Solar Powered Moisture Control of Fresh Harvested Mangoes for Export Quality

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Abstract: Heat is developed specifically for insect control. In addition to that moisture on the mangoes is also controlled. The temperature and exposure time are adjusted to kill all stages of fruit fly infected produce. The treatment consists of a period of warming which can be faster or slower depending on a commodity's sensitivity to high temperatures. Then there is a holding period when the interior temperature of the produce reaches the desired temperature for the length of time required to kill the insect. To regulate the speed of the fan, the temperature sensor and moisture sensor are defined as inputs to the microcontroller. Taking in the temperature and moisture values, the Arduino thus defines a control strategy. It is a crucial step to control the speed of the fan and the heating coil temperature as it may over dry the mangoes or under dry them resulting in a loss and spoilage of quality.

Keyword: Heat Treatment, Fruit Flies, Quarantine, Commodity's.

I.INTRODUCTION

Losses in quantity and quality occur after harvest at different points in the handling chain. A loss assessment study conducted under this project in 2015, showed that losses amounted to 31 percent due mainly to decay that manifested at the retail level. Bruising and weight loss which represent loss in marketable weight are the other nature of losses. These losses can be attributed to poor harvesting, rough handling, and poor packaging and transport conditions. The high incidence of decay mainly in the form of anthracnose and stem end rot can be attributed to the high level of pre-harvest infection due to improper disease management during production. Anthracnose is a latent infection and symptoms of the disease become apparent only as the fruit ripens. Decay of mangoes at the retail level Photo 3. Good quality mangoes desired by consumers post-harvest losses represent a waste of the resources – land, labour, energy, water, fertilizer, etc. that went into producing the crop. Every effort must, therefore, be made to minimize these losses. Unless these losses are minimized, the gains from production will be offset and potential income cannot be realized. Moreover, consumers are now increasingly paying attention to quality and safety. They are looking for and are willing to pay a premium price for good quality mangoes that are safe. Preservation of the nutritive value goes hand in hand with the prevention of quality deterioration. With the changing tastes and lifestyles of consumers, and the need to reduce the high levels of post-harvest losses, the need for good post-harvest handling becomes a matter of concern. The continuous growth of supermarkets and hypermarkets and the demands from institutional buyers require giving more attention to post-harvest handling of mango to satisfy demand for better quality and safe produce.

The main motivation of the project is to protect the post harvested mangoes having high amount of moisture on it so these types of fruits get damaged and easily expose to various diseases so to get rid of that we should remove excess moisture and expose them to hygienic environment. These mangoes are mainly used for exporting to foreign countries so generally post harvested mangoes has less ripening time to increase that time which can be using smartly by using today's technology. It makes use of wi-fi technology to communicate from android device.

II.LITERATURE SURVEY

Solar drying is one of the most efficient and cost-effective, renewable, and sustainable technologies to conserve agricultural products in Asian and sub-Saharan African (SSA) countries. This review paper presents the different types of solar dryers that are widely used in Africa and Asia. In addition, the pre-eminent effects of their use on product quality, as well as their economic, environmental, and social impacts, are highlighted. Since financial, external, and structural factors play a key role in the adoption and scaling of solar dryers, this paper also discusses the impact of these factors on the effectiveness of solar drying technologies in selected Asian and SSA countries [1].

Vitamin A deficiency, which is especially widespread among children younger than age 5 years, is a major barrier to reducing child mortality rates in French-speaking West Africa. A large amount of an indigenous plant source of provitamin A carotenoids are lost to postharvest waste. For example, the postharvest loss of mangoes in the region exceeds an annual total of 100,000 metric tons. In our study, 3.75 metric tons of fresh mangoes were dried using a solar dryer to a final moisture content of 10% to 12%, yielding a total of 360 kg dried mango. The product analysis revealed 4,000±500 µg beta carotene/100 g and 3,680±150 µg beta carotene/100 g after 2 and 6 months of storage, respectively. Thus, one greenhouse solar dryer can reduce postharvest mango waste by 3.75 tons providing up to 1.15 million retinol activity equivalents of dietary vitamin A. The use of this technology that requires solar energy and manpower has the potential of increasing dietary vitamin A supply by up to 27,000-fold, compared to the currently available vitamin A in the region. Moreover, mango is a fruit that is well-liked by the population in this geographic area increasing the likelihood of its ready acceptance. Reducing postharvest loss of mangoes by using greenhouse model solar dryers is a promising strategy to help combat vitamin A deficiency in French-speaking West Africa [2].

A hybrid solar dryer was designed and constructed using direct solar energy and a heat exchanger. The dryer consists of solar collector, reflector, heat exchanger cum heat storage unit and drying chamber. The drying chamber was located under the collector. The dryer was operated during the normal sunny days as a solar dryer and during cloudy days as a hybrid solar dryer. Drying was also carried at night with stored heat energy in water which was collected during the time of sunshine and with electric heaters located at water tank. The efficiency of the solar dryer was raised by recycling about 65% of the drying air in the solar dryer and exhausting a small amount of it outside the dryer. Under mid-European summer conditions, it can raise up the air temperature from 30 to 40 degrees above the ambient temperature. The solar dryer was tested for drying of ripe banana slices. The capacity of the dryer was to dry about 30KG of banana slices in 8 hours in sunny day from an initial moisture content of 82% to the final moisture content of 18% (wb). In the same time, it reduced to only 62%(wb) moisture content in open sun drying method. The colour, aroma and texture of the solar dried products were better than the sun drying products [3].

III.PROPOSED METHODOLOGY

To overcome these problems, our proposed system is solar powered moisture-controlled system is a eco-friendly method for environment as well as for human and mango. This method is conducted using hot air and is an alternative to cut down the need to use chemical products to assure the quality of fruits or vegetables. The application of heat treatment significantly reduces fruit softening, by maintaining firmness and extending shelf-life. Thus, heat treatment applied at temperatures between 45-47 degrees centigrade and effectiveness of a heat treatment depends on proper planning by a "heat-treatment team" for moisture control and pest control.
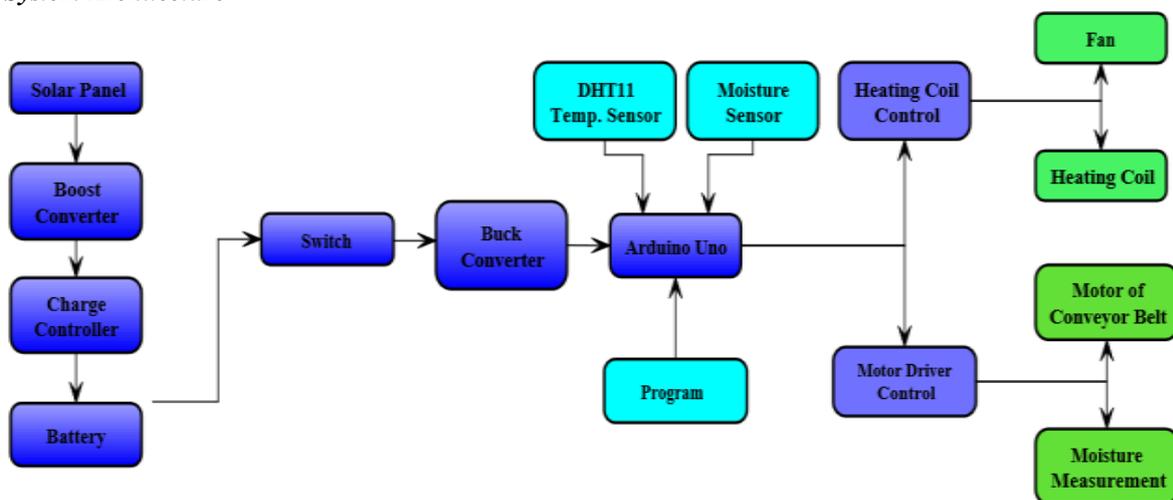
System Architecture

Fig1: Block diagram of System Architecture

a) Power Supply:

The 5V regulator requires a min input voltage of 6.2 volts and can take a maximum input voltage of 20V – so the power supply you hook up to your DC jack needs to be in that range for voltage. The sweet spot is more like 7-12 volts, if your power supply is much higher than that, you're wasting a lot of power on that 5V regulator in the form of heat dissipation.
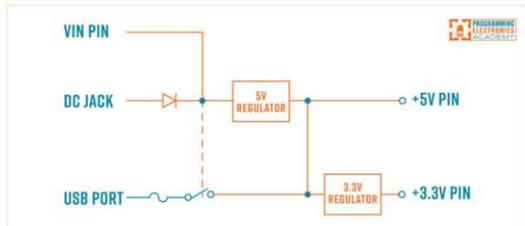

Fig2: Power Diagram

b) Arduino UNO:

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards can read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.
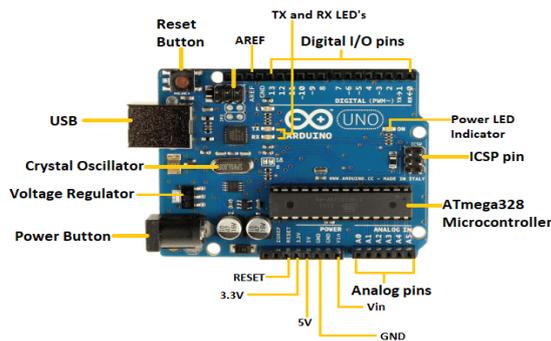

Fig3: Arduino UNO

c) ESP8266 Wi-Fi module:

In 2014, an ESP8266 Wi-Fi module was introduced and developed by third-party manufacturers like AI thinkers, which is mainly utilized for IoT-based embedded applications development. It is capable of handling various functions of the Wi-Fi network from another application processor. It is a SOC integrated with a TCP/IP protocol stack, which can provide microcontroller access to any type of Wi-Fi network. This article deals with the pin configuration, specifications, circuit diagram, applications, and alternatives of the ESP8266 Wi-Fi module.
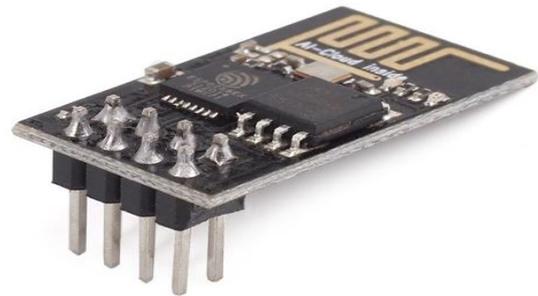

Fig4: ESP8266 Wi-Fi Module

d) Solar Panel:

A solar cell panel, solar electric panel, photo-voltaic (PV) module, PV panel or solar panel is an assembly of photovoltaic solar cells mounted in a (usually rectangular) frame, and a neatly organized collection of PV panels is called a photovoltaic system or solar array. Solar panels capture sunlight as a source of radiant energy, which is converted into electric energy in the form of direct current (DC) electricity.
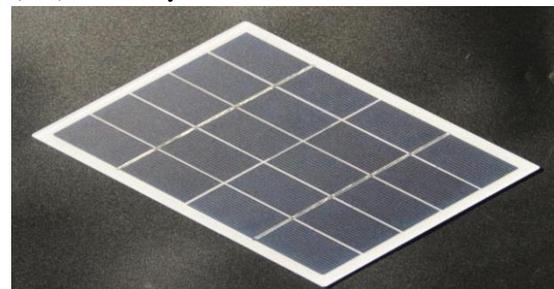

Fig5: Solar Panel

e) DHT11 Temperature Sensor:

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.
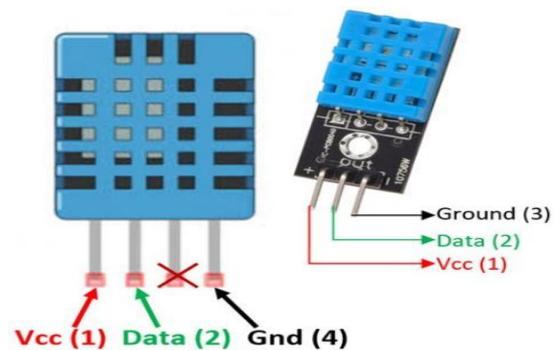

Fig6: DHT11 Temperature Sensor

f)   Moisture Sensor:

The moisture of the soil plays an essential role in the irrigation field as well as in gardens for plants. As nutrients in the soil provide the food to the plants for their growth. Supplying water to the plants is also essential to change the temperature of the plants. The temperature of the plant can be changed with water using the method like transpiration. And plant root systems are also developed better when rising within moist soil. Extreme soil moisture levels can guide to anaerobic situations that can encourage the plant's growth as well as soil pathogens. This article discusses an overview of the soil moisture sensor, working and its applications.
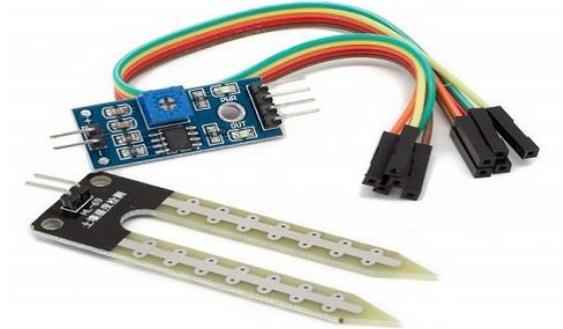

Fig7: Moisture Sensor

IV.IMPLEMENTATION AND WORKING

The Arduino is get connected to various components like Wi-Fi module, motor driver, charge controller dht temperature sensor and moisture sensor ,16*2 LCD Display, conveyer belt. Moisture sensor is connected to the Arduino for pins grd, 5v and temperature sensor is connected to the pin no A0. The pins of Arduino UNO are connected to the Wi-Fi module which is very important for the real time monitoring of the temperature and moisture. Then motor driver is connected to the pins 11 and 12 of Arduino and it is further connected to the 12v DC fan and motors for conveyer belt. LCD Display is used to display the temperature, Moisture and Humidity and the pin of LCD is connected to the pins tx,2,3,4,5,6,7 of the Arduino UNO. Solar panel is connected to the charge controller, and it is connected to the Lithium-Ion Batteries. Nichrome wire is connected to the single Lithium Ion Battery, and which is used for the heating.

FLOW CHART:

Initialize the variables like m1, m2. Display the humidity and temperature and moisture values using dht.h file. If the temperature (temp>47.5), cut the power supply for fan and Nichrome wire. If not, fan should be on along with nichrome wire heating.
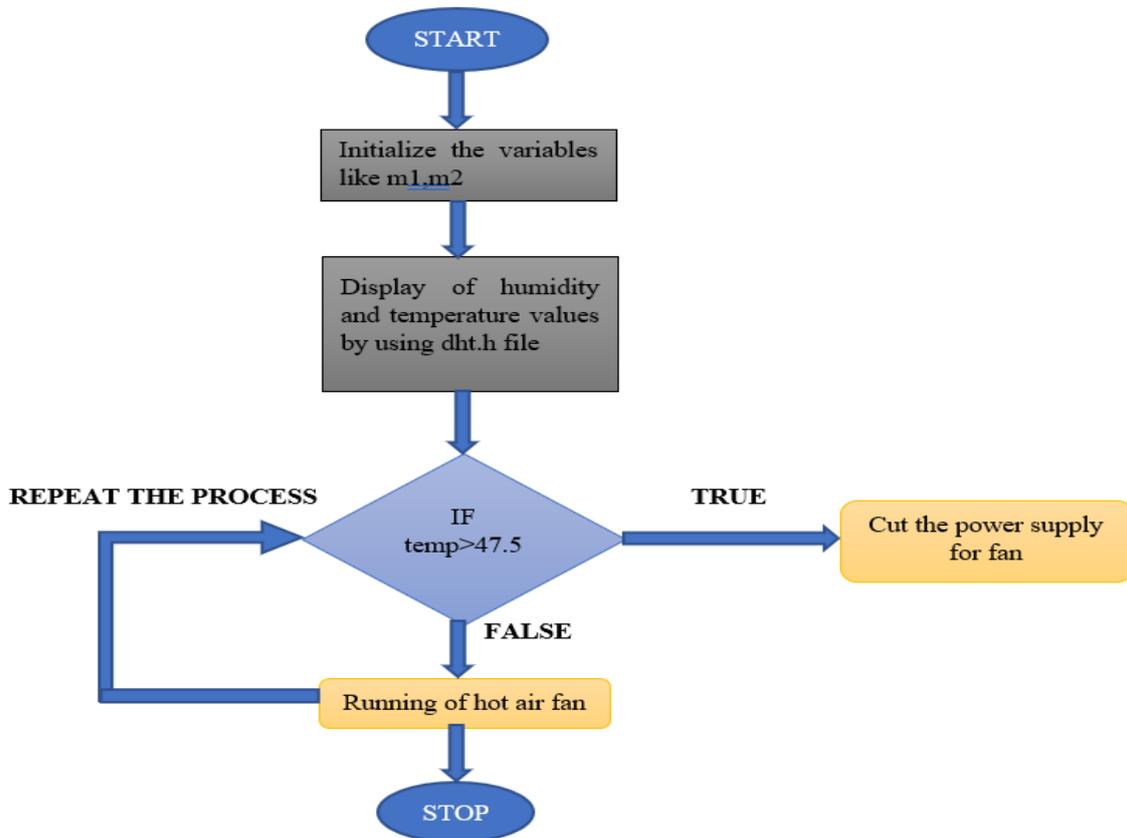

Fig8: Flow chart

Working:

When the code gets dumped into the Arduino and if we give supply the process will start .If the temperature of the room is less than 47.5 degrees centigrade then the DC fan will on whether the temperature is more than that then the fan will be in off state and we need to maintain that much temperature up to 20 min at that room. The values will get displayed on the LCD display and at the same time we can monitor them through our mobile by using thing view app by interfacing wi-fi module. Thus moisture will get controlled which in turn , the ripening time of mangoes will get delayed and the mangoes almost to about 9-11 days from 6-7 days. The diseases, Fungus will get removed.
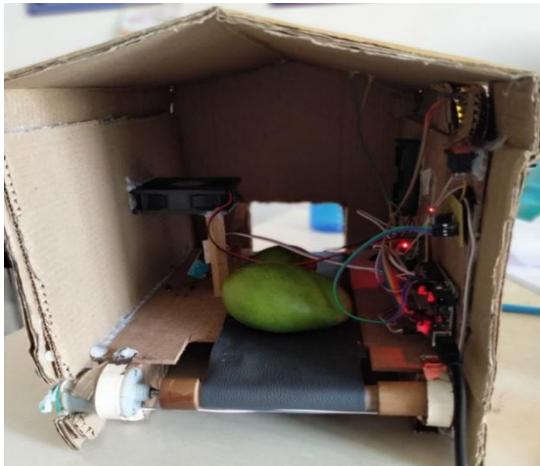
IV.RESULTS
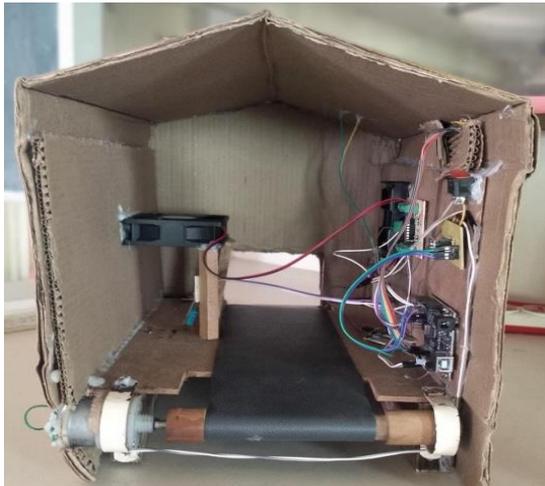
a. Setup

b. Post Harvested Mangoes

c. Mangoes are placed on the conveyer belt and started the process of heat treatment.

d. Fan will rotate for the temperature less than 47.5 degrees, above it will stop.

e. Without heat treatment mangoes will get ripe in 6-7 days.

V. CONCLUSION AND FUTURE SCOPE

In the paper, we discussed about the implementation of "SOLAR POWERED MOISTURE CONTROL OF FRESH HARVESTED MANGOES FOR EXPORT QUALITY" has been successfully designed and tested. In this system, heat treatment of mangoes if the temperature changing board is at user end, then it will be helpful. But now at this stage one must change at some point of code so it can be useful for other vegetables and fruits. This is used at post harvesting process. It reduces manpower for all the activities of drying and pest control.

If we arrange user end temperature changing interface so that the industry can change the temperature according to their crops for different types of fruits and vegetables.

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