IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

I-FARM: An Automatic Drip Irrigation System

Prof. N. R. Talhar[1], Gaikwad Anjali[2], Ghodke Agraja[3], Minal Kumavat[4], Swapnali Shinde[5]

Department of Computer Engineering, AISSMSCOE, Pune, India[1, 2,3,4,5]

Abstract: Reduction and deficiency in fresh water resources globally has raised serious alarms in last few years. Efficient management of water resources play an important role in the agriculture sector. Unfortunately, this is not given prime importance in the world countries because of adhering to traditional practices. This paper presents a smart system that uses sensors to control water supply in agriculture fields. Sensor values are sent to the centralized server through Wi-Fi communication modules. A user friendly interface is build to visualize the daily data. The users can control irrigation using their smart phone as well.

Keywords: Automation, Android Phone, WI-FI, sensor, cloud server.

I. INTRODUCTION

Agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial, and institutional improvements.

There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. For instance, the one system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page**.** [1]

MobiCrop was a system designed as a mobile distributed system that follows a three-layered deployment; comprising of mobile nodes, a cloud-hosted middleware, and a cloud-hosted database server. Since the data that is being pushed to the mobile is resident on the database server, caching methodology on the mobile has been proposed to support offline accessibility of pesticide information. They have adapted the dual caching technique to store data on the mobile and on the middleware. [2]

WSN is the best way to solve the agricultural problems related to farming resources optimization, decision making support, and land monitoring. This approach provides real-time information about the lands and crops that will help farmers make right decisions. Automatic irrigation will optimize the usage of water and fertilizer and furthermore maintain the moisture level and healthiness of the plant. [3]

In addition, other systems proposed a soil moisture sensor at each place where the moisture has to be monitored. Once the moisture reaches a particular level, the system takes appropriate steps to regulate or even stop the water flow. The circuit also monitors the water in the water source so that if the water level becomes very low, it switches off the motor to prevent damage to the motor due to dry run. [5]

In this paper, the development of the deployment of the simulation of an automated irrigation system based on microcontrollers and wireless is presented. The aim of the implementation was to demonstrate that the automatic irrigation can be used to optimize the water usage.

II. SYSTEM ARCHITECTURE

I-Farm is basically based on main four modules Admin PC, Android Application, Cloud server and hardware. Interaction of all modules is given below in block diagram [Fig1].

Admin PC, Android app and cloud servers are connected to each other through Wi-Fi network. Communication between them occurs through this network only.

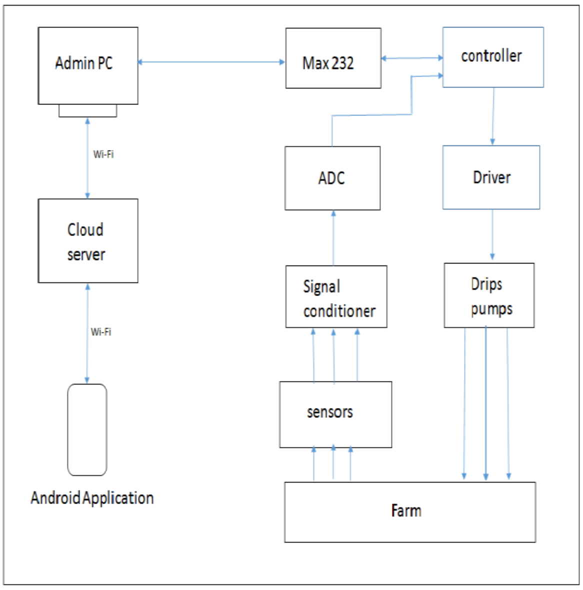

Fig1. Block Diagram of system.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

III. HARDWARE IMPLEMENTATION

Integrated Chips:

In this system mainly three IC's has been used: ATmega32, MAX232, ULN2803.

1. **ATmega32**: It is used because of; ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. Because of these features we are using ATmega32 microcontroller.
2. **MAX232**: The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide TIA-232 voltage level outputs (approx. ± 7.5 volts) from a single five volt supply via on-chip charge pumps and external capacitors. This makes it useful for implementing TIA-232 in devices that otherwise do not need any other voltages. The receivers reduce TIA-232 inputs, which may be as high as ± 25 volts, to standard five volt TTL levels. These receivers have a typical threshold of 1.3 volts and a typical hysteresis of 0.5 volts.
3. **ULN2803**: A ULN2803 is an Integrated Circuit (IC) chip with a High Voltage/High Current Darlington Transistor Array. It allows you to interface TTL signals with higher voltage/current loads. In English, the chip takes low level signals (TLL, CMOS, PMOS, NMOS - which operate at low voltages and low currents) and acts as a relay of sorts itself, switching on or off a higher level signal on the opposite side. The ULN2803 comes in an 18-pin IC configuration and includes eight (8) transistors. Pins 1-8 receive the low level signals; pin 9 is grounded (for the low level signal reference). Pin 10 is the common on the high side and would generally be connected to the positive of the voltage you are applying to the relay coil. Pins 11-18 are the outputs (Pin 1 drives Pin 18, Pin 2 drives 17, etc.).

Power Supply:

For power supply transformer, diode bridge, capacitor, 7805 and 7812 ICs has been used.

1. **Transformer**: Used transformer was Step down transformer. That has been used to decrease actual voltage (230v AC) to 0-15v AC.
2. **Diode Bridge**: Diode Bridge is AC to DC convertor. That has been used to convert voltage from AC to DC, as per the requirement of all other ICs.
3. **Capacitor**: Capacitor has been used to remove fluctuation of AC voltage from DC voltage Generated by Diode Bridge.
4. **7805 and 7812 ICs**: This ICs has been used to generate the voltage of 5V and 12V respectively. ULN2803 and Relay board operated on 12V and all other circuit voltage were 5V.

Sensors and Device:

Used sensors were Soil Moisture, Water Level, Humidity, Light (Brightness) and device is Motor which is 12V 100 rpm.

The sensor values are fed into the ADC of the microcontroller for processing. A switching device (ULN2803), in form of a relay, controls the actuator, which in turn controls the irrigation in the field. The digital values of sensors are transferred to the server, which stores, update and route the data to user. The microcontroller and PC are connected to each other using MAX232, which converts the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The microcontroller is programmed with the embedded C language.

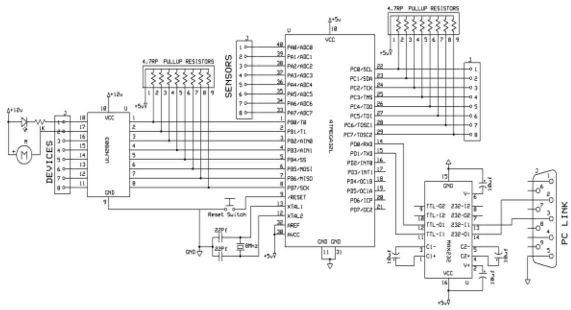

Fig2. Circuit Diagram for hardware module

IV. SOFTWARE IMPLEMENTATION

We have developed a GUI using Java on the admin PC through which users can have access over the farm (only the authenticated user). They can check for the values, change the threshold value and even can turn on the device as required. They can also select the mode of operation like auto mode or prediction mode or manual mode.

In auto mode, if the values of sensors have reached beyond the threshold, then the respective devices will get turned on automatically.

While in prediction mode, we have used the naive bayes algorithm to predict which device to be turned on based on sensor values. We also have developed an android application for the users so that they can have control over the farm from their home too.

Data gathered from sensors is given to Admin PC through USB port. This data is also fed into server continuously. When Android user is allowed to operate farm, from Admin PC this data is also provided to Android app.

Admin PC can change threshold, test devices and sensors, allow control to Android app, change the mode (manual, auto, prediction mode).

GUI is shown in Fig 3. Android user has limited operations only such as he can change threshold or can on/off devices.GUI is shown in Fig 4.

IJARCCE

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

As server, Admin PC and Android app are on Wi-Fi network Admin and app user has to give IP address of hotspot (access point).

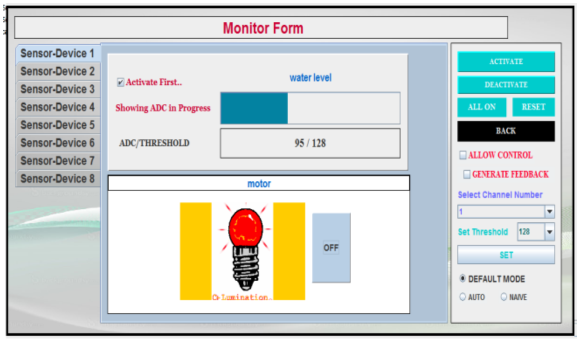

Fig3. Main GUI/form of Admin PC

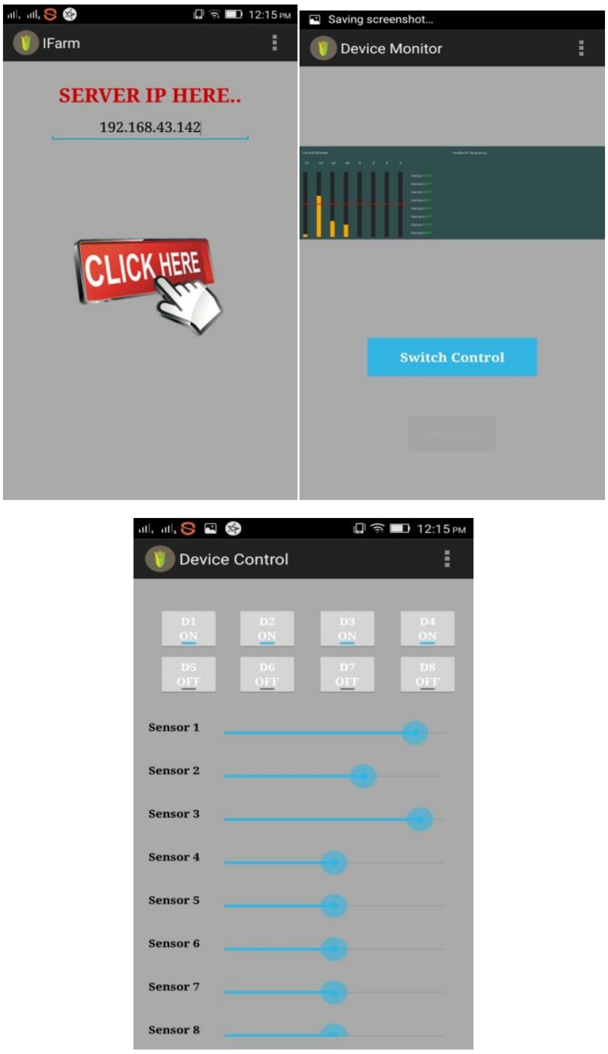

Fig4. GUI of Android App.

V. ALGORITHM USED

For prediction mode Naive Bayes algorithm is used. It is a simple probabilistic classifier, based on Bayes theorem. It requires a small amount of training data. Moreover, the training time with Naive Bayes is significantly smaller. Naive Bayes is used when you have limited resources in terms of CPU and Memory. Following is an instance of algorithm used in system. In following table values of sensors are 0, 1, 2. 0 is for low value of sensor, 1 is for mid and 2 is for high value for sensor. And Device_status 1 is for indicating ON status and 0 for OFF status.

Table1. Data set for Naive bayes algorithm

Sensor1	Sensor2	Sensor3	Device_Status
0	1	2	1
1	0	1	0
2	0	0	0
0	2	1	0
1	2	0	1

Data Sample is: {sensor 1=0, sensor 2=2, sensor 3=0}
Two classes are: C1 = Device_status = on.
C2 = Device_status = off.

P(Ci): P(Device_status = on) = 2/5 = 0.4
P(Device_status = off) = 3/5= 0.6

Compute P(X |Ci) for each class
P(sensor 1 = 0 | Device_status = on) = 1/2 = 0.5
P(sensor 1 = 0 | Device_status = off) = 1/3 = 0.33
P(sensor 2 = 2 | Device_status = on) = 1/2 = 0.5
P(sensor 2 = 2 | Device_status = off) = 1/3 = 0.33
P(sensor 3 = 0 | Device_status = on) = 1/2 = 0.5
P(sensor 3 = 0 | Device_status = off) = 1/3 = 0.33

X = {sensor 1=0, sensor 2=2, sensor 3=0}

P(X|Ci) : P(X|Device_status = on) = 0.5*0.5*0.5=1.5
P(X|Device_status = off) = 0.33*0.33*0.33=0.99
P(X|Ci)*P(Ci) :
P(X|Device_status = on) * P(Device_status = on) = 0.6
P(X|Device_status = off) * P(Device_status = off) = 0.594

Hence X belongs to class ON.

VI. CONCLUSION AND FUTURE WORK

We developed a system named I-Farm is an automatic water irrigation system. I-Farm totally operates on outputs from sensors and immediate action of farming devices on that outputs. Main components are :

- Admin PC and Java based application.
- Hardware.
- Android Application.
- Cloud server.

I-Farm is low cost, scalable, reliable system. This system is useful to farmer to reduce workload and helps in water conservation and proper utilization.

If we deploy I-Farm on large scale as our system is a simulation only, initial cost will be high but it will be beneficial to Indian farming.

In this system further features can be added such as mobile alerts through messages, app for different mobile platforms.

ISSN (Online) 2278-1021
ISSN (Print) 2319 5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 5, Issue 3, March 2016

ACKNOWLEDGEMENT

Apart from our own, the success of this project depends largely on the encouragement and guidelines of many others. We are especially grateful to our guide **Prof. N.R. Talhar** and **Prof D. P. Gaikwad,** Head of Computer Engineering Department, AISSMSCOE who has provided guidance, expertise and encouragement. We are thankful to the staff of Computer Engineering Department for their cooperation and support. We would like to put forward our heartfelt acknowledgement to all our classmates, friends and all those who have directly or indirectly provided their over whelming support during this project work and the development of this report.

REFERENCES

[1]. Joaqun Gutirrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel ngel Porta-Gndara, Automated Irrigation System Using a Wireless Sensor Network and GPRS Module, IEEE transactions on instrumentation and measurement, vol. 63, no. 1, january 2014.

[2]. Richard K. Lomotey, Yiding Chai, Shomoyita Jamal and Ralph Deters, MobiCrop: Supporting Crop Farmers with a Cloud-Enabled Mobile App, 2013 IEEE 6th International Conference on Service-Oriented Computing and Applications.

[3]. Mohamed Rawidean Mohd Kassim, Ibrahim Mat, Ahmad Nizar Harun, Wireless Sensor Network in Precision Agriculture Application,978-1-4799-4383-8/14/$31.00 c 2014 IEEE.

[4]. Prachi Patil, Akshay Narkhede, Ajita Chalke, Harshali Kalaskar, Manita Rajput, Real Time Automation of Agricultural Environment, 978-1-4799-3759-2/14/$31.00c 2014 IEEE.

[5]. Sabrine Khriji , Dhouha El Houssaini , Mohamed Wassim Jmal , Christian Viehweger, Mohamed Abid , Olfa Kanoun, Precision irrigation based on wireless sensor network, IET Sci. Meas. Technol., 2014, Vol. 8, Iss. 3, pp. 98106 doi: 10.1049/iet-smt.2013.0137

[6]. S. R. Nandurkar, V. R. Thool, R. C. Thool, Design and Development of Precision Agriculture System Using Wireless Sensor Network, SGGSIE& T,Nanded ,(MS) India-431606

DOI 10.17148/IJARCCE.2016.53104