MONITOR AND CONTROL SENSORS IN THE GREENHOUSE USING LORA TECHNOLOGY

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Introduction:

In the third decade of the twentieth century, and based on cisco, the communication world will enter a major challenge to provide a connection for more than 50 billion devices that have the ability to access the internet in a huge network called IoT. Supportive devices will be widespread in the industrial, security, agricultural, health, and all smart sectors [1]. Wireless communications ensure convenient, fast, and efficient use for people who use these devices, and also provide the ability to covering long distances [2]. The advantage of wireless communication is the possibility of reach to the locations that are dangerous or relatively remote [3]. There are several technologies approved in wireless communications to manage and control electronic devices inside greenhouses near plants, these technologies take the readings from multi types of sensors [4].

Previous works show obviously that different types of wireless sensor networks can be used for monitoring and controlling such as ZigBee, Wi-Fi networks, etc.[5].In this paper, Present LoRa as new wireless sensor networks, LoRa is the abbreviated name of the long-range, and also it is a part of a low power wide area network (LPWAN)[6]. It is distinguished by saving energy consumption, low cost, and the ability to reach very far distances [7].

Characteristics	Bluetooth	Zigbee	NFC	LPWAN
FrequencyBand	2.4 GHz	2.4 GHz	13.56 MHz	Sub- GHz ISM band
Topology	Star-bus Network	Star, Mesh, Cluster	P2P network	Star
Data Rate	1 Mbps	250 kbps	424 kbps	2 kbps
Range	Short range 10-30 m	Short range 10-100 m	Short range 10cm-1 m	Long range 10km-50km
Power Consumption	12.5 mA	40 mA	50 mA	30 mA

Table-Comparison between various communication protocols

These characteristics and critical factors are very useful to develop a new smart system for monitoring and controlling greenhouse sensors without need any infrastructure [9]. The designed system is divided into two parts, The First Part is a measure and control part consists of using three types of sensors that will be linked inside the greenhouse, which used to measure the temperature and humidity and checks for the presence of fires,

in addition to using the relay as an electric switch when needed, all those sensors connected to LoRa end-node, this end-node used LoRa as wireless communication to send the data (sensors readings). The Second part is a monitor and control part, it starts from the LoRa gateway that receives the data sent from the measure and control part via the LoRa technology so that the gateway redirects and upload the readings data to the cloud computing using the WiFi technique to provide easy monitor and control from anywhere in the world.

Problem Statement:

Due to the fears from the corona pandemic and its consequences from curfews, spacing, and the difficulty to reach work centers, including the greenhouse in the agricultural sector.

Proposed System:

In the proposed smart system for monitor and control the greenhouse. The sensors are activated when the sensor board is turned on, to detect the individual parameters of the greenhouse air.

These parameters help us to understand the nature of the current environment for the house first-hand and help in sensing the flame, which avoids both the greenhouse and the plants burning or the damage, and the possibility of sending a feedback signal to relay sensor to operate any device such as water sprays or air vents.

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Advantages of Proposed System:

1. Provide real-time information on critical climate factors to maintain the best conditions for plant growth while driving energy efficiency.
2. Any person authorized to control the greenhouse can access the readings and take the necessary steps from any location where he is located in.
3. It supports preserving readings from interference.
4. The readings have been obtained by LoRa wireless process using modern technology supports long distances and consumes little energy

Fig.1. Smart Monitor and Control for Greenhouse Sensors System

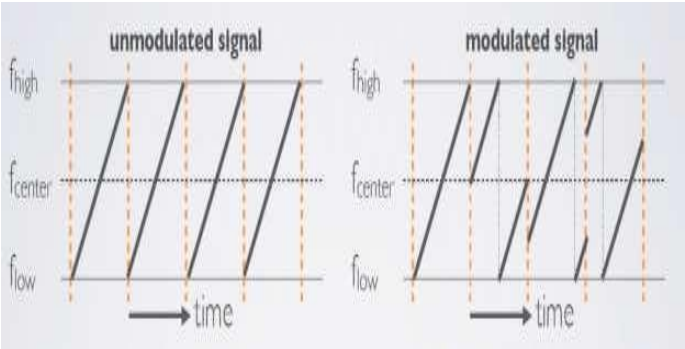
Methodology:

The monitoring and controlling sensors in the greenhouse include hardware components and software programs. The proposed system consists of two work fields, one in the greenhouse and the other is near the controller operator. Each one of those fields contains hardware and software parts. In the greenhouse field, there are temperature and humidity, flame, and relay sensors. These three sensors connected together or individually to arduino microcontroller with dragino LoRa shield. The dragino LoRa shield is a long-range transceiver on an arduino shield form factor and based on the open-source library. With low datarates, the LoRa shield allows the user to reach extremely long ranges to send data. It provides connectivity of the ultra-long-range spread spectrum and high sensitivity to interference while reducing current consumption.

Lora shield Features

- 3.3v or 5v I/O Arduino Board have full Compatibility
- Frequency Band are pre-configure in the factory: 433 MHZ/868 MHZ and 915 MHZ
- Low energy consumption
- Arduino Leonardo, Uno, Mega, DUE are Compatible with the LoRa shield.
- Have an External Antenna

The Arduino Integrated Development Environment (IDE) program helps us to programmed the hardware parts using LoRa modulation to code the data and send it to the gateway. The LoRa modulation has a very unique method, see Fig.4, it is represented by the chirps that are cyclically-shifted, and it is the frequency jumps that determines how the data is encoded onto the chirps. This type of coding makes the transmitted signal strong in interference, which means high protection.



On the other side near the controller person, the dragino LoRa gateway is found, which is a very recent technology, and its version 1.0 came up in January 2015[18], LG01-N it is an open- source single-channel, it lets you bridge LoRa wireless network to an IP network through WiFi and Ethernet.

LG01-N Features:

- Have Open Source system
- Low energy consumption
- Firmware upgrade easily
- Software upgradable automatically
- Connect to IoT servers with Flexible protocol
- Auto-Provisioning
- Built-in web server
- Internet connection via WiFi, LAN, Or 3G/4G via optional LTE module
- Failsafe design provides robustly system
- Can Support 300 nodes
- available at 433/868/915/920 MHz LoRa band
- LoRa: 5~10 km.is The Max range , Area:>500m is the Density

Expected Outcome of Proposed Work:

In the proposed smart system for monitor and control the greenhouse, the sensors are activated when the sensor board is turned on, to detect the individual parameters of the greenhouse air. These parameters help us to understand the nature of the current environment for the house first-hand and help in sensing the flame, which avoids both the greenhouse and the plants' the burning or the damage, and the possibility of sending a feedback signal to relay sensor to operate any device such as water sprays or air vents. The readings have been obtained by LoRa wireless process using modern technology supports long distances and consumes little energy. It supports preserving readings from interference. The material aspect is the most important thing in the communications world, so the LoRa offers a technology that saves money without need for sophisticated and expensive devices. When the system gets connected to the IoT network, any person authorized to control the greenhouse can access the readings and take the necessary steps from any location where he is located in. The website that uses in this paper offered the ability to obtain readings value and accurate information about the system like the frequency and time used to sending or receiving, and this indicates the high reliability for the system and the ease of handling with it.

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