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IOT Based Agriculture Automation with Intrusion Detection

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***Abstract*—** Today we are living in 21st century where automation is playing important role in human life. Automation allows us to control household appliances like light, door, fan, AC etc. It also provides security and emergency system to be activated. Automation not only refers to reduce human efforts but also embarks on energy efficacy and time saving. The main objective of Automation and security is to minimize human intervention and to help create more effective and efficient systems to control appliances and save human effort and time. This paper put forwards the design of automation and security system using Arduino and Ethernet Shield. The design is based on a standalone embedded system board. Agricultural appliances are connected to the Arduino and communication is established between the Ethernet Shield and the site. Appliances are connected to the input/output ports of the embedded system board and their status is passed to the Ethernet shield. This developed an authentication to the system for authorized person to access appliances. It presents the design and implementation of automation system that can monitor and control appliances via the use of internet without any manual intervention. The system so devised is a low cost system and is highly scalable with less modification.

***Keywords*—** Arduino Uno; cloud networking; ethernet shield; e-learning;internet of things (IOT); Wi-Fi; etc.

I. INTRODUCTION

The Internet of Things (IOTs) can be described as connecting everyday objects like smart-phones, Internet TVs, sensors and actuators to the Internet where the devices are intelligently linked together enabling new forms of communication between things and people, and between things themselves. Building IOTs has advanced significantly in the last couple of years since it has added a new dimension to the world of information and communication technologies. The internet of Things (IOT) is a recent communication paradigm that envisions a near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the internet"[1]. By working in this way access and communication with the different variety of gadgets and devices like camera, audio recorder, smart watches, Google glass, Digital broad displays, sensors etc would become an everyday affair and user friendly. The IOT nurtures the improvement of learning circumstance that make use of the huge subject data generated by those objects to provide dynamic services to teachers, learners and even to content developers in modern Campus. Smart campus enables us to use IOT methodologies to make it available for farmers. The paper aims to create smart agriculture fields with shows field temp, moisture or humidity using website-based applications (software) which allow us to share via IOT enabled medium to accesses within network limit. This paper seeks the developments of a model which describe architecture of IOT enabled smart field and communication between smart farmer & farm.

The main objective of this paper is to discuss a way of utilizing IOT technology for an agriculture field in which data collection can be possible by using devices for e-farming application in real-time.

II. SYSTEM ANALYSIS

A. Problem Definition

Agriculture automation systems face four main challenges, these are high cost of ownership, inflexibility, poor manageability, and difficulty in achieving security. The main objectives of this research is to design and implement a agriculture automation system using IOT that is capable of controlling and automating most of the agriculture field through an easy manageable website interface. With advancement of technology things are becoming simpler and easier for us. Automatic systems are being preferred over manual system. Through this paper it is exhibited how to design arduino based real-time agriculture automation using Internet Of Things. The proposed system has a great flexibility by using Wi-Fi technology to interconnect its distributed sensors to agriculture automation server. This will decrease the deployment cost and will increase the ability of upgrading, and system reconfiguration.

B. Proposed System Feature

The proposed system is a distributed agriculture automation system, consists of server, sensors. Server controls and monitors the various sensors, and can be easily configured to handle more hardware interface module (sensors). The

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Arduino uno development board, with Ethernet shield acts as website server. Automation System can be accessed from the website browser of any local PC in the same LAN using server iP, or remotely from any PC or mobile handheld device connected to the internet with appropriate website browser through server real IP (Internet Protocol). WiFi technology is selected to be the network infrastructure that connects server and the sensors. WiFi is chosen to improve system security (by using secure WiFi connection), and to increase system mobility and scalability.

III. System Design and Implementation

A. Proposed Agriculture Automation System

The proposed model of the agriculture automation system is as shown in the figure1. The model consists of different sensors like temperature sensor, soil moisture sensor, and LDR etc. Initially the Arduino Uno connects to the internet through Ethernet shield. When the connection is established it will start reading the parameters of sensors like p1, p2, p3 etc . The threshold levels for the required sensors are set and sent to the website server

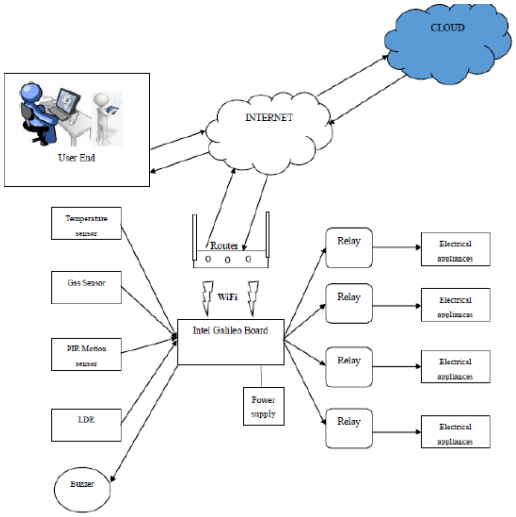

Fig. 1. Proposed model of Agriculture automation system.

The data can be analyzed anywhere any time. If the sensor parameters are greater than the threshold level then the respective action is taken and required actuation is done for the controlling of the parameters. In the proposed model the temperature, gas leakage, motion in the field is monitored. if the temperature exceeds the threshold level then the cooler will turn on automatically and it will be turned off when the temperature is below the set threshold. The required lights are turned on/off automatically by detecting the light outside the field using the LDR. The user can also monitor the electric appliances through the internet via website server. If the lights or any electrical appliances are left on in hurry this can be seen and turned off remotely through simply typing the IP address of the website server and thus monitoring and control through the internet is achieved.

B. Proposed Agriculture Automation System Functions

The proposed Agriculture automation system has the capabilities to control the following components in user's field and monitor the following alarms:

- Temperature and humidity
- Motion detection
- Light level
- The proposed field automation system can control the following appliance:
- Lights on/off/dim
- Fan on/off
- On/off different appliance like motors required for irrigation.

C. Software Design

Front End Design: HTML is a format that tells a computer how to display a website page. The documents themselves are plain text files with special "tags" or codes that a website browser uses to interpret and display information on your computer screen. HTML stands for Hyper Text Markup Language; an HTML file is a text file containing small markup tags. The markup tags tell the website browser how to display the page. An HTML files must have an html or html file extension.

D. Implementation Setup

When the connection is established it will start reading the parameters of sensors. The threshold levels for the required sensors are set and are later monitored and compared. The sensor data are sent to the website server and stored in the cloud. The data can be analyzed anywhere any time. A model field is built for the agriculture automation system and is as shown in the figure 3. At the door of the field a motion sensor is fixed to detect any movement near the door. Light 1 will turn on automatically when light sensor detects the darkness. A cooler/Fan will turn on when the farm temperature exceeds the set threshold and in turn reduces the temperature. Relay is used to switch the electrical appliances like motors, pumps, light, fan etc. The Arduino uno is placed in store room or garage. The Arduino uno is connected with Ethernet Shied with the antennas for the connectivity with internet.

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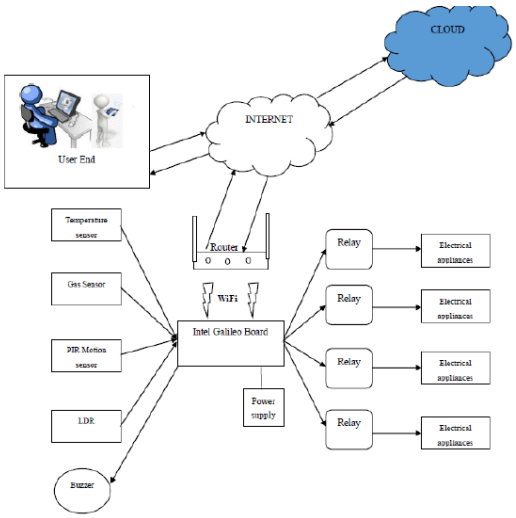

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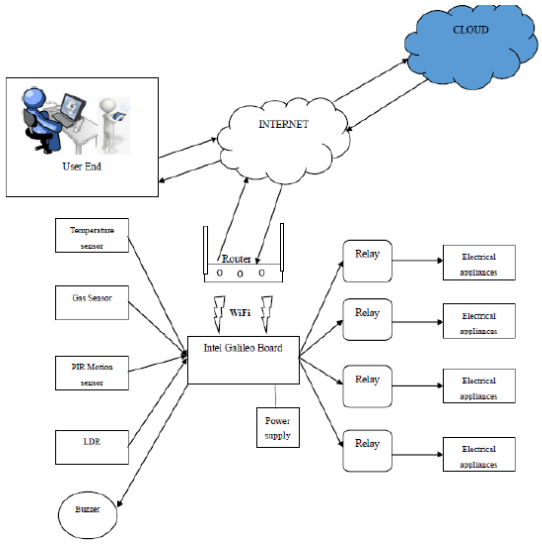

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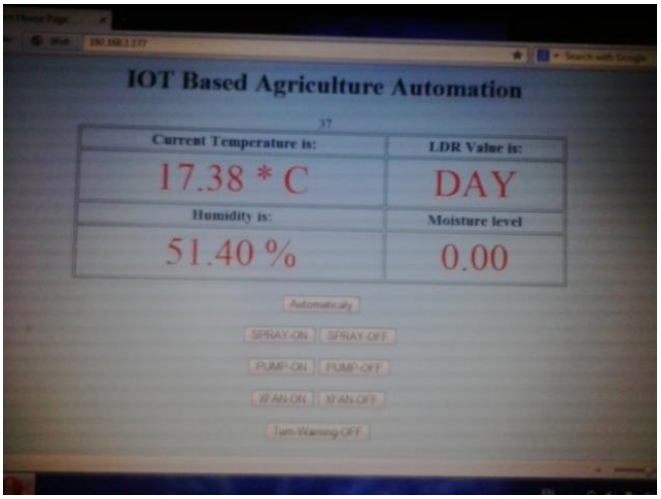

Fig. 2. Website design prototype.

VI. RESULTS

After the successful connection to the server, the data of sensor are sent to the website server for monitoring of the system. The figure 2 shows the website server page which will allow us to monitor and control the system. By entering the assigned iP address in the website browser this website server page will appear. The website server gives the information about the temperature in different places of the field and motion state in the field. it also gives the status of the various electrical appliances like light, fan etc which i can control remotely. The graph shown in the figure 3 gives the analysis

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of the temperature at different time and threshold level of the temperature. By seeing the graph we can come to know the change in the temperature. And at what time the temperature was low/ high. we can also know that was temperature was above the threshold level or not, if was above then at what time.

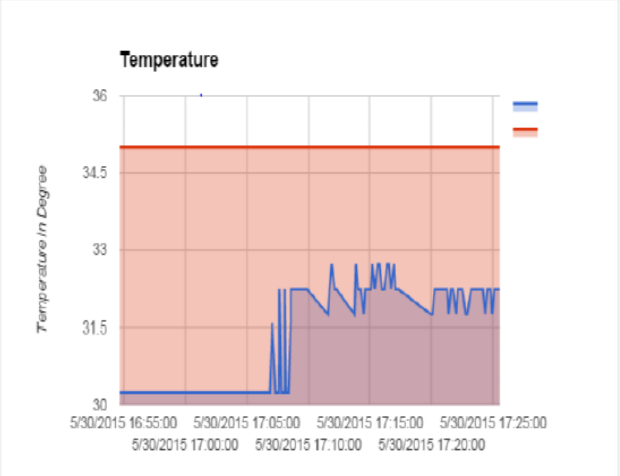

Fig. 3 Graph showing the different temperature value along with the threshold.

VII. Conclusion and Future Work

A. Conclusion

The agriculture automation using internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances ire successfully controlled remotely through internet. The designed system not only monitors the sensor data, like temperature, gas, light, motion sensors, but also actuates a process according to the requirement, for example switching on the light when it gets dark.

B. Future work

Using this system as framework, the system can be expanded to include various other options which could include field security feature like capturing the photo of a person moving around the field and storing it onto the cloud. This will reduce the data storage than using the CCTV camera which will record all the time and stores it. The system can be expanded for energy monitoring, or stations. This kind of a system with respective changes can be implemented in the hospitals for disable people or in industries where human invasion is impossible or dangerous, and it can also be implemented for environmental monitoring.

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