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Crop Field Management Based On IoT Using ARM7

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Abstract: Agriculture is the backbone of Indian economy. But, when considering technology that is deployed in this field we find that development is not tremendous. The most common problems faced in agriculture fields are need for regular manual irrigation, detection of disease associated with plants, effects on abnormal plant growth and safety of the crop field. This paper presents solutions to all these drawbacks and can be implemented by agriculture field monitoring and analysis using Wi-Fi. The parameters such as soil moisture, water level in tank, pH of soil, growth level of plants and presence of intruder are monitored and suitable actions are taken. This project describes a design using various sensor connected with ARM7 Microcontroller which transmits the data using Wi-Fi. Plant disease is detected using digital image processing. Field conditions are site specifically monitored across the field based on a plant growth, soil property, intruder alert and wirelessly transmitted to the user.

Keywords: IoT; Wi-Fi; Arm7; Agriculture monitoring; Sensors; Image processing

I. INTRODUCTION

Agriculture remains the sector which contributes the highest to India's GDP. Almost 80 % of our population depends on agriculture for their living. India has evidenced a relentless average national annual upsurge in the kilograms produced per hectare for some agricultural products, over the last 60 years. These gains have come mainly from India's green revolution, improving road and power generation infrastructure, knowledge of gains and reforms. Despite these recent accomplishments, agriculture has the potential for major productivity and total output gains, because crop yields in India are still just 30% to 60% of the best sustainable crop yields achievable in the farms of developed and other developing countries. Natural resources such as land, water, soil and other resources must be better managed so that more productive and resilient agriculture can be achieved. Efficient water management is a major concern in many cropping systems in semiarid areas. When considering technology that is deployed in this field we find that development is not tremendous. With the passage of time, the agriculture sector is facing more problems and greater challenges such as falling land fertility and dwindling water reservoirs. India is blessed with a large chunk of cultivable land, but the output produced does not do justice to the country's potential. The concept of IoT can be of great help in providing solutions to problems faced in agricultural field. In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere. IoT-based smart farming is highly efficient when compared with the conventional approach. The applications of IoT-based smart farming are not only target conventional, large farming operations, but could also be new levers to uplift other growing or common trends in agricultural. In terms of environmental issues, IoT-based smart farming can provide great benefits including more efficient water usage, or optimization of inputs and treatments.

II. LITERATURE SURVEY

A. Joaquin Gutierrez, Juan Francisco Villa-Medina, "Automated irrigation system using wireless sensor network and GPRS module", VOL.63 No.1, January 2014

An automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. The automated system was tested in a sage crop field for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved. Three replicas of the automated system have been used successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be useful in water limited and geographically isolated areas.

B. Sanku Kumar Roy, Sudip Misra, "A Prototype for agricultural intrusion detection wireless sensor network", Conference Paper, June 2015

The attack of animals in the agricultural land and the theft of crops by humans cause heavy loss in cultivation. In this work, we propose a hardware prototype using Wireless Sensor Network (WSN) for intruder detection in an agricultural field. The proposed system is named Agricultural Intrusion Detection (AID). It helps to

generate alarms in the farmer's house and at the same time transmits a text message to the farmer's cell phone when an intruder enters into the field.

C. Amritha A Joshi, B.D. Jadhav, "Monitoring and controlling rice diseases using image processing techniques", conference paper, May 2017

Identification of the diseases is the key to prevent qualitative and quantitative loss of agricultural yields. Rice (Oryza Sative) is one of the essential crops in India and losses due to the diseases badly impact the economy. Manual detection of the diseases is very difficult and not accurate. This creates a need for Image processing techniques which will help in accurate and timely detection of the diseases and overcome the limitations of the human vision. A new technique to diagnose and classify rice diseases has been proposed in this paper. Four diseases namely rice bacterial blight, rice blast; rice brown spot and rice sheath rot have been identified and classified. Different features like shape, the colour of a diseased portion of the leaf have been extracted by developing an algorithm. All the extracted features have been combined as per the diseases and diseases have been classified using Minimum Distance Classifier (MDC) and k-Nearest Neighbour classifier (k-NN).

III. BLOCK DIAGRAM

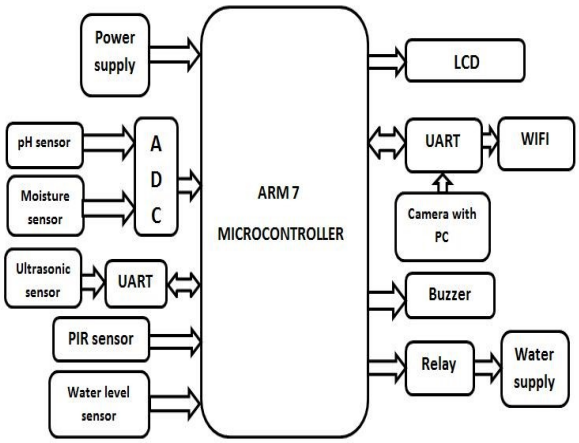

Fig 1. Block Diagram

IV. IMPLEMENTATION

This paper gives four main solutions for the problems faced by farmers. They are irrigation system, monitor plant growth and determine the soil nature, intruder detection and disease detection.

A. Irrigation System

The moisture sensor is a DHT11 sensor. DHT11 sensor is used for checking the moisture content in the soil. It consists of a humidity sensing component, a NTC (negative temperature coefficient) temperature sensor (or thermistor) and an IC on the back side of the sensor. The moisture level sensor gives analog values which must be converted into digital value by using an ADC. Later, ADC is interfaced with the ARM7 controller. The system will continuously check the moisture content in the soil. For suppose, if the moisture level goes low the system checks the water level in the supply tank. If sufficient water is available in the supply tank then the controller sends a signal to the motor. The relay is used to boost the voltage level and the motor is turned ON. If the soil moisture is level is less and there is no sufficient water level in the supply tank the pump will not be turned on.

B. Monitor Plant Growth And Determine The Soil Nature

The system can regularly monitor the growth of the plant with help of an ultrasonic sensor. The distance is calculated by the ultrasonic sensor. The ultrasonic sensor uses UART for the serial communication which is interfaced with the ARM7 microcontroller. With the continuous plant growth monitoring, the farmer can achieve maximum crop productiveness. The system can also determine the soil nature like determining the various pH levels in the soil. The pH level can be acidic, neutral or alkaline. Soil pH is a measure of the acidity and alkalinity in soils. pH levels range from 0 to 14, with 7 being neutral, below 7 acidic and above 7 alkaline. The optimal pH range for most plants is between 5.5 and 7.0. The pH sensor is used to measure the pH of soil the sensor is connected to the ARM7 through in-built ADC. The pH value and the soil nature are displayed on LCD. Thus, by knowing the pH level in the soil, the farmer can decide which fertilizer can be used on the crops.

C. Intruder Detection

Nowadays security of agricultural field is very important. Threats to agricultural field can come from many sources. Intentional destruction or contamination of crops is a possibility that producers must guard against. A system has been designed for protecting the crop in the field. The system is implemented which detects for any intruder entering the field by using an IR sensor. An IR sensor can measure the heat of an object as well as detects the motion. IR Sensors work by using a specific light sensor to detect a selected light wavelength in the Infrared (IR) spectrum. The IR sensor is interfaced with the ARM7 microcontroller. Suppose if any intruder is detected then the buzzer which is a passive device will automatically turn-on and simultaneously the message "Intruder Detected" will be displayed on LCD. This will help farmers to increase the yield and productivity in an agricultural field.

D. Disease Detection

The disease in plants is detected by image processing technique. Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. Image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. A MATLAB code is written to identify various diseases. The original image and the image of diseased plant is captured and stored in the database. The image of the field is captured using web camera and these images are compared with the images in the database. If the captured

image contains any diseased plant then the message "Disease Detected" is displayed on LCD.

The output data from all the sensors used in this project are conveyed to the owner using Wi-Fi technology. Wi-Fi module used in this project is ESP8266. TCP client application has to be installed in an android phone. This app is used to receive the notifications by the owner about irrigation, pH value in the soil, intruder detection, proper plant growth and disease detection. The owner must be connected to the Wi-Fi network always. Therefore, this helps the owner to maintain agricultural field more efficiently.

V. RESULTS

Fig 2. Result

VI. CONCLUSION AND FUTURE SCOPE

This project is a prototype design which implements the solution for irrigation system, monitoring plant growth, field security, disease detection and distant monitoring .Here the soil moisture level is checked and depending on the moisture level the irrigation is controlled which helps to conserve water and the ultrasonic sensor will sense the incoming signals from the plant and monitor the plant growth is low or high and the IR sensor is used to detect any intruders. where the infrared rays emitting from the animals, humans etc. are received from the IR sensor and detects the intruder and the MATLAB is used to detect the disease and all these applications will help the owner to monitor the field and owner gets the notification on his mobile through Wi-Fi which helps in distant monitoring. The project which we have developed is just a prototype and which acts as a preliminary version of a device and where we can extend sensor for longer meters and a longer range of Wi-Fi module. So this can be developed in real time application Therefore, in future a system can be built which automatically maintains the field on its own with help of IoT functionality and embedded robotic System which work in association with water quality measuring system, to automatically maintain the various parameters of field without affecting life or growth of crops. This consequently leads to reduce the demand of manpower and increase in growth rate.

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