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App based Garden Bot for Regulation of Water Level in plants

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Abstract - *An automated irrigation system is developed to optimize the use of water for plants and verify water scarcity problem. It is difficult to manually assess the amount of moisture required in the soil for the healthy growth of plants therefore the soil is either left dry for a long period of time, or flooded unnecessarily hence both destroy the nutrients and minerals from the soil that are vital for the plants. In this paper app based garden bot is developed for the automatic regulation of water level in plants. The system uses Raspberry Pi board as a base and low cost capacitive sensors for providing the low power consumption and cost effective solution to automatic irrigation of plants. The system is programmed using Python and Java based App where the communication between them is carried out based on the concept of socket forwarding.*

Key Words: Agriculture,Sensor, Irrigation system,Garden Bot,Android Application.

1. INTRODUCTION

The optimal quantity of water is vital to the growth of plants where the level of moisture in the soil is one of the factors responsible for the healthy growth of plants. Due to limited water resources and water scarcity it is important to make efficient use of water resources for the quality growth of plants. The objective of irrigation system is to provide the adequate supply of water to plants. The manual irrigation system is not sufficient for efficient use of water resources.

In accordance to the shortage of water and fluctuating weather conditions, the automated Irrigation system is crucial when the plants can't be automatically watered when the people are away from their homes and irregular watering leads to mineral loss in the soil and end up the rotting of plants. Thus the automated irrigation system provides solution to the problem of watering from remote location, adequately sensing the soil moisture for the adequate supply of water to plants for their healthy growth. The android based garden bot using raspberry pie and capacitive sensors provides a low cost and power consumption solution for automatic irrigation system. The proposed automated irrigation system works on self made capacitive sensors and a Raspberry pi board (ensuring minimal cost and power consumption) for automatic irrigation using an android app based on sensor input and microcontroller.

In this paper a design is proposed for automated irrigation system using Raspberry microcontroller and low cost capacitive sensors. A capacitive sensor is used to measure soil moisture and is inserted at various positions near to the plants. The sensor output is given to raspberry microcontroller. The level of water sensed by sensors is used as input to decide the manual/automatic on or off of motor controlling the supply of water to plants. Thus the automatic irrigation system has shown to be valuable in optimizing the use of water efficiently based on direct soil water measurements.

2. RELATED WORK

In [13] GSM based Home automation system is developed using App-Inventor for android mobile phone. In [14] android based automated irrigation system is developed using raspberry. A fully automated drip irrigation system is controlled and monitored by using Raspberry Pi. In [4] soil moisture, temperature and pressure sensors are used to monitor the irrigation operations. Simulation results prove promising. In [11] distributed wireless network of soil and temperature sensors are distributed in the root zone of plants. An algorithm was developed based on threshold values of sensors and programmed into a microcontroller-based gateway for controlling water quantity. In [18] small embedded system device (ESD) is developed for whole irrigation process.

In [2] user's on/off command for irrigation system is processed at raspberry pie using python script and arduino microcontrollers receive commands from raspberry pie using zigbee protocol. In [6] automated irrigation system is designed by using controllable parameter such as temperature, soil moisture and air

humidity as they are the important factors to be controlled in PA(Precision Agriculture). In [12] real-time spatial interpolation is proposed using nearby AWS to predict real-time local weather parameter. A correction technique is also proposed by using sparse WSN with soil moisture sensor installed in it. In [3] wireless irrigation system for a smart home garden is integrated with existing smart home control systems. The system containing slave nodes and a master station is equipped with a wireless microcontroller.

In [20] the system containing distributed wireless sensor network of soil moisture, and temperature sensors is placed in the crop field. Zig bee protocol is used for handling the sensor information and the water quantity is controlled using an algorithm based on threshold values of the sensors. In [17] an FPGA based irrigation control system is proposed. In [7] GSM and web application based real time automatic irrigation system is proposed using raspberry pi2 and 8051. In [21] Home Automation system based on android is designed to automate the 8 bit Bluetooth interfaced microcontroller to control a number of home appliances. In [24]GSM Based Automated Irrigation Control using Rain gun Irrigation System is proposed . The microcontroller based rain gun irrigation system is automated to irrigate the fields when there is intense requirement of water.

In [22] GSM based Automatic Irrigation Control System is proposed for efficient use of resources and crop planning by using an Android Mobile. In [23] Irrigation Control System Using Android and GSM is proposed for Efficient Use of Water and Power. In [16] distributed Wireless Sensor Network is proposed for remote sensing and control of an irrigation system. In[10] Automatic Plant Irrigation System is proposed based on Microcontroller. In [9] A wireless drip irrigation automation is proposed using soil moisture sensors. In [25] remote control of irrigation using mobile phone based on embedded application. In [15] Android smartphone is proposed for control of Home appliances. In [1] wireless sensor network is used for control of irrigation and real time monitoring of water content of soil using sensors. In [8] a Green House Automation is proposed using Zigbee and Smart Phone.

In [5] Raspberry pi based system is proposed for automatic control of water motor and plant growth using web cam and live streaming of farm is shown on android mobiles using wifi. In [19] hardware implementation of multiplatform control system is proposed for house automation using both hardware and software technologies.

3. PROPOSED SYSTEM

The Android app is developed using Java to interface with raspberry pie microcontroller. The app provides the user interface to authenticate the user identity for automation of irrigation system. The user login information is stored in the database and is retrieved to verify the identity of authenticated users. The users upon successful login send the sensor data request to microcontroller and the requested data is retrieved from the sensor database to identify the water level in plants. Thus upon receiving the sensor data on android app it is processed using water level threshold in order to give on/off command to microcontroller. Hence the microcontroller upon receiving the on/off command from user, the motor is on/off accordingly for the supply of water to plants.

The python script is run on microcontroller to process the command received from android and store the sensor data in database. The block diagram of the android app and its interfacing is given below in Figure 1.

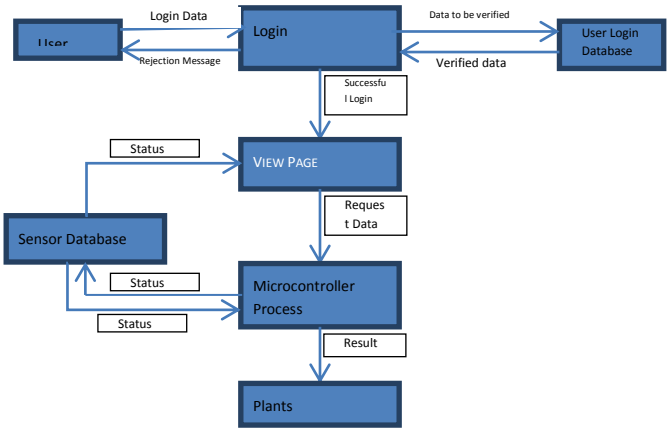


Figure 1: Block diagram of android app and its interfacing

4. System Methodology

The layout of the proposed system is given below in Figure 2. The android app interface with the server is done using

Wifi/3G Network. The interfacing of microcontroller with server and sensor is done using USB to serial bridge.

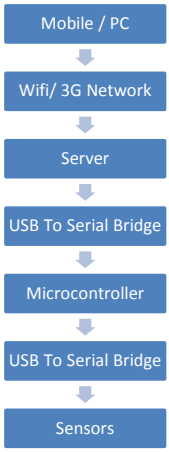


Figure 2 : Layout of the Proposed System.

The flow of the steps involved in the working of the system is given below.

Steps

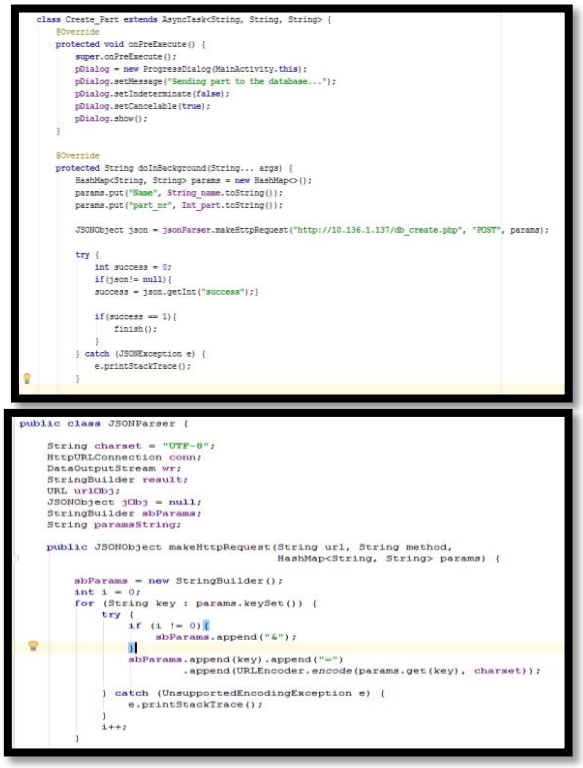
1) Start
2) Database created on the raspberry pi's apache server
3) Sensor readings are stored in database
4) App retrieves water level reading of soil
5) App commands the action to be performed
6) Server sends the signal to the system.

End

5. Experiment

The experiment was conducted to test the automatic control of irrigation using android based app, raspberry pi and low cost capacitor sensors. The hardware requirements are: an android phone/emulator from android studio, raspberry pi (2B), Internet connection with port 80 forwarded to the IP of Raspberry Pi. The software requirements are : android studio, raspbian OS for the Raspberry PI, Apache 2 for the server to be run on the Pi ,PHP to create, modify and manage the databases and MySQL for the databases.

The database is created using server side php scripting. On client side java,json parser library is used for making the app and the server communication. JSON Parser library is used for parsing the PHP code to Java and vice-versa, thus making app and the server, both, to comprehend the parameters correctly and the Http connection is established. The Snap shot of json library and httpconection with raspberry is given below in Figure 3.



```
class Create_Part extends AsyncTask<String, String, String> {
    @Override
    protected void onPreExecute() {
        super.onPreExecute();
        pDialog = new ProgressDialog(MainActivity.this);
        pDialog.setMessage("Sending part to the database...");
        pDialog.setIndeterminate(false);
        pDialog.setCancelable(true);
        pDialog.show();
    }

    @Override
    protected String doInBackground(String... args) {
        HashMap<String, String> params = new HashMap<>();
        params.put("Name", String_name.toString());
        params.put("part_nr", Int_part.toString());

        JSONObject json = jsonParser.makeHttpRequest("http://10.136.1.137/db_create.php", "POST", params);

        try {
            int success = 0;
            if(json!= null){
            success = json.getInt("success");}

            if(success == 1){
                finish();
            }
        } catch (JSONException e) {
            e.printStackTrace();
        }
```

```
public class JSONParser {

    String charset = "UTF-8";
    HttpURLConnection conn;
    DataOutputStream wr;
    StringBuilder result;
    URL urlObj;
    JSONObject jObj = null;
    StringBuilder sbParams;
    String paramsString;

    public JSONObject makeHttpRequest(String url, String method,
                                      HashMap<String, String> params) {

        sbParams = new StringBuilder();
        int i = 0;
        for (String key : params.keySet()) {
            try {
                if (i != 0){
                    sbParams.append("&");
                }
                sbParams.append(key).append("=")
                        .append(URLEncoder.encode(params.get(key), charset));

            } catch (UnsupportedEncodingException e) {
                e.printStackTrace();
            }
            i++;
        }
```

Figure 3: SnapShot of JSON Parser and http connection with Raspberry Pi.

The Android studio emulator is used for simulation of app communication with raspberry pie for send/receiving data based on post method. Snapshot of app simulation is given below in Figure 4.

Figure 4 : SnapShot of emulator simulation of Client App and its GUI interface.

6. Advantages

- Use of Low cost capacitor sensors for sensing soil moisture.
- Labor cost is reduced
- Efficient use of water resource using app based automatic control of irrigation..
- Self learning of the proposed system based on simulations in order to obtain the optimal setting of sensors for supply of adequate amount of water using app.

7. CONCLUSIONS

In this paper android based garden bot is proposed for automatic irrigation of plants. The system makes use of low cost capacitor sensors for sensing the soil moisture. The android app is programmed to retrieve the sensor data from raspberry pi microcontroller and enables the user to control the water supply for irrigation automatically. The system is run for several simulation using sensor reading and user input in order to obtain the optimal setting of sensors for automatic irrigation. By continuously monitoring the status of the soil, the flow of water can be controlled and thereby reduce the wastage. The design is low power, low cost, small size, robust and highly versatile. Thus, this system avoids over irrigation, under irrigation and reduces the wastage of water. The main advantage is that the system's action can be changed according to the situation (crops, weather conditions, soil etc.). By implementing this system, agricultural, horticultural lands, parks, gardens can be irrigated.

REFERENCES

[1] Adamchuk, V. I., Hummel, J. W., Morgan, M. T., & Upadhyaya, S. K. (2004). On-the-go soil sensors for precision agriculture. *Computers and electronics in agriculture*, *44*(1), 71-91.

[2] Agrawal, N., & Singhal, S. (2015). Smart drip irrigation system using raspberry pi and arduino. In *International Conference on Computing, Communication & Automation (ICCCA),* 928-932, IEEE.

[3] Al-Ali, A. R., Qasaimeh, M., Al-Mardini, M., Radder, S., & Zualkernan, I. A. (2015). ZigBee-based irrigation system for home gardens. In International Conference on Communications, Signal Processing, and their Applications (ICCSPA), 1-5, IEEE.

[4] Bennis, I., Fouchal, H., Zytoune, O., & Aboutajdine, D. (2015). Drip Irrigation System using Wireless Sensor Networks. In *Federated Conference on Computer Science and Information Systems (FedCSIS),* . 1297-1302, IEEE.

[5] Chate, B. K., & Rana, J. G. (2016). SMART IRRIGATION SYSTEM USING RASPBERRY PI.

[6] Chikankar, P. B., Mehetre, D., & Das, S. (2015). An automatic irrigation system using ZigBee in wireless sensor network. In *International Conference on Pervasive Computing (ICPC),* 1-5, IEEE.

[7] Dhanekula, H., & Kumar, K. K. (2016). GSM and Web Application based Real-Time Automatic Irrigation System using Raspberry pi 2 and 8051.*Indian Journal of Science and Technology*, *9*(17).

[8] Dhumal, Y. R., & Chitode, J. S. (2013). Green house automation using Zigbee and smart phone. *International Journal of Advanced Research in Computer Science and Software Engineering Research Paper*, *3*(5).

[9] Dursun, M., & Ozden, S. (2011). A wireless application of drip irrigation automation supported by soil moisture sensors. *Scientific Research and Essays*, *6*(7), 1573-1582.

[10] Gunturi, V. N. R. (2013). Micro controller based automatic plant irrigation system. *International Journal of Advancements in Research & Technology*,*2*(4), 194-198.

[11] Gutiérrez, J., Villa-Medina, J. F., Nieto-Garibay, A., & Porta-Gándara, M. Á. (2014). Automated irrigation system using a wireless sensor network and GPRS module. *IEEE transactions on instrumentation and measurement*,*63*(1), 166-176.

[12] Hema, N., & Kant, K. (2014). Local weather interpolation using remote AWS data with error corrections using sparse WSN for automated irrigation for Indian farming. In *International Conference on Contemporary Computing (IC3), 2014 Seventh* , 478-483,. IEEE.

[13] Jivani, M. N. (2014). GSM Based Home Automation System Using App-Inventor for Android Mobile Phone. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*, *3*(9).

[14] Jadhav, S., & Hambarde, S.(2016). Android based Automated Irrigation System using Raspberry Pi, *International Journal of Science and Research* , 5(6),2345-51.

[15] Khadke, S. K. (2014). Home Appliances Control System Based On Android Smartphone. *IOSR Journal of Electronics and Communication Engineering*,*9*(3), 67-72.

[16] Kim, Y., Evans, R. G., & Iversen, W. M. (2008). Remote sensing and control of an irrigation system using a distributed wireless sensor network. *IEEE Transactions on Instrumentation and Measurement*, *57*(7), 1379-1387.

[17] Lai, Z., & Dai, Y. (2012). An Irrigation Control System Based on an FPGA. In *Second International Conference on ,Instrumentation, Measurement, Computer, Communication and Control (IMCCC), 2012,* 159-163, IEEE.

[18] Malge, S., & Bhole, K. (2015). Novel, low cost remotely operated smart irrigation system. In *International Conference on Industrial Instrumentation and Control (ICIC),* 1501-1505, IEEE.

[19] Mowad, M. A. E. L., Fathy, A., & Hafez, A. (2014). Smart home automated control system using android application and microcontroller. *International Journal of Scientific & Engineering Research*, *5*(5), 935-939.

[20] Nisha, G., & Megala, J. (2014). Wireless sensor Network based automated irrigation and crop field monitoring system. In *2014 Sixth International Conference on Advanced Computing (ICoAC)* ,189-194,. IEEE.

[21] Panth, S., & Jivani, M. (2013). Home automation system (HAS) using android for mobile phone. *International Journal of Electronics and Computer Science Engineering ISSN-2277-1956*.

[22] Pavithra, D. S., & Srinath, M. S. (2014). GSM based Automatic Irrigation Control System for Efficient Use of Resources and Crop Planning by Using an Android Mobile. *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN*, 2278-1684, 49-55.

[23] Shabadi, L., & Patil, N. (2014). Nikita. M, Shruti. J, Smitha. P and Swati C,"Irrigation Control System Using Android and GSM for Efficient Use of Water and Power". *International Journal of Advanced Research in Computer Science and Software Engineering*, *4*(7).

[24] Suresh, R., Gopinath, S., Govindaraju, K., Devika, T., & Vanitha, N. S. (2014). GSM based Automated Irrigation Control using Raingun Irrigation System. *International Journal of Advanced Research in Computer and Communication Engineering*, *3*(2).

[25] Sumeetha, S., & Sharmila, D. (2012). Embedded based Remote Control Application using Mobile Phone in Irrigation. *Bannari Amman Institute of Technology, Sathyamangalam, Tamil Nadu, INDIA*.