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Domestic Vegetables Dryer

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Abstract : This Paper Technology has improved from time to time including in getting a better performance of a photovoltaics (PV) panels yet less worked needed to maintain the output. However, solar array is usually being placed in an open area, its surfaces are likely to be exposed to impurities that can reduce the solar power generation. Hence, this project proposed an efficient way to clean a PV array as well as controlling and monitoring the panels via IoT in order to improve the voltage and current output. In the proposed prototype, the output that need to be considered are PV panels surface image, voltage and current output from the PV panels and the efficiency of the robot cleaning to clean more than one panel. The results show that the distance-monitoring model analyses the sensing data and the specific method for measuring the values of adapted sensors and also the self-controlling of the output linked equipment. Since solar has been a high demand market currently, this prototype should be able to operate and fulfill all the market demand.

I. INTRODUCTION

Vegetables are subject to spoilage under the influence of microbial, chemical or physical effects, and the nutritional value, colour, texture and palatability of vegetable are subject to spoilage. After hunting enormous animals that they really can not consume all at once, primitive humans realized they needed a way to store their prizes, and so "vegetable preservation" was born in ancient civilizations. Preserving vegetable means protecting it from both the internal and external elements that con- tribute to vegetable degradation. Vegetable preservation techniques are used to keep vegetables fresh for longer without sacrificing their flavour, texture, or nutritional value. The main idea behind all vegetable preservation methods is to reduce the activity or completely kill pathogenic bacteria. Vegetable preservation includes various stages of vegetable processing to maintain the quality of vegetable at the desired level in order to achieve maximum profit and nutritional value . Vegetable storage, processing and preservation are essential for continuous supply of vegetable in season and out of season.

Vegetable that is safe and hygienic must be prioritized above all other fundamental necessities. Only vegetable preservation may be able to meet the demand and supply of sanitary. Dehydration, freezing, chilling, chemical treatment, and thermal heating are some of the ways that can be used. Drying is a traditional way to preserve vegetable through various methods such as sun, microwave and vacuum drying.

A sys- tem was developed with a temperature and solar light sensor to deter- mine the strength of sunlight and dehydration time of dates. For a food and industries, the IoT a game changer. However, the IoT do- main is a vast heterogeneity of major obstacle Smart webs of linked and context-sensitive things which can be identified, felt, and operated remotely makes up the Internet of Things.

II. LITERATURE SURVEY

"Research on Intelligent Vegetable Warming Board Based on 52 Microcontroller", Liu Chang; Yu Haixia, 2023 IEEE International Conference on Image Processing and Computer Applications (ICIPCA)

Intelligent warming boards are playing an increasingly important role in daily life, facilitating many details in daily life. This design is mainly based on the STC89C52 microcontroller and temperature sensor DS18B20 as the core design of an intelligent vegetable warming board. The design can achieve manual and automatic control modes through buttons and Bluetooth modules, and can be applied to various occasions to achieve various functions such as hot vegetable warming, drying clothes, thawing, insulation of

vegetable, warm milk and warm wine. At the same time, the HC-05 Bluetooth module can also be used to constantly query, detect, and display the working status of the warming board on the mobile phone, and has voice reporting function.

"Design, manufacturing and test of a mixed-mode solar dryer for vegetable products". Saber Chemkhi . 2022 13th International Renewable Energy Congress (IREC)
This work was focused on the experimental study of a mixed-mode solar dryer. This dryer is designed and manufactured at the mechanical engineering department of ISSAT Kairouan. Mainly a solar collector, a drying box equipped with three trays for crops and covered with a transparent glass cover, a chimney, composes it and it is equipped with an electric air fan. The presented dryer is characterized by two coupled heat transfer modes; convective heat transfer and direct solar radiation to dry the vegetable products. The solar dryer is tested in Kairouan city during June 2022 and applied to dry two vegetable products, red pepper and banana. The experimental results are acceptable and the system present high thermal efficiency and short dying time from 4 to 7 hours. Compared to conventional convective drying in a tunnel dryer, the solar system can save a lot of energy and reduce the drying time considerably. Moreover, the final quality of the dry products is acceptable for human safe consumption.

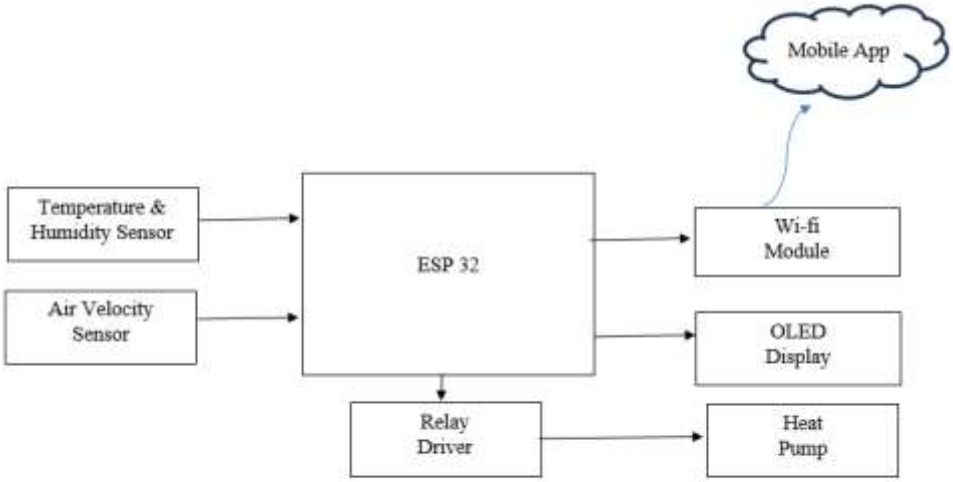
"Experimental studies on drying of orange peel in solar tunnel dryer using sensible heat storage material", Sandeep Bukke; B.Basant Kumar Pillai; Karthikeyan A.K, 2016 International Conference on Energy Efficient Technologies for Sustainability (ICEETS)
A solar tunnel dryer along with solar air heater has been built with sensible heat storage material at VIT University, Vellore, mainly for drying agricultural and horticulture product on small scale. The pebbles coated with black color are used as sensible heat storage material, in the dryer. A mass of 36 Kgs are used inside the dryer. The current paper determines the performance of the dryer to dry orange peels. It took 14 hrs to dry in natural convection where as it took 8 hrs to dry in natural convection along with sensible heat storage material. Solar tunnel dryer integrated with solar air heater and sensible heat storage material represents a more drying efficiency than mechanical dryers no additional cost is used to run and maintaining of dryer and natural convection with sensible heat storage is a good method improving performance of the dryer.

"IoT Based Solar Energy Dryer", Vaishnavi Nair; Vishakha Nalawade; Prachi Patil; Ramgopal Sahu, 2021 IEEE Pune Section International Conference (PuneCon)
Many developing and growing nations that are experiencing economic growth, postharvest loss of agriculture products is a big issue. On the one hand, there is an insufficient knowledge of the significant number of losses, and on the other side, there is insufficient information about the benefits of employing simple postharvest and conservation measures. Many countries waste a considerable amount of agricultural production. The introduction of proper postharvest technology could aid in the reduction of vegetable waste. It also contributes to the increase of product quality, resulting in a high market price. Drying and storing freshly harvested cereals, fruits, and vegetables is the most common method of preserving them. Since ancient times, people have dried the commodities in the open sun; nevertheless, it is not without disadvantages, such as a high reliance on climatic conditions, sluggish drying rates, and the possibility of contamination, and so on. When employing mechanical dryers, these issues can be avoided; nevertheless, they consume a lot of energy. Simple solar-powered drying, in addition to mechanical treatments, can reduce the moisture content of vegies and fruits, allowing them to be stored for an extended period. Such a basic method has enormous promise, especially in regions where industrial preservation technologies are unavailable or inapplicable. The key objective is to run the entire system on clean and efficient energy like solar energy. The excess solar charge stored in the battery can be converted into AC to operate loads like lighting a bulb, especially in rural areas.

The authors intended to implement a closed circuit which can monitor the utilization of electrical energy and its automatic control on it. The radio frequency signals emitted detects the electricity status in each room and power off the circuit when user leaves the room. A microcontroller is programmed to ensure safety measures [4]. This is the alternate method of drying the agricultural products under the sun with solar dryer which consist of a heating element. It is a cost-effective way and can be used in large scale by local people. The energy trapped by the absorbers is the main element of the system.

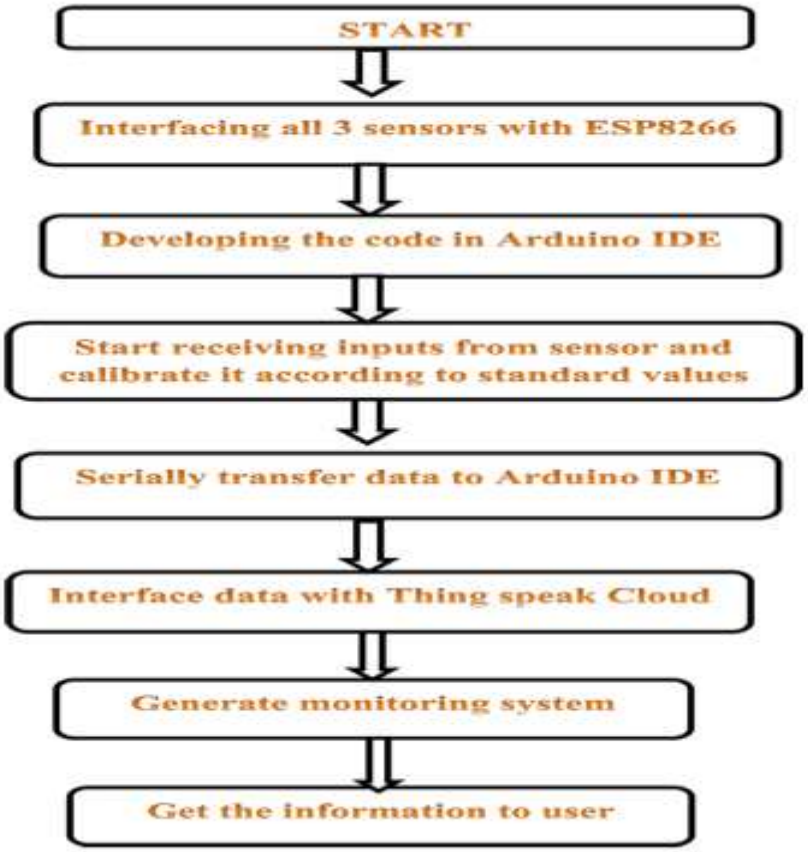
III. METHODOLOGY

3.1 Block Diagram



The entire IoT based system is composed of two parts: Server and Client. When power supply is given, sensors starts sensing the corresponding parameters. The data collected by sensors is conditioned and amplified to interface it with ESP 32 system. Simultaneously the sensed values uploaded onto webpage. The authorized person can access the data from any place at any time, monitor the parameters and control the load through IoT successfully.

3.2 Flow Chart



3.3 Hardware Description

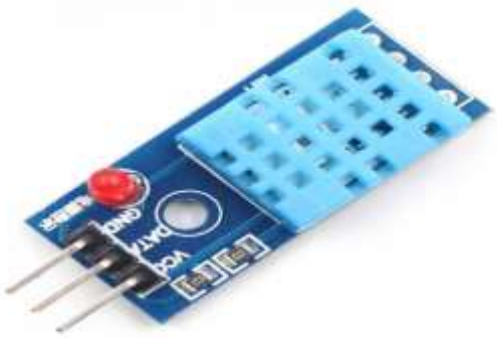
3.3.1 ESP 32 Controller

Microcontroller is the heart of the system, which works as a mini computer and can receive as well as send information or command to the peripheral devices connected to it. ESP32 is in the series of low power and low cost on chip microcontroller. It comes up with already integrated dual mode Bluetooth and Wi-Fi. It is especially aimed to pro- vide versatility, robustness and reliability in a large number of applications. This microcontroller programmed in Arduino IDE to run the drying system automatically based on readings of different sensors.

The various specification of ESP-32 microcontroller is as follows

- USB-to-UART interface and voltage regulator circuit: Most full- featured development microcontroller boards have these two features such as USB-to-UART interface and voltage regulator circuit. This component was important to easily connect the ESP32 to user's computer to upload code and apply power.
- Boot or Reset buttons: This button was used to put the board in flashing mode or reset (restart) the board but some boards don't have the BOOT button. Usually, microcontroller boards go into flashing mode automatically.
- Pin configuration and the number of pins: To properly use the ESP32 in particular projects, user need to have access to the board pin out (like a map that shows which pin corresponds to which GPIO and its features). So make sure user have access to the pin out of the board, otherwise it may end up using the ESP32 incorrectly.
- Antenna connector: Most boards come with an onboard antenna for Wi-Fi signal. Some boards come with an antenna connector to optionally connect an external antenna. Adding an external antenna increases users Wi-Fi range.
- Battery connector: If user wants to power ESP32 using batteries, there are development boards that come with connectors for LiPo batteries but user can also power an ESP32 microcontroller with batteries through the power pins.
- Power and GND Pins: There were pins on the microcontroller board that provide 3.3 V, 5 V power and ground through them.

3.3.2 DHT 11 Sensor



Features:

1. Input Supply voltage (VDC): 3.3 ~ 5
2. Supply Current (mA): measurement 0.3mA standby 60μA.
3. Temperature measurement range: 0~50 degrees
4. Temperature measurement error: ±2 degrees
5. Humidity measurement range: 20%~95%RH
6. Humidity measurement error: ±5%RH

3.3.3 Air Velocity Sensor

Features:

1. Model: HX710B
2. Data Output Rate:10 SPS / 80SPS
3. Max. Operating Current (mA):1.5
4. IC Package:16 Pin SOP

3.3.4 Relay

The relay is the main power switch so this means that it can be turned on or off with or without current. Controlling a relay with a Wi-Fi mod- ule is as easy as controlling the output like a motor. There are many types of modules: Single channel, dual channel, 4 channels and 8 channels. A type of relay called a contractor that can handle the high power required to directly control an electrical load. Relays with calibrated operating characteristics and, in some cases, multiple operating coils are used to protect electrical circuits from overload and failure. In relation to the mains voltage, the relay has three connection options. There are common pin (COM), normal open pin (NO), and normal close pin (NC). There is no contact between the common pin and the normally open (NO) pin. User can activate the relay and connect the COM pins to power the load. There is contact between the COM pin and the NC pin because a connection between the COM and NC pins is always required, even when the relay is off. When the relay is activated, the circuit opens and the load is no longer powered.

Features:

1. Channel: 1 channel
2. Relay Voltage: 5V
3. High impedance controller pin
4. Pull-down circuit for the avoidance of malfunction
5. One normally closed contact and one normally open contact
6. Triode drive, increasing relay coil

3.4 Software description

There are three software use for simulation and programming such as;

1. Arduino IDE
2. Proteus
3. Fritzing

1. Arduino IDE:

For C and C++ modules, Arduino IDE may be written. It is used to write and upload programs to compatible Arduino boards and other product creation boxes with the aid of third-party cores. All the process that has been program will be uploaded to Arduino board for execution. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. NB: Versions of the Arduino Software (IDE) prior to 1.0 saved sketches with the extension .pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the .ino extension on save.

2.Proteus

Proteus 8.1 is a program resource set that is used mainly for development of computer projects. The key aim of the program is to generate schematics and electronic prints for the development of printed circuit boards by electronic engineers and technicians.

3.Fritzing

Fritzing is a resource available to everyone for training, exchanging and designing their online creations. It helps users to formulate a diagram and thereby to add a component to rather qualified cable diagrams. The consumer can also build and create his own PCBs from the files they build.

IV. RESULTS

IV. CONCLUSION

The created intelligent system uses the environment's humidity rather than weight to control the drying process in real-time while also designing the product's drying kinematics. Thus, the system's complexity is reduced. Furthermore, the system provides feedback to the process owners and calculates the amount of time needed to finish the drying process based on the items' input status. As it becomes better, the model can regulate the process on its own until the right amount of moisture is reached. The drying process's duration can be calculated, so the process owners can simply schedule its prior to and subsequent activities. Lastly, since the ideal moisture content may be specified, wasteful heating is avoided, resulting in the most efficient use of energy. The system created for this project has a finite capacity. A new difficulty that has to be handled occurs when it is wanted to construct systems with different capacities or when the current system is used for purposes other than its maximum capacity. The best location for the moisture sensors to be employed in the oven is the issue at hand. When the furnace initially starts up, the time estimations could not be accurate if the positioning is not ideal. Variations in drying speeds can also happen. Future research on furnace design and sensor location optimisation can be conducted.

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