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SOLAR POWERED WATER PUMPING & DISTRIBUTION NETWORK

HARI.S[1] , RENGANATHAN.M[2], ABDUL AJIS.A[3], SUDHARSAN.A[4],Mr.V.YOKESWARAN[5]

M.Tech.
UG Student, Dept. of EEE., E.G.S Pillay Engineering College, Nagapattinam, TamilNadu, India
UG Student, Dept. of EEE., E.G.S Pillay Engineering College, Nagapattinam, TamilNadu, India
UG Student, Dept. of EEE., E.G.S Pillay Engineering College, Nagapattinam, TamilNadu, India
UG Student, Dept. of EEE., E.G.S Pillay Engineering College, Nagapattinam, TamilNadu, India
Assistant Professor, Dept. of EEE., E.G.S Pillay Engineering College, Nagapattinam, TamilNadu, India

ABSTRACT:

This project aims to design and implement sustainable water pumping and distribution network powered by solar energy, The system incorporates sensors for monitoring water quality parameters such as Total Dissolved Solids (TDS) and PH levels and water level by Ultra sonic sensor. Additionally, it employs solenoid valves controlled by relays to regulate water flow efficiently.

The ESP32 microcontroller serves as the central control unit, facilitating real-time data acquisition from TDS and pH sensors. Initially, the sensor data is received by an ARDUINO UNO board, which then feeds this information to the ESP32 microcontroller for further processing and decision-making. These sensors provide vital information regarding water quality, ensuring that only safe and suitable water is distributed. The project aims to address challenges associated with water scarcity and inefficient water distribution by providing a sustainable solution. By leveraging IOT technology and solar power, the system offers a scalable and adaptable approach to water management in both rural and urban environments.

INTRODUCTION :

In the realm of sustainable development, harnessing renewable energy sources for vital utilities like water distribution holds immense promise. The advent of solar-powered water pumping and distribution networks signifies a significant leap towards efficient, eco-friendly, and cost-effective water management systems. This innovative project is designed to revolutionize the traditional methods of water distribution by integrating solar energy to power pumping mechanisms and centralized control systems, ensuring optimal resource utilization and environmental conservation.
At its core, the solar-powered water pumping and distribution network operates as a centralized system, where a single point serves as the control center for monitoring and regulating water flow across various distribution channels. By leveraging solar energy, the project mitigates reliance on conventional energy sources, thereby reducing carbon emissions and dependency on non-renewable resources. The integration of solar power not only enhances the sustainability of the water distribution network but also lowers operational costs in the long run, making it economically viable for both urban and rural settings.
One of the key features of this project is its focus on water quality monitoring. Beyond merely distributing water, the system incorporates advanced sensors and monitoring devices to continuously assess the quality of water flowing through the network. This proactive approach to water quality management ensures that consumers receive safe and potable water, thereby safeguarding public health and well-being. Additionally, real-time monitoring enables prompt detection of any anomalies or contamination events, facilitating swift response measures to prevent widespread waterborne diseases or environmental hazards.

Furthermore, the centralized control system enables efficient management of water distribution, allowing for dynamic adjustments in response to fluctuating demand or supply conditions. Through intelligent algorithms and data analytics, the network optimizes water flow, minimizes wastage, and ensures equitable distribution to meet the diverse needs of communities. By providing reliable access to clean water, particularly in underserved areas, the project contributes to poverty alleviation, improved sanitation, and overall socio-economic development.

ELATED WORK :

Water quality monitoring and controlling in overhead tanks is essential for ensuring the supply of safe and clean drinking water to households and communities. With increasing concerns over waterborne diseases and contaminants, it has become imperative to implement robust systems to monitor and maintain water quality standards.

The process begins with the installation of sensors and monitoring equipment within the overhead tanks. These sensors are capable of measuring various parameters such as pH levels, turbidity, chlorine concentration, temperature, and microbial content. Real-time data from these sensors is then transmitted to a central monitoring station or control unit.

Using advanced technology and automated systems, water quality parameters are continuously monitored and analyzed. Any deviation from predetermined thresholds triggers immediate alerts to operators or relevant authorities. This allows for prompt action to be taken, such as adjusting chemical dosages or initiating cleaning procedures, to maintain water quality within acceptable limits.

]Moreover, remote access capabilities enable operators to monitor water quality status from anywhere, facilitating timely interventions even in situations where on-site presence is not possible. Additionally, historical data logging allows for trend analysis and predictive maintenance, ensuring proactive measures to prevent potential issues.

Incorporating water quality monitoring and controlling systems in overhead tanks not only safeguards public health but also optimizes resource utilization by minimizing wastage and reducing operational costs associated with manual monitoring and maintenance. Overall, the implementation of such systems plays a crucial role in ensuring the continuous supply of safe and potable water to communities.

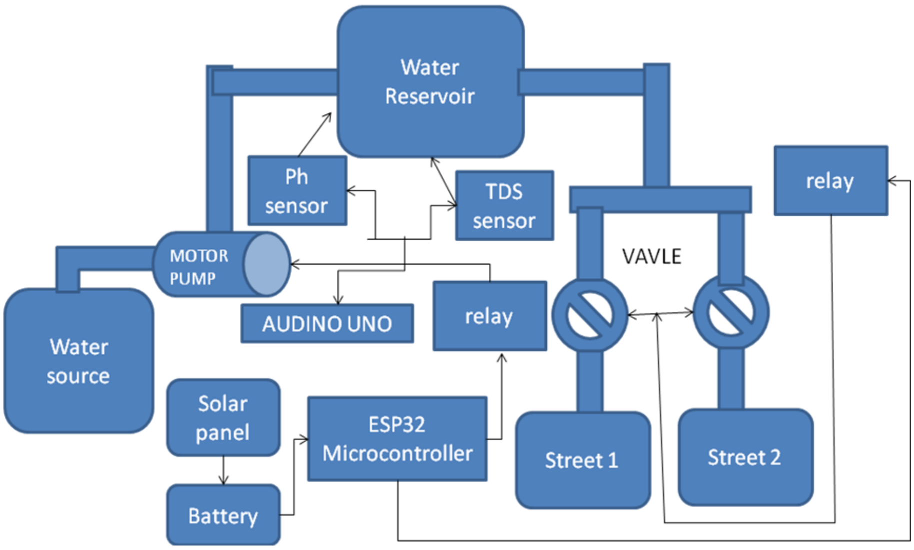
\On the server side, we have established a robust web-based platform to receive, store, and visualize the sensor readings in real-time. This web server provides users with a user-friendly interface to monitor the water quality, quantity, and tank levels remotely. Additionally, it enables administrators to set thresholds and receive alerts in case of any deviations from predefined parameters, ensuring prompt action can be taken to maintain optimal water management.1. Similar Projects: Explore existing projects or DIY tutorials available online that implement message door lock systems using Arduino. This could involve examining project documentation, code repositories, and user feedback to gain insights into different design approaches, challenges encountered, and potential improvements.

III.PROPOSED SYSTEM

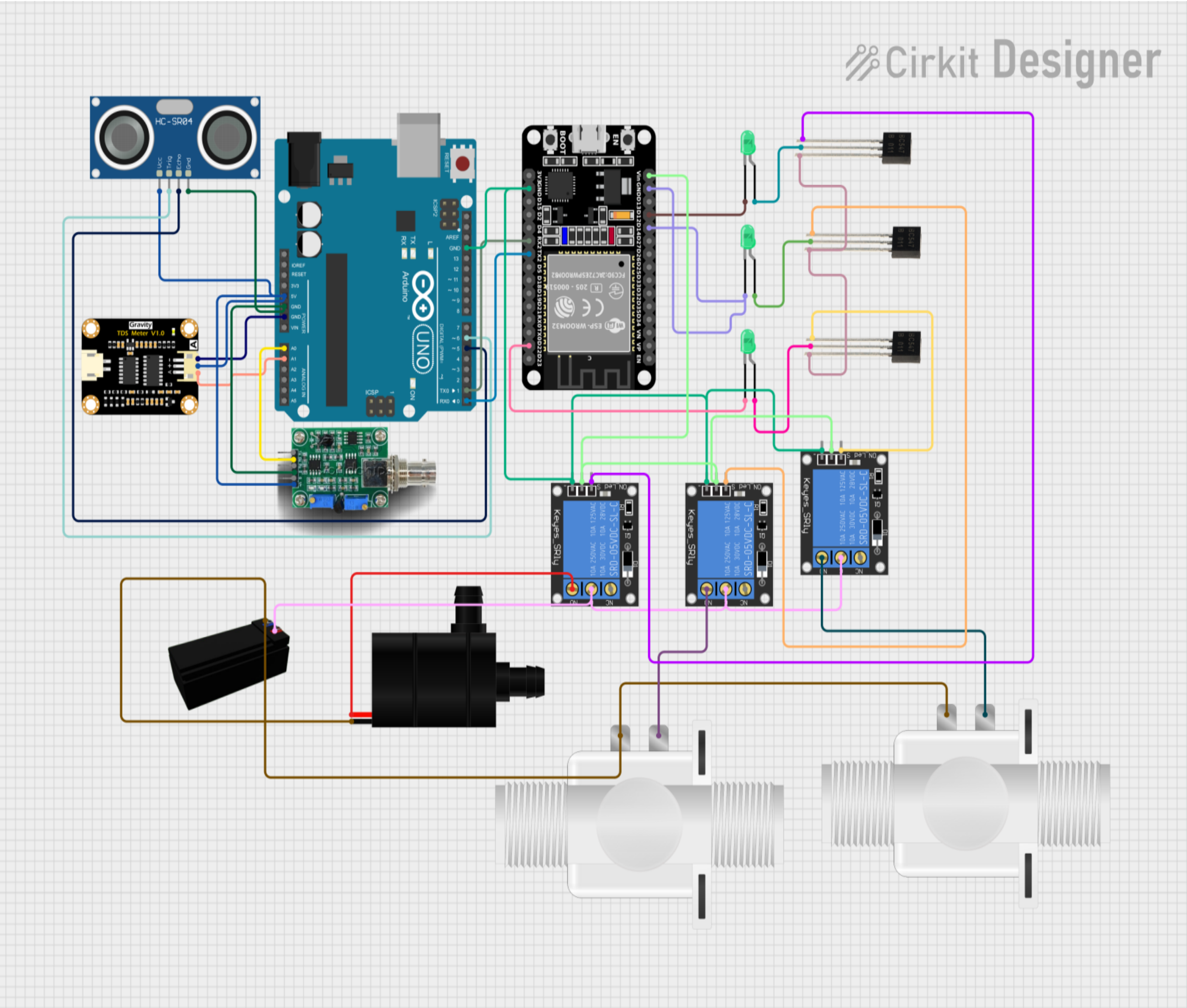
The proposed system for the solar-powered smart water pumping and distribution network entails utilizing an ESP32 microcontroller to regulate relays, which in turn control solenoidal valves responsible for managing water supply within the municipality. The ESP32 microcontroller serves as the central processing unit, orchestrating the operation of the entire system. Through its control of relays, the microcontroller manages the opening and closing of solenoidal valves, thereby controlling the flow of water within the municipality's distribution network.At the core of this system is its reliance on solar power, harnessing renewable energy to operate efficiently and sustainably. Solar panels will be integrated to provide the necessary power supply to the ESP32 microcontroller and associated components. This ensures that the system operates independently of traditional power sources,reducing dependency on non-renewable energy and minimizing environmental impact.The functionality of the system extends to the management of water distribution across various water tanks within the municipality office.By strategically positioning solenoidal valves at key points in the distribution network, the system can regulate the flow of water to different tanks as per the municipality's requirements.This capability allows for optimal utilization of available water resources, preventing wastage and ensuring a consistent supply to meet the municipality's needs. Through the integration of IoT (Internet of Things) technology, stakeholders can remotely access and manage the system using a dedicated interface.In summary, the proposed system integrates solar power, ESP32 microcontroller technology, solenoidal valves, and IoT capabilities to create a sustainable and intelligent water pumping and distribution network for municipalities.

VI. Block Digram

Firstly, solar panels harness energy from the sun to charge a battery, ensuring a sustainable power source. A microcontroller, such as the ESP32, manages the system's operations. It communicates with various components to ensure efficient functionality. Upon receiving data from sensors, including pH and TDS sensors, the microcontroller evaluates water quality. When water is needed, the microcontroller activates a relay, initiating the pump to draw water into the tank. Once filled, the microcontroller commands a valve to open, directing water flow to designated areas, such as street networks .Moreover, the ESP32 is linked to the municipality server, enabling remote monitoring and control. This facilitates seamless management, allowing operators to remotely operate the system, adjust pump operations, and regulate valve openings for efficient water distribution. In summary, the Solar Power Water Pumping and Distribution Network integrates solar energy, sensor technology, and microcontroller control to ensure sustainable and effective water distribution. Its connectivity to the municipality server enhances operational flexibility and management capabilities.



V. Circuit Diagram



The core of the system involves the utilization of an ESP32 Microcontroller and an Arduino Uno. These components serve as the brains behind the operation, orchestrating the entire system's functionality.

Within the Arduino Uno, three crucial sensors are integrated: a TDS sensor, a pH sensor, and an ultrasonic sensor for water level monitoring. These sensors play pivotal roles in ensuring the quality and quantity of water being pumped and distributed. The TDS sensor measures the Total Dissolved Solids in the water, providing insights into its purity. Meanwhile, the pH sensor determines the acidity or alkalinity of the water, essential for various applications. Lastly, the ultrasonic sensor accurately gauges the water level, preventing overflow or shortage issues.

The Arduino Uno serves as the intermediary between these sensors and the ESP32 Microcontroller. It collects data from the sensors and transmits it to the ESP32 for further processing and decision-making. The ESP32, being a powerful microcontroller with built-in Wi-Fi capabilities, acts as the central hub for the entire system. It receives data from the Arduino Uno, analyzes it, and executes commands accordingly.

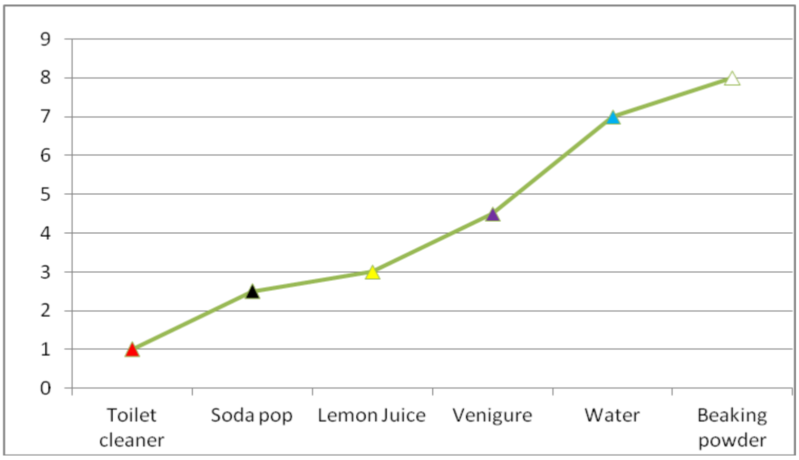
The heart of the system lies in its ability to control the water flow using solenoidal valves, facilitated by two relays connected to the ESP32 Microcontroller. These relays act as switches, regulating the flow of water through the network. By intelligently controlling these valves based on the data received from the sensors, the system ensures optimal water distribution and usage efficiency.

Furthermore, all these components and functionalities are seamlessly integrated and controlled from a single centralized point. This centralized control not only simplifies operation but also enhances monitoring and maintenance capabilities. With SolarWells, harnessing the power of solar energy for water management becomes not just a concept, but a tangible reality, paving the way for sustainable and efficient water distribution systems.

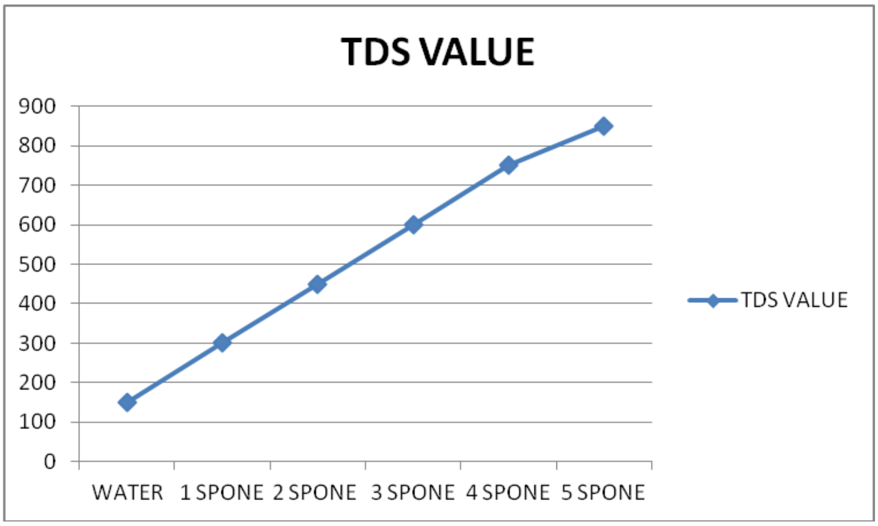
VI.Monitoring result

Outpu taken by varying TDS And PH Sensor by increasing alkain level in water.

House hold Chemicales	PH value
Toilet cleaner	1
Soda pop	2.5
Lemon Juice	3
Venigure	4.5
Water	7
Beaking powder	8



SALT	TDS VALUE
WATER	150
1 SPONE	300
2 SPONE	450
3 SPONE	600
4 SPONE	750
5 SPONE	850



VII.CONCLUSION

The implementation of a solar-powered water pumping and distribution network, utilizing ESP32 microcontroller and Arduino UNO, presents a promising solution for addressing water scarcity in remote communities. By integrating sensors such as TDS, pH, and ultrasonic for water quality and level monitoring, the system ensures efficient and reliable operation. The Arduino UNO acts as a central hub, collecting data from the sensors and transmitting it to the ESP32 microcontroller. Through this centralized control, the network optimizes water distribution, ensuring equitable access while minimizing wastage. The use of solar power not only reduces dependency on fossil fuels but also makes the system sustainable and cost-effective in the long run. Furthermore, the incorporation of relay switches controlled by the microcontroller enables precise control over solenoid valves, enhancing the efficiency of the pumping and distribution process. Overall, this project demonstrates the feasibility and effectiveness of harnessing renewable energy and smart technology to provide clean water access to underserved communities, contributing to sustainable development and improving quality of life.

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