Wireless Sensor Network (WSN) based Smart Agriculture on Remote Monitoring System using Internet of Things (IOT)

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Abstract- Now-a-days wireless sensor networks (WSN) are used for many applications. There are lots of physical methods to cultivate a healthy crop in agriculture. But it requires a lot of manual work involved which is a burden now days. In this paper, an agricultural environment monitoring system is described using Internet of Things, open source platform ATMEGA328 and ESP32 and Wireless Sensor Network. In this system, the Wireless Sensor nodes collect the data of various environmental parameters such as temperature, humidity, soil moisture etc. and send the collected data to ATMEGA328 and ESP32. The ESP32 stores the data in a database of a web server (DBMS). The node MCU also WIFI device it act as router device .A client side website is developed to show the data. If the collected environmental data reaches in a threshold condition, a e-mail notification is sent to the user as a warning. In this paper, secured routing algorithm is proposed to find the trusted node by using trust model and the malicious report is checked, and routing is done using BFS, the utilization of sensors data that acquaint for wireless sensing of real time data monitor and transfer them into the specified kind and facilitate to forward the perceived data across the network through cloud using WIFI. Here the project work deals with the IOT Thing Speak internet service that would be a generous API service that act as variety for the vary of sensors to look at the perceived data at cloud level and composite a special feature of porting the perceived data using a unique channel ID and browse API key that is assigned by services and prepared to trace data based on coordinator.

Key Terms **-** Secure Routing, Software Agents, and Wireless Sensor Networks

I. INTRODUCTION

The Wireless Sensor Network consists of various sensor nodes connected to coordinator, where every node is connected to one or extra nodes and quite a few sensors. Every such sensor network node has typically several parts internal and external antenna connected to transceiver, an electronic circuit and microcontroller, for interfacing with the sensors and a low energy source, usually a battery or solar an embedded form of energy harvest. Mesh refers to interconnected devices or nodes. Wireless mesh networks often consist of mesh clients devices, mesh routers devices and gateways devices. Mobility of nodes is less frequent and fast inter connected. If nodes devices were to constantly or frequently move, the mesh will spending more time updating routes than delivering data. Mesh is interconnected to node devices based on MAC address they sent to coordinator then stored data on cloud computing. Cloud computing also pivoting about a point concepts from utility computing to provide metrics for the services used. The public cloud pay-per-use models. In addition, measured services are an essential part of the feedback loop in routine computing, allowing services to scale on-demand and to perform routine failure recovery. creating a Jason file for WSN data's like soil moister ,PH level ,air pressure ,humidity and temperature .every WSN haven separate channel id and SOCKET API key then sensor nodes send information to coordinator node the coordinator create an separate server network .

II. LITERATURE SURVEY

Wireless Sensor Network are a promising approach used in various applications but finding an optimal routes discovery is many problematic due to dynamicity, heterogeneity, resource scarcity and so on. Generally, residual energy of sensors in sink coverage area is drained very quickly compared to other areas in Wireless Sensor Network. The Optimized QoS-based Clustering with Multipath Routing Protocol for Wireless sensor network reduces the energy consumption in sink coverage area by applying the Modified Particle Swarm Optimization based on clustering algorithm to form clusters to select cluster heads in the sink coverage areas and to solve the energy whole problem.

III. PROBLEM STATEMENT

For 30 acres land, the man power need nearly 200 members to work for manual work and their daily salary is 200, so the cost is high for to do farming. The security to crops from animals, the farmers have to stay in farm land for long to nights. The water wastage could be reduced using IOT implementation.

IV. PROPOSED METHOD

In the present system, every node is integrated with different sensors and devices and they are interconnected to one central server via wireless communication modules. The server sends and receives information from user using internet connectivity. There are two modes of operation viz., auto mode and manual mode. In auto mode system takes its own decisions and controls the installed devices whereas in manual mode user can control the operations of system using android app or PC commands.

▪ In agriculture field, water management is important factor for irrigation of crops.

▪ The moisture sensor is used to know the condition of the land whether dry or wet. The output will be shown in LCD.
▪ If the land is dry means the motor will be automatically ON/OFF and water is managed to the land.
▪ Solar power is used to run the motor.

V. BLOCK DIAGRAM

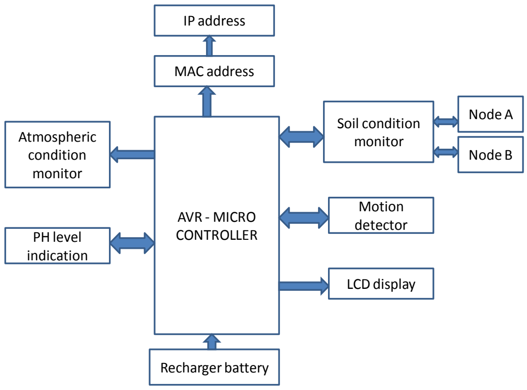

Fig.1: Hardware Section

A. Operation

In this system is combination of both software and hardware components.
In this hardware consists of AVR microcontroller is used to connect the different types of sensor to collect the information's. An rechargeable battery to save the power source.MC also detect the atmospheric condition monitor as well as soil condition monitor also measures the soil PH level and moisture condition indicates in liquid crystal display(LCD). It's the fastest remote monitoring system. NODE MCU its an wi fi access board it act as on router and coordinator its send collection of sensor data to cloud storage based on API KEY. Every node haven saperate MAC address so they are secured network MAC address.

B. ESP 32 Modules

ESP 32 is embedded with Tensilica L106 32-bit micro controller (MCU), which features extra low power consumption and 16-bit RSIC and low Bluetooth. The CPU clock speed is 80MHz. It can also access a maximum value of 160MHz. ESP32 is often integrated with external sensors and other specific devices through its GPIOs; codes for such applications are provided in examples in the SDK.

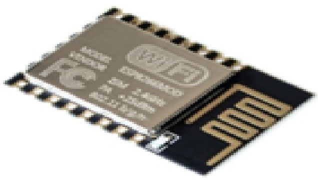

Fig.2: ESP32 module

C. AVR Microcontroller

An AVR Micro controller is Family of **RISC** Microcontroller from Atmel microcontroller. A series of 8-bit RISC (reduced instruction set computer) microcontrollers from Atmega .All AVR microcontrollers share same instruction set and a basic Central Processing Unit (Harvard) architecture. It has 8-Bit general purpose registers .Mostly instruction Execute in Single clock cycle. This makes it faster among 8 bit microcontrollers.AVR was designed for efficient execution of compiled C code in keil software.

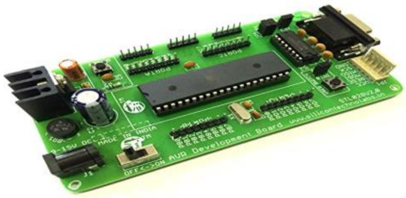

Fig.3: AVR microcontroller

D. LCD Display

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. This LCD has 2 registers; they are a) Command and b) Data. The command register are used to stores the command instructions given to the LCD. The data register are used to stores the data to be displayed on the Liquid Crystal Display . The data is the ASCII key value of the character to be displayed on the LCD.

Fig.4: LCD display

E. Temperature Sensor

Besides all these classifications, integrated circuits have been linear designed to provide ease of use while measuring temperatures in the desired linear scale. For example, the LM35 IC from analog sensor is a precision temperature sensor IC that offers reading directly on the Celsius scale and LM34 is another one offering readings on the Fahrenheit scale and ADC converter . These ICs provide Voltage readings which are directly proportional to multiplier of temperature and hence can be directly read off a multicentre, or fed directly into an ADC (analog to digital converter) for further processing. Many semiconductor companies like Analog Devices, ZMD and STMicroelectronics are into temperature sensors design and even provide signal processing circuitry and digital I/O interfaces for microcontrollers.

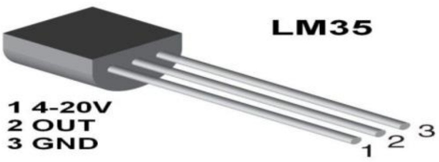

Fig.5: Temperature sensor

F. Moisture Sensor

The Moisture Sensor can be used to detect the moisture level of the soil, if there is water around the sensor and plant in dry condition inform you, let the plants in your garden reach out for human help and it will communicate your smart phone. They can be very easy to use, just insert it into the soil and then analog data read it. With the help of this sensor, it will be attainable to make the plant remind you .

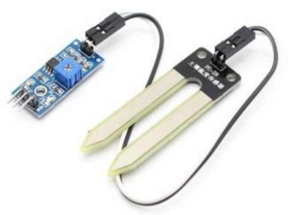

Fig.6: moisture sensor

G. Infrared Sensor

It is an electronic instrument used to sense the characteristics of surroundings and also capable of detecting the motion of the object. They are the pyro-electric sensors which detect movement, ideal for security purposes and used as motion detector to track the objects or activate specific system. The range of distance is between **15cm-150cm.** the supply voltage ranges between **4.5v-5.5v dc.**

Fig.7: infrared sensor

A. SOFTWARE USED

1) keil software

- Keil IDE compiler
- Languages used: Embedded C, C++.

AVR Studio is an Integrated Development Environment (IDE) for writing and debugging AVR Applications in Windows 9x/ME/NT/2000/XP/VISTA/7/8 Environments. AVR Studio provides a management tool, source file editor, simulator, and assembler and front-end for C/C++, programming, emulation and on-chip debugging. AVR Studio supports the complete range of ATMEL AVR tools and each release will always contain the most up-to-date updates for both the tools and support of new AVR devices. AVR has a four modular architecture, which allows even more interaction with third party software vendors. Graphic user interface and other modules can be written and hooked to the system.

SQL Database and Power BI

At this point, the data found in the amount of database needs to be transformed into a more user denoted as will not be understand SQL queries. Hence, to cater for this problem, Power BI is used to reconstruct the amount of data into a visual representation such as a graph.

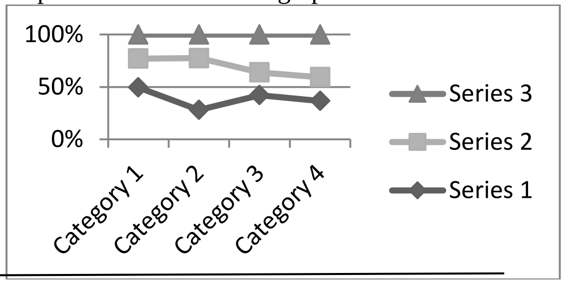

Fig.8: Graph representation

2) Thingspeak**.**

ThingSpeak web page is used for (IOT) Internet of Things application and API to store and recover data from things using the Hyper text transfer protocol over the Internet acess. ThingSpeak enables the creation of sensor logging applications, data analysis applications, and a day to day thing with status updates. ThingSpeak is used to support of IoT applications. The Thingspeak is the core logic of the proposed system. In general, a dataset is needed to train the machine to in the data in order to decide whether or not. For better precision, an Open weather map.com API is with the aim of knowing when the water pump needs to be opened. The pseudo code gives a simple illustration on how the machine learning system works producing code that is portable across wide platforms.

VI. RESULT & DISCUSSION

In this section, the overall working of the system is explained. The following diagram shows the Animated View of the Smart agriculture Based IOT being proposed for Agriculture Temperature monitoring and Moisture Monitoring and ph level indications then animal attacks is shown using buzzer indications.

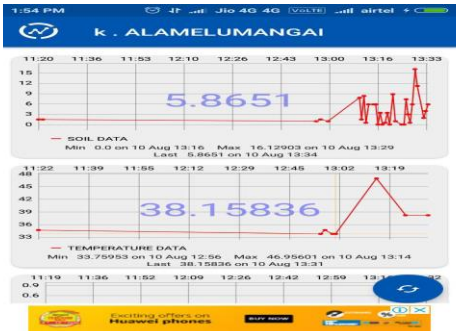

Fig.8: Android application monitoring

Fig.9: nutrition level monitor and ph level monitor.

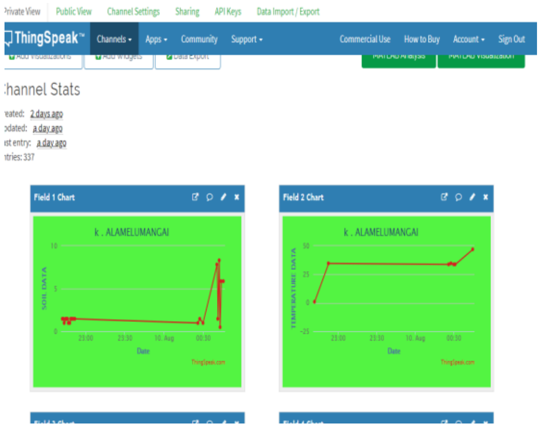

Fig.10: Live Data of Soil Moisture and temperature Date and Time from Thingspeak web page.

VII. FUTURE ENHANCEMENT

Future work would be focused more on increasing sensors on this sensor to fetch more data especially with regard to Pest Control and by also integrating GPS module in this IOT to enhance this Agriculture IOT Technology to full-fledged Agriculture Precision ready product.

VIII. CONCLUSION

This multipurpose system gives an advance method to The system mainly monitors the behavior of soil moisture, air humidity, and air temperature, PH level and see how it contributes to evaluate the needs of water in a plant. The system uses machine learning and compares actual values obtaining from sensors with a threshold value that has been fed to the machine learning for analysis. After this process, the machine learning cross checks the result obtained with weather forecast and then decides whether irrigation needs to be done or not. The farmer receives a notification on his smart phone and he can choose to turn on the water pump with a button click. Moreover, the system has a web app and is helpful if ever the farmer wants to see the statistical sensor data and assess the change in sensor readings throughout a time period. Furthermore, the system can calibrated for different type of plants, that is, the user is provided with a list of plants choices in his web app and mobile app. With this the user can choose the specific type of plant that is being cultivated and obtained threshold value and thus a more accurate irrigation prediction.. The entries that could also been saved safely for an farmers acknowledgement with date an time condition.

IX. ACKNOWLEDGEMENT

I wish to acknowledge the help provide by many people around the world that are too numerous to mention here.

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