customer should pay the amount in the online mode. We are using Razor pay payment gateway for the transaction purpose. After the completion of online transaction, a webpage will be opened by displaying **Thank you for Visiting** and the control will be given to the Hardware part.

4.3 Hardware(BackEnd) part:

The Central servo motor present in the hardware part will take the glass at the bottom of the containers. The servo motor placed in the container will fall down certain quantity of fruit pieces into the glass. After that the DC motor will crush the fruit pieces with low RPM, without losing the nutrients present in the juice. Then the Filter servo will filter the juice for separating the minor waste peal present in the juice. After that Out servo will serve the juice to the customer. This whole process will take 30sec to complete.

CHAPTER-5

5.1 Applications:

- Software Companies:
- Hospitals
- Railway Stations
- Gyms
- Shopping Malls
- Institutions

5.2 Advantages:

- Vending machines are loaded with a wide variety of healthier juices. This gives employees easy access to healthier food choices, that can support their personal wellness goals, as well as reduce the stress of running out for tea break when deadlines are looming.
- When employees are satisfied and when they are healthy, they take less time off of work due to health issues.
- The health and wellness of your staff can impact the success of your business through improved productivity and reduced absenteeism.
- It has low maintenance cost.
- It can reduce manpower.
- No provision of bargaining.
- Vending machines have the flexibility to be placed indoors and outdoors.

CHAPTER-6

6.1 Conclusion:

- The whole process is mainly based on graphical user interface.

- Based on this commands, this whole process will be done within 30 sec of time.

- We will decrease manpower here and also, we can produce fresh and hygiene juice.

- Vending dispenser is also called as minimarket, because customer will get the required juice after the completion of online transaction.

- Not only juices we can dispense different types of food items by changing this process in the programming.

6.2 Future scope:

Not only juices we can dispense many food items in future. We can get more profits and at the same time we can reduce manpower. We can modify the LCD display by changing the commands in the program. The convenience of cashless payment method using Razor pay favorable to be implemented on vending machine India. In addition, the accuracy of the optical touch panel developed in this work can be further increased by several methods.

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