IoT based Plant Care System at Green House

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Abstract – Internet of Things (IoT) is definitely not an advanced instinct, it is available all over. It is with gadgets, Sensors, Clouds, Big information, and information with business. It is the blend of customary installed frameworks joined with little remote miniature sensors, control frameworks with mechanization, and others that makes an enormous foundation.

This paper is about maintaining the plant care systems at the greenhouse. Here, we can monitor the temperature level, soil moisture level and the detection of the minerals level in the greenhouse.

We integrated the sensor modules with the application to display the values of temperature level, soil moisture level and pH level. We can monitor the level status through the application.

Index Terms : IoT, Arduino board, C++, Java

I. Introduction

A green house is the place where plants, for example, blossoms and vegetables are grown[1]. Nurseries warmup during the day when sun-beams enters through it, which warms the plant, soil and design. Green houses help to shield crops from numerous sicknesses, especially those that are soil borne and sprinkle onto plants in the downpour[1]. Nursery impact is a characteristic wonder and useful to individual. Various ranchers neglect to get great benefits from the nursery crops for the explanation that they can't oversee two fundamental elements, which decides plant development just as efficiency. Green house temperature ought not go under a specific degree, High dampness can result to trim happening, buildup of water fume on different nursery surfaces, and water vanishing from the moist soil. To conquer such difficulties, this nursery checking and control framework acts the hero. This undertaking shows the plan and execution of a different sensors for nursery climate observing and controlling[2]

IoT assumes an essential part in Greenhouse checking which distinguishes the dirt substance ,water level and furthermore temperature just as dampness. IoT helps individuals and things to be associated whenever, wherever, with anybody, in a perfect world utilizing any organization and any assistance. Computerization is another significant use of IoT advances. It assists with checking and control the nursery climate by utilizing various kinds of sensors and actuators that temperature, and mugginess, dampness, soil pH and water level in soil too.

IoT assists with connecting the object of the virtual world with this present reality, so the availability is empowered whenever for anything at any spot. IoT will make another existence where every one of the residing creatures, actual articles, climate, genuine information and virtual information will collaborate with one another simultaneously and same spot.

The huge improvement of IoTs in the course of the most recent few years has made another measurement to the universe of data and correspondence advances. The IoTs innovation can be utilized for making new ideas and wide advancement space for brilliant homes to give knowledge, comfort and improved personal satisfaction.

The rising number of web empowered gadgets which can arrange and speak with web empowered devices and with one another are as of now under way, the Internet of Things portrays this upset. All that like items, vehicles, conditions, outfitting, and garments will have increasingly more data related with them. It likewise can turn into a fundamental piece of the Internet, produce more significant data, organization, impart, sense, etc.,.. Every one of these states are alluded by the Internet of Things (IoT)[1].

All the nursery boundaries like mugginess, temperature, soil dampness, light force, pH are followed by the framework and this informations are transferred in the data set.

In this undertaking it assumes a significant part in the majority of the fields. The utilization of IoT expanded in view of the different benefits we can get from that. The agribusiness is the territory where a ton of progress is required in light of the fact that that is one of the fundamental necessities and a huge area of individuals is associated with that. A large portion of the territory the serious issue is the water shortage in view of low precipitation and despite the fact that there is precipitation the water is squandered as a result of no legitimate game plan for the capacity of water[5] Numerous methods are proposed in IoT as far as giving a superior water system to the yield. The IoT gadgets can likewise be utilized in home for observing the nursery ongoing. The Raspberry and Ardunio assumes a significant part in preparing the data that is gotten from different sensors[6]. The expense of these gadgets will be moderate and the significant issue is the utilization of enormous measure of sensors and different gadgets. Much examination center is around finding the impact of these gadgets in the climate.

The establishment of the sensors for finding the mugginess level is one main consideration to maintain a strategic distance from the wastage of water.

II. Model Explanation

1. Temperature sensor will detect the temperature of the surroundings if there is higher than the required temperature. Then, the cooler fan will turn on to lower the high temperature.

2. Soil moisture sensor will detect the amount of water present in the soil. If there is no enough amount of water in the soil, the water pump will provide the water to the soil.
   If there is enough amount of water in the soil, the water pump will stop providing the water supply automatically.
3. pH sensor is to detect the minerals in the soil. If there is low amount of any particular minerals in the soil, the sensor will notify us.

4. Notifications sent to app :
   1. If sensor detects the high temperature, notification will popup.
   2. If sensor detects the low moisture content in soil, notification will popup.
   3. If sensor detects the low amount of minerals in the soil, notification will popup

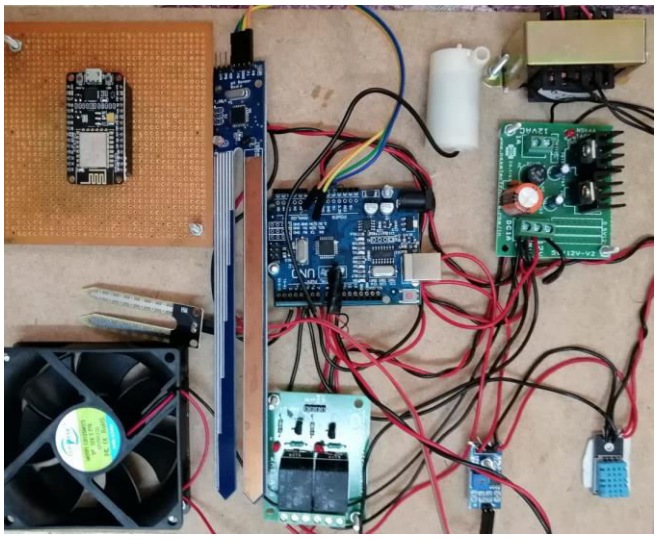


Figure (i). Connections of Sensors of temperature, water and pH sensor.

App-Functionality:

1. The functionality of our app is based on cooler fan and water pump and soil moisture content in the soil. After turning ON the water pump, user will be able to set the timer and application will notify ,once the timer ends.

2. Similarly , if temperature and humidity are high, the cooler fan will automatically set up to run, meanwhile the pH sensor will check for the mineral content in the soil, if it's low the notification in application will notify to supply minerals to the field.

III. Literature Survey

Plant checking and shrewd cultivating framework utilizing IoT by Ramkumar.E, Nagarani .S and Roger Rozario A. P, they have proposed with plant observing and shrewd cultivating utilizing IoT in the Raspberry Pi stage[3]. The principle reason for mechanization is to give solace to individuals by decreasing the manual work and to improve the general presentation of any framework without the client cooperation. The significant boundaries for the quality and efficiency of plant development are soil and air temperature, stickiness, daylight, soil dampness and pH. Data to the client about the plant well being and development might be given to the client by consistently observing and recording these nursery boundaries[3]. It gives a superior comprehension of what every boundary means for the development of plants. Every one of the sensors (Temperature, dampness, stickiness, LDR, pH) utilized in this venture interface with the Raspberry Pi regulator. Furthermore, this data about the nursery can be straightforwardly checked and constrained by the proprietor of the nursery through their advanced mobile phone utilizing IoT[3]. A camera is given in this framework to screen the nursery through brilliant gadget. This shrewd planting framework will give accommodation and solace to the client by detecting and controlling the boundaries of the nursery without their actual presence[7]. Any android upheld gadget can be utilized to introduce the shrewd planting application. The product's utilized are PHP, CSS, HTML, Apache 2, Python, and SQL. The CSS and PHP programming's are utilized to create and plan a site page. Apache 2 is utilized as a web worker in Linux framework. The Python climate gives the space to coding in Raspberry Pi. SQL is utilized in programming and intended for overseeing information held in a social data set administration framework. All information are put away in the data set and can be recovered whenever. This will assist the client with understanding the connection between the plant development and the referenced nursery boundaries

Improvement of Plant Monitoring Using IoT by A. Pravin1, T. Prem Jacob2 and P. Asha3, they have proposed the primary issue in farming is water shortage. The water asset isn't utilized in a viable way, so the water is squandered. To beat this water system interaction can be robotized.

The utilization of Internet of things in this field will be useful to diminish the wastage of water. So the temperature just as stickiness and light are estimated by methods for sensors and depend up on the result further handling can be performed[3] We propose a framework that will catch every one of the insights concerning the dirt and the temperature by methods for various sensors. The detected data will be ship off the processor and depends up on the result the alarm message will be passed and the fitting measure of water will be delivered to the harvest. What's more, the additional data identified with the manure amount and whether there is any arrangement of genuine assault on the harvest that will likewise be recognized by the framework[4].The benefit of this framework will track down the recent concerns as far as soil condition, mugginess and harvest condition and the data will be quickly passed to the ranchers.

IV. Existing Work

A similar research work was done in Ramkumar.E, Nagarani.S, Roger Rozario A. P journal[3]. They proposed designing plant monitoring and smart gardening system using IoT with the help of a controller Raspberry Pi. All the parameters of the garden like temperature, humidity, moisture are controlled with the help of sensors like humidity sensor, moisture sensor,temperature sensor is interfaced with the Raspberry Pi board. And this information about the garden can be directly monitored and controlled by the owner of the garden through his or her mobile phone using IoT. The proposed system is generally for the people who love gardening but are busy in their jobs or day- to- day lives. It is not possible for the people to maintain garden regularly. This will cause improper growth of the plants. This system helps to solve those worries. Thus, by installation of this application on the owner‘s smart phone the user can forget about watering the plants on a regular basis. This proposed system takes care of this tedious job. Moreover,this system also tracks humidity, soil and air temperature, pH, It then uploads this information to cloud through the database. Humidity is the presence of water in the air. The presence of water vapor also influences various physical, chemical biological processes. Humidity measurement determines the amount of water vapor present in the gas. It is the mixture of pure gas such as nitrogen and argon.[3]

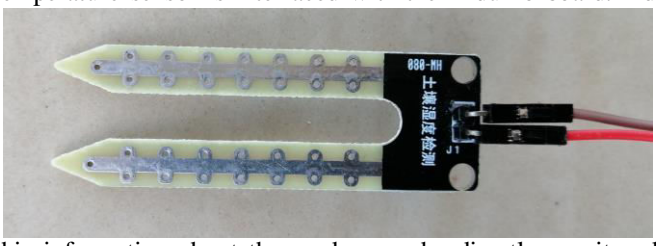
The system helps to save water, the utility bills, also the thirst of the plant is also fulfilled. The application can also be used by the user to control the water valve manually. Thus the user can water the plants from anywhere and pour his/her love on the plants[4]. This system water valve is simply attached to a hose, making a simplest watering system ever. Based on the sensor reading it will allow turn on or off and gives the plant a precise amount of water they need. This system is also made to display different charts based on the sensor reading and graph is plotted to check the plant growth. The open source cloud database is used by this stem to reduce the cost of the issues of storing large amount of data. All the data are gathered by the sensor and the value is refreshed for every 2 minutes. All the sensor data are stored and sent to the mobile application and also to windows application. Also the watering of the plants is also checked regularly which can be done manually or automatically. It integrates Android, windows, Raspberry Pi, IoT to work in tandem to achieve the system goals. It also gives an enjoyable experience to the user[4]. A very low implementation cost is enough for this system and assures to be successful compared to other kickstarter projects in which there is an issue of high cost. All the platforms used in this project are of open source and free to use. The primary aim of the project is to reduce the implementation cost compared to another system. The application builds on this system receive the data from humidity, moisture, LDR, temperature sensor. All these data can be viewed in the database using numerical values, charts and graphs. It displays the real time data. The refresh gap is 2 minutes. The front end application and the cloud are 2-way connected to retrieve the data as well as give command to the Raspberry Pi hardware to water the plants in the garden[3]

As per the above related work we retained the ideas and also we extended with some of our new features to develop this project as an enhancing one[3]

In this project, we implemented to detect the soil minerals by using the pH sensor, meanwhile it will be notified in the application. It will help the client to know about the status of minerals level and according to the deficiency of the minerals the user can supply the minrals based on thier current need and it will lead the perfect gardening.

V. Proposed Work

Here we have designed the plant care system with integration of IoT and mobile app. the parameters of the garden like temperature, humidity, moisture are controlled with the help of sensors like humidity sensor, moisture sensor, LDR, temperature sensor is interfaced with the Arduino board.And

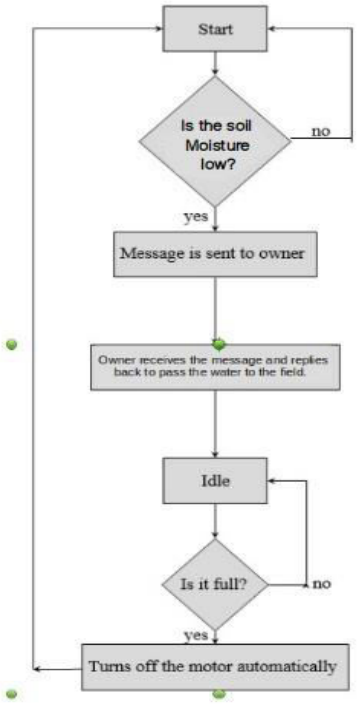


this information about the garden can be directly monitored and controlled by the owner of the garden through his or her mobile phone using IoT. The proposed system is generally for the people who love gardening but are busy in their jobs or day- to- day lives. It is not possible for the people to maintain garden regularly. This will cause improper growth of the plants. This system helps to solve those worries.

Figure (ii) Water electrodes to detects the water level in tank

i) Soil moisture sensor will detect the amount of water present in the soil. If not having the enough amount of water in the soil, the water pump will provide the water to the soil.

ii) If there is enough amount of water in the soil means, the water pump will stop providing the water supply.



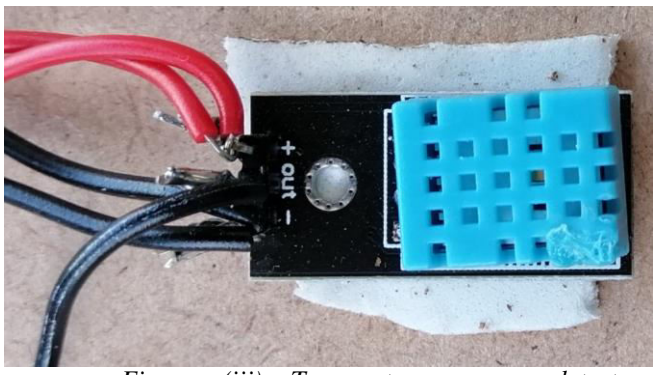


Figure (iii) Temperature sensor detects the temperature of the soil.

Temperature sensor:

It will detect the temperature of the surroundings if there is higher than the required temperature. Then, the cooler fan will turn on to lower the high temperature.

Cooler fan will automatically starts to run, tf the temperature is more than 35 deg celsius.

Temperature sensors are a simple instrument that measures the degree of hotness or coolness and converts it into a readable unit.

The basic principle of working of the temperature sensors is the voltage across the diode terminals. If the voltage increases, the temperature also rises, followed by a voltage drop between the transistor terminals of base and emitter in a diode.

Figure (iv) Cooler Fan

Moisture pH sensor :

The sensor to distinguish the minerals in the dirt. On the off chance that there is low measure of a specific minerals in the dirt, the sensor will inform us to put the minerals.

The Soil Moisture Sensor utilizes capacitance to quantify dielectric permittivity of the encompassing medium. In soil, dielectric permittivity is a component of the water content. The sensor makes a voltage corresponding to the dielectric permittivity, and subsequently the water substance of the dirt. The opposition between the two directing plates changes in a reverse way with the measure of dampness present in the dirt.

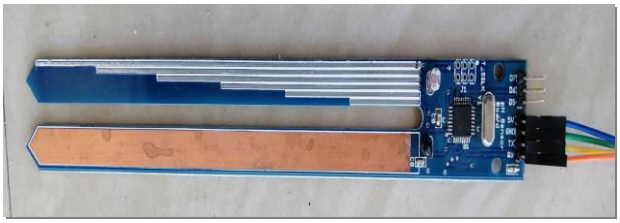


Figure (v) pH sensor

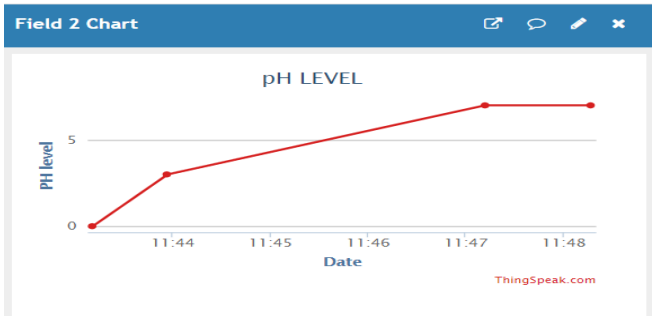
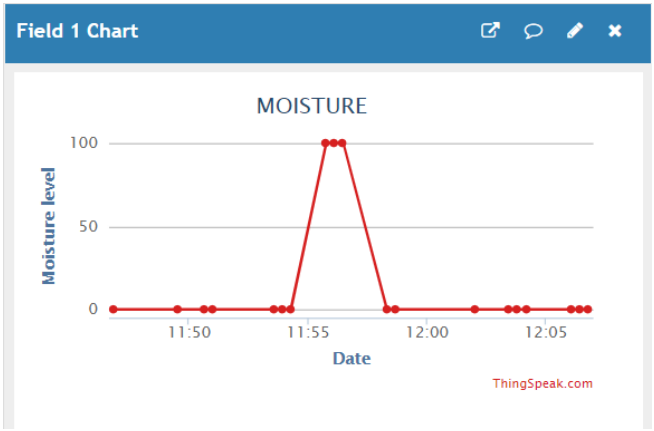


Figure (vi) pH level chart



Figure(vii) Moisture Reading chart

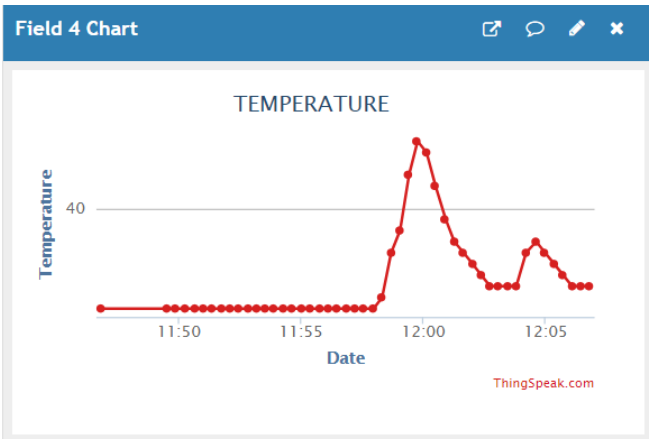


Figure (viii) Temperature level chart

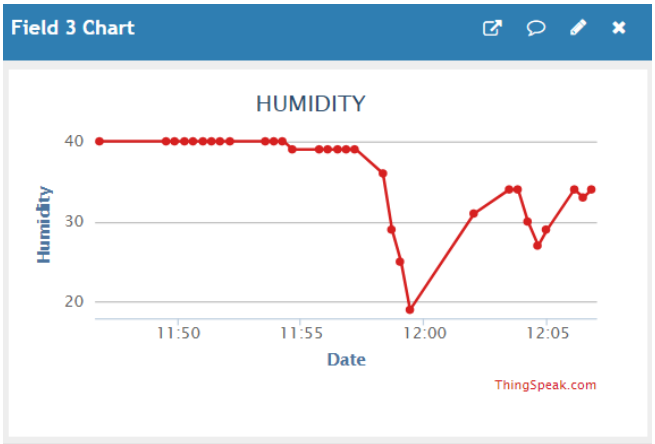


Figure (ix) Humidity level chart

Application User Interface :

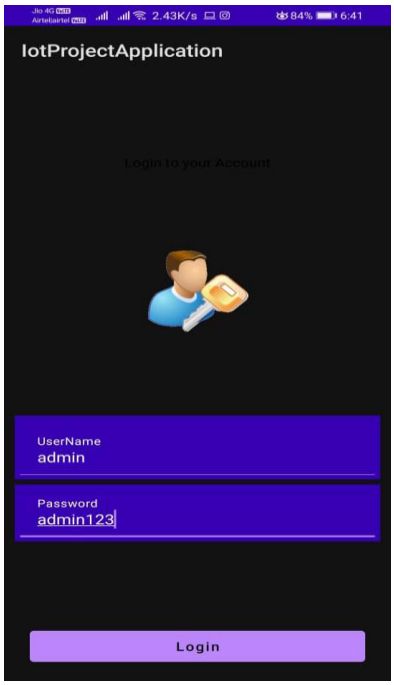


Figure (x) Application login interface

Figure(xi) Application dashboard page

In this application, we configured the requirements of temperature, humidity, soil moisture and pH level. Therefore, it will be notified us with the current level status of our greenhouse.

Futuristic work:

We are planning to implement this project to identify the water level present in tank by using the moisture sensor and if the water level is low, it will automatically detects and fill the tank by using the water motor.

It helps to avoid the field supply water motor to run, when the tank is empty.

Also, we would like to plan to fix the camera with night vision in field, to see the field whenever we wish at anytime and anywhere from our application itself.

Conclusion:

This paper is about maintaining the plant care systems at the greenhouse. Here, we integrated the sensor modules with the application and it can monitor the temperature level, soil moisture level and the detection of the minerals level in the greenhouse. It assists with saving water and service bills.

Also, our application will be notified with the status of temperature, humidity and soil moisture level.

For plant growth minerals also play a vital role on it, we can keep on eye on that also by using our application.

References:

1. O. Pandithurai, S. Aishwarya, B. Aparna and K. Kavitha, "AGRO-TECH: A DIGITAL MODEL FOR MONITORIN SOIL AND CROPS USING INTERNET OF THINGS (IOT)", 2017 IEEE Third International Conference on Science Technology Engineering & Management (ICONSTEM),Published : 2017.

2. Qing-Ying Ren; Li-Feng Wang; Jian-Qiu Huang; Cong Zhang; Qing-An Huang "Remote Sensing of Temperature and humidity by wireless sensors" , 2015 IEEE Third International Conference on Science Technology Engineering, Published: 2015.

3. Tomen:A Plant monitoring and smart gardening system using IoT Ramkumar.E, Nagarani.S, Roger Rozario A. P, Arjuman Banu.S

4. Suhas Athani; C H Tejeshwar; Mayur M Patil; Priyadarshini Patil; Rahul Kulkarni "Soil moisture monitoring using IoT enabled arduino sensors with neural networks", 2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), Published: 2017.

5. A.M. Ezhilazhahi; P.T.V. Bhuvaneswari "Plant soil moisture monitoring using wireless sensor networks" , 2017 Third International Conference on Sensing, Signal Processing and Security (ICSSS), Published: 2017.

6. Mohamed A. Elashiri; Ahmed T. Shawky, "Smart Greenhouses Using IoT" , 2018 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), Published: 2018.

7. Mokh. Sholihul Hadi; Pradipta Adi Nugraha; I Made Wirawan; Ilham Ari Elbaith Zaeni; Muhammad Alfian Mizar; Mhd Irvan , "Smart Garden Irrigation System", 2020 4th International Conference on Vocational Education and Training (ICOVET), Published: 2020.

8. Rahul Dagar; Subhranil Som; Sunil Kumar Khatri, "Smart Farming – IoT in Agriculture", 2018 International Conference on Inventive Research in Computing Applications (ICIRCA), Published: 2018.

9. Nisar Ahmad; Ali Hussain; Ihsan Ullah; Bizzat Hussain Zaidi, "IOT based Wireless Sensor Network for Precision Agriculture", 2019 7th International Electrical Engineering Congress (iEECON), Published: 2019.

10. Rubeena Aafreen; Salwa Yasmeen Neyaz; Raaziyah Shamim; M. Salim Beg, "IoT based system for telemetry and control of Greenhouse environment", 2019 International Conference on Electrical, Electronics and Computer Engineering (UPCON), Published: 2019.

11. V. Chaithra, C. Harshitha, K. T. Shwetha, U. R. Sowmyashri and S Ramesh, "IoT based Automated Polyhouse Monitoring and Control System", IJRESM, vol. 1, no. 5, pp. 9-11, may 2018.

12. K. Krishna Kishore, M. H. Sai Kumar and M. B. S. Murthy, "Automatic Plant Monitoring System", International Conference on Trends in Electronics and Informatics, pp. 744-748, 2017.

13) AT. R. V. Anandharajan, G. A. Hariharan, K. K. Vignajeth, R. Jijendiran and Kushmita, "Weather Monitoring", 2016 2nd International Conference on Computational Intelligence and Networks (CINE), pp. 106-111, 2016.

14)Dae-Heon Park, Beom-Jin Kang, Kyung-Ryong Cho, Chang-Sun Shin, Sung-Eon Cho, Jang-Woo Park, et al., "A Study On Greenhouse Automatic Control System Based Onwireless Sensor Network", Wireless Personal Communication Springer journal, vol. 56, pp. 117-130, 2011.

15)A. Tzounis et al., "Internet of Things In Agriculture Recent Advances and Future Challenges", Biosystems engineering, vol. 164, pp. 31-48, 2017.