VERTICAL FARMING USING RENEWABLE ENERGY SOURCE

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Abstract: This project introduces a Smart Agricultural Drone equipped with a dual-functionality system for precise pesticide spraying and rat detection using advanced image processing. The drone, characterized by a robust frame and efficient propulsion, integrates cutting-edge technology to optimize agricultural practices. The pesticide spraying mechanism ensures even coverage, reducing waste and environmental impact. Concurrently, the intelligent image processing system, employing machine learning algorithms, enables real-time detection of rat infestations, providing early intervention for crop protection. The drone's autonomous navigation and integration of GPS technology further enhance its operational efficiency. Through comprehensive testing and validation, this project demonstrates the potential to revolutionize precision agriculture by offering farmers a sustainable, data-driven solution to enhance crop yields and mitigate challenges in modern farming practices.

Keywords: Vertical farming ,temperature humidity and nutrient spray control

I. INTRODUCTION

By growing crops in layers or structures stacked vertically, vertical farming is a novel way to agriculture that maximizes the use of available space. The problems with traditional agriculture, such as the paucity of water, the restricted amount of arable land, and the negative environmental effects of conventional agricultural operations, might be greatly mitigated by this creative farming technique. The use of renewable energy sources is a critical component that augments the sustainability of verticalfarming.

Vertical farms depend heavily on renewable energy since it offers a sustainable and clean substitute for conventional fossil fuels. Vertical farming operations may be powered by carefully placed solar panels, wind turbines, and other renewable energy sources.

II. LITERATURE SURVEY

(1)"IoT implementation for indoor vertical farming watering system,"

The technique of growing plants in layers that are stacked vertically, or "vertical farming," maximizes the use of available space because it may be done indoors. Utilizing controlled-environment agriculture (CEA) technology, where all environmental conditions are controllable, is the fundamental premise behind vertical farming. As a result, an automated system made of Internet of Things devices is used in this project to provide a regulated environment for vertical farming. Building a system to monitor and manage water content using a web browser on a laptop, mobile phone, and other portable and small devices is the primary goal of this project. Using sensors and automated systems, aeroponic farming in Internet of Things devices monitors and regulates the environment, nutrient levels,

(2) “Development of a Low-Cost and Modular Vertical Farming Rig for Sustainable Farming Process”

This paper study aims to explore the potential of low-cost, modular vertical farms in households for sustainable and efficient crop production. It investigates the effectiveness of advanced monitoring systems, mechanical drives, and the Nutrient Film Technique (NFT) Aeroponics method in optimizing plant growth and maintenance. The objective of this project is to domesticate vertical farming technology in Nigeria at a low cost with the use of sustainable materials and to remotely monitor the vertical farm using an automated camera drive. The current research of this paper covers how best farmers can use robotics and computer vision to carry out monitoring activities on the vertical farm remotely using Wi-Fi cameras and stepper motors [8]. Another crucial aspect of this project is to fully automate the supply

(3)." **Impact Analysis of Renewable Energy Generation System on Spinning Reserve and Operating Cost**,"
The impact study of the renewable energy generation system on the spinning reserve and operating costs is presented in this research. Economic dispatch is used in the analysis to determine which renewable energy generation system experiences the most extreme output swings. Furthermore, Thailand's power generation system is used to show the suggested analytical model. By changing the installed capacity of wind and solar power generating systems, the experimental results assess the effects of renewable energy generation systems on spinning reserve and operational costs.The findings demonstrate that significant variations in the installed capacity of wind and solar power systems, along with a rise in their production, can lead to changes in the system's spinning reserve and operational costs.

(4)**" Hydro link - Automatic Water Level Controller,"**
A vital resource for all living things is water. A key purpose of the proposed work is to use available resources to achieve sustainable growth. To that end, a water level controller called a "Hydro link" is proposed for autonomous water pumping activity. Apartment living is the most common and cost-effective living option in most large cities. To ensure that the conservator tank has an adequate amount of water, a controller is created and operates using a basic method. The objective is completed by the suggested system using straightforward and efficient circuits. The suggested system calculates how much water each apartment uses, and each apartment's occupant can pay according to their utility needs. In this paper, the suggested system is put into practice, and its outcomes are examined.

(5) . "Study of Charging Strategies of Lithium Batteries and their Effect on the Batteries Technologies"

This paper measures the charging behaviors of lithium batteries using three alternative technologies. To compare the functionality of Li-Ion, LiFePO4, and Li-Po batteries, three chargers were used: Graupner Ultra Duo 60 Plus, EVM BQ27546, and LTC4054 units. Analysis was done on charging at various C-rates. The chargers' logged data provides details on the charging parameters of the batteries, such as internal resistance, capacity, voltage, current, and efficiency. While the vendor of the LTC4054 battery charger claims to be utilizing the CC-CV approach, our data indicate that the current decreases from the very beginning until the battery is fully charged. The Graupner and EVM chargers were found to be following the CC-CV algorithm. Based on the data, LiFePO4 is the best option at the suggested 1C-rate because its charging efficiency is 100%, whereas Li-Po and Li-Ion have charging efficiencies of 96% and 90%, respectively. According to the research, a charger is just as important because, depending on the battery technology, they need to work together.

(6) **"Design and Implementation of IoT-Based Aeroponic Farming System"**

From this paper, Growing in popularity, urban gardening improves food security in metropolitan areas. One type of urban farming is aeroponics, in which nutrients are sprayed on plant roots that are hung in the air. An Internet of Things system for tracking and managing evapotranspiration in an aeroponic setting is described in this research. A microcontroller, a single-board computer, actuators, and sensors make up the system. The system's sensors gather information on the temperature of the water, total dissolved solids (TDS), humidity, air temperature, and pH of the plant environment. Next, using a fuzzy algorithm, the system determines the proper actuator action to lower the level of evapotranspiration in aeroponic plants by calculating the level of evapotranspiration using the Blaney-Criddle approach.

(7) **. "Research on rejection magnetic levitation model simulation and wavelet analysis of its signal"**

The rejection magnetic levitation system is capable of stable levitation, as demonstrated by the principle analysis, modeling, and experimental validation. Due to the absence of any physical link between the dangling magnet and the measured object, no physical friction interference is present. The system has strong impact resistance and can operate quickly, steadily, and in balance. The aluminum plate is utilized to boost vertical damping, which enables the suspension magnet to be balanced more rapidly, when it is vertically regulated to no solenoid. Wavelet denoising is applied to the vertical measurement signal, which allows it to accurately represent the change from the vertical to the suspended magnet. The system is lightweight and small since it is powered by a unipolar DC battery.

(8) **"Automatic Dual-Axis Solar Tracking System for Enhancing the Performance of a Solar Photovoltaic Panel"**

This paper presents an autonomous dual-axis solar tracking system that tracks the sun's movement across the sky, thereby increasing the efficiency of a solar photovoltaic panel. The aim of this study is to assess dual-axis solar panel efficiency and compare it with single-axis solar panel efficiency. Four light-dependent resistors (LDRs) are used in the device's dual-axis solar tracking mechanism to follow the sun's beams. The study's conclusions indicate that the dual-axis solar tracker can generate substantially more energy than the single-axis solar tracker. Moreover, it is capable of producing a lot more energy than a single-axis solar tracker. Two-axis tracking devices can be installed to boost solar photovoltaic systems' efficiency.

(9)**"Simple design and implementation of solar tracking system two axis with four sensors for**

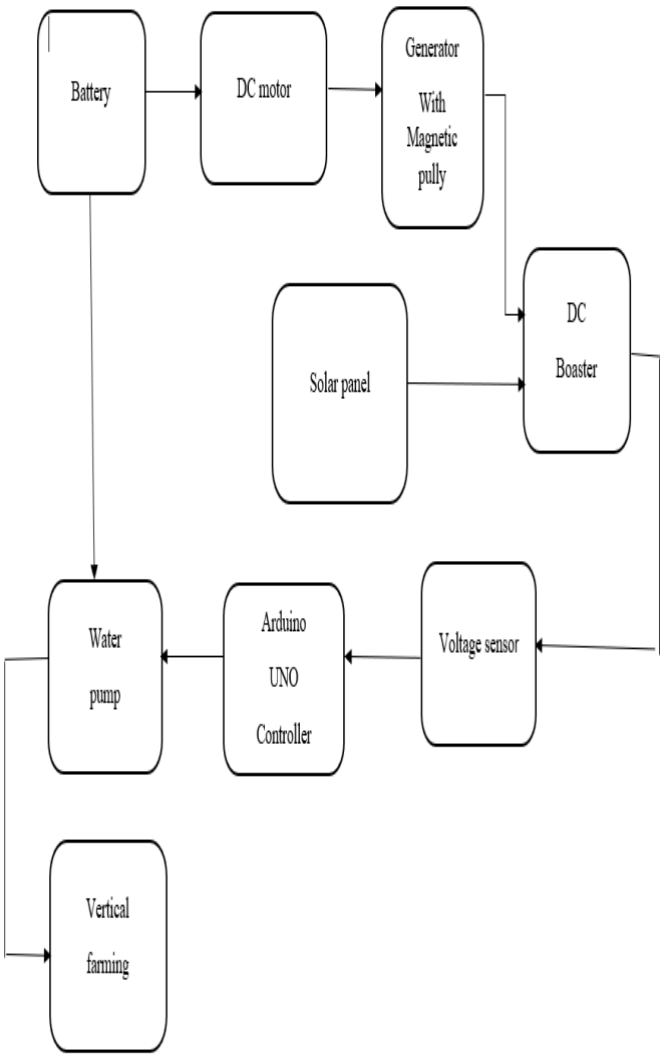
Analysis of Conventional and Interleaved Boost Converter with Solar Photovoltaic System"
From this paper,Renewable energy sources have garnered a lot of attention. This is because traditional generating stations are placing strain on the world's fossil fuel stocks. Solar photovoltaic systems are the primary application for DC-to-DC boost converters. PV output is not constant; it fluctuates depending on the temperature and level of irradiation. We see a significant voltage ripple when we use a traditional boost converter. A power electronics converter that reduces ripple in input current, power, and output voltage in comparison to a typical boost converter is called an interleaved boost converter. This study presents the design and analysis of conventional and two-stage IBC. Additionally, use MATLAB/Simulink to simulate a two-stage IBC circuit and a traditional boost converter circuit using a P&O-based MPPT method. We examined and contrasted the performance of IBC and traditional DC-DC converters. Another possibility is that, in solar photovoltaic systems, IBCs perform better than traditional boost converters. Additionally, we present an analysis and comparison of a solar PV system using a two-stage IBC and a traditional boost converter. We have discovered numerous advantages to two-stage IBC. The system performs better as a result of the examination of the IBC related to renewable energy systems. The system's overall effectiveness and performance increased as a result.

(10). **"Performance modelling of a small-scale wind and solar energy hybrid system"**
This paper included a brief overview of the theory governing hybrid systems that combine solar and wind energy, as well as simulations of the features and operations of each component.
the framework. The MPPT method is a crucial strategy for raising system efficiency. However, if the battery is already fully charged and the load is quite small, MPPT might not even be hazardous. In this instance, balancing the power generated and consumed requires adjusting the PV panel and wind turbine outputs in accordance with the load. The battery system simulation still needs improvement.

(11)**. "An Overview of Neodymium Magnets over Normal Magnets for the Generation of Energy**"
An Overview of Neodymium Magnets over Normal Magnets for the Generation of Energy: This is the title of the paper published in the International Journal on Recent and Innovation Trends in Computing and Communication .Neodymium Magnets These are the most widely used type of rare-earth magnet, made from an alloy of neodymium, iron and boron. They have higher magnetic strength, coercivity and energy product than other types of magnets, but lower Curie temperature and corrosion resistance2.Magnetic Energy to Kinetic Energy The paper discusses how neodymium magnets can be used to convert magnetic energy into kinetic energy by using special arrangements of magnets, such as a magnetic turbine3. The paper also compares neodymium magnets with hematite magnets, which are weaker and have different magnetic properties.
New Applications,The paper mentions some of the new applications of neodymium magnets in various fields, such as space exploration, medical imaging, electric motors, magnetic jewellery and toys.

(12)**. "Process Management and Technological Challenges in the Aspect of Permanent Magnets Recovery-the Second Life of Neodymium Magnets**."
On the basis of the PFMEA (process FMEA), three process irregularities, which greatly increase the risk of process failure are selected. In order to ensure the stability of the process of magnets recovery, it is necessary to implement a multi-level inter-operational control and selection of magnetic aggregates (powders) obtained from WEEE. On the basis of the Risk Performance Number (RPN), 5 new operations appeared in the process, which, as shown by the repeated PFMEA analysis, significantly improved the course of the process

III. METHODOLOGY



IV. COMPONENTS USED

1 DC motor

A DC motor typically consists of a stator (stationary part) and a rotor (rotating part). The stator contains the magnets or magnetic field-producing components, while the rotor carries the armature windings or coils

2 DHT20 Digital Temperature and Humidity sensor

DHT20 is a new upgraded product of DHT11, equipped with a dedicated ASIC sensor chip, a high-performance semiconductor silicon-based capacitive humidity sensor and a standard on-chip temperature sensor, and uses a standard I2C data output signal format. Its performance has been greatly improved and has exceeded the reliability level of the previousgeneration sensor(DHT11)

3 Water pump

A water pump is a mechanical device designed to move water from one place to another. These devices are commonly used in various applications, including residential, commercial, industrial, and agricultural settings. The primary purpose of a water pump is to create a flow of water, enabling the transportation of fluids from a lower level to a higher one or to circulate water within a system

4 Battery

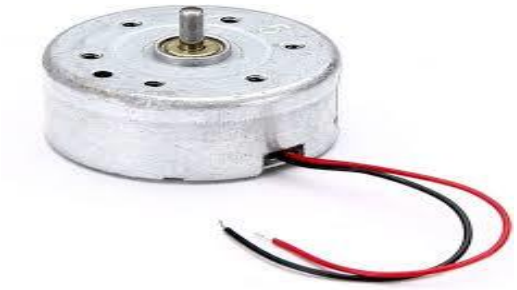
Lithium-ion batteries are a type of rechargeable battery that uses lithium ions as the main charge carrier. They are widely used in electronic devices due to their high energy density and relatively low self-discharge rate.
The capacity of a battery is measured in milliampere-hours (mAh), which represents the amount of charge the battery can store

5 Neodymium magnets

A neodymium magnet (also known as NdFeB, NIB or Neo magnet) is a permanent magnet made from an alloy of neodymium, iron, and boron to form the Nd2Fe14B tetragonal crystalline structure.[1] They are the most widely used type of rare-earth magnet, Neodymium Magnets are also help us recycle as a fundamental part of a Magnetic Separator or Eddy Current Separator as manufactured by Bunting Magnetics.

6 Generator

Generator that provides power to the vertical farming system. Vertical farms often require various equipment, including lighting systems (such as LED grow lights), climate control systems, irrigation systems, and other technologies to create an optimal environment for plant growth.



7 Float switch

A float switch is a fundamental device utilized for liquid level detection in containers or tanks. Comprising a buoyant float tethered to a lever or rod, its operation is straightforward yet reliable. As the liquid level within the container fluctuates, the float ascends or descends accordingly, activating or deactivating an integrated switch mechanism

8 Boost converter

A boost converter is a type of DC-DC converter used to step up or increase the voltage level from a lower input voltage to a higher output voltage. Operating on the principle of inductance, capacitors, and switches, a boost converter efficiently transfers energy from the input source to the output load.

9 Voltage sensor

A voltage sensor is an essential component used to measure the voltage level in electrical circuits accurately. Typically, it comprises a sensing element, signal conditioning circuitry, and an output interface.

10 Bulb

A direct current (DC) LED bulb is a type of lighting fixture that uses light-emitting diodes (LEDs) as its light source. DC LED bulbs are intended to directly accept DC power, in contrast to conventional incandescent bulbs, which usually require alternating current (AC) power. This makes them appropriate for situations where DC power sources are accessible or preferred

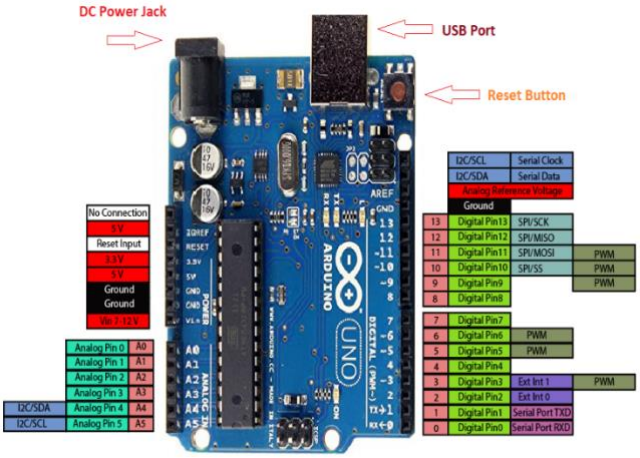
11 Lcd display

Typically, a 16x2 LCD display consists of a monochrome LCD panel, a backlight for improved visibility in low-light conditions, and an integrated controller circuit responsible for driving the display and interpreting commands from the connected microcontroller or other host device

SOFTWARE COMPONENTS

1 Ardunio UNO

The Arduino UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.



CONCLUSION

Future vertical farming systems will benefit from precision agriculture technologies and automation, optimizing resource use and minimizing waste. The ability to tightly control environmental variables ensures optimal conditions for plant growth, enhancing overall productivity.Incorporating renewable energy into vertical farming promotes resilience by reducing dependency on traditional power grids. Hybrid systems and energy storage solutions enhance reliability, ensuring a stable power supply even in adverse conditions.Ongoing research and development efforts will drive technological innovation, leading to more efficient and integrated solutions. Collaborations between agriculture, engineering, and energy sectors will likely yield breakthroughs in sustainable farming practices. As awareness of the

environmental impact of traditional agriculture grows, there is potential for widespread adoption of vertical farming using renewable energy. Governments, businesses, and communities may increasingly recognize its role in bolstering food security and mitigating the challenges associated with climate change.The architectural design of vertical farms may evolve to seamlessly incorporate renewable energy elements. Greenhouses with integrated solar panels, wind turbines, and other technologies could become standard features, enhancing overall efficiency and sustainability.

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