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Automated Sensor based Artificial Ripening System using Arduino and IoT

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***Abstract*: Climate change affects fruit crops' growth and development by delaying fruit ripening, reducing color development, and lowering fruit quality and yield. The irregular date palm fruit ripening in the past few years is assumed to be related to climatic change. The current study aimed to design and validate an automated sensor-based artificial ripening system (S-BARS) combined with ultrasound pretreatment for artificial ripening date fruits cv.Khalas. A sensor-based control system was constructed to allow continuous real-time recording and control over the process variables. The impact of processing variables, i.e., the artificial ripening temperature (ART-temp) and relative humidity (ART-RH). The system for controlling temperature & humidity automatically is achieved by using microcontroller system. Arduino Uno due to its increased popularity finds its varied range of applications. Temperature & Humidity sensor and Microcontroller are the hardware used interfaced with computer, and the temperature is controlled in the room. Temperature, humidity & other parameters are displayed on LCD display. We have designed temperature & Humidity control as an automatic system that has been not attempted before the way it has been implemented.**

***Keywords*: Fruit ripening system, organic fruit ripping, IoT.**

1. Introduction

A robust and vibrant food processing industry is essential for reducing the loss of perishable agricultural products, extending the shelf life of food items, ensuring the value addition of agricultural products, diversifying and commercializing agriculture, creating jobs, raising farmer incomes, and building surplus for the export of agricultural and processed foods. All sectors, including the private, public, and cooperative sectors, have specific roles to play in the era of economic liberalization, and the Ministry encourages their active engagement.

A growing interest in a more balanced diet that includes a higher consumption of fibre, vitamins, and minerals has contributed to a global trend towards the consumption of fresh fruits and vegetables. Based on this, in part, because of the decreased calorie requirements of modern life and increased knowledge of the value of maintaining a nutritious diet for a higher standard of living.

Given the high rates of postharvest losses and the high cost of the actual production, harvesting, packaging, and shipping fruit to market, methods to accurately and quickly assess the level are needed because some fruits cannot ripen normally if detached from the parent plant when physiologically immature.

Designing modified environment storage and transport containers is difficult due to the possibility of temperature misuse throughout the supply chain. Anaerobic conditions eventually develop inside modified atmosphere (MA) storage as a result of increased respiration rate caused by higher than ideal temperature, which reduces the storage's shelf life.

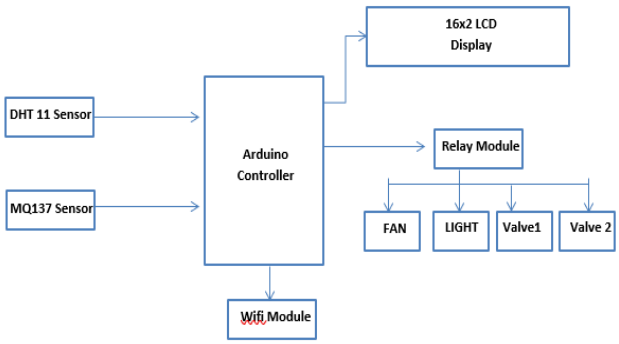

Fig. 1. Block diagram

Hardware Requirements:

- Ardiuno Uno Controller
- ESP8266-01
- DHT11
- Ammonia Sensor MQ137
- 16x2 LCD Display
- Fan
- Light
- Valves
- Power Supply

Software Requirements:

- Arduino IDE

A. Arduino Uno

Arduino UNO is an ATmega328-based microcontroller. It features 6 analogue pins and 14 digital input/output pins. The Arduino board requires 5 volts to operate. It comes with a USB

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cable and is programmed using the Arduino IDE, which stands for Integrated Communication Area on USB type B. It is linked to the supply using an adapter.

Fig. 2. Arduino Uno

B. ESP8266-01

The ESP8266 module can only operate at 3.3V; anything higher than 3.7V will cause the module to malfunction. The FTDI board, which enables 3.3V programming, is the most effective tool for programming an ESP-01. It is advised to purchase one if you don't already have one, but you can also use an Arduino board in the interim. One common issue with the ESP-01 that everyone has is the powering up issue. Since the module requires some power while being programmed, you can either use a potential divider or an Arduino 3.3V pin to supply power. Therefore, it's crucial to create a tiny voltage regulator for 3.31v that can deliver at least 500mA.

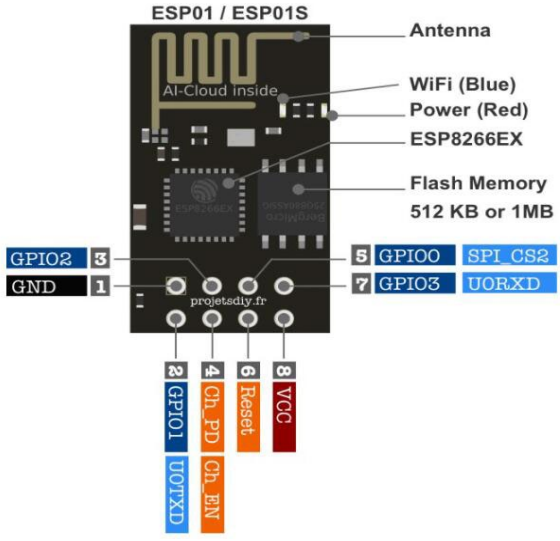

Fig. 3. ESP8266-01

C. Relay

A temperature and humidity sensor complex with a calibrated digital signal output is part of the DHT11 Temperature & Humidity Sensor. It guarantees high dependability and outstanding long-term stability by utilising the unique digital-signal-acquisition technique and temperature & humidity monitoring technology. This sensor connects to a high performance 8-bit microcontroller and combines a resistive-type humidity measurement component with an NTC temperature measurement component to provide great quality, quick response, anti-interference capability, and cost effectiveness.

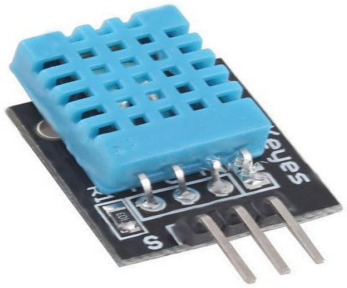

Fig. 4. Relay

A typical temperature and humidity sensor is the DHT11. The sensor includes a dedicated NTC for temperature measurement and an 8-bit microprocessor for serial data output of temperature and humidity information. Additionally, factory calibrated, the sensor makes it simple to interface with other microcontrollers. Sensor is also factory calibrated and hence easy to interface with other microcontrollers.

D. Ammonia Sensor MQ137

Ammonia detector works on electrochemical principle. Electrochemical sensors are electrochemical measuring transducers for measuring the partial pressure of gases under atmospheric conditions. The ambient air being monitored diffuses through a membrane into the liquid electrolyte in the sensor

Fig. 5. Ammonia sensor MQ137

Fig. 6. MQ137 Pinout

E. 16x2 LCD Display

Liquid crystal display is referred to as LCD. It is a particular type of electronic display module used in a wide array of circuits and devices, including mobile phones, calculators, computers, TVs, and other electronics. These displays are mostly preferred for seven segments and multi-segment light-emitting diodes. The main advantages of adopting this module are its low cost, ease of programming, animations, and unlimited ability to display bespoke characters, unique

animations, etc. The output voltage is 12V or 0V and output current is 5A.

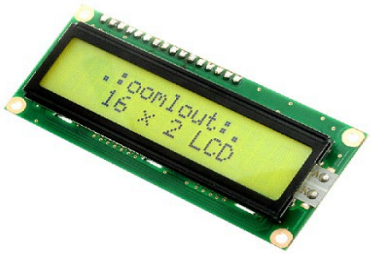

Fig. 7. E. 16x2 LCD display

F. Four-Channel Relay Module

The four-channel relay module contains four 5V relays and the associated switching and isolating components, which makes interfacing with a microcontroller or sensor easy with minimum components and connections. The contacts on each relay are specified for 250VAC and 30VDC and 10A in each case, as marked on the body of the relays

The 4 Channel Relay Module is a convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc. The relays terminal (COM, NO and NC) is being brought out with screw terminal. It also comes with a LED to indicate the status of relay.

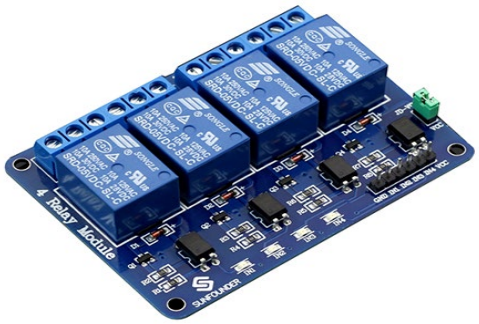

Fig. 8. Four-channel relay module

2. Circuit and Working

A temperature and humidity value can be sent from the DHT11's second data pin to the Arduino Uno's fifth pin.The DHT11's first and fourth pins are used for Vcc and Gnd, while the third pin is unconnected. The analogue pin A0 is linked to the MQ sensor's analogue output.

Temperature, humidity, and gas level values are processed by the Arduino Uno and sent to an ESP8266 WiFi module. The second (Rx) and third (Tx) pins of the Arduino Uno are connected to the Tx and Rx pins of the ESP8266. Ensure that the ESP8266's input voltage is 3.3V and not 5V (otherwise, a device may be damaged). We are using the AMS1117 Voltage Regulator Circuit for that. It can control voltages between 9V and 3.3V.

3. Construction and Testing

ThingSpeak is an open source platform to store and retrieve a data for Internet of Things application. To use this, you need to register in ThingSpeak cloud and then login to your account. After create a new channel with temperature in one field and humidity in another field as shown in Fig. Once you created a new channel, it will generate a two API keys, they are READ API keys and WRITE API keys. First, copy the WRITE API keys from

ThingsSpeak and paste it into the line (String apiKey = "**********";) of the program. Next, replace the Host_Name and Password with your WiFi name and WiFi password in the two lines given below in the program. (String Host_Name = "Pantech" and String Password = "pantech123")

The Arduino program Uses DHT library, if it is not presented in your arduino IDE, select SketchàInclude libraryàManage librariesàInstall DHT Sensor library. Then compile the program and upload to a Arduino Uno through Arduino IDE. Ensure that WiFi modem and internet connection in your Smartphone or PC are working properly. After uploaded a program, the Temperature and Humidity data is uploaded on ThingSpeak platform.

4. Conclusion

This paper presented the implementation of automated sensor based artificial ripening system using Arduino and IoT.

References

[1] D. Paul *et al.,* Modeling of modified atmosphere packaging based on designs with a membrane and perforations J. Membr. Sci., 2002.

[2] J. C. Montanez *et al.,* Modelling the gas exchange rate in perforation-mediated modified atmosphere packaging: Effect of the external air movement and tube dimensions J. Food Eng., 2010.

[3] M. Mashabela *et al.,* Influence of different types of modified atmosphere packaging films and storage time on quality and bioactive compounds in fresh-cut cauliflower Food Packaging Shelf Life, 2019.

[4] N. R. Markarian *et al.,* Computerized monitoring and control for a research controlled-atmosphere storage facility Comput. Electron. Agric., 2003.

[5] P. V. Mahajan *et al.,* Analysis of water vapour transmission rate of perforation-mediated modified atmosphere packaging (PM-MAP) Biosyst. Eng., 2008.

[6] P. Mahajan *et al.,* Quality and safety of fresh horticultural commodities: Recent advances and future perspectives Food Packaging Shelf Life, 2017.

[7] J. H. Lee *et al.,* Fresh produce container adaptively controlled in its atmosphere modification under variable temperature conditions Biosyst. Eng., 2018.

[8] N. Keshri *et al.,* Development of sensor system for real-time measurement of respiration rate of fresh produce Comput. Electron. Agric., 2019.

[9] S. Kartal *et al.,* Use of microperforated films and oxygen scavengers to maintain storage stability of fresh strawberries Postharvest Biol. Technol., 2012.