

(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

An Automatic Form Monitoring System Using Arduino and Wireless Sensor Networks

B.Vidheya Raju

Assistant Professor, Department of Electronics and Communications Engineering, Aditya Engineering College,

Surampalem, Andhra Pradesh, India

ABSTRACT: Irrigation has been the backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of irrigation to supply water to the land. In the present scenario on conservation of water is of high importance. By knowing the status of moisture and temperature through GSM with the use of moisture, Raindrop and temperature sensors, water flow can be controlled by just sending a message from our mobile and also adaptively sprinkling water to simulate the effect of rainfall. Central to this design is an Arduino Uno microcontroller which monitors the farm condition and controls the distribution of water on the farm. Relays are controlled by the microcontroller through the high current driver IC and provided for controlling the system, which controls the flow of water to different parts of the field and also used to shut-off the main motor which is used to pump the water to the field. This irrigation system allows farmers to reduce runoff from over watering saturated soils, avoid irrigating at the wrong time of day and in effect improve the crop yield by ensuring adequate water supply when needed.

KEYWORDS: Arduino Uno, GSM module, Temperature, Moisture, Raindrop sensors.

I. INTRODUCTION

Water is a resource that all living species need. It is therefore very precious and has to be used with moderation to be preserved for the generations to come. Agriculture is an industry that uses a lot of water. Most of the time, this resource is not used efficiently and substantial amounts of water are wasted. In the near future, these wastes will represent a large sum of money. In this Paper, an Automated Irrigation System is suggested to minimize the water input and human intervention, while satisfying the plants' needs.

The System consists of two sections, the transmitter section and receiver section. The entire transmitter section will be placed in the farm where as the receiver section is a mobile.

At Transmitter:

- Arduino Uno.
- Moisture sensors.
- Temperature sensor.

II. BLOCK DIAGRAM



Fig 1: Block Diagram



(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

- Raindrop sensor.
- LCD Display.
- ➢ GSM Module.
- ➢ Alarm.
- Power Supply.
- Water flow system.

At Receiver:

Mobile phone.

The transmitter section consists of separate modules as shown in the block diagram. The main module in the system is the Arduino board. Here we are using an Arduino UNO R3 board, After Arduino, the critical modules are the sensors; In this 3 moisture sensors, a raindrop sensor and a temperature sensor are used. For any field only one raindrop and one temperature sensors are sufficient whereas depending on the area the moisture sensor varies accordingly. If the area is large then more moisture sensors are required. This is because the moisture levels will not be the same in the entire field. The system also consists of an LCD display in which the values that are measured by the sensors will be displayed and an alarm is used to indicate the people working in the farm and here one AC water pump and four water flow switches are used, inside these water flow switches we have relays, a relay is an electrically operated switch, which is similar to the working of a tap. A sprinkler is also used in order to sprinkle the water to the plants during heavy temperatures. One of the main modules of the system is the GSM modem. This GSM modem is used for transmitting and receiving the information to and from the farmer. The power supply of 5v is required for the function of Arduino, moisture sensors, rain drop sensor and LCD display and a 12 volts supply is required for the function of GSM modem, temperature sensor and water flow switches.

III. WORKING

The moisture sensors are placed at different parts of the field and if the moisture levels are less than the prescribed level then the moisture sensor sends a request to the Arduino board. As soon as the Arduino gets a request from the moisture sensors, it sends a message to the farmer as well as displaying the moisture levels in the LCD display and the alarm will be "ON "if the readings are above threshold levels Message, LCD display, Alarm - all these three happens at the same time. If the farmer sends a reply telling the Arduino board to start the motor and supply water, the water will be supplied and if there is no response from the farmer anyone working in the farm can simply switch ON the button which is below LCD display and alarm, here the LCD display and alarm are used as an indication to the workers in the field. Let us consider that the farmer has not replied to the message and there is no one working in the farm, in this type of situation the Arduino board waits for a particular period of time (15 min) as programmed and automatically switches the motor ON. Hence it is known as Automatic irrigation system. Once the motor is ON, it can't be stopped by using button (which can be used to switch ON the motor). It can only be stopped through a message from the farmer. It is simply for more security purpose to avoid someone accidentally switching the button OFF.

Once the Arduino gets the input to switch on the motor, it switches the motor pump ON. The motor pump pumps the water to all the water flow switches equally. Since the water is required in a specific area the relays are used to pump the water to where it required. If all the relays are OFF, the motor will be OFF to avoid the motor pipelines from blasting and the motor will be ON when anyone of the relay is ON. Consider a scenario, where the water is being pumped through water flow switches and suddenly rain comes and if the rain comes while watering everything done



(An ISO 3297: 2007 Certified Organization)
Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

here will be OFF no use, since there is no need to supply water while it is already raining. So to overcome this problem raindrop sensor will be used. The raindrop sensor senses the rain based on the diameter of the raindrops. If the diameter is more that means there is a heavy rainfall and the raindrop sensor sends a request to the Arduino board to switch OFF the water pump and as soon as it gets the request the Arduino switches for water pump OFF. If the diameter of the raindrop is small means there is a small rain and the water will be pumped through water flow switches. Until now the work have done entirely for the ground part. During summer or during heavy temperatures we should not only concentrate on the ground part, we should also take care of the leaves. The leaves will be regularly dried whenever there is a heavy temperature. To overcome this a temperature sensor is used which regularly senses the temperature and if the temperature is higher than the prescribed temperature $(48^{\circ}C)$, the water will be sprinkled on to the leaves through a sprinkler which is connected to a water flow switch about 5 min.

Here in this system the farmer will be notified each and everything through a SMS which will be sent by using a GSM module

IV. HARDWARE DESIGN

1. ARDUINOUNO:

Arduino is a microcontroller for making computers that can sense and control different devices. It's an open source platform based on an ATmega328 microcontroller board, and a development environment for writing software for the board. Arduino projects are stand-alone, and they can be operated on displaying devices with software. The preassembled devices are available or they can be assembled as per our need. The Arduino programming language is working done on wires, a similar physical computing platform, which is based on the Processing multimedia programming environment. The hardware consists of a simple open hardware design for the Arduino board with an on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the Arduino board

Voltage 16MHz regulator crystal	ATmega16U2 microcontroller IC/USB controller	Operating Voltage	5V
2.1mm x 5.5mm Male center positive	USB-B port to computer	Input Voltage (recommended)	7-12V
	Reset button		
	ICSP for USB interface	Input Voltage (limits)	6-20V
	(I2C) SCL – Serial clock	Digital I/O Pins	14 (of which 6 provide
	Ancr Pin-13 LED		PWM output)
Not connected	(SPI) SCK – Serial clock 12 – (SPI) MISO – Master-in, slave-out (SPI) MISO – Master-in, slave-out	Analog Input Pins	6
3.3V Output SV O	-10 (SPI) NOSI = Master out, stave in -10 (SPI) SS - Slave select	DC Current per I/O Pin	40 mA
Ground GRD B	Note: Pins denoted with "~" are PWM supported	DC Current for 3.3V Pin	50 mA
Analog pin 0 → A0 Analog pin 1 → A1 Analog pin 2 → A A1 Analog pin 3 → A A2 2 Analog pin 3 → A A2 2	C - 6 C - 7 C	Flash Memory	32 KB of which 0.5 KB used by boot loader
(I2C) SDA - A4 2 (I2C) SCL - A5 2	9 1x + 1 → TXD 1x + 0 → RXD	SRAM	2 KB
ATmega328 microcontroller IC	VCC RESET	EEPROM	1 KB
ICSP for ATmega328	MOSI SCK GND MISO	Clock Speed	16 MHz

Fig 2. Arduino Board

Technical Specifications Table:



(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

2. ARDUINO UNO SOFTWARE (IDE):

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.



FEATURES:-Inexpensive Simple Open source and extensible software

Fig 3. Arduino IDE Software

3. GSM MODEM:

A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages. GSM modems can be a quick and efficient way to get started with SMS, because a special subscription to an SMS service provider is not required. In most parts of the world, GSM modems are a cost effective solution for receiving SMS messages, because the sender is paying for the message delivery. A GSM modem could also be a standard GSM mobile phone with the appropriate cable and software driver to connect to a serial port or USB port on your computer.



Command	Description Check if serial interface and GSM modem is working.	
AT		
ATE0	Turn echo off, less traffic on serial line.	
AT+CNMI	Display of new incoming SMS.	
AT+CPMS	Selection of SMS memory.	
AT+CMGF	SMS string format, how they are compressed.	
AT+CMGR	Read new message from a given memory location.	
AT+CMGS	Send message to a given recipient.	
AT+CMGD	Delete message.	

Fig 4. GSM Modem

AT Commands Table



(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

4. SENSORS:

a. MOISTURE SENSOR:

The Soil Moisture Sensor is used to measure the volumetric water content of soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science etc. The Soil moisture sensors are used specially to measure the water content in soil. A one soil moisture probe is made up of multiple soil moisture sensors. Technological methodology used it soil moisture sensor is the electrical resistance of the soil.

The health of a plant is influenced by many factors, one of the most important being the ready availability of moisture in the soil. Soil moisture is an important component in the atmospheric water cycle, both on a small agricultural scale and in large-scale modeling of land/ atmosphere interaction. Vegetation and crops always depend more on the moisture available at root level than on precipitation occurrence. Water budgeting for irrigation planning, as well as the actual scheduling. In this particular project, we have used the moisture sensors which can be inserted in the soil, in order to measure the moisture content of the soil.





Fig 6: Interfacing of Moisture sensor with Arduino

b. RAIN DROP SENSOR:

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The rain sensor detects water that completes the circuits on its sensor boards' printed leads. The sensor board acts as a variable resistor that will change from 100k ohms when wet to 2M ohms when dry. In short, the wetter the board the more current that will be conducted.



Fig 7: Raindrop sensor



Fig 8: Interfacing of Raindrop sensor with Arduino



(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

c. TEMPERATURE SENSOR:

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.





Fig 9: Temperature sensor

5. SUBMERSIBLE PUMP

A submersible pump (or electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitations, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps.

Fig 10: Interfacing of Temperature sensor with Arduino



Fig 11: Submersible Pump

V. **RECEIVER**

Mobile Phone:

The control of end user is a very important aspect in our project this is a unique extension to our system that makes it different from other systems. The mobile is used to receive the user's command as on or off to control the motor and supply the water to the plants as per user choice. The phone number of end user is necessary to send the message to the Arduino and this is done via GSM.



Fig 12: Mobile layout for messages



(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

VI. EXPERIMENTAL RESULTS

Step1: Switch ON the power supply then power will be distributed to all the components.



Step2: Checking the moisture sensors working and displaying their condition on the LCD according to the threshold values (<630) and Sending a message from the GSM to the farmer about the moisture levels.



Step3: Sending message to the GSM to switch on the motor by the farmer based on the threshold value







(An ISO 3297: 2007 Certified Organization) Website: <u>www.ijirset.com</u> Vol. 6, Issue 7, July 2017

Step4: Water flow from the pump based on the MOTOR ON condition



Step4: Checking the raindrop sensor values if it is case: 1 then the system will send a message to former indicating that it is raining and farmer sent a message MOTOR OFF then the system will automatically Switch off the Motor raining otherwise not raining.





(An ISO 3297: 2007 Certified Organization)

Website: <u>www.ijirset.com</u>

Vol. 6, Issue 7, July 2017

VII. CONCLUSION

There is an urgent need for a system that makes the agricultural process easier and burden free from the farmer's side. With the recent advancement of technology it has become necessary to increase the annual crop production output of our country India, an entirely agro centric economy. The proposed system can optimize water levels based on things such as soil moisture readings and weather predictions. This is done with wireless moisture sensors, Temperature and Raindrop sensors that communicate with the Arduino controller. The Controller will send the information to the former via GSM module the former will know whether or not the landscape is in need of water.

Future scope:

This system has enormous potential and may be used in various other ways, due to its cheap and cost efficient design.

- 1. Use it as a home automation controller, by adding a few more 240 volt relays.
- 2. Remotely perform jobs.
- 3. Use a float switch in a tank, so that the system automatically shuts the pump down, once the reservoir is full.
- 4. Use it in conjunction with a solar panel, so that the entire system is ecofriendly.

REFERENCES

- [1] W. A. Jury and H. J. Vaux, —The emerging global water crisis: Managing scarcity and conflict between water users, || Adv. Agronomy, vol. 95, pp. 1–76, Sep. 2007.
- [2] X. Wang, W. Yang, A. Wheaton, N. Cooley, and B.Moran, -Efficient registration of optical and IR images for automatic plant water stress assessment, || Compute. Electron. Agricult. vol. 74, no. 2, pp. 230-237, Nov. 2010.
- [3] G. Yuan, Y. Luo, X. Sun, and D. Tang, -Evaluation of a crop water stress index for detecting water stress in winter wheat in the North China Plain, || Agricola. Water Manag., vol. 64, no. 1, pp. 29-40, Jan. 2004.
- [4] S. B. Idso, R. D. Jackson, P. J. Pinter, Jr., R. J. Reginato, and J. L. Hatfield, -Normalizing the stress degree day parameter for environmental variability, || Agricult. Meteorol., vol. 24, pp. 45-55, Jan. 1981.
- [5] Y.Erdem, L.Arin, T.Erdem, S.Polat, M.Deveci, H.Okursoy, and H. T. Gültas, -Crop water stress index for assessing irrigation scheduling of drip irrigated broccoli (Brassica oleracea L. var. italica), || Agricult. Water Manag., vol. 98, no. 1, pp. 148–156, Dec. 2010.
- [6] S. A. O' Shaughnessy and S. R. Evett, -Canopy temperature based system effectively schedules and controls center pivot irrigation of cotton, || Agricult Water Manag., vol. 97, no. 9, pp. 1310–1316, Apr. 2010.
- [7] R. G. Allen, L. S. Pereira, D. Raes, and M. Smith, Crop Evapotranspiration-Guidelines for Computing Crop Water Requirements—FAO Irrigation and Drainage Paper 56. Rome, Italy:FAO, 1998.
- [8] S. L. Davis and M. D. Dukes, -Irrigation scheduling performance, || Agricult. Water Manag., vol. 98, no. 1, pp. 19– 28, Dec. 2010.
- [9] K. W. Migliaccio, B. Schaffer, J. H. Crane, and F. S. Davies, —Plant response to evapo transpiration and soil water sensor irrigation scheduling methods for papaya production in south Florida, || Agricult. WaterManag., vol.97, no. 10, pp. 1452–1460, Oct. 2010.
- [10] O. M. Grant, M. J. Davies, H. Longbottom, and C. J. Atkinson, Irrigation scheduling and irrigation systems: Optimising irrigation efficiency for container ornamental shrubs, || Irrigation Sci., vol. 27, no. 2, pp. 139-153, Jan. 2009.
- Blonquist JM, Jones SB, Robinson DA. Precise irrigation scheduling for turfgrass using a subsurface electromagnetic soil moisture sensor. Agricult Water Management. 2006 Jul; 84:153–65.
- [12] Kim Y, Evans RG, Iversen WM. Remote sensing and con- trol of an irrigation system using a distributed wireless sensor network. IEEE Trans Instrum Meaurement. 2008 Jul; 57(7):1379–87.
- [13] Chavan CH, Karande PV. Wireless monitoring of soil moisture, temperature and humidity using zig bee in agri- culture. International Journal of Engineering Trends and Technology (IJETT). 2014 May; 11(10):1–5.
- [14] Vijaya kumar S, VishnuVardhan D. Wireless Network Sensors for Precise Agriculture Monitoring. (IJIRSE) International Journal of Innovative Research in Science and Engineering. 2011 Mar; 307–10.
- [15] Dalip, VK. Efect of Environmental Parameters on GSM and GPS. Indian Journal of Science and Technology. 2014 Aug; 7(8):1183-8.
- [16] Prakash M, Gowshika U, Ravichandran T. A Smart Device Integrated with an Android for Alerting a Person's Health Condition: Internet of hings. Indian Journal of Science and Technology. 2016 Feb; 9(6):1–6.
 [18]Nallani S, Berlin Hency V. Low Power Cost Effective Automatic Irrigation System. Indian Journal of Science and Technology. 2015 Sep; 8(23):1–6.