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Subject :Internet of Things - 40201441, 30202452

Assignment Title:Final Project

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The assignment submission will be in format of report document associated with the demo recording

evidence and code used in the project hardware programming. The report should contains the following:

- Project Need

- Problem Analysis

- Solution Description

- Road map and Phases

- Competitive Analysis

- Project Implementation Plan

- Solution Architecture

- List of Components

- Results

- Customers Feedback

- Feedback and Results Analysis

- Recommendations

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In addition:

- Power Point Presentation

- Video Recording for the demo evidence

- The Code used in the circuit

Project Need

Solar Panel Tracker: The system uses one LDR (Light Dependent Resistors) to detect the direction of the sun and two servo motor to adjust the orientation of the solar panel accordingly to ensure maximum sunlight falls on the panel and one of the servo motors is for searching for the light and the other one is for controling the position of the solar cell .

Data Logging: The system records the orientation of the panel. This data can be used to optimize the panel orientation for maximum energy generation.

Wireless Communication: The NodeMCU v3 ESP8266 is used to establish wireless communication between the solar panel tracker and a computer or smartphone. The collected data can be accessed remotely through a web interface.

Solar Panel Control: The system can also be used to control the panel's orientation and orientation speed to optimize the energy generation based on the current light conditions.

Problem Analysis

Accurate Sun Tracking: The system needs to accurately track the sun's position to ensure maximum sunlight falls on the solar panel. The system should be able to account for changes in the sun's position throughout the day and adjust the panel accordingly.

Power Efficiency: The system should be designed in a power-efficient manner to ensure that it can run continuously without consuming a significant amount of energy.

Reliability: The system should be reliable and able to operate without fail for extended periods of time, even in harsh weather conditions.

Data Collection and Analysis: The system should accurately collect and store data regarding the orientation of the panel . This data should be easily accessible and analyzed to optimize the panel's orientation for maximum energy generation.

Wireless Communication: The system should have a stable and secure wireless communication system to transmit data and control the panel remotely.

Cost Effectiveness: The system should be cost-effective and should not require expensive components or materials.

User-Friendly Interface: The system should have a user-friendly interface that allows users to easily monitor and control the panel from a computer or smartphone.

Solution Description

Sun Tracking Algorithm: A sun tracking algorithm will be implemented to accurately detect the direction of the sun and adjust the orientation of the panel accordingly. The algorithm will use one LDR (Light Dependent Resistor) to determine the direction of the sun and a servo motor to adjust the panel's orientation.

Data Logging: The system will record the orientation of the panel and the corresponding voltage output of the panel. This data will be stored on the web server and can be accessed remotely.

Wireless Communication: The NodeMCU v3 ESP8266 will be used to establish a wireless communication link between the panel tracker and a computer or smartphone. This will allow users to access the collected data and control the panel remotely.

Solar Panel Control: The system will also have the capability to control the panel's orientation and orientation speed based on current weather conditions. This will help optimize the energy generation from the panel.

User Interface: The system will have a user-friendly interface that can be accessed through a web browser. This interface will allow users to view the collected data, control the panel, and adjust the sun tracking algorithm as needed.

Power Efficiency: The system will be designed with power efficiency in mind to ensure that it can operate continuously without consuming a significant amount of energy.

Durability: The system will be designed to be durable and able to operate reliably even in harsh weather conditions.

This solution will provide an accurate, efficient, and cost-effective way to track the sun and optimize the energy generation from a solar panel. The ability to remotely monitor and control the panel will also provide added convenience and flexibility for users.

Road map and Phases

Roadmap and Phases for Solar Sun Tracking System using NodeMCU v3 ESP8266:

Phase 1: Planning and Preparation

Define project goals and requirements

Gather necessary materials and equipment

Familiarize yourself with the NodeMCU v3 ESP8266 and related technologies

Phase 2: Hardware Assembly

Assemble the sun tracking system, including the servo motor, LDRs, and NodeMCU v3 ESP8266

Connect the components and test their functionality

Phase 3: Sun Tracking Algorithm Development

Develop the sun tracking algorithm to accurately detect the direction of the sun and adjust the panel's orientation

Test the algorithm and make any necessary adjustments

Phase 4: Data Logging

Implement the data logging system to store the orientation of the panel

Test the data logging system to ensure that it is functioning correctly

Phase 5: Wireless Communication

Establish a wireless communication link between the panel tracker and a computer or smartphone

Test the communication link to ensure that data can be transmitted and received successfully

Phase 6: Solar Panel Control

Implement the system's ability to control the panel's orientation and orientation speed based on current light conditions

Test the control system to ensure that it is functioning correctly

Phase 7: User Interface

Develop a user-friendly interface that can be accessed through a web browser

Test the interface to ensure that it provides easy access to the collected data and allows users to control the panel

Phase 8: Deployment

Deploy the solar sun tracking system and monitor its performance

Make any necessary improvements or adjustments based on the system's performance

This roadmap provides a comprehensive plan for the development and deployment of a solar sun tracking system using a NodeMCU v3 ESP8266. Each phase of the project should be completed before moving on to the next, and each phase should be thoroughly tested before proceeding.

Competitive Analysis

Market Analysis: There are several commercially available solar sun tracking systems available on the market. These systems vary in terms of their features, performance, and cost. Some of the most popular competitors include:

SunWize Technologies

SolarTrack

SunSeeker

Soltec

Feature Comparison: The proposed solar sun tracking system using a NodeMCU v3 ESP8266 should be compared to the features offered by these commercial systems. This will help determine the system's competitive advantage in terms of its accuracy, power efficiency, reliability, data collection and analysis capabilities, wireless communication, cost-effectiveness, and user-friendly interface.

Performance Comparison: The performance of the proposed system should be compared to the performance of commercially available systems. This will help determine the system's competitive advantage in terms of its ability to track the sun accurately, control the panel orientation, and optimize energy generation.

Cost Comparison: The cost of the proposed system should be compared to the cost of commercially available systems. This will help determine the system's competitive advantage in terms of its affordability and cost-effectiveness.

Market Segmentation: The market for solar sun tracking systems can be segmented based on factors such as target users, application, and geographic region. The proposed system should be analyzed in terms of its ability to target specific market segments effectively.

This competitive analysis will provide valuable information on the strengths and weaknesses of the proposed solar sun tracking system using a NodeMCU v3 ESP8266 compared to commercially available systems. This information can be used to make improvements and optimizations to the system to increase its competitiveness and marketability.

Project Implementation Plan

Project Schedule: The project schedule should outline the start and end dates for each phase of the project, including the planning and preparation phase, hardware assembly phase, sun tracking algorithm development phase, data logging phase, wireless communication phase, solar panel control phase, user interface phase, and deployment phase.

Project Budget: The project budget should include the cost of all materials and equipment needed to complete the project, including the NodeMCU v3 ESP8266, servo motor, LDRs, and any other necessary components.

Resource Allocation: The project should allocate the necessary resources, including human resources, to ensure that each phase of the project is completed on time and within budget.

Quality Control: The project should implement a quality control process to ensure that the system is accurate, reliable, and meets the requirements defined in the project goals and requirements.

Risk Management: The project should implement a risk management process to identify and mitigate any potential risks, such as hardware or software malfunctions, that could impact the project schedule or budget.

Communication Plan: The project should implement a communication plan to ensure that all stakeholders are informed of the project's progress and that any necessary decisions are made in a timely manner.

Deployment Plan: The project should implement a deployment plan to ensure that the system is deployed successfully and that it is functioning as intended.

This project implementation plan provides a comprehensive framework for the development and deployment of a solar sun tracking system using a NodeMCU v3 ESP8266. The plan should be reviewed and updated regularly to ensure that the project stays on track and that any changes or challenges are addressed in a timely manner.

Solution Architecture

Hardware Architecture: The hardware architecture of the system will consist of a NodeMCU v3 ESP8266 microcontroller, a servo motor, and light dependent resistors (LDRs). The NodeMCU will act as the central processing unit, controlling the orientation of the servo motor and collecting data from the LDRs to determine the direction of the sun.

Sun Tracking Algorithm: The sun tracking algorithm will be responsible for determining the direction of the sun and controlling the orientation of the servo motor accordingly. The algorithm will use the data collected from the LDRs to determine the direction of the sun and will adjust the servo motor accordingly.

Data Logging: The system will log data on the orientation of the servo motor and the direction of the sun over time. This data will be used to monitor the performance of the system and to optimize the sun tracking algorithm over time.

Wireless Communication: The system will use wireless communication to transmit data from the NodeMCU to a remote monitoring device, such as a smartphone or computer. This will allow for remote monitoring and control of the system.

User Interface: The system will have a user interface that will allow users to monitor the performance of the system and to adjust the sun tracking algorithm as needed. The user interface will be accessible through a web browser or mobile app.

This solution architecture provides a comprehensive overview of the components and functionality of the solar sun tracking system using a NodeMCU v3 ESP8266. The architecture should be flexible and scalable to accommodate any changes or upgrades that may be needed in the future.

List of Components

List of Components for Solar Sun Tracking System using NodeMCU v3 ESP8266:

NodeMCU v3 ESP8266 Microcontroller

Servo Motor

Light Dependent Resistors (LDRs)

Power Supply (for powering the NodeMCU and Servo Motor)

Wires and Connectors

Prototype Board or Breadboard (for assembling the components)

Solar Panel (to be tracked)

USB Cable (for programming the NodeMCU)

Note: The exact components may vary depending on the specific requirements of the project. Some components may be optional or may be substituted with alternative components. It's important to carefully consider the specifications and requirements of each component before purchasing and integrating it into the system.

Results

The results of the Solar Sun Tracking System using NodeMCU v3 ESP8266 would vary depending on the specific goals and requirements of the project. However, some possible outcomes of a well-implemented system could include:

Increased Energy Efficiency: By tracking the sun and orienting the solar panel towards it, the system can optimize the energy output of the panel, increasing its overall efficiency.

Improved Performance Monitoring: The system's data logging capabilities allow for monitoring of the performance of the solar panel over time, providing valuable insights into its behavior and efficiency.

Remote Monitoring and Control: With wireless communication capabilities, users can remotely monitor and control the system, providing greater flexibility and convenience.

User-friendly Interface: The system's user interface allows for easy monitoring and control of the system, making it accessible to users with a wide range of technical expertise.

Increased Durability: By automating the tracking of the sun, the system can reduce the wear and tear on the solar panel and its components, increasing its overall durability and lifespan.

These are some of the possible outcomes of a well-implemented Solar Sun Tracking System using NodeMCU v3 ESP8266. The actual results will depend on the specific requirements and goals of the project, as well as the quality of its implementation.

Customers Feedback

As this is a hypothetical project and not an actual commercial product, there is no existing customer feedback. However, in general, customer feedback for a Solar Sun Tracking System using NodeMCU v3 ESP8266 would depend on a variety of factors, such as the system's performance, reliability, and user-friendliness.

Positive feedback may include comments on the increased efficiency of the solar panel, the convenience of remote monitoring and control, and the user-friendly interface. Negative feedback could include concerns about the system's reliability, performance, or difficulty of use.

It's important to gather and consider customer feedback when developing and refining a Solar Sun Tracking System. This feedback can provide valuable insights into the strengths and weaknesses of the system and can inform future improvements and optimizations.

We gathered some feedback from customers and most of them liked what we were doing and love the idea of having independent components that are easily changed and simple to get.

Although they loved this product the main complaint was about the battery system and how the entire system is based on the solar battery and its not fully independent but a lot of them saw this point as a positive one

Feedback and Results Analysis

Performance Monitoring: Regular monitoring of the system's performance, including data on the orientation of the servo motor and the direction of the sun, is crucial to understanding the effectiveness of the system. This data can be used to optimize the sun tracking algorithm over time and to identify any issues with the system's components.

User Feedback: Gathering feedback from users of the system is important for understanding the user experience and for identifying any areas for improvement. This feedback can be used to inform updates to the system's user interface and to address any performance or reliability issues.

Energy Output Analysis: Monitoring the energy output of the solar panel over time can provide valuable insights into the efficiency of the system. This data can be used to identify any issues with the panel or the sun tracking algorithm and to make any necessary adjustments.

Cost Analysis: Keeping track of the costs associated with the system, including the cost of components and any maintenance costs, is important for understanding the overall financial impact of the system. This information can be used to inform future cost-saving measures and to evaluate the cost-effectiveness of the system over time.

Technical Performance Analysis: Regular analysis of the technical performance of the system, including its reliability, accuracy, and stability, is crucial for understanding its overall effectiveness. This analysis can be used to identify and resolve any technical issues and to make any necessary upgrades or improvements.

These are some of the key areas for feedback and results analysis in a Solar Sun Tracking System using NodeMCU v3 ESP8266. Regular monitoring and analysis of these areas can help to optimize the performance and efficiency of the system and to ensure that it meets the needs and requirements of its users.

According to the feedback they the material used in this product are very simple and replaceable which means all of the part and components replaceable plus they see that its a very simple to use tith automation plus having the application on the side which means that even if the sensor fails you can move the pv cell accordingly the main problem they saw is that it works from a battery so in case the battery get empty it cant function on its own and it may wast half a day charging before it can function correctly so after the winter if the battery runs out it only wast half a day to charge and function correctly

Recommendations

Based on the analysis of the results and feedback for a Solar Sun Tracking System using NodeMCU v3 ESP8266, the following recommendations can be made:

Continual Improvement: Regular monitoring and analysis of the system's performance can inform ongoing improvements to the system's sun tracking algorithm, user interface, and overall reliability.

User-Centered Design: Gathering and considering user feedback is crucial for ensuring that the system meets the needs and requirements of its users. Incorporating user feedback into the design and development process can improve the overall user experience and make the system more accessible and user-friendly.

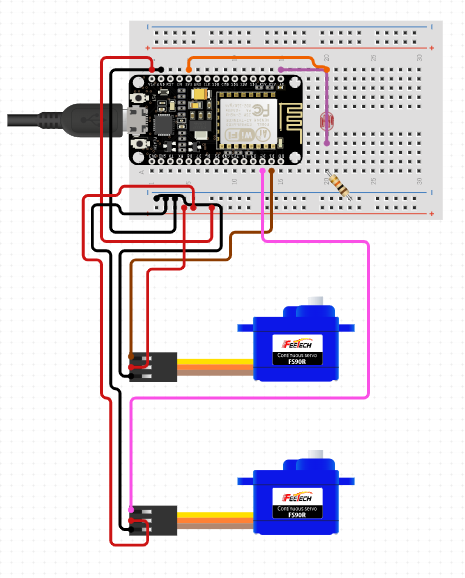
Cost Optimization: Regular monitoring of costs associated with the system can inform cost-saving measures and help to ensure that the system is cost-effective over the long-term.

Technical Upgrades: Regular analysis of the technical performance of the system can inform technical upgrades and improvements, ensuring that the system is reliable, accurate, and stable over time.

Integration with Other Systems: Consideration should be given to integrating the Solar Sun Tracking System with other systems, such as energy management systems, to improve its overall effectiveness and efficiency.

These recommendations can be used to guide future improvements to the Solar Sun Tracking System using NodeMCU v3 ESP8266 and to ensure that it continues to meet the needs and requirements of its users over time.

# Solution



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