An IOT based Automated Greenhouse Monitoring and Automatic Irrigation Control System using Arduino and Embedded Raspberry pi

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Abstract- This technology use to protect the plant from damage caused by Arid Regions and Unseasonal Rains. This technology makes better use of water. Fertilizer along with water provide for good growth and development of plant. With the help of this technology the water valve turns ON automatically when there is a need for water. The water valve automatically shuts OFF if not needed. Detect and Display Air Pollution indoors. Divide the field and placed soil moisture sensors each of the divide blocks, according to the soil moisture sensors. In rainy days, this technology makes the water valve fully packed. Water tanks make such a way that field with water level and measuring water level using an ultrasonic sensor. Temperature and air humidity are controlled by humidity sensor and temperature sensors to operate window automatically match environment condition in green house. A valve window and protection system control using iot system (using app or web). Green house utilizing solar system so energy saving is also increase. Due to iot connectivity farmer monitor current process (like which valve is open, tank level using ultrasonic sensor also plant live monitoring by camera) and also statically analysis of power consumption, water consumption, temperature and humidity data, etc. The water consumption monitor using water flow valve and also monitor water consumption. Raspberry pi process data and automation work also integrate with arduino for take low level data collection. For iot software use of BLYNK android mobile application for lives monitor and operation and Telegram Bot for notification.

Keywords: Iot, Agriculture, Farm analysis and Security, Raspberry Pi, Arduino, BLYNK, Telegram Bot

Introduction:

This project can be developed for far farm or dry area .By making good use of water through this project, enough water can be supplied to the plant. This reduces the vigor of weeds. The plant also needs to be provided with some periodic nutrition. This is a great option for the growth and development of the plant. Fertilizer will be given along with the water. It will reach every plant comfortably along with the water. With the help of this technology the water valve turns ON automatically when there is a need for water. The water valve automatically shuts OFF if not needed. Over time, air pollution also occurs inside the structure. Air pollution detectors have been used keeping this in mind. Due to the close structure, a close and open window has been placed to allow air inside and outside air.

Due to the lack of time and tower problems, it is necessary to meet the demand for good technology, which is automated. This can monitor and control even remotely. Facilities like call center pump on and off system are not getting the facilities as desired. Because of which new technology should be considered, which should be easy to control and monitor, and also that technology has a long life. Along with the other work, the demand to monitor the farm by phone and control the farm whose data is available on the phone. IOT is the solution to many problems. IOT is the first and good choice for remote monitoring and control. Whom anyone can control from anywhere.

A water tank make such a way that field with water level and measuring water level using an ultrasonic sensor. Temperature and air humidity are controlled by DHT11 to operate window automatically match environment condition in green house. A valve window and protection system control using iot system (using app or web). Green house utilizing solar system so energy saving is also increase. Due to iot connectivity farmer monitor current process (like which valve is open, tank level using ultrasonic sensor also plant live monitoring using camera) and also statically

analysis of power consumption, temperature and humidity data, water consumption etc. water consumption monitor using water flow valve and also monitor water consumption. Raspberry pi process data and automation work also integrate with arduino for take low level data collection. For iot software use of BLYNK mobile application for lives monitor and operation and Telegram Bot continuous log in for notification.

2. Motivation:

Overview of the farmers Problems:
Thought to create this system by negotiating with the farmers. Keeping in mind the prevailing circumstances, it is possible to solve the problems to some extent.

- Uses text sms service: Due to the lack of tower problems, it is necessary to meet the demand for good technology, which is automated and can monitor and control even remotely.
- Call center pumps use ON and OFF systems. Since the facilities are not available as intended, new technology should be developed which should be easy to control and monitor and should have a long lifespan.
- Along with college, the demand to monitor and control the farm by phone. The data should easily and securely available over the phone.

3. System implementation:

I. Block diagram

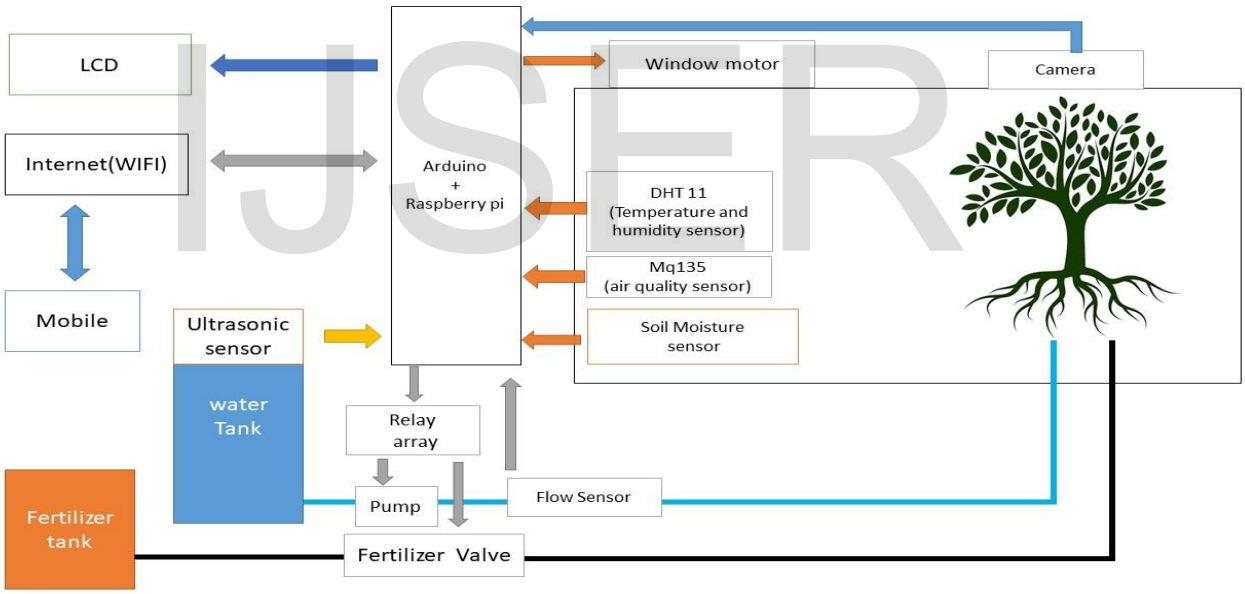


Fig.1 Block Diagram

Sensors (DHT 11, Air Quality, soil moisture, ultrasonic, water flow), components (LCD, window motor, camera, pump, water or compost valve) and processors (Arduino and Raspberry Pi) all are connected to the greenhouse. Arduino data taken and sent to the embedded Raspberry Pi via USB port. Raspberry Pi turns the relay ON and OFF by processing from Python programming. Data displays on LCD. Due to internet connectivity, the farmer can monitor live data like present state of pump and valve, fill in water tank camera view of farm, environment condition, etc and also remotely operate valve and pump if needed.

II. Processors

i. For collecting data **Ardiuno NANO:**

Here, in this system used Arduino to take data from sensors which are connected to greenhouse with digitally input and digitally output as well as transmit and receive. It comes with small size.

ii. Processing and utilize data **RASPBERRY PI:**

This is the latest product in the raspberry pi B+ 3 range, 64 bit quad core processor, wireless LAN, faster Ethernet and 40 GPIO pins(for input and output), Bluetooth 4.1, 1GB ram, 4 USB ports (mouse, keyboard pen drive, external Wi-Fi etc.), full HDMI port(connect monitor), 3.5mm audio jack and composite video, camera interface(web cam or digital cam), micro SD card slot(storage), video core IV 3D graphics core, micro usb port(less power consumption) we can use as minicomputer.

III. Farmer user interfaces

i. **BLYNK application:**

For iot base remote monitoring and control of live data blynk platform is suitable due to easy of use.

ii. Telegram Bot :

Telegram bot is chat bot that can communicate with person using script. In this system telegram bot can update farmer about state of farm like pump, valve, etc. Telegram bot also provide data if farmer ask present environmental and situation report.

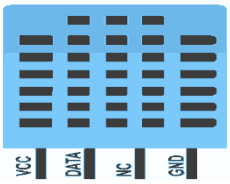
IV. Components

Taking components as per requirement. These are as follow.

i. MQ135 (Air quality sensor):

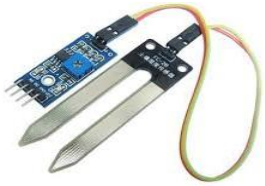
MQ135 take to measure air quality, smoke and Gas leaks. Used for family, surrounding environment and other gas detection.

ii. DHT11 (temperature and humidity sensor):



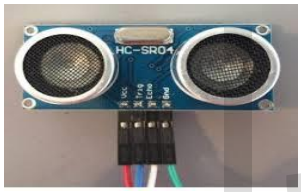
DHT11 used to sense of temperature and humidity. It connected to micro controller (such as arduino, raspberry pi etc).

iii. Soil Moisture Sensor:



Two Rod plates put in the soil and Measure the value of soil (water is a good conductor) current flows through Rod to soil, read the value and send data to Arduino through analog pins.

iv. Ultrasonic Sensor:



There are 4 pins. Trigger pin is used to transmit data and echo pin is used to receive data come from ultrasonic. This echo pin becomes output pin at arduino board, and sends data.

v. Water flow sensor:

As the water flows, the fan will rotate, and will count its rpm (rotation per minute) and send signals to the digital processor.

vi. Raindrop Sensor:

When a small amount of water is sprayed, the digital output decreases, the switch indicator turns on. And this raindrop sensor used to take a high level of output when the water droplets are restored to the initial state when cleaned.

V. Flow diagram:

Using Arduino, data collected from sensors (such as temperature and humidity, air quality, soil moisture, ultrasonic, water flow) and transfer to Embedded Raspberry
Pi using USART (comp port) and separates it through Python scripting. And the loaded data from the Separated data on Blynk Server, Displaying on 20x4 LCD. And farmer gets information up to date.

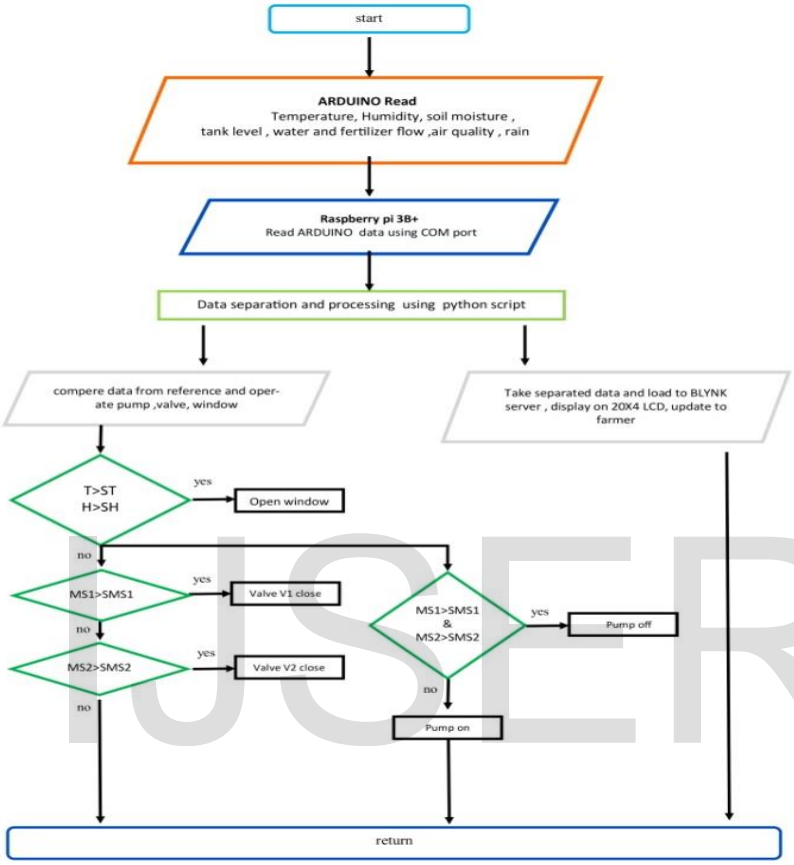


Fig.2 flow chart

Comparison of data T> ST (set temperature), H> SH (set humidity) which is set level and managed by management references. MS1> SMS1 (Set Humidity Sensor 1) has set the level, valve open if level rises and MS2> SMS2 (Set Humidity Sensor 2) valve closes if it falls below set level. And the pump opens or closes when both the conditions> MS1> SMS1 & MS2> SMS2 come together.

VI. Hardware implementation:

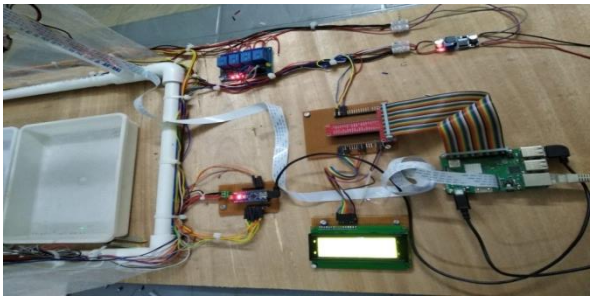


Fig.3.Hardware analytic result

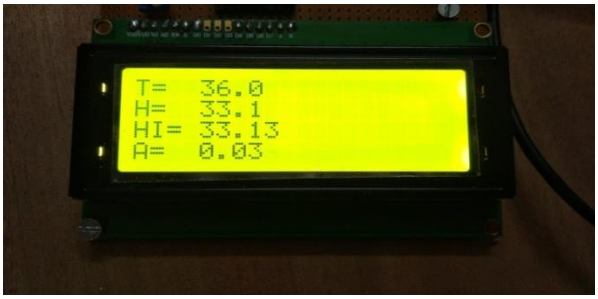


Fig.4 LCD displaying parameters value

Followed the stages below to develop this system.

1st Stage:

- Tried to implement this technique.
- All sensors are connected to arduino. First, the data from sensor is taken. The data is received by Raspberry Pi via the USB port.
- Data from Raspberry Pi will be utilized in python programming scripting.

2nd stage:

- The data will take its place according to the process of the sensor used.
- The valve or pump in this system is open or closed. This will be done by Raspberry pi relay.
- The relay will operate the pump and valve (ON or OFF). The remaining data will be displayed on the LCD.

3rd stage:

- Embedded Raspberry Pi is based on Python scripting.
- All data (humidity, temperature, air quality etc.) are loaded on the BLYNK server.
- A farmer can get data on Telegram Bot.
- Flow sensor measures flow of water and fertilizer. So, farmer can evolution of consumption of water and fertilizer can help to predict future expensive.
- Due to Ultrasonic sensor, system can measure the level of fill tank ideally of water and fertilizer.

4. Farmer Intersection:

Possibility to control remotely controls environment of greenhouse and also perform live observation using embedded Arduino and raspberry Pi. Iot is good choice for remote monitoring and control.

Fig.5 Telegram Bot server *Fig.6 BLYNK app server*

5. Conclusion: The temperature, humidity and air quality are helps to grow plant more efficiently under observation. Update results are displayed on LCD. By Iot system, the data are delivering in real time data by Telegram bot and Blynk application. So, we can observe, controlling and live monitoring at our handset.
Conventional results conclude that our system provides solution for automatic greenhouse irrigation activities.

6. **Future work:**

- The current system runs on a local server. Working on a web server in the future.
- Data processing is delayed, so in future speed of processing and increase productivity is main priority.

References:

[1] Vimal, P. V., & Shivaprakasha, K. S.: " IOT based greenhouse environment monitoring and controlling system using Arduino platform," 2017 (ICICICT).
[2] Pranjali D. Shiyale, Hemangi Thombre, Gautam Tyagi, Aarti Chauhan, "IOT-Based Smart Greenhouse Automation" Department of Electronics Engineering Nagpur, India, IJCRT may 2020.
[3] Pooja P. Korade1, Amruta A. Pandav2, Varsha R. Kamble3,Varsha M. Swami 4, Madhuri N. Sachane, "IOT BASED ADVANCED GREENHOUSE SYSTEM" Department of Electronics &Telecommunication Engineering Sharad Institute of Technology, College Of Engineering Yadrav, Maharashtra India June 2020
[4] Manasi R. Kulkarni , Neha N. Yadav , Sanket A. Kore-Mali, Prof. Saurabh R. Prasad, "GREENHOUSE AUTOMATION USING IOT" ,Department of Electronics and Telecommunication Engineering, DKTE Society's, Textile and Engineering Institute, Ichalkaranji, India, April 2020
[5] ShreyasBhujbal, Yash Deshpande,Arpit Gupta,Ojas Bhalsekar ,"IOT Based Smart Greenhouse" B.Tech Scholars, Department of Electronics Engineering, Viswakarma Institute of Technology, Pune,India IJIRSET.2018
[6] Neel P.Shah, Priyang P.Bhatt, "Greenhouse Automation and Monitoring Syetem design and implementation",department of computer engineering,G.H.patel college og Enginnering and Technology, V.V.Nagar,Anand, Gujarat, india IJARCS December 2017.
[7] Prof.D.O.Shirsath,Punam kamble,Rohini Mane,Ashwini Kolap, Prof.R.S.More ,"IOT Based Smart Greenhouse Automation Using Arduino" IJIRCST March 2017

[8] Dr. Jennifer S.Raj , J Vijitha ananthi ,"Automation using IOT in Greenhouse Environment" department of Electronic and Communication Engineering, Gnanamani college of technology, Namakal, india JITDW 2019
[9] MD Jiabul Hoque,MD.Razu Ahmed and Saif Hunnan, " An automated Greenhouse Monitoring and Controlling System ising Sensors and Solar Power" international Islamic University Chittagong EJERS April 2020
[10] Prof. C.R.Dongarsane,Mr.Patil Pranav Balasaheb, Mr.Patil Nilesh Rangrao, Mr.Patil Pranit Ramesh, "Greenhouse Automation using IOT" Sanjeevan Engineering Institute and Technology,Panhala,Department of E&TC IRJET Jan 2017
[11] Arduino cookbook, 2nd edition, author-Michael Margolis
[12] Learning internet of things, author-Peter Waher
[13] iot with raspberry pi and arduino, author- Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain
[14] Learning IoT with Python and Raspberry **Pi,** authors Elizabeth I. Horvath, Eva A. Horvath