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SMART AGRICULTURE SYSTEM USING IOT AND MACHINE LEARNING

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ABSTRACT:

The farming of agriculture has started past 12000 years back, Neolithic age gave birth to civilization, Farming than later begin continued as traditional farming practices. India begins an agrarian's country is dependent on rains, soil dampness and environmental challenges. Our farmers upgrading to modern state of agriculture technology in cultivation. Globally the IoT systems has contributed its application in many fields and proven to be successful. It is the time that all Indian farmers need to be introduced to Smart Agriculture systems for higher crop yield. The productivity with compilation of data from sensors, actuators and modern electronic gadgets the farmers can monitor agriculture fields, with the use of ESP-32 camera module. Smart Agriculture can switch ON/OFF the pump motor acknowledging the moisture levels, buzz the buzzer and notify the farmer in the case of any pest near the crop, with the help of sensors which are interfaced to process module Arduino-Uno. It can also predict which crop is suitable to grow in a particular area by considering the different soil compositions of that particular area. In our proof of the concept of such a prediction model we have used K-NN algorithm. The Smart Agriculture system can be operated from anywhere with the help of network technology. A Microcontroller has been used as for ensuring low-cost and small size of the system.

Keywords: Microcontroller, ESP8266, ESP32 CAM, Crop Recommendation, Relay, Motor, IR sensor

INTRODUCTION:

The smart irrigation system has wide scope to automate the complete irrigation system. Here we are building a IoT based Irrigation System using Arduino-Uno Module and Soil Moisture sensor.

It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to ThingSpeak online server using ESP8266 to update the values of sensors. The System consists of water pump which will be used to pump the water on the land depending upon the Moisture level values.

To control the pest we are using IR sensor to detect any pest movement in the field and alert the farmer with this information. Live streaming of the agriculture land is also provided to the farmer using ESP-32 camera module which can be accessed over the internet from everywhere.

Our project also includes crop recommendation using machine learning based on K-Nearest Neighbours algorithm. This is basically a software program which takes different values such as pH value, Nitrogen, Phosphorus, Potassium, Temperature and Humidity of the soil as input and with all this information the software program recommends which crop is suitable growing at that place.

Existing System: Consist of only one moisture sensor which does not cover the whole field area. DC motor is used which is directly connected to relay and power supply is given from Arduino board. When the moisture sensor detect the water levels the ON/OFF of motor takes place. When the water is low i.e. low moisture the motor is turned On, and when the water level is high i.e. high moisture the motor is turned off. LCD shows the present state of moisture sensor. There is no wireless transmission of data to the farmer.

Proposed System:

Water irrigation: 3 moisture sensors will be continuously detecting the water levels from different corners of field. Based on these values of moisture sensors the AC motor switches ON/OFF.

Pest Control: To control pest, an IR sensor is used to identify any movement in the field and alert the farmer by online website as well as buzzer which is present in the field.

Field monitoring: As agriculture is important part of a farmers life he can monitor his agriculture field over the internet using ESP32 camera module.

Crop recommendation: First a machine learning project based on k-nearest neighbours algorithm helps farmers to know which crop can be grown in field according to its conditions. This is a python-based software which takes different values as inputs such as amount of nitrogen, phosphorus, potassium, average rainfall, PH level of soil and gives the best crop to be grown in that area as an output.

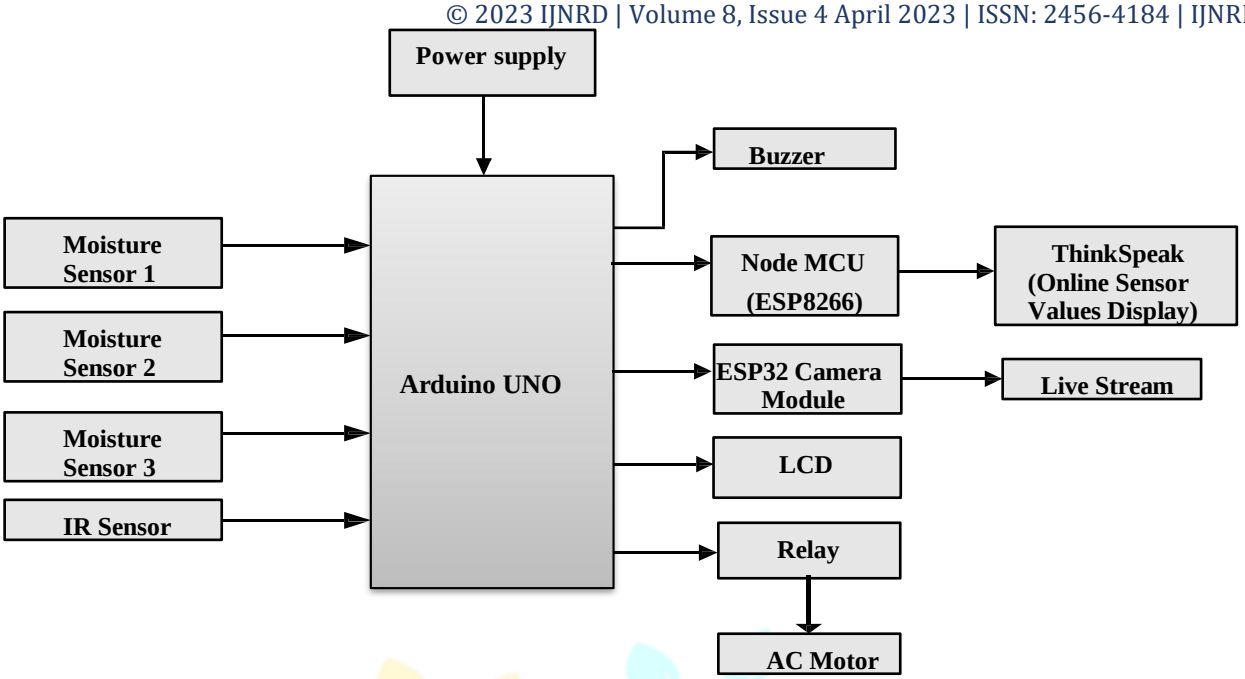

Fig: Block Diagram

Working:

This section presents the system overview, design, and implementation details. specification of the smart Agriculture system using IOT and Machine Learning. The moisture sensors which are placed in the farming lands detects the water level i.e. It detects weather the land is wet or dry and then it sends to the Arduino-UNO. If the signal received is dry the uno sends ON signal to relay. Pump is controlled by the relay which switches ON the pump and after the agriculture land gets wet it automatically turns OFF the pump. i.e., The pump is switched ON/OFF based on the moisture content.

IR sensor which is placed in the farming land helps in detecting any moment in the land. This IR sensor is connected to the buzzer through Arduino and when the IR detects any motion it automatically turns ON the buzzer and notify this information online which helps the farmer to protect their lands. ESP32 camera is used for live streaming.

1. **Arduino-UNO:** It is an open source microcontroller board based on ATmega328P. It has 14 digital I/O pins, (of which 6 can be used as PWM outputs), 6 analog inputs, it is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board. All of our sensors are attached to input output pins of this board.

2. **ESP32 CAM:** It has a inbuilt wi-fi module and Storage with 4MB ROM and 32KB RAM. ESP32-CAM is a advance development board with Wi-Fi camera. It allows creating IP camera projects for video streaming with different resolutions.

3. **SOIL MOISTURE SENSOR:** Soil moisture sensor is one kind of sensor used to detect the soil moisture content. This sensor has two outputs like the analog output as well as the digital output. The digital o/p is permanent and the analog o/p threshold can be changed. The working principle of soil moisture sensor is open & short circuit concept. Here the LED gives an indication when the output is high or low.

4. **RELAY:** Relay which is act as a switch and it give 12V power to the lock. Relay is also a switch that connects or disconnects two circuits. But instead of manual operation a relay is applied with electrical signal, which in turn connects or disconnects another circuit.

5. **WI-FI MODULE ESP8266**: The Wi-Fi module ESP8266 is a low-cost module, used to interface the microprocessors. It has a 96 KB of data RAM as well as a 64KB of instruction RAM

6. **LCD:** A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. We have used 16x2 LCD which displays the present conditions of 3 moisture sensors and IR sensor.

The Machine Learning model uses K-Nearest Neighbour algorithm to predict which crop is suitable to grow in the field with the help of the soil characteristics. By using this model we have tried to solve the problem of Indian farmers choosing which crop to grow. We have a dataset of around 2200 lines, on the basis of which we can predict which crop to grow. We can predict almost 22 different types of crops.

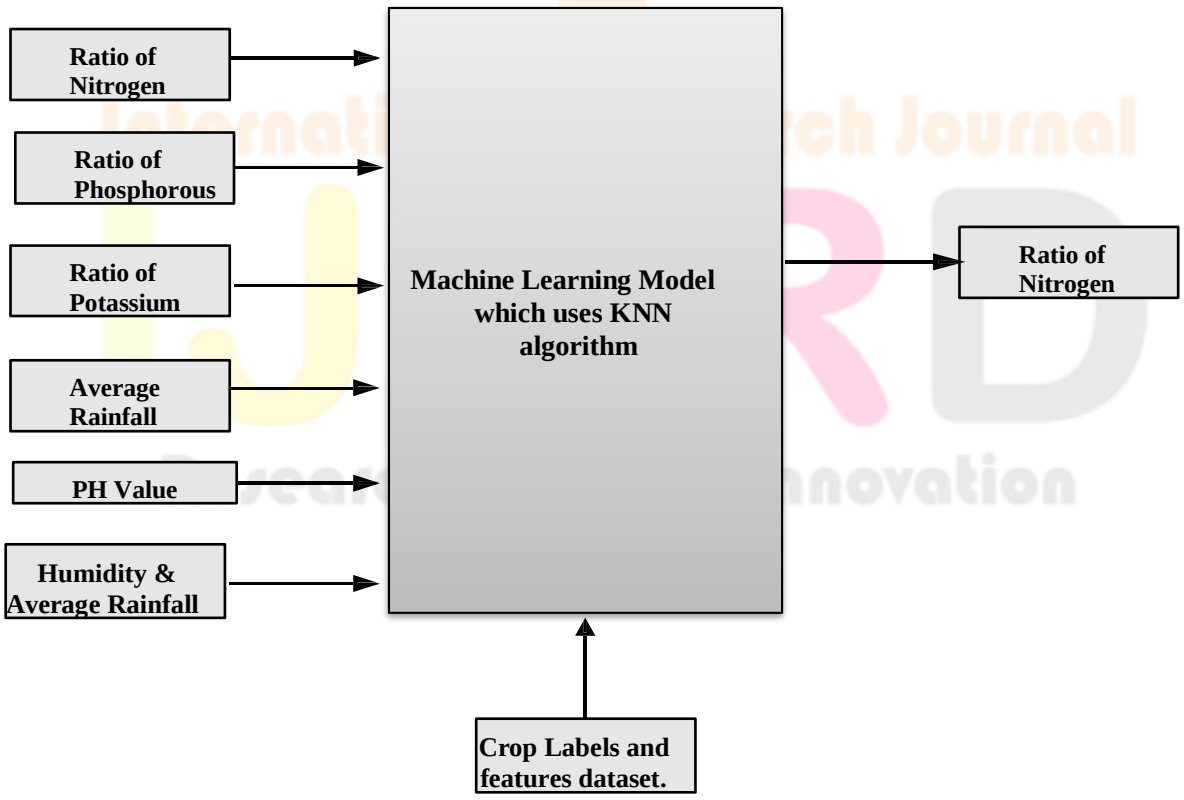

Fig: Block Diagram software

The K-NN working can be explained on the basis of the below algorithm

- Step-1: Select the number of K of the neighbours.
- Step-2: Calculate the Euclidean distance of the K number of neighbours.
- Step-3: Take the K nearest neighbour as per the calculated distance.
- Step-4: Among the k neighbour, count the number of the data points in each category.
- Step-5: Assign the new data points to that category for which the number of neighbours is maximum.
- Step-6: Our model is ready

CONCLUSION:

Smart agriculture system can bring numerous benefits to agriculture, land scaping and water conservation. By utilising the data from soil sensors, and other sources, these systems can provide the plants with the right amount of water at the right time, reducing water waste and increasing crop yields. The proposed crop recommendation system is a great helper for the farmers in India.

The aim is to make farmers aware of modern tools and infrastructure and promote precision farming. A well-informed decision can directly affect their profits.

Overall, the use of smart agriculture system is a promising solution to the challenges of water scarcity and sustainable agriculture. By reducing water usage and increasing crop yields, these system can help to create more sustainable and resilient future for agriculture and landscaping.

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