

# ADVANCED CONTROL SYSTEM BASED FRUIT RIPENING CHAMBER

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**Abstract**— Ripening chambers play a vital role in extending the shelf life and period of marketing, avoiding shortage and post-harvest losses reducing transport bottlenecks during peak period of production and maintenance of quality of produce. In a Advanced fruit Ripening Chamber; the main aim is to design an fruit ripening system by controlling temperature without using any harmful chemical. And system should also be able to maintain the quality of the fruit. In this paper, contain the design of system with layout, circuit diagram.

**Keywords**—Advance Ripening, Electric Heating, Temperature & Humidity Sensor, Maturity Prediction, Economic Impact

## 1. Introduction

India is one of the largest producers of fruits in the world with an annual production estimated at 50 (approx.) million MT. Among them a large no of fruits like mango, banana, papaya, guava, etc. come under the climacteric fruits, which needs proper ripening chambers to make them ripen in a controlled way. These fruits continue to ripen even after harvesting and also respire which involves intake of Oxygen and emission of CO<sub>2</sub>. For the ripened fruit to have the right color, taste, flavor etc. the ripening should occur in a controlled atmosphere in which the temperature, humidity, oxygen and CO<sub>2</sub> concentration has to be maintained at the optimum level, which are different for different fruits. This can only be done by carrying out the ripening operation in fruit ripening chambers. Though there are several types of ripening and storage chambers which are used globally, in India mostly cold room or Cold Stores are used for the purpose. In addition there are several manufactures of fruit storage and ripening chambers.

The ripening also involves respiration of the fruits which consume oxygen and emit CO<sub>2</sub>. CO<sub>2</sub> concentration also has to be controlled as its concentration beyond 1% will retard ripening, delay the effect of ethylene and cause quality problems. In Short various parameters like CO<sub>2</sub> and Oxygen concentration, temperature and humidity have to be monitored and controlled for getting the best results. This can only be done in an air tight cold room or ripening chamber equipped with an Advanced Ripening Chamber Control System. Depending upon the type of fruits the climatic conditions like temperature humidity and constituent gas concentration have to be controlled and maintained in the Fruit Storage Chamber. This also needs a micro controller based control system incorporating the relevant sensors.

## 2. Problem in previous system

We have observed earlier that fruit ripening by natural process takes more time to ripen. The methods of fruit ripening having fast operations affecting the human health

Placing the fruits intended for ripening inside an air tight room and applying smoke inside smoke chambers for the purpose of ripening. Smoke emanates acetylene gas. Several fruit traders follow this technique to achieve uniform ripening especially in edible fruits like banana and mango. But the major drawback of this method is that the fruits do not attain uniform color and flavor. In addition, the persistence of smoke odor on the product impairs its quality.

Most climatic fruits in India are ripened with industrial grade calcium carbide. It usually contains traces of arsenic and phosphorus, and, thus, use of this chemical is illegal in most countries. Calcium carbide, once dissolved in water, produces acetylene which acts as an artificial ripening agent. Acetylene is believed to affect the nervous system by reducing oxygen supply to brain. Arsenic and phosphorus are toxic and exposure may cause severe health hazards.

Method selected for applying ethylene depends on cost, convenience and safety factors. Use of diluted ethylene gas mixtures is safe

than using pure ethylene, which is explosive and flammable at concentrations of 3% or higher.

Ethylene releasing compounds such as ethephon (2-chloroethyl phosphoric acid) are sometimes used to ripen tomatoes destined for processing. When using ethephon as spray, amount of ethylene released will increase as pH and/or relative humidity increase.

The drawback of earlier fruit ripening system is the fruits are not ripen in proper manner i.e. some fruits are over ripped where as some fruits are under ripped due to non-uniform spreading of above such chemicals like ethylene, acetylene, calcium carbide etc. which causes spots on the fruits such as black or white.

Due to this fruits get excessively heated which can further affect the human health. Which may also lead to harmful diseases like mouth ulcers, piles etc.

### 3.System description & methodology

#### System layout

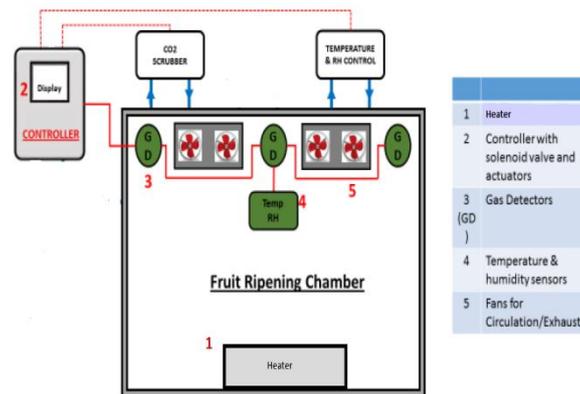


Fig1 Layout of Fruit Ripening System

- Above fig shows layout of fruit ripening system which is automatic electrically controlled. The Microcontroller PIC16F877A is used as controller.
- It consists a heater which is used to maintain temperature in chamber
- There are temperature and humidity sensors used. And also there are fans used for circulations/exhaust.

#### 3.1 Working Principle

The control system of the fruit ripening chamber is shown above. With the help of this temperature of chamber is controlled during the ripening process. In this control system Microcontroller PIC16F877A is the main component used which is supplied by 1-phase regulated AC supply. When we put the fruits in the chamber the ripening process starts & in that process the temperature of the chamber increases due to the extraction of CO<sub>2</sub> gas. This gas is sensed by a gas sensor & temperature is sensed by a DHT11 sensor which gives a signal to the microcontroller. The microcontroller then takes immediate action to start the exhaust fan and cooling fan, which are controlled by a motor driver.

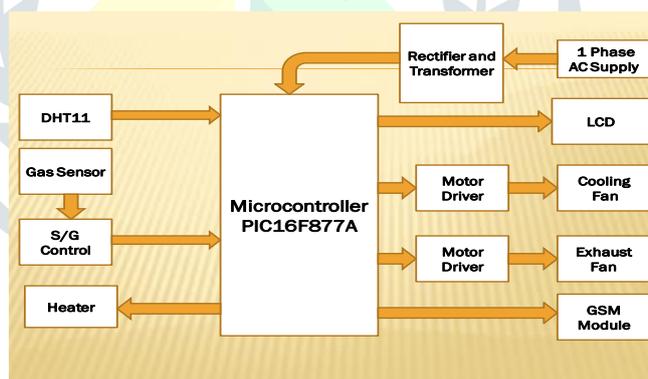


Fig2 Block diagram of system

If the temperature of the chamber is already less than 32°C, then the heater starts & the range of temperature in the chamber is between (32-33)°C. In an advanced fruit ripening chamber, the GSM module is introduced, which gives us proper information about the ripening process at specific time intervals so that the fruits are ripe in a proper manner and no fruits are spoiled.

Table No.1 Difference between Chemical and Electric heating.

Chemical	Electric heating
We cannot maintain colour & flavor of fruits while we apply smoke to ripen the fruits.	We can maintain colour & flavor by using electric heating.
Chemicals like	No issues of

ethylene flammable and explosive.	are and	explosivity as no use of no chemicals.
There are spots on fruits when we use chemicals.		As we don't use chemicals there are no spots on fruits.
Chemical ripening is harmful to the human beings.		Electric heating is not harmful to the human beings.

### 3.2 Components Used

#### 3.2.1 DHT11

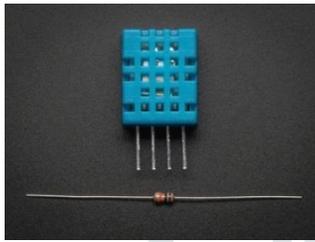


Fig3DHT11

- Low cost
- 3 to 5V power and I/O
- 2.5mA max current use during conversion (while requesting data)
- Good for 20-80% humidity readings with 5% accuracy
- Good for 0-50°C temperature reading  $\pm 2^\circ\text{C}$  accuracy
- No more than 1 Hz sampling rate (once every second)
- Body size 15.5mm x 12mm x 5.5mm

#### 2. Microcontroller PIC16F877A

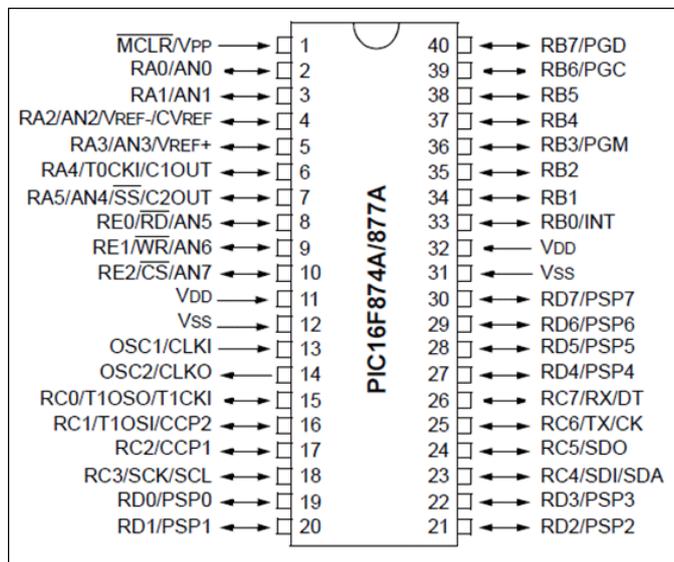


Fig4 Microcontroller PIC16f874A

**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.

3.LCD

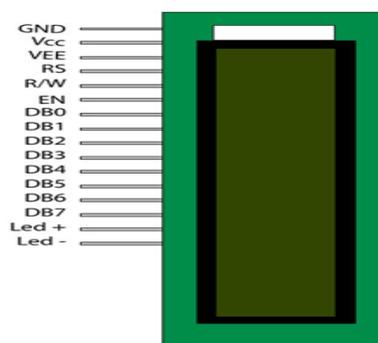


Fig5 LCD

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register

stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

#### 4. Motor Driver L293D

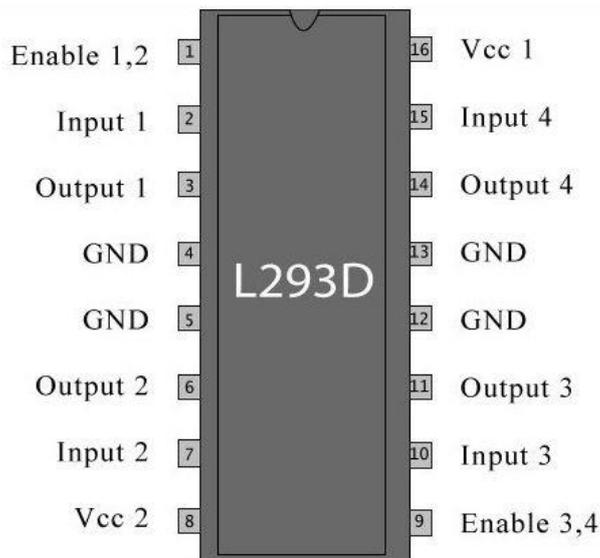


Fig6 Motor driver L293D

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver integrated circuit (IC).

#### 5. Exhaust Fan

A fan that moves air out of an enclosure. Type's attic fans a fan that blows heated air out of the attic of a building. Type of fan a device for creating a current of air by movement of a surface or surfaces.

#### 6. Co2 Sensor



Fig7 CO2 Sensor

A carbon dioxide sensor or CO<sub>2</sub> sensor is an instrument for the measurement of carbon dioxide gas. The most common principles for CO<sub>2</sub> sensors are infrared gas sensors (NDIR) and chemical gas sensors. Measuring carbon dioxide is important in monitoring indoor air quality, the function of the lungs in the form of a capnograph device, and many industrial processes.

#### 4.CONCLUSION

In this paper we have discussed the process of fruit ripening by using Electrical heating which is very advantageous as compared to chemical ripening process of fruits. By using these Advance fruit ripening process we can serve healthy and quality

products to our civilians. As we used Electric heating we are decreasing here the cost of fruit ripening system as compare to earlier systems.

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