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Smart Irrigation system using remote monitoring

[1]Dr.T.Joby Titus , [2]D.Indhu,[3] R. Arun Prasath, [4] D.Shanthi
[1]Professor,[2,3,4] Assistant Professor, Department of ECE
Dhanalakshmi Srinivasan College of Engineering ,Coimbatore, India

Abstract-
The economic growth of India depends on Agriculture sector and water is the most essential source for agriculture. The agriculture sector depends on the effort of farmerto do cultivation and continuously monitoring the fields. The usage of water depends on the type of crop, as the excess water leads to damage of crops. In India, agriculture contributes about16% of total GDP and 10% of total exports. To reduce the effort of farmer in round the clock monitoring, a Smart Irrigation and draining system interfaced with IoT is proposed. Our system replaces the conventional model of watering the crops, as it leads to draining if excess water is available in field with the help of a sensor module and the control module using NODEMCU microcontroller. This system helps the farmer to know about the status of fields. Efficient water irrigation sector reduces the wastage of water. The proposed system uses a sensor module to collect on field data base. The sensor module includes temperature, humidity, soil moisture sensors which collects the real time field data and automatically drives the motor.Our proposed system reduces the human effort and monitors the field through IoT interfaced device.
Keywords *- Agriculture, Sensor Module, Microcontroller, IoT*

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I. INTRODUCTION

In India the agricultural sector depends on monsoon season and to boost the cultivation of food products, fresh water irrigation system plays a major role. The water management system is the major challenge in many arid and semi-arid farming systems and to optimize the water consumption for agricultural crops, an automated irrigation system is required. Automatic irrigation system is capable of sensing the water requirement of soil in-order to avoid overwatering and under watering. The agricultural farm located in high evaporation area leads to increase in soil salinity due to fast evaporation condition, resulting in a deposit of harmful salts on the soil surface. A smart irrigation system analysis the water moisture level and soil condition and it provides the key parameters in governing precision agriculture. The crop yield is affected by low irrigation in terms of water management eventually reduces crop yield to crop stress. The Internet of Things(IoT) plays the major role in precise water management from remote location.To achieve smart and intelligent connectivity of physical devices, the sensors, actuators, and network connectivity modules are interfaced to exchange thedata among themselves, machines and humans. The technology advances in information sharing from remote location also improves the agriculture sector for remote access and remote controlling. Thus, IoT has the potential for transforming agriculture, thereby increasing the crop productivity while enhancing the quality of production, by managing and controlling the activities used for agriculture sector. The existing smart irrigation system is focussed on water saving methods using wireless sensor networks (WSNs), where the irrigation condition is a predefined static value for the entire crop duration. The entire field may not require irrigation at that point and the irrigation treatment differs with the growing stage of crop. This method of treating the crops is termed as dynamic irrigation, which is performed in terms of time schedule and volume of water additionally. The agricultural system totally depend on the farmer's activities, where farmers may lack expertise to use the current technologies, a simple solution is highly desirable from the farmer's point of view. In addition to automatic irrigation, the proposed system offers manual irrigation with remote access.The system uses a water-level sensor that generates discrete values according to the level of water present in a field.

BhuwanKashyap, et al.,(2021) referred that the sensing methodologies plays the major role in precision agriculture to monitor soil moisture and nutrient content. The key sensing methodologies in soil moisture determination depends on identification of measurement metrics, laboratory-based testing, remote and proximal sensing techniques. The electrophoresis method leads to inorganic ion detection in soil. The recent work suggest that the sensor technology point towards the trend of developing low-cost, easy to use, field-deployable or portable sensing systems for precise monitoring of crop field. The nutrient monitoring method helps the crop management under various stages.

The crop growth analysed by Glili Yao, et al.,(2020), proposed an active light source apparatus for monitoring and diagnosing the crop growth stage. The crop growth information can be extracted using Portable spectrometers in an efficient manner. The existing methodologies extract the spectral reflectance and calculates the vegetation index. The active light source apparatus is developed based canopy shape characteristics and spectral monitoring mechanisms for row-cultivated crops. The apparatus is capable of eliminating ambient light interface using modulated light source. The canopy reflectance spectral information is extracted using high pass filter, which improves the sign-noise ratio. The system analyses Crop canopy vegetation indexes, normalized difference vegetation index (NDVI), ratio vegetation index (RVI). The system also provides crop growth parameters such as leaf area index (LAI), leaf dry weight (LDW), leaf nitrogen accumulation (LNA) and leaf nitrogen content (LNC). The apparatus is capable of producing high test stability within the standard test height range. The rice and wheat experimental results demonstrated the accurate vegetation index results.

The IoT applied on agriculture sector was analysed by PreetKour et al.,(2019). The technology advances leads to shifting the cconventional approach to the most advanced ones in agricultural sector. The optimization technique adapted in modern agricultural sector is real time monitoring of farms with hybridisation of species. The technology industry is racing to provide more optimal solutions for agricultural sector. The research area in modern agriculture includes IoT, cloud computing, big data analytics and wireless sensor networks to predict the real time scenario of farm and crop growth. The recent greenhouse environmental monitoring and mobile greenhouse environment monitoring is possible due to IoT interfacing.

IoT model is applied on agriculture sector was analysed by PreetKour et al.,(2019). The technology advances leads to shifting the cconventional approach to the most advanced ones in agricultural sector. The optimization technique adapted in modern agricultural sector is real time monitoring of farms with hybridisation of species. The technology industry is racing to provide more optimal solutions for agricultural sector. The recent greenhouse environmental monitoring and mobile greenhouse environment monitoring is possible due to IoT interfacing.

A fuzzy system is analysed by Abdullah, et al.,(2016) to analyse sensor parameters in farm location. The conventional farming system uses labour to continuously monitor the farm. The sensor network interfacing using fuzzy system enables the remote monitoring of real time data and the farmer is provided with the information such as air humidity, temperature, soil moisture through IoT interfaced mobile application. The fuzzy system adapts a timer to control the irrigation system in the farm and it doesn't predicts the soil moisture content. The fuzzy system allows a framework to control pump switching time according to user-defined variables based on the sensor values.This system reduces the irrigation time as it is predefined based on the sensor data base.

Xia Geng, et al.,(2020) proposed a system for Mobile Greenhouse Environment with multipoint monitoring systeminterfaced using Internet of Things. To analyse the parameter in mobile farm, an architecture model with motion control functions are incorporated. This system uses a Raspberry Pi controller and an Arduino chip, in which the Raspberry Pi act as data server to store crop image and the Arduino act as masterchip for the mobile system in movable greenhouse environment. The mobile system is integrated with the Raspberry Pi controller to monitor sensor data. The data handled in the system is subjected to Cyclic Redundancy Check (CRC) to eliminate transmission error.

The rest of the paper is organized as section 2 explains the existing methodology in irrigation system, section 3 briefs the proposed methodology of smart irrigation system. Section for shows the hardware layout and the results and Section 5 concludes the paper.

II. EXISTING SYSTEM

The existing irrigation system in agricultural farm is based on fixed schedule irrigation system and it doesn't rely on the climatic changes and soil nature. controllers are based on fixed schedule. Based on the coverage ofarea the irrigation time is decided. The time schedule can be changed by the farmer based on the technical perspectives and it does not suit throughout the year for crop growth and the type of crop.

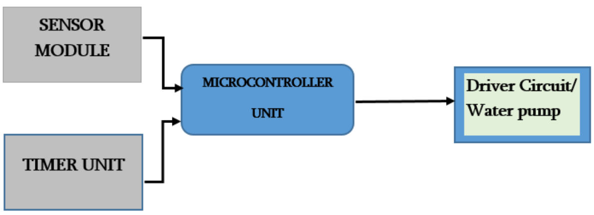

Fig-1: Timer controlled irrigation system

The timer controlled irrigation system uses the sensor data to fix the time schedule at different stages of crop growth and the time schedule is run by the timer unit. The microcontroller operates the water pump based on the time schedule with respect to sensor data. The conventional way of irrigation system leads to more wastage of water irrespective of its requirement. To eliminate this drawback and efficient use of irrigation system in farm land, a smart irrigation system is proposed with remote monitoring system.

III. PROPOSED METHODOLOGY:

The proposed smart agriculture system incorporate with the number of sensor modules and provides remote monitoringusing IoT interface modules. The system analyses the sensor data and the microcontroller takes control for precise irrigation system. The system includes a water pump for irrigation purpose of farm land and a dryer motor to extract the excess water in farm land. Here the microcontroller is interfaced to IoT device, which enables the farmer to monitor the crop growth and the stage of crop from remote location using mobile application. The excess water in farmland, which stress the crop growth is extracted using this method and the sensor data operates the dryer motor. The system also enables the farmer to operate the irrigation motor and dryer motor irrespective of sensor data from remote location. Farmers experimental analysis can also be incorporated for remote manual irrigation based on the requirement in various cases, such as climate change, and crop stage. The method of combining automatic dynamic irrigation and manual irrigation is an intelligent methodology at different stages of crop growth.

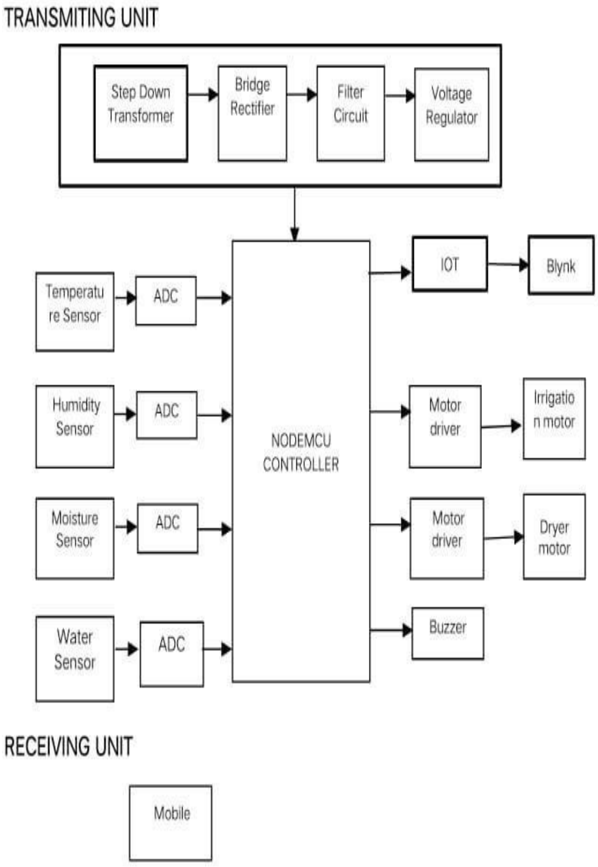

Fig2. Block Diagram of Proposed Methodology

The irrigation motor is switched on based on the soil moisture sensor data and the water level senor in farm land decides the off state of irrigation motor. This system replaces the conventional method of irrigation method operated with fixed time duration irrespective of its requirement. The proposed methodology includes and rain sensor to monitor the rainfall rate in farm land and the system can be either automated or manually operated by the farmer for irrigation purpose. The system includes Node MCU, Soil moisture Sensor, Rain Sensor, 2 Channel relay, mini submersible motors.

IV. EXPERIMENTAL RESULTS

The real time monitoring of soil sensor and the irrigation motor on condition, communicated to farmer through Think-speak application is shown in Fig 3 and Fig 4. Real time soil report analysis can be determined from the remote location.

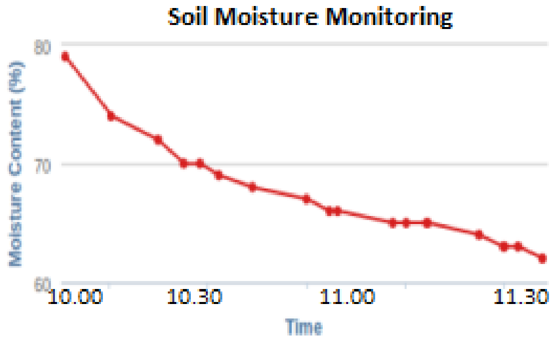

Fig3.Soil moisture sensor data

The results predict that, if the soil moisture content is more the irrigation motor remains in OFF state and if the value is beyond the threshold limit then the dryer motor is turned on state. Fig. 5 shows the hardware setup in demo version to demonstrate smart irrigation system.

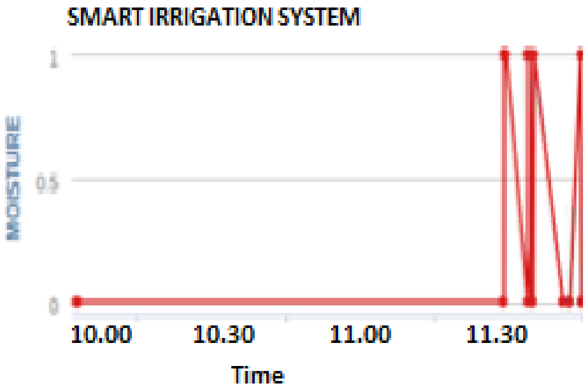

Fig4.Irrigation motor on condition

The system works with remote access if it is connected with internet. For wide usage with sensor module the microcontroller can be chosen as raspberry pi controller. The system can be enhanced with quality monitoring of crop stages.

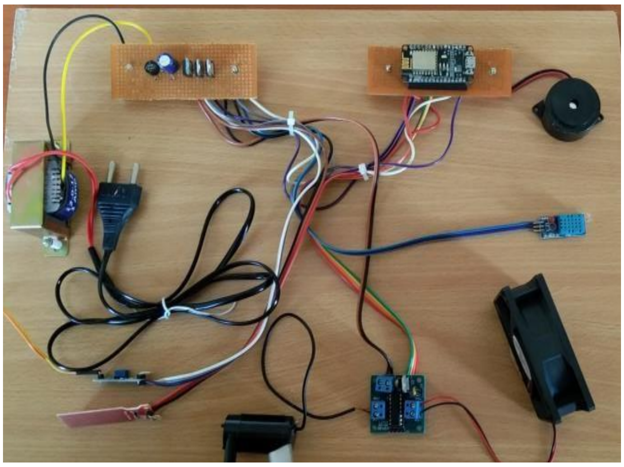

Fig 5.Hardware Interface

V. CONCLUSION AND FUTURE SCOPE

Thus this system concluded with the smart irrigation system model controls with NODEMCU. This system avoids over irrigation, under irrigation, top soil erosion and reduce the wastage of water. The research area in modern agriculture includes IoT, cloud computing, big data analytics and wireless sensor networks to predict the real time scenario of farm and crop growth. Among this, the proposed smart irrigation system improves the availability and reliability as compared to the conventional methods. The weather conditions are incorporated to obtain precise control of farm crops. Here the multi-sensor moduleimproves the reliability. In large scale applications, high sensitivity sensors can be implemented for large areas of agricultural lands.The main advantage is that the system's action can be changed according to the situation (crops, weather conditions, soil etc.). Thus, this system is cheaper and efficient when compared to other type of automation irrigation system. In future, the work may extended with the image processing model with real-time survey model using web cam is planned and the deep convolution neural network is analyzed for feature analysis if crop like leaf disease detection and growth monitoring system.

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