International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

APP AND WIRELESS SENSOR NETWORK BASED AGRO SYSTEM

Mayur A. Morvekar[1], Dhanaji P. Satpute[2], Kaveri B. Patil[3], Pragati V. Dalal[4], Ranjana Gite[5]

[1-4]B.E. Students, [5]Assistant Professor
[1-5]Department of Electronics & Telecommunication Engineering,
Vidyalankar Institute of Technology, Mumbai, Maharashtra, India

---

Abstract - *The project App and Wireless Sensor Network (WSN) based agro system is based on agriculture theme. Agriculture is the main occupation in India. To make it more prosperous and beneficial, Indian farmer should do a scientific farming. This project will help farmer in many activities from testing the nature of soil based on moisture content measuring and measuring surrounding humidity and temperature and suggesting required water level. And it also stores these values for future use. The project Wireless Sensor Network (WSN) based agro system is very simple to use. Sensors will be fixed which continuously sense the moisture, temperature and humidity values and required water will be supplied. This project is user friendly and reduces manual work of labor. The main aims of this project is to efficient use of water and investigate, identify how the use of mobile phones with respect to WSN enables farmers to monitor and control their farm field.*

***Key Words*: WSN, MQTT, Agriculture, Firebase, Node-Red, MIT App inventor.**

1. INTRODUCTION

Agriculture is the broadest economic sector and play an important role in the overall economic development of a nation in India, around 70% of the population earns the livelihood from agriculture. Technological advancements within the area of agriculture will ascertain to extend the competence of certain farming activities. The recent betterment in information and communication technologies has allowed farmers to acquire a vast amount of site-specific data for the fields. The main activities involved are data collection, processing, and variable rate of application of inputs. We can reduce a lot of manual work in the sector of agriculture using automation. In this report, we have proposed methodology for smart farming by linking multiple sensor nodes through wireless sensor network. Our system focuses on the measurement of physical parameters such as soil moisture content, humidity and temperature content of the soil that plays a vital role in farming activities. Based on the parameters of the soil measured, the required quantity of water is provided to the crops using a smart irrigator. These efforts have been made to enable farmers improve their productivity and further to facilitate a preventive method to avoid risk.

Main objectives of the project are as follows:

- Continuous monitoring of soil parameters like soil moisture, temperature and humidity to check and maintain fertility of soil.
- According to the condition of field adequate amount of water should be supplied. So, that problem of excessive or lack of water will not be there.
- Facilitating the farmer to have a live access of the field from anywhere they want.
- Storing the past data for future analysis helping them to decide the crop and amount of water needed for particular crop.

2. LITERATURE SURVEY

In their paper, Nikesh Gondchawar1, Prof. Dr. R. S. Kawitkar [1] have proposed remote sensing robot which is based on GPS to perform some tasks like weeding, spraying, moisture sensing, scaring to animals or birds, keeping vigilance, smart irrigation, temperature, humidity maintenance, and theft detection within the warehouse. All this tasks are operated through remote or computer with internet and the operations will be performed by connecting sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller, and raspberry pi.

In the year 2010, Jeonghwan Hwang, Changsun Shin and Hyun Yoe have [2] proposed an agricultural environment monitoring server system for monitoring information concerning an outdoors agricultural production environment utilizing Wireless Sensor Network (WSN) technology. The proposed agricultural environment monitoring server system collects environmental and soil information on the outdoors through WSN-based environmental and soil sensors, collects image information through CCTVs, and collects location information using GPS modules. This collected information is converted into a database through the agricultural environment monitoring server consisting of a sensor manager, which manages information collected from the WSN sensors, an image information manager, which manages image information collected from CCTVs, and a GPS manager, which processes location information of the agricultural environment monitoring server system, and provides it to producers.

3. EXSISTING PRODUCT

Blossom 7 Zone Smart Irrigation Controller, WI-FI Enabled with Real Time Weather Optimization [3]
Features:

1. Uses up-to-the minute satellite based weather data so

sprinklers water only when they need to
2. Helps to prevent over-watering
3. Enables you to optimize your water usage
4. Create a watering schedule for your sprinkler system from anywhere by using a smartphone or tablet
5. Installs in as little as 15 minutes
6. Simplify your life with the power of Smart Watering
7. Wi-Fi enabled system
8. Blossom is for indoor installation only
9. Each zone is specifically watered based on layout and vegetation
10. Blossom app features a clean, user-centric dashboard designed to make tracking watering schedule easy

Drawback of existing system:

- Product cost is high. Not affordable to farmers.
- Used for indoor installation only. It cannot cover large farms.
- Data cannot be stored for future use.

4. PROPOSED SYSTEM

This system finds the moisture content in soil, requirement of moisture to the crop morever as temperature and humidity of surroundings which can affect the moisture in soil and accordingly it controls the watering maintaining proper moisture level. This all sensor data is sends to raspberry pi and database to visualize real time display of contents on localhost morever as on mobile app and to use for future analysis to decide the crop quality and amount of water needed for particular crop.

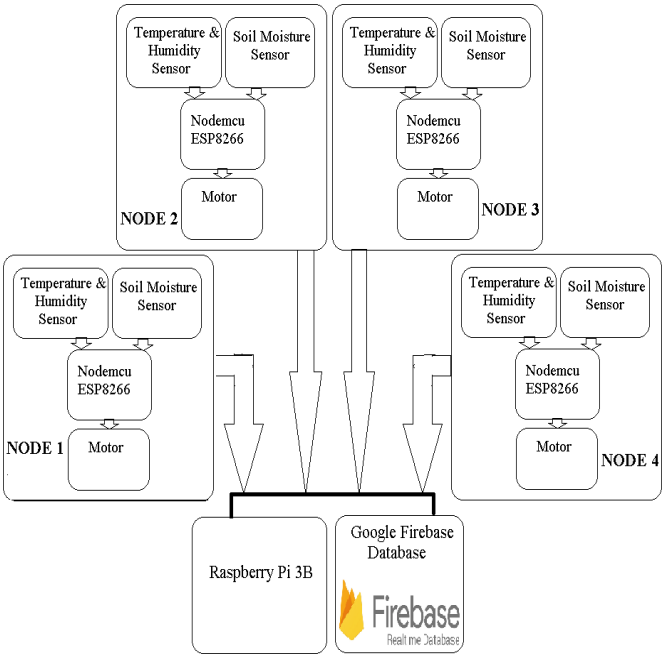

Fig-1: Block Diagram

4.1 HARDWARE DISCRIPTION

Raspberry Pi 3B

It is a small single board computer. There is extended 40 pin GPIO header. It is main node which collects all the information from sensor nodes. The rasbian operating system is loaded through micro SD card. Also it has a Broadcom BCM2837 SoC and 64 bit processor. It works on 5V/2.5A DC power input. It work as a server which is not available in arduino that's why we use Raspberry pi in our project.

ESP8266 Wi-Fi Module

ESP8266 is a low cost, low power integrated with Wi-Fi module. It has Tensilica Xtensa 32 bit LX106 RISC microprocessor with clock frequency 80 to 160 MHz. It integrates 802.11b/g/n HT40 Wi-Fi transceiver, so that it can connect with Wi-Fi network and interact with internet. This Wi-Fi module runs on 3 to 3.6V input power. It has total 30 pins for connecting external devices or sensors.

Soil Moisture Sensor

The soil moisture sensor consists of two probes that are used to measure the volumetric content of water. The 2 probes allow this current to undergo the soil, which provides the resistance value to measure the moisture value. When there's water, the soil will conduct more electricity, which suggests that there'll be less resistance. Dry soil conducts electricity poorly, so when there's less water, then the soil will conduct less electricity, which suggests that there'll be more resistance.

Temperature-Humidity Sensor (DHT11)

The factors affecting moisture are humidity and temperature. So to keep a watch on humidity and temperature, this sensor is used. Not only soil moisture content but also humidity temperature values are considered to switch on and off the watering system and for how much time it should remain on.

Submersible Pump

It is 5V pump which is placed under the water used for irrigation system. It will turn ON/OFF according to the sensor data.

Relay Module

A relay is an electrically operated switch. Relays are used where it is need to control a circuit by one signal. When a small current flows in the input circuit, it activates the electromagnet which produces magnetic field. The

energized electromagnet pulls metal bar in the output circuit, closing the circuit hence large current flows through the output circuit (it can be lamp, electric motor).

4.2 SOFTWARE DESCRIPTION

Node-RED

Node-RED is a programming tool to connect devices in different way. It is an open source tool for implementation of IoT applications. It gives browser based editor. Node-Red is a lightweight runtime is built on Node.js. This software is running on Raspberry pi and the communication between ESP8266 and Node-RED is established using MQTT protocol.

Communication Interface - MQTT

MQTT is a machine to machine connectivity protocol. It sends command/message for connecting with other devices or sensors wirelessly.
The transfer consists of three different components:
Publisher: sends messages.
Broker: forward messages to registered subscribers.
Subscriber: receives message through the broker.

Database

Database is an important part of the system. Here we used Google Firebase Realtime Database which allows data to be shared with multiple clients. Where the client can access this data from android app. It is known as NoSQL database which means the data is stored in the form of JSON object instead of table format. It consists of key/value pair. Key uniquely identifies object and the value represents the data which is received from sensors.

APP INVENTOR TOOL

MIT App inventor is open source software provided by Google and currently maintained by Massachusetts Institute of Technology (MIT). It is not like hard coding software to develop android application. Creating the design of app is as easy as selecting and placing widgets in the smart phone screen.

4.3 METHODOLOGY

There are total 4 nodes which represents 4 part/area of farm field. Each node consists of ESP8266 Wi-Fi module, sensors and water pump. This all client (ESP8266) are connected to Raspberry pi. Also database is connected to each ESP8266 through Wi-Fi connection with internet.

Initially sensor data is send to the Raspberry pi through MQTT protocol, so that user can easily access this data using Node-RED dashboard/GUI through localhost (without internet). Simultaneously this data is stored into the Goggle firebase with respect to time, date and their Node section.

MIT app is interlinked with the Google firebase through realtime database URL so that sensor data, water pump status of each node is also available on android app.

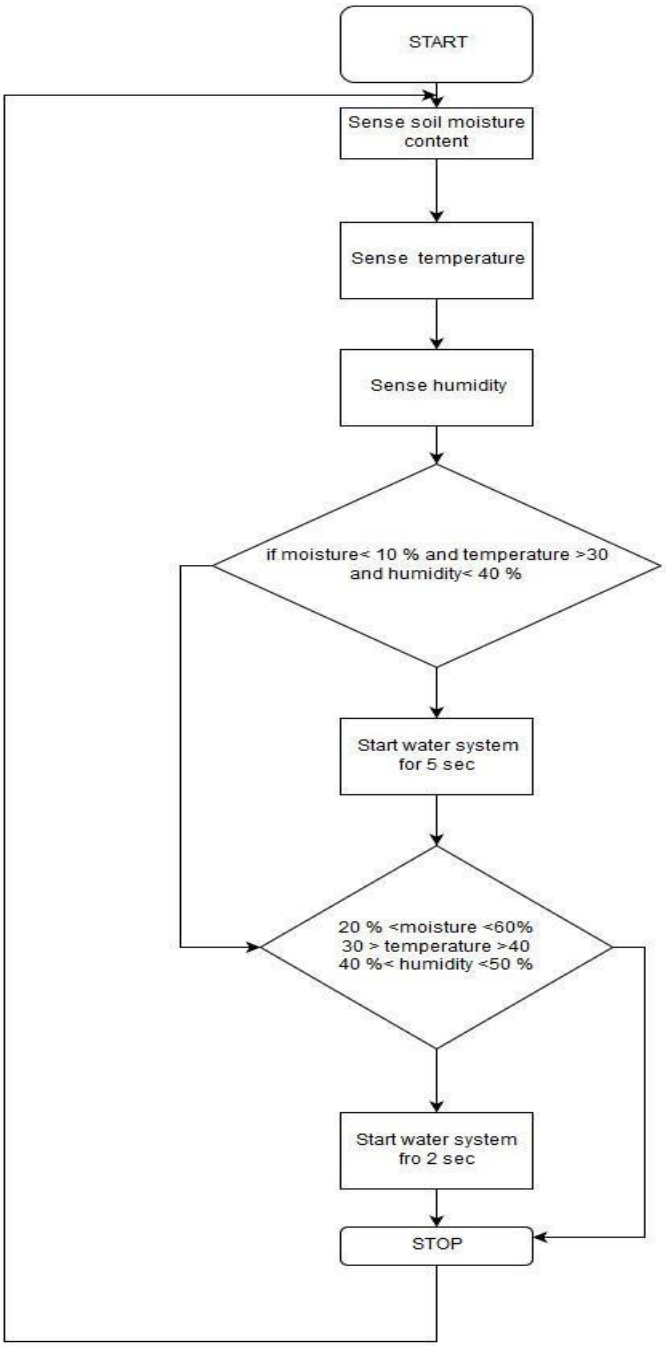

Fig-2: Irrigation Control

The logics of the algorithm help to identify whether there's need of water to plant or not. First the moisture sensor senses the soil. The digital value is send to the Raspberry pi through ESP-8266 Wi-Fi module which decides whether to soil is wet or dry and in step with that waters the plant for two or 5 sec. If the soil is dry, Raspberry pi send command to pump to starts which results in water to flow. If the soil is wet, Raspberry pi turns the pump off and water flow stop.

5. EXPERIMENTAL RESULTS

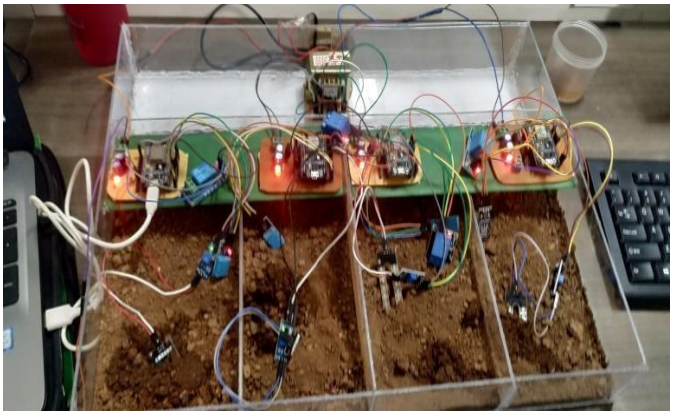

Fig-3: Model

Table -1: Testing Results

Soil condition	Soil moisture resistance	Temperature	Humidity	Motor status
Dry Soil	122	32	40	ON
Medium Wet Soil	93	50	55	ON
Wet Soil	55	32.7	65	OFF

Fig-4: GUI Output

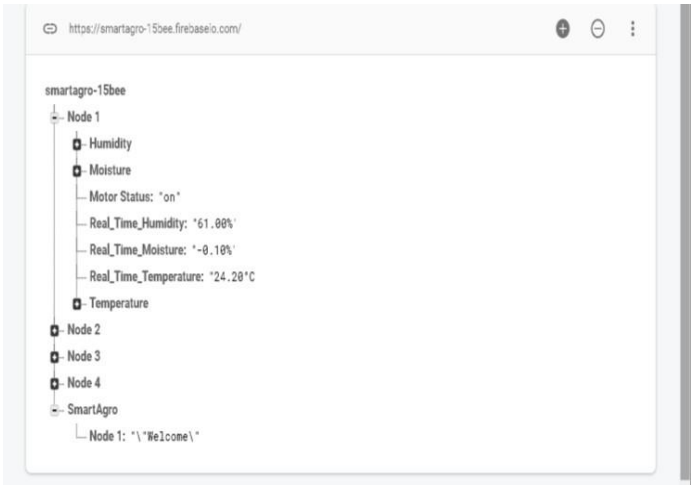

Fig-5: Realtime Database

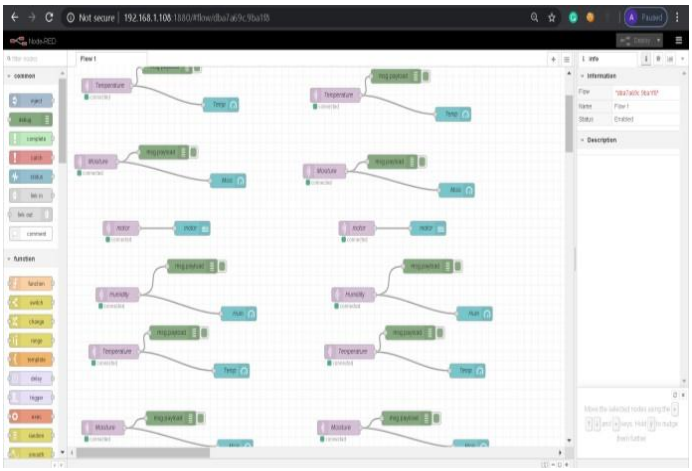

Fig-6: Node-RED Editor

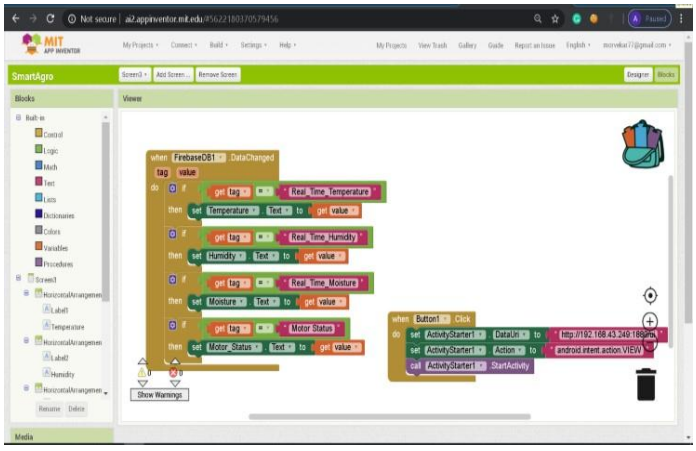

Fig-7: App Logic Design

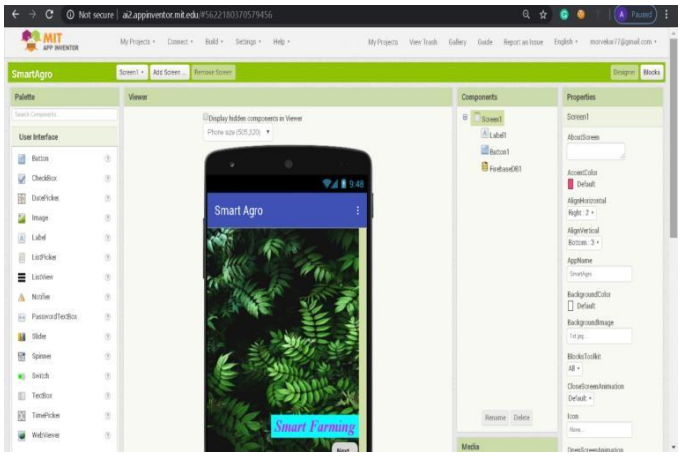

Fig-8: App Design

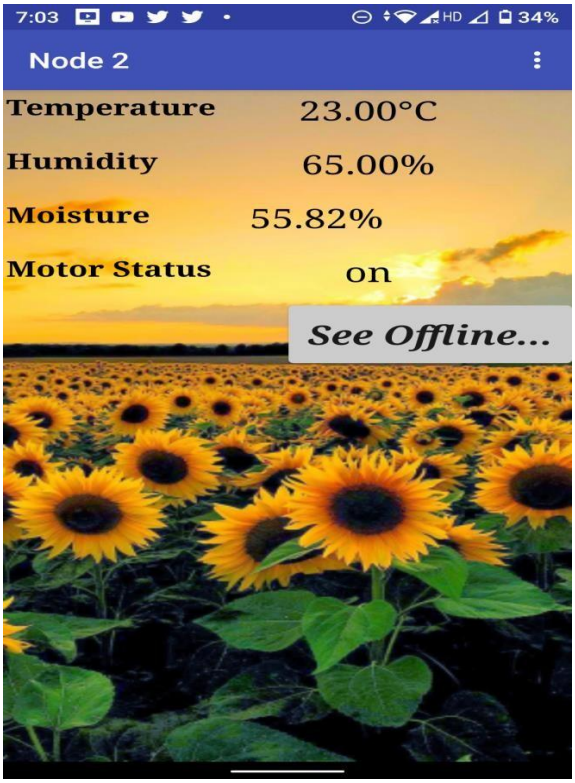

Fig-9: Mobile App

6. CONCLUSIONS

The proposed system provides low cost and flexible smart agriculture system. This concept also gives mobile interface for accessing real time data and secure database so that it is helpful take good crop value by analyzing past data. We have tested the soil using soil moisture sensor. The values of soil moisture content are varying with respect to water content present in that soil. ESp-8266 keeps track of moisture level, humidity and temperature in the farm area and accordingly it switches ON/OFF irrigations system for particular duration of time. And these values are also displayed and stored in database for future use. Here we have controlled duration of water supply depending upon sensor value i.e. either for 5 second or for 2 second.

REFERENCES

[1] Nikesh Gondchawar, Prof. Dr. R. S. Kawitkar have proposed "Smart Agriculture Using IoT and WSN Based Modern Technologies". International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 6, June 2016, ISSN(Online): 2320 – 9801

[2] Jeonghwan Hwang, Changsun Shin and Hyun Yoe have proposed "Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks". School of Information and Communication Engineering, Sunchon National University, Maegok-dong, Suncheon-si, Jeollanam-do, Korea published on: 8 December 2010

[3] https://www.scotts.com/en-us/products/tools-accessories/blossom-7-smart-watering-controller

[4] https://randomnerdtutorials.com/what-is-mqtt-and-how-it-works/

[5] https://nodered.org/

[6] https://appinventor.mit.edu/

BIOGRAPHIES

Mayur A. Morvekar
B.E. Student, Department of Electronics and Telecommunication Engineering, Vidyalankar Institute of Technology, Mumbai-400437

Dhanaji P. Satpute
B.E. Student, Department of Electronics and Telecommunication Engineering, Vidyalankar Institute of Technology, Mumbai-400437

Kaveri B. Patil
B.E. Student, Department of Electronics and Telecommunication Engineering, Vidyalankar Institute of Technology, Mumbai-400437

Pragati V. Dalal
B.E. Student, Department of Electronics and Telecommunication Engineering, Vidyalankar Institute of Technology, Mumbai-400437

Ranjana Gite
Assistant Professor, Department of Electronics and Telecommunication Engineering, Vidyalankar Institute of Technology, Mumbai-400437