IoT Based Smart Irrigation Monitoring & Controlling System in Agriculture

Md. Mehedi Islam, Md. Al-Momin, A. B. M. Tauhid, Md. Kamal Hossain, Sumonto Sarker

Abstract: This work is primarily about the improvement of current agricultural practices by using modern technologies for betterment of agriculture and modernization the traditional agriculture system.

Internet of Things(IoT) plays a crowning role in smart agriculture. The project will help root level farmers to get into smart irrigation in term of agriculture. Which provide greater service in less cost in irrigation and lowest man power. Smart irrigation is an empirical concept because IoT sensors capable of providing information about their agriculture fields and making irrigation automated by Internet of Things. The feature of this paper includes monitoring temperature, humidity, pH and water level in agricultural field through sensors. The data from sensors are sent to Web server database using wireless transmission. Controlling of all these operations will be through any remote smart device or computer connected to internet and rain condition is also applied to the operations. It will be performed by interfacing sensors, IFTT app, Smart agriculture app, Wi-Fi and raspberry pi.

Keywords: Internet of Things, Smart irrigation, Raspberry pi, Smart Agriculture.

I. INTRODUCTION

People all over world depend on agriculture for their living and it plays vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of any country. Unfortunately, many farmers still dealing with the traditional methods of farming which results in low production of crops. But wherever automation had been accomplished and human beings had been replaced by automatic machineries, the production has been increased. Hence there is need to implement internet of things in the agriculture sector for increasing the yield. Most of the papers imparts the use of wireless sensor network which gathers the information from various types of sensors and then transfer that to main cloud server using wireless protocol. The collected data provides the information about different parameters which in turns helps to monitor the irrigation system. This paper therefore proposes a system which is useful in monitoring the real time field data as well as controlling the field operations which makes the system easy and flexible. The main aim of this paper is to make irrigation smart using IoT technologies. This paper includes the features of monitoring temperature, humidity, pH and water level in agricultural field through sensors. It includes smart irrigation with smart control based on real time field data. Regulating of all these operations will be done by any remote smart phone or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi and raspberry pi.

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II. LITERATURE REVIEW

In this paper, there is a monitoring system where data gathered by the sensors to computer by Wi-Fi module and upgrade information about the water assets, soil quality. [1] It focuses on monitoring some parameters of a greenhouse agriculture field and control the specific parameters by using Bluetooth module [2] It aims at creating agriculture smart access of temperature, soil moisture and relative humidity information by using DHT11 and transfers data to cloud server for remote access [3] From this paper, details about parameters such as humidity and temperature values are uploaded to the website using the Arduino microcontroller at regular interval of time through ESP8266 Wi-Fi module. [4] The most important feature of this paper, all the information about the field condition through sensors is sent on the farmer mobile application using Wi-Fi Relay Module and Arduino UNO R3 and automatically control the water supply [5]
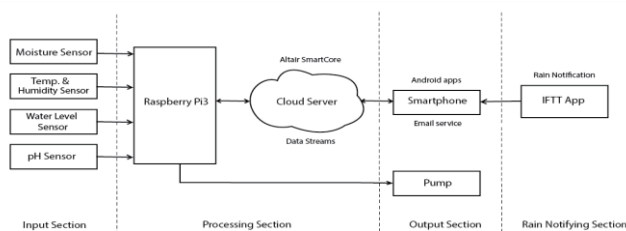
III. PROPOSED MODEL

Fig1: Proposed model

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IV. METHODOLOGY

This project is run under the input of several number of sensors which up next processed by Raspberry Pi and by the condition of this project. Firstly, moisture sensor will have to sense the condition of the soil. Soil may be in dry or watery. This sensor is adjacent to water. When the dry level of the soil is high in such a condition the pump will be automatically on and this information is saved and stored in the free server Altair Smartcore and in the meantime the user will get the information about the pump on condition and the information of temperature and humidity of the land which will be gotten by the temperature and humidity sensor.
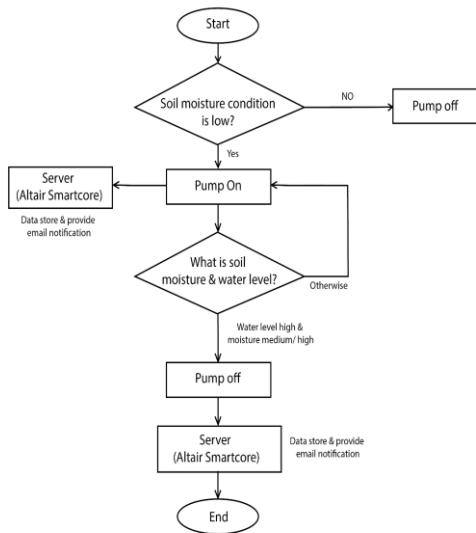

Fig2: Block diagram of this project

Secondly, with the help of Water level sensor the flow of water can be measured. After a certain period, this pump need to be off. For turned off the pump the condition of moisture sensor and water level when will be medium. Also the notification of turned off the pump shown to the notification bar of the user. With it the additional information of temperature and humidity will get the user.
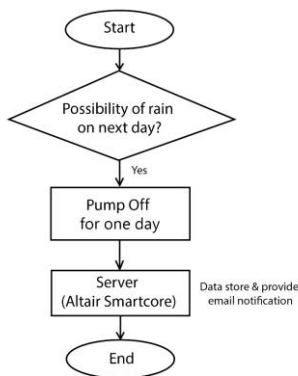

Fig3: Block diagram on rain condition

If there is rainy day, the next day then there is no need of water in the field although the dry condition of the soil is high that means moisture level is low. In this case, we use the IFTT app. This app will give information about the weather update of the next day. If there is any possibility of rain on next day, the app will send notification of rain.

When we get notification of rain from the IFTT app, then we turn of the pump for one day. IFTT is a free web-based-service to create chains of simple conditional statements, called applets. This IFTT app is connected to user's smartphone.
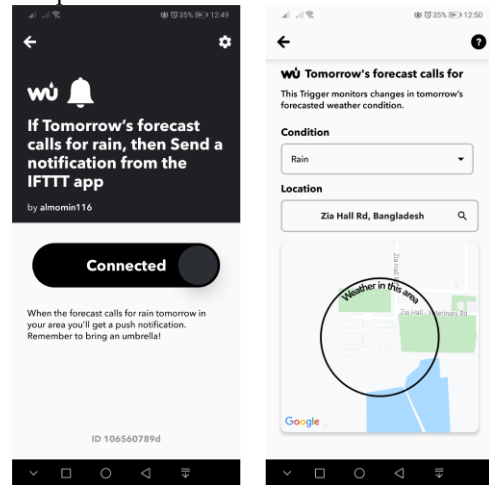

Fig4: IFTT app's connection and location setup

To get access the application need to create an Id by user gmail account. After creating IFTT user account, user has to turn on the rain notification connection. If tomorrow's forecast calls for rain, then send a notification from the IFTT app. When the forecast calls for rain tomorrow in user area he will get notification. To get notification of user need to locate the field area. When the appropriate connection between the app server and user will be established, then the user gets start notification from the app server. The app server notifies the user by the notification "Partly cloudy tomorrow! Expect a high of ..F(..C) and a low of ..F (..C). The UV index is 0." When user get notifyied about rain then there is no need to turn on the pump for today, as next day will be rain. So user have to turn off the pump for one day by smart agriculture app.

At the same time of turning off the pump, the information will be store at altair smartcore server with date and time. User also get an email for the condition of pump off with present condition of land humidity and temperature.
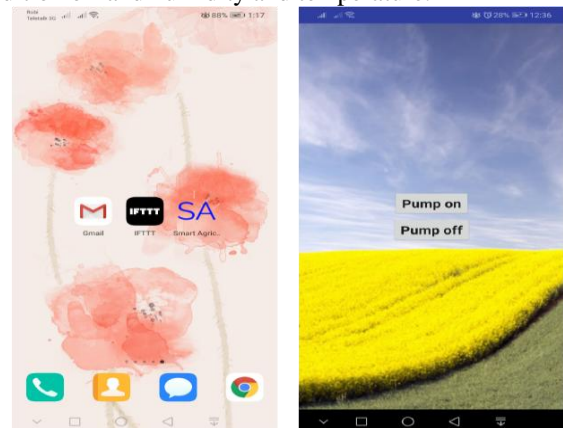

Fig5: Smart agriculture App to turn On/ Off pump

Soil pH: Soil pH is the metering of the acidity (sourness) or alkalinity (sweetness) of soil. A numerical scale is used to reveal pH. The scale is up to 0.00 to 14.00, with 0.00 being sourest and 14.0 being most alkaline.

The value 7.00 is neutral that is neither acid or alkaline. Soil pH influences several soil factors affecting plant growth, such as (a) nutrient availability, (b) soil structure, (c) soil bacteria, (d) toxic elements, and (e) nutrient leaching. Bacterial activity that exemption nitrogen from organic matter and certain fertilizers is particularly affected by soil pH, because bacteria operate best in the pH range of 5.5 to 7.00. Plant nutrients with a pH below 5.00 is much more rapidly than from soils with values between 5.00 and 7.50. Aluminum may cause toxic to plant growth in certain soils with a pH below 5.0. The structure of the soil, especially of clay, is affected by pH. In the optimum pH range (5.5 to 7.0) clay soils are pulverized and are easily worked, whereas if the soil pH is either extremely acid or extremely alkaline. A pH determination will produce good plant growth or whether it will need to be behaved to adjust the pH level. The pH is not a scale of fertility, but it does affect the fertilizer nutrients.

To correct soil pH: The pH sensor will sense the pH condition of the soil. Soil may be in acidity or alkalinity (for range 5.5 to 7.0). When the acidity of the soil is high in such a condition this information of pH is saved and stored in the free server Altair Smartcore and in the meantime the user will get the email information to provide Lime or Wood Ash and the user can know the current pH value of his field. Same as when the sensor will sense the value of pH is larger than 7.0 means soil maybe in alkalinity, value of pH is saved and stored in the free server Altair Smartcore and in the meantime the user will get the email information to provide Sulfur, Sphagnum Peat, Aluminum Sulfate and Iron Sulfate, Acidifying Fertilizer, Mulches and Compost in his field.

## V. RESULT AND DISCUSSION

(a) Pump turn on condition:
When the moisture of the agriculture field is less than a certain level then the pump turns on automatically. In the period of turn on the pump an email containing temperature and humidity date time information is provided to the user. The figure for the email turn on notification is given below: -
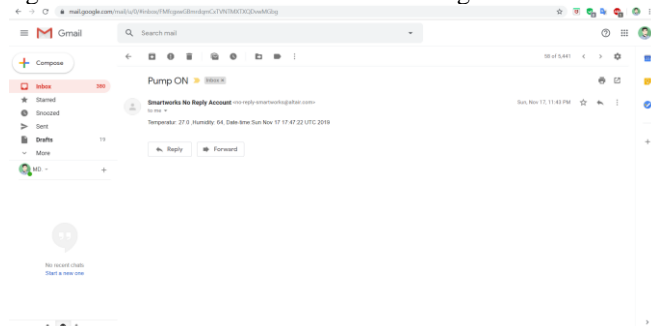
**Fig6: Pump turn On notification**

(b) Pump turn off condition:
The flow of water can be measured. After a certain period, this pump need to be off. For turned off the pump the condition of moisture sensor and water level when will be medium. Also the notification of turned off the pump shown to the notification bar of the user. With it the additional information of temperature and humidity will get the user.
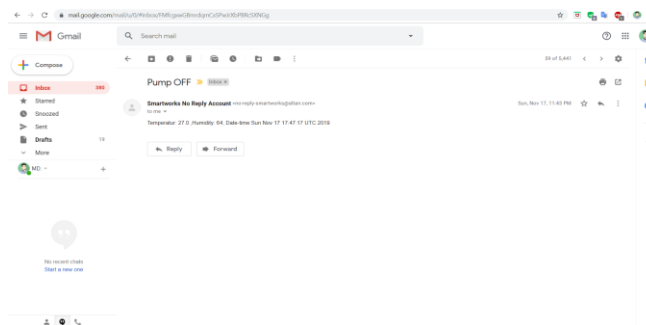

Fig7: Pump turn Off notification

(c) For high Acidity condition: When the acidity of the soil is high in such a condition user will get the email information to provide Lime or Wood Ash and the user can know the current pH value of his field.
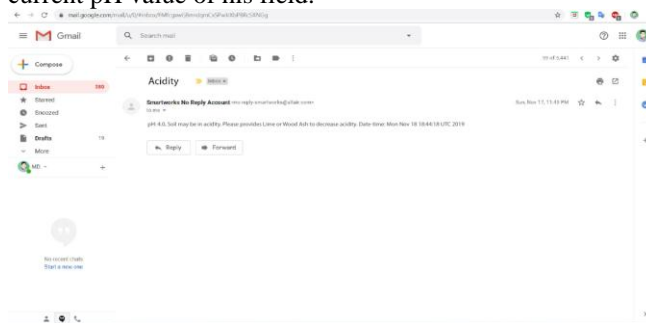
Fig8: Notification of high acidity

(d) For high Alkalinity condition: When the sensor will sense the value of pH is larger than 7.0 means soil maybe in alkalinity, value of pH is saved and stored in the free server Altair Smartcore and in the meantime the user will get the email information to provide Sulfur, Sphagnum Peat, Aluminum Sulfate and Iron Sulfate, Acidifying Fertilizer, Mulches and Compost in his field.
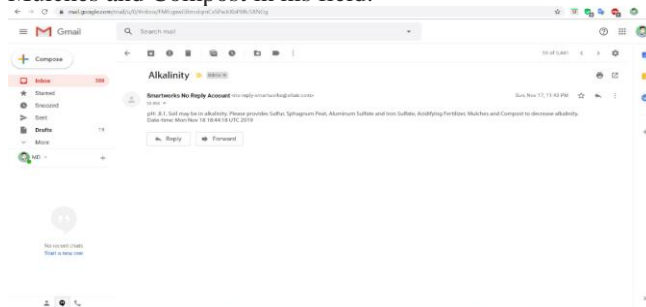
Fig9: Notification of high alkalinity

(e) Data base:
A relational database is, simply, a database that stores related information across multiple tables and allows you to query information in more than one table at the same time. Altair SmartCore is a cloud-native platform, which offers an integrated set of services and features to help you easily connect your things to the digital world. Available as a Platform as a Service (PaaS) or on-premises, Altair Smart-Core will help you execute your IoT projects faster in an easy-to-use, reliable, and highly scalable environment. This project need database to analysis for for future work or statically view on which can be easily made decision. Database will record every information such as time date and operation condition of the device .it will be recorded the on/off condition of the device at which instant time.

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Fig9: Data Stream

Fig10: Physical view of Smart Irrigation Monitoring & Controlling system in Agriculture

VI. CONCLUSION AND FUTURE WORK

Our intention of this research work was to establish a flexible, economical, easily configurable and most importantly, a portable system which can solve our water wastage problem. It is a robust system and small in size. Our proposed system for water level monitoring comes under the field of Internet of Things (IoT). Nowadays water level monitoring is vital in many industries too like oil and automotive etc. Using our smart system, we can analysis the usage and also detect the leakage in the tanks of these industries. In future this project can be implemented adding quality sensor and so on. That can give information about the soil which is less fertilizer and how fertilize by using compost and which exact fertilizer has to use will be notified.

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