Survey on Intelligent IOT Based System for Agriculture

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***Abstract*- Agriculture is one of the major parts of a country's economy. But recently, weather change has affected crop growth adversely and farmers are suffering. In such a situation, it is necessary for us to get smarter and be able to use the resources we have intelligently. We propose a method of farming wherein a farmer's job is reduced immensely and resources are used adequately. We aim to develop an IoT based project which will automatically do the work of irrigation on the basis of an FC-28 soil moisture sensor. We will be using machine learning to predict the possibility of a crop getting affected by a disease. This system will also provide suggestions to the farmer on how to prevent these diseases and if at all the crop gets infected, what all can he do to solve this issue. Farmer will also be notified regarding the health of the soil, on the basis of which required fertilizers can be suggested. All the sensor data can be extracted using Raspberry Pi. The farmer can get all the measured data (soil humidity, temperature, pH etc.) on the android application. This app also provides him with the ability to control the irrigation. The main target of this system is to provide farmers with a system which can help him grow a high yield of healthy crops with adequate use of resources.**

***Index terms*- Irrigation, Fertilizers, Crop disease, Arduino, Raspberry Pi and Sensors**

I.INTRODUCTION

Agriculture has been one of the major contributors to the GDP of India. Around 60-70% of our population depends upon agriculture as their source of livelihood, out of which 50% is the direct workforce.[12] Even after huge enhancements in technology in almost every sector, farmers have been using manual methods to monitor and manage all the agricultural processes. This is the reason that Indian farmers face huge issues related to the productivity. There might be problems like excess or reduced irrigation, or improper fertilizer utilization without proper knowledge about soil's current state and crop's requirement. The climate change has affected average rainfall severely. Many farmers have not been able to irrigate crops adequately leading to reduced or no productivity. Automated systems can help farmers cope with such issues by using available water and resources intelligently.

II. LITERATURE SURVEY

A literature review is an objective, critical summary of published research literature relevant to a topic under consideration for research. Ten published articles have been referred in order to create a firm base about the project.

Following is a brief overview of all the ten papers that have been referred.

Intelligent IoT Based Automated Irrigation System [1]

Author - Yuthika Shekhar, Ekta Dagur, Sourabh Mishra, Year - 2017

Description - This paper presents "Intelligent Irrigation System" where machines can talk to each other without any human intervention. This shows a complete intelligent IoT based automated irrigation system developed.

Smart Irrigation System Using IOT and Raspberry Pi [2]

Author - Swapnali B. Pawar, Priti Rajput, Asif Shaikh, Year – 2018

Description – This paper concentrates on building a system wherein the irrigation system for agriculture is made smarter. It aims at building a system that can be used to save energy and water both. It can also live stream the farm on the app.

Research on Intelligent Agriculture Planting System Based on Internet of Things Technology [3]

Author - Yunsheng Chen, Shuduo Zhao, Yunxu Zhou, Year - 2018

Description – This paper analyzes the key technologies of the Internet of things applied in the

intelligent agriculture. It constructs the intelligent agricultural planting system based on the Internet of things technology.

Intelligent Farming for Farmers using Control System in IoT [4]

Author - Manju More E, Year - 2018

Description – The aim of this paper is to help the farmers in their daily life. It monitors the moisture of soil, humidity of the air, light intensity around the crops for its better growth. A set of decision rules is applied to developed automated system to make a decision.

An Appropriate Model Predicting Pest/Diseases of Crops Using Machine Learning Algorithms [5]

Author - Hemantkumar Wani, Nilima Ashtankar, Year - 2017

Description - This paper focuses on Wireless Sensor Network where it can be used in Agriculture. It helps for increasing yield output by providing early prediction of plant diseases and pest. Paper gives an idea of how to deploy WSN on the field and how the Machine learning model is fitted for prediction of pest/diseases using Naïve Bayes Kernel Algorithm.

IOT Based Smart Agricultural Monitoring System [6]

Author - Dr. G. Rajakumar, M. Saroja Sankari, D. Shanmugapriya, S. P. Uma Maheswari, Year - 2018

Description – In this paper, various sensors like temperature sensor, a moisture sensor, ultrasonic sensor and humidity sensor are deployed and connected to Arduino UNO. If the moisture level is low then automatically off water pump.

Smart Farming – IoT in Agriculture [7]

Author - Rahul Dagar, Subhranil Som, Sunil Kumar Khatri, Year - 2018

Description – This project uses a water volume sensor is used to keep track of water flowing through the pipe. The soil moisture sensor is used to keep track of soil moisture according to which irrigation is done. The temperature is regulated as per the temperature sensor data.

The Crop Disease and Pest Warning and Prediction System [8]

Author - Juhua Luo, Wenjiang Huang, Jihua Wang, Chaoling Wei, Year - 2017

Description - -The aim of this study was to establish the warning and prediction system for crop diseases. This paper described mainly warning flow, database design and the main functions of the system.

Mathematical Modelling of Crop Yield Forecasting & Forewarning of Pests/Diseases [9]

Author - R. Srivastava, Chandramauli Gupta, Himanshu Gupta, Naunidh Singh, Nand Kumar, Year - 2015

Description - A full-fledged algorithm for performing statistical forecasting Estimating the agricultural yield for a variety of Rabi and Kharif crops has been developed. A model for forecasting of crop yield based on historical data and pertinent external climatic information was developed.

Smart Farming System Using Sensors for Agricultural Task Automation [10]

Author - Chetan Dwarkani M, Ganesh Ram R, Jagannathan S, R. Priyatharshini, Year - 2015

Description - In this paper, they have proposed a novel methodology for smart farming. Their system focuses on the measurement of physical parameters such as soil moisture content, nutrient content, and pH of the soil that plays a vital role in farming activities. The detailed modeling and control strategies of a smart irrigator and smart farming system are demonstrated in this paper.

III. PROPOSED SYSTEM

3.1 Overview

The system will be designed to control and monitor the present environmental conditions of the agricultural plot using sensors. These sensors and the chips will the controlled by Raspberry Pi 3 to implement IoT. All the data fetched by sensors will be processed and actions will be performed accordingly. The complete system is automated and very minimum human interaction is needed. This system can also be managed manually using Android application. The environmental parameters to be checked are temperature, moisture, humidity, pH and light. The user can set threshold values for the parameters and get alerts on the mobile phone whenever the parameters deviate from threshold value.

Existing System Architecture [1]

The existing intelligent agricultural system consists of two sensors for irrigation purpose, i.e. Temperature sensor and soil moisture sensor. The temperature sensor continuously monitors the soil temperature whereas a soil moisture sensor collects

the data regarding the soil's moisture. Both of these data are time to time sent to the microcontroller. In this system, Arduino is used to collect the data. This data is then sent to edge level processor called Raspberry pi 3 using serial communication for further processing. In raspberry pi3, K-NN Machine learning algorithm been employed for predicting the soil condition based on Moisture and Temperature level. The data is processed there and decisions are made on the basis of a trained model. The predicted output is then used for sending the control signal to Arduino for controlling water pump for watering the field accordingly. The last and final component is recording the soil moisture and Temperature level. This stage also does prediction with date and time in the cloud server. The farmer can access this cloud data remotely to have good knowledge and understanding on field being irrigated. If the field shows dry status, farmer can instantly turn on the irrigation facility and turn on when soil has enough water. Though this system provides farmers a continuous update regarding soil's status but that increases manual work of farmers.[1]

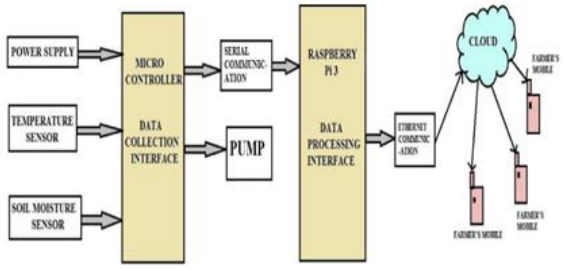

Figure 1 Existing system architecture

Proposed System Architecture

In today's life, use of technology can be seen in almost every field. If agriculture or farming is combined with automation, it will reduce manual work to a greater extent. India being a tropical country relies on agriculture for large part of its GDP. But recent atmospheric changes have caused a huge issue in crop production. The proposed system's first focus is on automated irrigation. In this, multiple factors such as soil temperature, soil moisture, outer temperature, outer humidity, and water availability will be considered to predict the status of soil. Water availability is an important aspect when it comes to irrigation nowadays as there are very few water sources available at some places which needs to be used adequately. Once the soil's status if identified the actions such as starting or stopping irrigation can be done automatically by the system. Secondly, the soil pH will be monitored time to time to inform farmer about the soil's health. pH of the soil tells a lot about future of plants. Every crop requires different kinds of soil pH levels, and farmer must put fertilizers in accordance to that. This system will also suggest the fertilizers to be used by farmers to maintain soil health, via the Android app. Another major functionality of this project is disease prediction. For this, it will use soil temperature, soil moisture, soil pH, outer temperature and outer humidity.

All the necessary sensors will be connected common device, say Arduino. The Arduino will send this acquired data to raspberry pi3 for further processing. Raspberry pi3 sends this data back to Arduino for performing proper functions. The system will also consist of an android application, which can be used to monitor all these sensors output. It will also notify the farmer about the diseases if any. If at all, a plant gets diseased, the android application can help farmer find the solution regarding it.

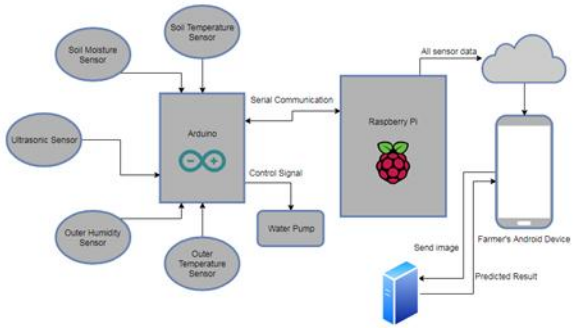

Figure 2 Proposed system architecture

3.2 Hardware and Software Specifications

The experiment setup is carried out on a computer system which has the different hardware and software specifications as given in Table 1 and Table 2 respectively.

Table 1 Hardware details

Processor	2 GHz Intel
HDD	500 GB
RAM	4 GB

Table 2 Software details

Operating System	Windows 10 Professional
Programming Language	JDK 1.8

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