SMART NETWORK ENABLED SENSOR DEVICE FOR FIELD AND WAREHOUSE MANAGEMENT

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Abstract - *Agriculture is the strength of Indian Economy. In this paper a simplified approach is developed to monitor and regulate field and warehouse conditions to optimize the resources and to create a more efficient yield. The smart agriculture system has wide scope to automate the complete agriculture system and take preventive measures in case of abnormalities. The field is monitored using different sensors that sense the field parameters like temperature, moisture, soil moisture, water level in the farm. We use sensors and Arduino uno for maintaining the system. Based on the sensor's data collected, the appropriate field and warehouse data is captured and analyzed for regulating the levels normally required for proper field and warehouse maintenance. Arduino uno controller adopts IoT technology to convey the messages with the help of ESP8266 Wi-Fi module and send timely information to the mobile application. The app developed helps to adjust the actuators for maintenance. The system mainly attains the importance in keeping tabs on the agricultural environment.*

Key Words: Smart farming, Warehouse management, IoT, Arduino uno, ESP8266 Wi- Fi module.

1. INTRODUCTION

Smart Farming is a hi-tech and effective program to grow agriculture and grow food in sustainable ways. With the latest agricultural-dependent technologies, the Internet of Things has brought significant benefits such as efficient utilization of resources, efficiency of installation and much more. Smart Farming-based IoT is developing the entire Agricultural System by realizing the field in real time. It keeps various things like moisture, temperature, soil etc. under check and gives a real crystal clear view. Also the warehouse should be periodically inspected to reduce the cost of grain storage due to weather conditions and underwriting.

In order to reduce manual labor and to simplify the work, a clever warehouse and stadium-enabled regulation and technology are used. The project is to include temperature, fire related information, soil moisture and any in-house movement using sensors and send alerts using IoT technology. With the help of a state-of-the-art farming system, humidity and soil temperature as well as a motion detector and housekeeping device can be remotely monitored with real-time data via smart phones. With the help of intelligent IoT farming systems, one can use sensors to map and keep track of the entire farm. This includes personnel figures, tools and assets of organizations.

2. METHODOLOGY

The proposed system design involves combination of technologies such as smart sensors enabled with network and app interface interconnected to provide on time review and response structure to overcome the abnormal situation. The primary hardware constitutes of four sensors namely DHT11 Moisture Sensor, LM35 Temperature Sensor, PIR Sensor for Sensor detection and smoke sensor for fire Detection.

In surveying the field, we use a moisture sensor to determine the moisture content of agricultural land. A number of sensor data are processed in Arduino and sent to mobile via ESP8266 Wi-Fi module. If the amount of moisture is below the specified limits, then we light the car pump through the BLYNK operating system that sends signals to the Wi-Fi Arduino that allow it to turn the car to provide enough water for the field.

In the case of warehouse keeping, the temperature sensor detects the temperature and if the temperature is low in the storage that may lead to mold formation. To fix the problem we have installed artificial light to create heat in the warehouse. By using the BLYNK app that sends signals to the Arduino-enabled Wi-fi that turns on the heat light to provide artificial heat effect.

The heating results from grain respiration and hot weather, as well as respiration from microorganisms, insects, and mites during storage. The resulting heat from respiration can lead to the development of hot spots within the grain. This could cause damage to crops so we have used a cooler fan to cool the heat by using the BLYNK app interface by turning on the fan switch and it sends the value to the Arduino and we receive the value with the help of ESP module. The temperature is controlled by means of a cooling fan and high intense light.

Same technology is used for fire alert and intruder detection. The smoke sensor detect the whether there is any fire alert and send the data to the mobile through ESP module. The PIR sensor detects the motion of intruder and prevent the menace with the help of ultrasonic repellent.

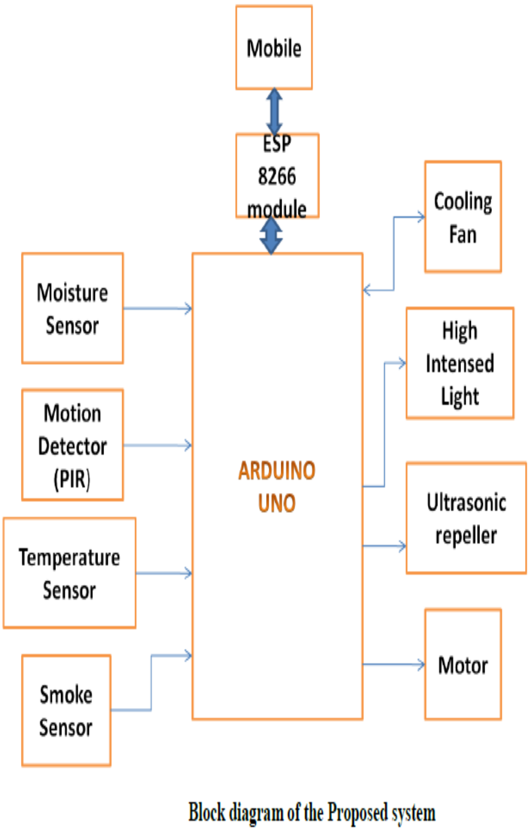

Fig -1: Block diagram of the Proposed system

The Arduino uno acts as the main controller where it collects sensor data, processes and sends the data to the mobile app which acts as human machine interface through the actuator works to control the motor, light, cooler fan and ultrasonic repeller systems.

The automation circuit is built around ESP8266, Blynk Android App, and a 4-channel relay board. The hardware is set according to the circuit diagram. AC mains appliances will be connected to relays which are controlled by the ESP8266. User has to install and configure the Blynk App. Then add bylnk app to Arduino library by installing Blynk Arduino Library and upload the firmware with pasting the authorization token and WiFi details in the code. After the code has uploaded, open the serial monitor set the baud rate to 9600. Then click the "Run" button in the top right corner of the Blynk app and run the program .Whenever the user presses a icon in the app, then that information will be send to ESP8266 via WiFi. The ESP8266 analyses the received commands and turns ON/OFF of the respective device via 4 – channel Relay board. Thus by reading the values from our application we can actuate the pump, light, repeller and fan according to our needs without being present in real place. And this also provides quick analysis about the present condition about the farm and warehouse. Therefore the prototype enables smart farm and warehouse monitoring in real time.

3. APPLIED TECHNOLOGIES

3.1 Smart Sensors

A smart sensor is a device that takes input from the physical environment and uses built-in compute resources to perform predefined functions upon detection of specific input and then process data. Smart sensors enable more accurate and automated collection of environmental data with less erroneous noise amongst the accurately recorded information. These devices are used for monitoring and control mechanisms in a wide variety of applications.

3.2 Internet of things (IOT)

The Internet of things is a system of interrelated computing devices, mechanical and digital machines that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The development of prototyping boards and the low price of sensors allow us easily use them in IoT projects.

3.3 Blynk Application

Blynk is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.

4. HARDWARE COMPONENTS

4.1 Arduino Uno

The Arduino Uno R3 is a small microcontroller board based on the Micro outline-package (DIP) of the ATmega328 AVR. It has 20 digital input / output pins (6 of which can be used as PWM output and 6 can be used as analog input). Programs can be downloaded to it from an easy-to-use Arduino computer program. The Arduino has a wider support community, making it much easier to get started with the attached electronics. The R3 is the third, and most recent, Arduino Uno update.

4.2 ESP8266 Wi-Fi module

ESP8266 is an inexpensive Wi-Fi hotspot, with full stack and microcontroller power, manufactured by Espressif Systems in Shanghai, China.

4.3 Temperature Sensor

LM35 is an accurate type of IC (integrated-circuit) Temperature sensors and enables the output of a line corresponding to the temperature in Celsius. Features of LM35: Measured directly at Celsius. Linear value is always + 10,0 mV / ° C and average voltage is 0.5 ° C (at + 25 ° C) accuracy and accuracy are given. Estimated for full scale range around Minimum -55 ° to Maximum value + 150 ° C. Very suitable for remote application. A very small rate decrease 4 to 30 volts is at operating level. The drain current is less than 60 µA. The standard deviations are only ± ¼ ° C. Impedance output is very low, load of 1 mA and 0.1 Ohm.

4.4 PIR Sensor

An infrared sensor (PIR sensor) is an electronic beam that measures light (IR) light from objects in its field of view. They are most commonly used in PIR-based motion detectors. PIR sensors detect normal vibration, but do not provide details of who caused the stimuli. For that purpose, an active IR sensor is required. PIR sensors are often referred to as "PIR", or sometimes "PID", via "infrared detector". They work perfectly to detect infrared radiation (radiant heat) that is emitted or reflected by objects.

4.5 Smoke Sensor

The smoke detector MQ2 is a smoke detector, usually as a fire indicator. Smoke droplets are stored in plastic containers, usually made up of a disk or square of 150 mm (6 in) in size and 25 millimetres (1 in) in size, but the shape and size vary. Smoking can be detected by eye (photoelectric) or by physical process (ionization); the identifier can use either, or both, modes.

4.6 Soil Moisture Instruments

DHT11 measures the volumetric water content in the soil. DHT11 is a basic, low-cost and low-cost digital burner. It uses an active humidity sensor and a thermistor to measure circulating air and emits a digital signal on a data pin.

5. SOFTWARE COMPONENTS

5.1 Arduino IDE

Arduino IDE is used to write and run the programs and these programs are known as sketch in Arduino . The IDE environment is written in Java and based on Processing and other open-source software. The programs can be written a language similar to C. After the sketch is written in the Arduino IDE, it should be uploaded on the Arduino board for execution.

6. EXPERIMENTAL RESULTS

The smart agriculture system has wide scope to automate the complete irrigation system and prevent the agricultural products. In our prototype we implemented the field monitoring concept in which moisture sensor detects the moisture content of the soil. The output of the sensor is connected to the Arduino uno and by means of ESP module we receive the output in our mobile. We control the pump operation from our mobile with the help of IOT. In warehouse monitoring, the temperature sensor detects the temperature and it sends the value to the Arduino and we receive the value with the help of ESP module. The temperature is controlled by means of a cooling fan and high intense light. The smoke sensor detects whether there is any fire alert and sends the data to the mobile through ESP module. The PIR sensor detects the motion of intruder and prevents the product with the help of ultrasonic repellent.

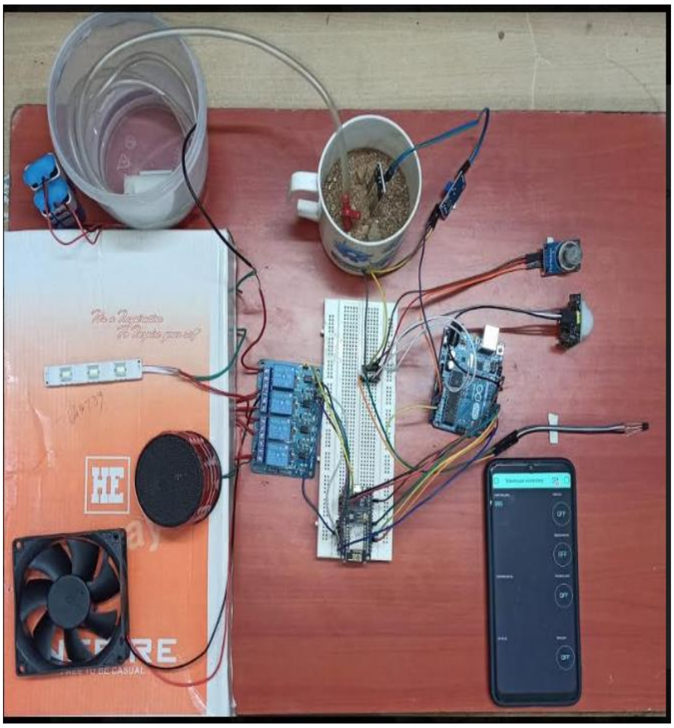

Fig-2: Prototype Circuit connections

This is modelled as lab prototype, in case of implementing the circuit model will be converted into single on board sensor with networked enabled device to sense the environment and actuate the remedial measure to avoid anomalies.

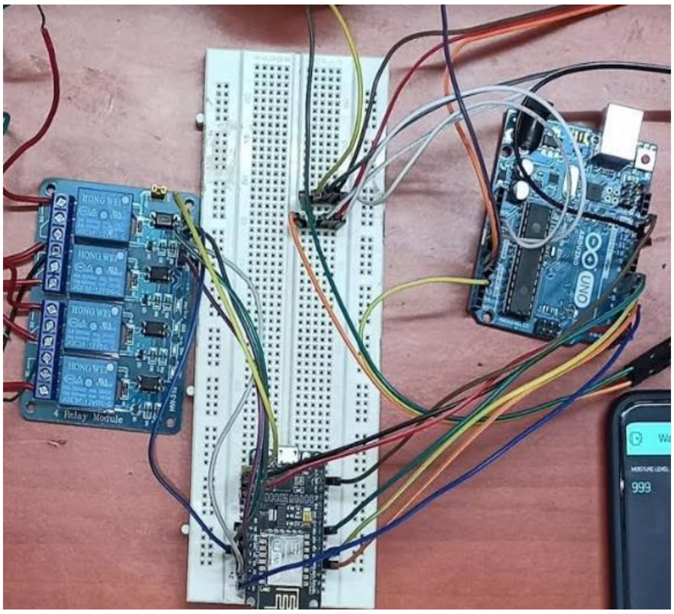

Fig-3: Arduino Uno Board Interface With ESP 8266 Module And Motor Driver Circuit

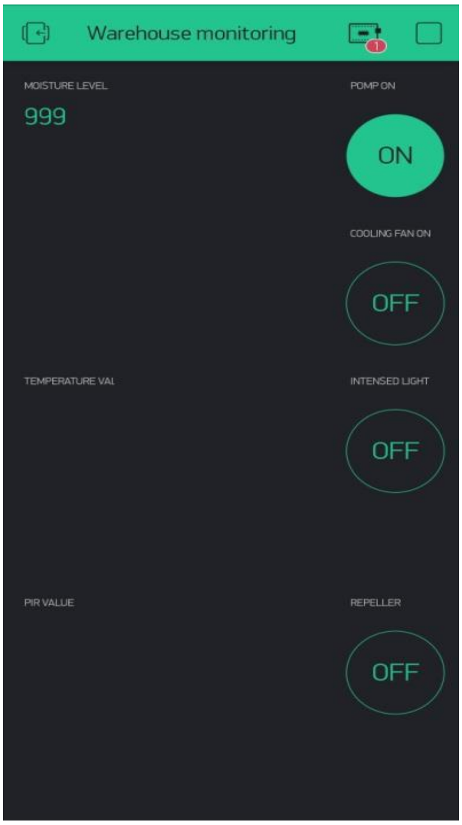

Fig-4 : Custom designed Blynk App for our Application.

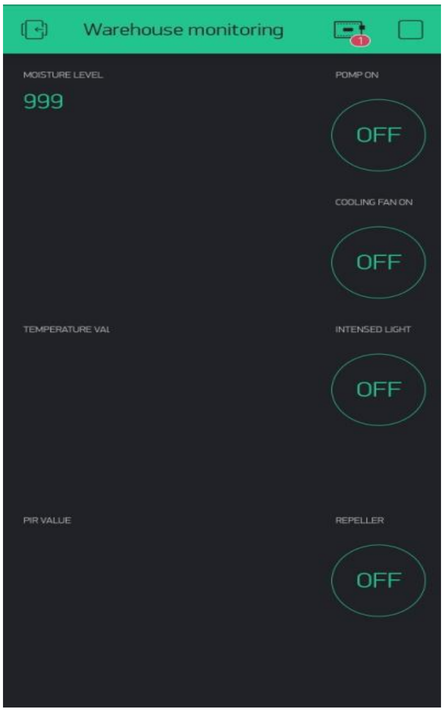

Fig-5: Using ON/OFF button in the app panel, necessary actuation can be done.

We used Blynk app to control our on board actuators of Arduino UNO. Using Blynk we can connect it to cloud and by installing Blynk libraries and providing author token to access our board. Bylnk app library should be added to Arduino and authentication code with Wi-Fi password should be written in program before executing.

7. CONCLUSION

Smart agriculture is done by using sensors and other components to reduce the work of a farmer. IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity. Our paper aims in solving the basic requirement in an economical way for field and its associated warehouse monitoring. The major advantage the system is implementing of Precision Agriculture (PA) with easy to use smart technology, which will optimize the yield of the crops and also will helps in analyzing the weather conditions of the field. In near future we can develop this system to provide more features with enhanced technical support.

REFERENCES

[1]. Rajalakshmi.P, Mrs.S.Devi Mahalakshmi "IOT Based Crop-Field Monitoring And Irrigation Automation" 10th International conference on Intelligent systems and control (ISCO), 7-8 Jan 2016 published in IEEE Xplore Nov 2016.

[2]. Prof. K. A. Patil And Prof N. R. Kale proposes "A Model For Smart Agriculture Using IOT" 2016 International Conference on Global Trends in signal Processing, Information Computing And Communication.

[3]. Dr.N.Suma, Sandra Rhea Samson, S. Saranya, G. Shanmugapriya, R. Subhashri „IOT Based Smart Agriculture Monitoring System‟ 2017 International Journal on Recent and Innovation Trends in Computing and Communication.

[4]. Mahammad shareef Mekala, Dr.P.Viswanathan„ A Survey: Smart agriculture IoT with cloud Computing‟ 978-1-5386-1716-8/17/$31.00 ©2017 IEEE

[5]. Prathibha S R1, Anupama Hongal 2, Jyothi M P3‟ IoT Based Monitoring System In Smart Agriculture‟ 2017 International Conference on Recent Advances in Electronics and Communication Technology.

[6]-Dr.M.Newlin Rajkumar, S. Abhinaya, Dr.V.Venkatesa Kumar "Intelligent Irrigation system-An IOT Based Approach" IEEE International Conference on Innovations in Green Energy and Healthcare Technologies (ICIGEHT'17)

[7]- P. B. Chikankar, D. Mehetre and S. Das, "An automatic irrigation system using ZigBee in wireless sensor network," 2015 International Conference on Pervasive Computing (ICPC), Pune, 2015, pp. 1-5.

[8] Dr.B.Gangwar,"Vision-2050", Indian Council of Agriculture Research, Government of India.

[9] P. Baronti and P. Pillai, "Wireless sensor networks: A survey on the state of the art and the 802.15.4 and Zigbee standards", Computers Communications-Elsevier, pp 1655-1695, 2006.