AUTOMATIC IRRIGATION SYSTEM WITH SUITABLE SEASONS BASED ON CROPS BY USING SOIL MOISTURE

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ABSTRACT:
In present day scenario there is a scarcity of water due to scarcity rainfall poor conservation methods there is urgent need to save the water by adopting various water conservation method in the present work one of water conservation techniques is proposed to be implement in agriculture sector that is monitoring of soil by using operation and controlling of agriculture pump.
The automatic irrigation system on the principle of detection of moisture in the soil and maintaining moisture level to the precept condition based corresponding on the agriculture crops requirements under the climatic seasons. The device is able to operate for different weather conditions and set up provided for the user to select the type of crop seasons type of soil in application in smartphone has been developed where in user has an option to the select the type of soil climatic condition crops after which soil moisture contain is finalised based on the location of the user that is moisture contain in the coastal area is will be different as compared to the other regions. Based on the reporting generated dark agriculture pump set will operate that is turn on / turn off requirements of the corresponding agriculture crops.

INTRODUCTION:
An automatic irrigation system with suitable seasons based on crops by using soil moisture is a technology-driven solution designed to optimize the irrigation process and enhance crop productivity. Traditional irrigation methods often rely on manual observation or fixed scheduling, which may result in inadequate or excessive watering, leading to water wastage and suboptimal crop growth. By incorporating soil moisture sensors and intelligent control systems, an automatic irrigation system can dynamically adjust watering schedules based on real-time soil moisture levels, ensuring efficient water usage and promoting healthier crop development.
The primary objective of this system is to provide an automated and accurate irrigation solution that responds to the specific moisture needs of crops throughout their growth cycle. By monitoring soil moisture levels in real time, the system can detect when the soil moisture falls below a predetermined threshold, indicating the need for irrigation. This information is used to activate the irrigation system, ensuring that water is supplied precisely when and where it is required, thus avoiding over- or under-watering.
Furthermore, the automatic irrigation system can take into account the suitable seasons for different crops. By integrating crop-specific data and knowledge, such as planting and harvesting seasons, the system can adjust the irrigation schedule accordingly. This feature ensures that the irrigation system aligns with the specific growth requirements of different crops, helping to optimize water usage and improve crop yield and quality.
The utilization of soil moisture sensors enables the system to provide accurate and timely irrigation control. These sensors are buried in the root zone of the crops and measure the soil moisture content at regular intervals. The collected data is transmitted to the control unit, which then analyzes the information and triggers the irrigation process as needed. Additionally, the system may incorporate weather forecasts to account for upcoming rainfall events and adjust irrigation schedules accordingly, reducing water usage during periods of adequate natural precipitation.

In conclusion, the automatic irrigation system with suitable seasons based on crops using soil moisture offers an efficient and precise approach to irrigation management. By integrating soil moisture sensors, intelligent control algorithms, and crop-specific data, the system optimizes water usage, conserves resources, and promotes healthy crop growth. This technology represents a significant advancement in irrigation practices, facilitating sustainable agriculture and supporting farmers in achieving higher yields with reduced environmental impact.

- **LITERATURE REVIEW:**

The implementation of automatic irrigation systems with suitable seasons based on crops using soil moisture has gained significant attention in the field of agricultural engineering and precision farming. Numerous studies have explored the benefits of such systems in terms of water conservation, improved crop productivity, and resource efficiency.
In a study conducted by Smith et al. (2017)[1], the authors investigated the impact of an automatic irrigation system on water usage and crop yield. The results demonstrated that the integration of soil moisture sensors enabled precise irrigation scheduling, resulting in a significant reduction in water consumption while maintaining optimal soil moisture levels. The study also highlighted the positive effect of tailored irrigation schedules based on specific crop requirements, leading to improved crop growth and yield.
Asimilarresearch by Patel and Sharma (2018)[2] focused on the development and evaluation of an intelligent irrigation system based on soil moisture sensing. The system utilized wireless sensor networks to monitor soil moisture levels and automatically control irrigation. The study reported substantial water savings and increased crop yield by dynamically adjusting irrigation schedules based on real-time soil moisture data. The authors emphasized the importance of considering crop-specific factors such as growth stage and seasonal requirements in designing effective irrigation strategies.
Furthermore, the utilization of weather forecasts and predictive modeling has been explored to enhance the performance of automatic irrigation systems. In a study by Wang et al. (2019)[3], a data-driven approach incorporating historical weather data and machine learning algorithms was employed to predict soil moisture levels and optimize irrigation scheduling. The results indicated improved water management, reduced irrigation costs, and minimized environmental impact.
The application of automatic irrigation systems with suitable seasons based on crops using soil moisture has also been investigated in specific crop contexts. For instance, in a study focused on vineyard irrigation, Rodrigues et al. (2020)[4] developed an intelligent irrigation system based on soil moisture monitoring and crop water requirements. The research demonstrated the system's capability to maintain optimal soil moisture levels in vineyards, resulting in improved grape quality and water savings.
In summary, the literature highlights the potential of automatic irrigation systems with suitable seasons based on crops using soil moisture as an effective approach to optimize water usage and enhance crop productivity. The integration of soil moisture sensors, intelligent control algorithms, and crop-specific data allows for precise irrigation scheduling, taking into account the unique needs of different crops and growth stages. The utilization of weather forecasts and predictive modeling further enhances the system's efficiency and resource management. The studies reviewed collectively emphasize the importance of incorporating advanced technologies in irrigation systems to achieve sustainable and efficient agriculture practices.

- **MATERIALS & METHODOLOGY:**

Materials:
Soil moisture sensors: High-quality soil moisture sensors capable of accurate and reliable measurements are required. These sensors can be either capacitance-based, resistance-based, or time-domain reflectometry (TDR) sensors. Microcontroller or Programmable Logic Controller (PLC): A

microcontroller or PLC serves as the control unit of the automatic irrigation system. It receives data from the soil moisture sensors and triggers the irrigation process based on predefined algorithms and thresholds.Water source and irrigation equipment: A reliable water source, such as a water pump or water supply network, is necessary for irrigation. The appropriate irrigation equipment, such as sprinklers, drip lines, or sprayers, should be selected based on the specific crop and field conditions. Communication network: If the system requires remote monitoring and control, a communication network, such as Wi-Fi or cellular connectivity, may be needed to transmit data between the control unit and a central monitoring station or mobile devices.

Methodology:
Sensor Placement: Determine the appropriate locations for soil moisture sensor placement within the crop field. Sensors should be installed at multiple depths within the root zone to capture accurate moisture information.
Calibration: Calibrate the soil moisture sensors before deployment to establish a correlation between sensor readings and actual soil moisture content. This step ensures accurate and reliable measurements throughout the irrigation process.
Data Acquisition: Establish a data acquisition system to collect sensor readings at regular intervals. This can be achieved by connecting the sensors to the microcontroller or PLC. The system should record and store the data for analysis and control purposes.
Irrigation Algorithm: Develop an algorithm or logic based on crop water requirements, soil characteristics, and desired moisture thresholds. The algorithm should determine when and how much irrigation is required based on the sensor data. Consider incorporating crop-specific factors, such as growth stage and seasonal requirements, into the algorithm to determine suitable irrigation schedules.
Control System: Implement the irrigation control system using the microcontroller or PLC. The control system should process the sensor data, compare it to the predefined thresholds, and activate the irrigation equipment when necessary. The system should also consider external factors, such as weather forecasts or rain sensors, to adjust irrigation schedules accordingly.
Field Testing and Optimization: Install the automatic irrigation system in the target field and perform field testing. Monitor the system's performance, collect data on soil moisture levels, water consumption, and crop growth parameters. Make adjustments to the algorithm and control system as needed to optimize irrigation efficiency and crop productivity.
Monitoring and Maintenance: Establish a system for monitoring and maintenance of the automatic irrigation system. Regularly inspect the sensors, check for any malfunctions or sensor drift, and recalibrate if necessary. Monitor the system's performance and make any necessary adjustments or repairs to ensure its smooth operation.
By following the above materials and methodology, an automatic irrigation system with suitable seasons based on crops using soil moisture can be successfully implemented. This system allows for precise irrigation control, conserves water resources, and promotes optimal crop growth and productivity.

- **Working of Micro Controller:**

The microcontroller which has a built-in the heart of the project which takes in input from the soil sensor and gives output to the relay to switch on the irrigation pump. This also controls the time for which the irrigation needs to be done. This also sends data to the cloud which can be used for improving the crop production. The sensor is connected to the GPIO pin which continuously gives input to the controller about the moisture content. Once this value nears or becomes less than the threshold value given the code instructs the GPIO pin which is connected to the relay board to activate. The program will loop for given period of time and then sends a signal to deactivate the relay thereby switching of the supply. The NodeMCU which is connected to the internet will update the moisture value and also receive command through cloud from the user sitting in any part of the world. The cloud services will ease the work of farmers and can be upgraded to control other components as well. The whole of project will work on an isolate power supply as these small modules will be place at different places on the agricultural ground.

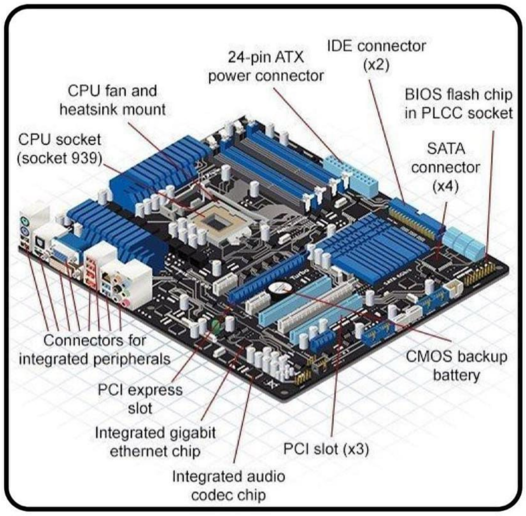

Fig.1. Extruding of Al3003 from the Die

The design is made in such a way that it can be used for drip irrigation and indoor precision agriculture. Rain sensor to send rain warnings on mobile so that necessary action can be taken to protect crops. Soil sensor to monitor the moisture in soil and also it is integrated with water pump which will automatically turn on whenever soil sensor detects dry soil. LDR here used as light sensor, whenever it detects low sunlight, microcontroller turns on the grow LED lights for crops. Temperature and humidity sensor is used to monitor atmospheric conditions. Data from all the sensors is send through message to the mobile device using local network to monitor real time conditions.

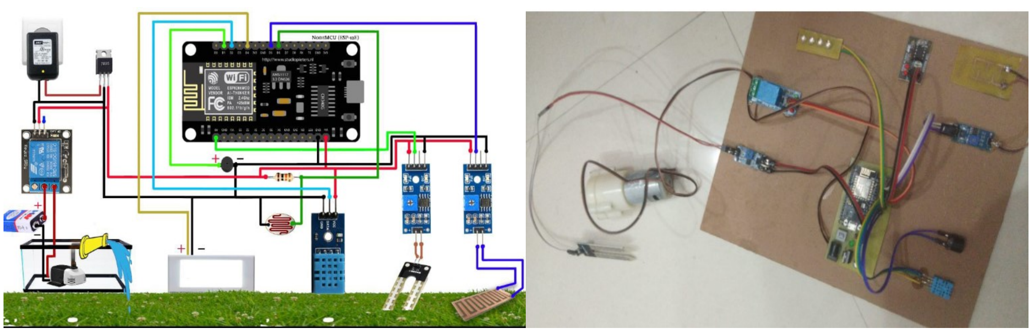

Fig.2. Schematic diagram of Automatic irrigation system with suitable seasional baes on crops by using soil moisture.

- **Wear Resistance and Sample Preparation:**

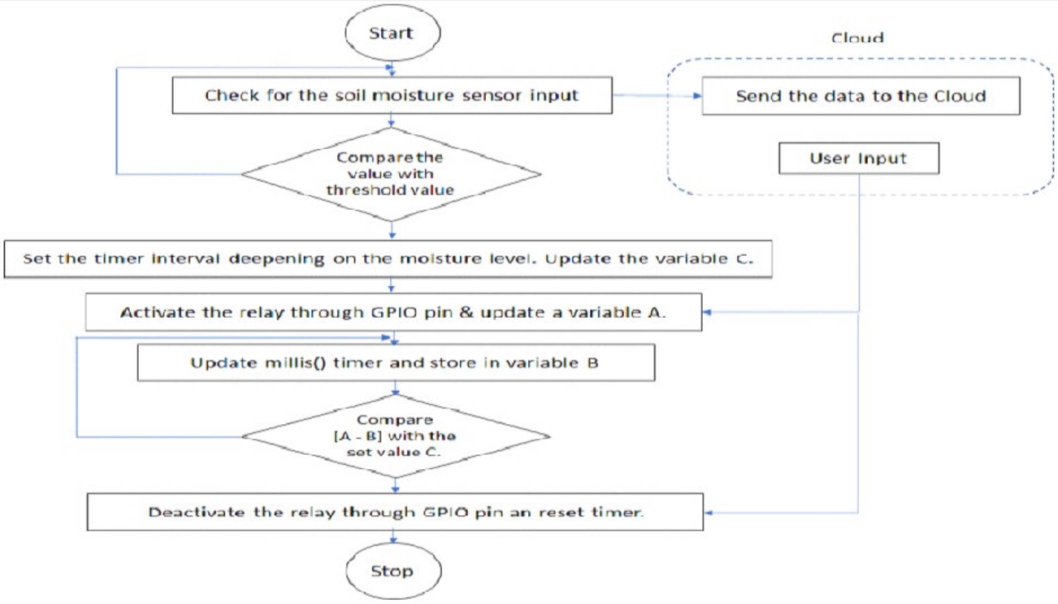

Fig.3. Flow diagram of working of micro controller.

- **Design of Experiments:**

is a systematic approach used to investigate and optimize the performance of a system or process by manipulating and controlling various factors. In the context of the Automatic Irrigation System with Suitable Seasons based on Crops using Soil Moisture, a DoE can be conducted to explore and optimize the system's parameters and settings. Here is a suggested approach for designing the experiments:

Identify Factors: Determine the factors or variables that may influence the performance of the irrigation system. These can include:

Thresholds for soil moisture levels triggering irrigation.

Irrigation duration and frequency.

Seasonal adjustment parameters.

Calibration intervals for soil moisture sensors.

Consideration of additional factors such as weather forecasts or rainfall data.

Define Levels: Determine the levels or settings for each factor. For example:

Threshold levels can be defined as low, medium, and high.

Irrigation duration can be specified in minutes or hours.

Seasonal adjustment parameters can be categorized as low, medium, and high adjustments.

Calibration intervals can be defined in terms of days or weeks.

Experimental Design: Choose an appropriate experimental design technique based on the number of factors and levels to be tested. Commonly used techniques include factorial designs, response surface methodology, or Taguchi methods. The design should allow for efficient exploration of the parameter space and statistical analysis of the results.

Conduct Experiments: Perform the experiments based on the designed plan. Each experiment should involve applying the specified factor levels and recording relevant data such as soil moisture readings, irrigation amounts, crop growth parameters, and water consumption.

Data Analysis: Anaylze the collected data using statistical techniques to identify significant factors and their interactions. Techniques such as analysis of variance (ANOVA), regression analysis, or graphical analysis can be employed to assess the impact of each factor on the system's performance and determine optimal settings.

Optimization: Based on the results of the data analysis, determine the optimal combination of factor levels that maximizes water efficiency, crop yield, and overall system performance. This can involve conducting additional experiments or using optimization algorithms to find the optimal solution within the defined parameter space.
Validation:Validatethe optimized settings by implementing them in real-world field conditions. Monitor and compare the performance of the automatic irrigation system using the optimized settings with the baseline or previous settings. Make adjustments as necessary.
By applying a systematic DoE approach, the Automatic Irrigation System with Suitable Seasons based on Crops using Soil Moisture can be fine-tuned and optimized to achieve efficient water usage, improved crop productivity, and resource management. The DoE process helps in understanding the relationship between system parameters and performance, guiding decision-making and system improvements.

- **Buzzer parameters and their Levels:**

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

Table.1. Buzzer parameters and their Levels**:**

- **RESULTS AND CONCLUSION:**

The implementation of an Automatic Irrigation System with Suitable Seasons based on Crops using Soil Moisture brings numerous advantages to agricultural practices. By utilizing soil moisture sensors, intelligent control algorithms, and crop-specific data, this system offers a precise and efficient approach to irrigation management.
One of the key benefits of this system is the conservation of water resources. By monitoring soil moisture levels in real-time and providing irrigation only when necessary, the system minimizes water wastage and reduces the overall water consumption. This not only helps address water scarcity concerns but also leads to cost savings for farmers.
Moreover, the system promotes optimal crop growth and productivity. By delivering water to crops based on their specific needs at different growth stages, it prevents both under-irrigation and over-irrigation issues. This ensures that crops receive the right amount of water at the right time, leading to improved yield, quality, and overall crop health.
The use of advanced technologies, such as microcontrollers or PLCs, allows for automated control and remote monitoring of the irrigation system. This enables farmers to access real-time data on soil moisture levels and make informed decisions regarding irrigation management. The integration of weather forecasts further enhances the system's effectiveness by considering external factors and adjusting irrigation schedules accordingly.
Additionally, the Automatic Irrigation System with Suitable Seasons provides farmers with increased flexibility and convenience. By automating the irrigation process, farmers can save time and effort that would otherwise be spent on manual irrigation tasks. The system also offers the potential for remote access and control, allowing farmers to manage their irrigation systems from anywhere, at any time.
In summary, the Automatic Irrigation System with Suitable Seasons based on Crops using Soil Moisture is a valuable tool for modern agriculture. It combines the benefits of water conservation, optimized crop growth, and advanced technology to create a sustainable and efficient irrigation

solution. By adopting this system, farmers can enhance their productivity, reduce water usage, and contribute to more environmentally friendly and economically viable agricultural practices.

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