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Smart Switching Agriculture Irrigation System*1*

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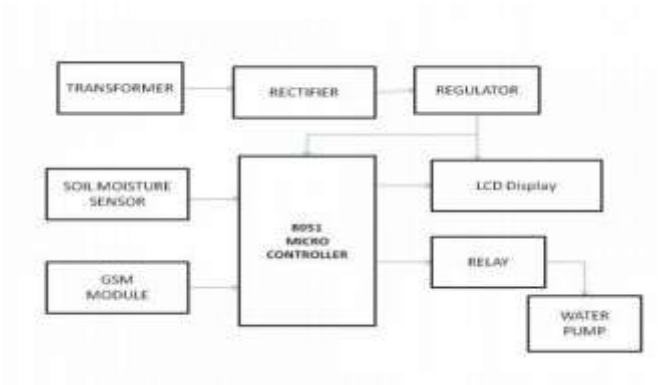
Abstract:
In the face of increasing water scarcity and the need for sustainable agriculture, the development of a Smart Switching irrigation system offers a transformative solution for effective water management in farming. This research introduces an innovative irrigation framework that utilizes IoT (Internet of Things) technology and smart sensors for real-time monitoring and control of agricultural irrigation processes. The system is designed to optimize water usage by integrating various environmental parameters, including soil moisture, temperature, and humidity, which dynamically inform irrigation needs. The Smart Switching system employs an automated mechanism that responds to changing environmental conditions, enabling timely irrigation without human intervention. By leveraging data analytics and machine learning algorithms, the system not only predicts irrigation requirements but also schedules watering based on factors such as crop type, growth stage, and weather forecasts. This tailored approach enhances both water efficiency and crop health, ensuring that plants receive the optimal amount of water precisely when needed. A user-friendly mobile application serves as the interface for farmers, allowing them to monitor soil conditions, adjust irrigation schedules, and receive alerts about their field's status from anywhere. This connectivity empowers farmers to make informed decisions, facilitating better resource management and improving overall productivity

Keywords: Arduino, Solar, Battery, Vehicle

Introduction:
The greenhouse based modern agriculture industries are the recent requirement in every part of agriculture in India. In this technology, the humidity and temperature of plants are precisely controlled. Due to the variable atmospheric circumstances these conditions sometimes may vary from place to place in large farmhouse, which makes very difficult to maintain the uniformity at all the places in the farmhouse manually, it is observed that for the first time an android phone-control the irrigation system, which could give the facilities of maintaining uniform environmental conditions are proposed. The android software development kit provides the tools and application programmable interface necessary to begin developing applications on the android platform using the java programming language. Mobile phones have almost become an integral part of human life serving multiple needs of humans. This application makes use of the GPRS [General Packet Radio Service] feature of mobile phone as a solution for irrigation control system. GSM (Global System for Mobile Communication) is used to inform the user about the exact field condition. The information is passed onto the user request in the form of SMS drip irrigation is artificial method of supplying water to the roots of the plant. It is also called micro irrigation. In past few years there is a rapid growth in this system.

Methodology:



Working:

Soil moisture sensor gives the voltage as per the moisture content in the land. If more water content in the land, then sensor gives more voltage and vice-versa. If voltage of the soil Moisture sensor is less than the fixed voltage then controller on the relay and starts the motor pump. And the If any message received from GSM, microcontroller processes the information According to program, controller reads that all value and displayed on the LCD. whenever gam Sends sums as a water pump on or pump off then this command goes to the controller an According to program controller on off the pump using this solid-state relay. And output will display on the LCD.

1. Sensors and data COLLECTION Soil Moisture Sensors: Measure moisture levels in the soil. Temperature & Humidity Sensors: Monitor environmental conditions. Water Level Sensors: Ensure sufficient water availability in the reservoir

2. Microcontroller & Processing Unit A microcontroller (Adriano, ESP8266, Raspberry Pi, etc.) processes sensor data. It compares real-time values with predefined threshold levels. If soil moisture is below the set threshold, the system activates the irrigation pump. If moisture levels are adequate, the system remains off to conserve water.

3. Smart Switching & Automation The system uses relay switches or solenoid valves to control the water pump. A timer-based automation may be included to schedule watering cycles. IoT-based connectivity allows remote monitoring and control via a smartphone app

4. Communication & Alerts Wi-Fi, GSM, or Lora modules send real-time updates to farmers. Farmers receive alerts about soil conditions, pump status, and water usage.

5. Power Supply & Energy Efficiency The system can operate on solar panels or traditional electric power,ensuring sustainability. Low-power microcontrollers enhance efficiency and reduce operational costs.

Operation Detail:

1. Solar Energy Utilization: PV panels efficiently transformed sunlight into electrical power, albeit their effectiveness varied according to the amount of sunlight.
2. Battery Backup Performance: By storing extra energy, the backup battery ensured uninterrupted functioning at night or in low sunlight.
3. Power Management System: Optimized performance and battery health through effective energy allocation among solar panels, battery, and motor.
4. Regenerative Braking: This technique effectively restored kinetic energy, increasing battery life and reducing power use. 5. Vehicle Performance & Range: The hybrid system worked well in a variety of weather conditions and increased driving range.
6. For increased efficiency, an energy monitoring system tracked battery health and energy usage in real time.
7. Decreased Grid Dependency: It was mostly powered by solar energy, which made it appropriate for off-grid uses.

Future Scope:

The various factors like soil moisture, climate conditions, soil ph., optimum temperature and solar receptivity can be taken these datasets can be uploaded to run machine tearing algorithms and the optimum input and the outputs generated. This can be more efficient when connected with a cloud computing network for constant update along with real time changes of instructions. The sensors can collectively provide accurate information for optimum growth and the whole
process can be automated with machine learning. This future prototype can be equipped with more sophisticated sensor which can monitor large area of land thus achieving higher productivity with less cost and manual labour. Further, we can train a deep learning model on image processing algorithms to include some more features such as predict the species of crop or the quality of crop based on its picture. We can further automate the system by training the model with previous data for the various soil types, their properties and the crop yield trends. This will help us to analyse and improve the proposed system. We can further thin on data on the climatic conditions of a region over the past years to predict a probable heavy monsoon or a drought and warn the farmers beforehand

Conclusion: Conclusion of smart switching for agriculture irrigation system the implementation of a smart switching system for agricultural irrigation significantly improves water management and resource efficiency. By integrating sensors, IT technologies, and automated control mechanisms, the system ensures optimal irrigation based on real-time data such as soil moisture, weather conditions, and crop requirements. This reduces water wastage, lowers operational costs, and enhances crop yields. Additionally, such systems promote sustainable farming practices by

minimizing the environmental impact associated with traditional irrigation methods. The adaptability and scalability of the technology make it suitable for both small-scale and large-scale agricultural applications, supporting the global need for smarter, more sustainable agriculture. Future enhancements may include machine learning algorithms for predictive analysis and further automation to adapt to diverse agricultural needs, ensuring even greater efficiency and productivity in the present era, the farmers use irrigation technique which involves a lot of manual labour. The farmers irrigate the land at regular intervals, a process that consumes more water and Results in wastage of water. Moreover, due to dependence on monsoon in countries like India, Irrigation more than often becomes difficult due to shortage of water. Hence, we require an automatic system that will precisely monitor and control the water requirements in the field to Increase the efficiency of the irrigation process. Installing automated irrigation monitoring System saves time and ensures judicious usage of water.

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