OPTIMAL IRRIGATION SYSTEMS FOR AGRICULTURE USING EMBEDDED SYSTEMS

B.Sathiyanaryanan[1], V.Prabhakaran[2]
[1]PG - Scholar, [2]Assistant Professor
Department of ECE, SRM University, Chennai

Abstract: The automated control of irrigation for farmlands with the objective of conserving the water and electricity is the purpose of the presented work. Optimal usage of resources is obtained using a smart wireless network is implemented in his project. Presently the farmer has to coordinate their activities with the presence of the availability of power supply for the pumps, availability of water and the requirement for the crops on a daily basis. An intelligent system that can measure the Humidity of the soil content and control the flow of water in a directed manner to various parts of the field and provide information regarding the same relieves the farmer from this concern and hence carry out his other duties to improve the productivity of his land. Such automation of activities would attract the youth of the nation into this noble profession. The humidity sensors used have been indigenously created as a low cost alternative to the commercially available counterparts.

Keywords: Moisture Sensors, Smart Communication, Intelligent System.

I. INTRODUCTION

Now days, water shortage is turning into one of the most important problem within the world. Many various ways are developed for conservation of water; we want water in every and each field. In our day to day life additionally water is crucial. Water is considered to be basic need of human. Water is required for everyone human beings, animals, plants, etc.

A. Overview Of Embedded System

An embedded system could be a computer system with an infatuated function within a larger mechanical or electrical system, typically with real-time computing constraints. it\'s embedded as a part of an entire device usually together with hardware and mechanical parts. In contrast, a general pc, such as a private pc (PC), is meant to be flexible and to fulfill a large vary of end-user needs. Embedded systems management several devices in common use today.

B. Modern Embedded System

An embedded system may be a automatic data processing system with a passionate function within a larger mechanical or electrical system, usually with real-time computing constraints. it\'s embedded as part of a complete device usually together with hardware and mechanical components. Embedded systems management several devices in common use today. 98 p.c of all microprocessors are factory-made as components of embedded systems.Since the embedded system is dedicated to specific tasks, design engineers can optimize it to reduce the size and cost of the product and increase the reliability and performance. Some embedded systems are mass-produced, benefiting from economies of scale.

C. Different Type Of Irrigation Technique

- Ditch Irrigation - Ditch Irrigation is a rather ancient methodology, where Ditches area unit dug out and seedlings area unit planted in rows. Siphon Tubes area unit used to move the water from the main ditch to the Canals.
- Terraced Irrigation - This is a really labor-intensive method of irrigation where The land is take away steps and supported by retaining walls. The flat square measures are used for planting and the idea is that the Water flows down each step. Watering every plot. These permits Steep land to be used for planting crops.
- Drip Irrigation - This is referred to as the most water efficient methodology of irrigation. Water drops right close to the root zone of a plant in a dripping Motion. If the system is put in properly you'll steady Reduce the loss of water through evaporation and runoff.
- Sprinkler System - This is associate degree irrigation system supported overhead Sprinklers, sprays or guns, put in on permanent risers. You Can also have the system buried underground and therefore the sprinklers Rise up when water pressure rises, that is a well-liked Irrigation system to be used on golf courses and parks.
- Rotary Systems - This methodology of irrigation is best suited to arger areas, for The sprinklers will reach distances of up to one hundred feet. The word "Rotary" is indicative of the mechanical driven sprinklers Moving in a circular motion, , thence reaching bigger distances. This system waters a bigger space with little amounts of Water over an extended amount of your time.

D. Need Of Optimal Irrigation Systems

Optimal irrigation systems are convenient, particularly for those who travel. If installed and programmed properly, optimal Irrigation systems can even save you cash, time and help In water conservation. Dead field grass and plants need to be replaced, and that are often low value. However the savings from best Irrigation systems will transcend that. Watering with A hose or with generator wastes water.

Neither methodology targets Plant roots with an important degree of precision. Optimal Irrigation systems can be programmed to discharge more precise Amounts of water during a targeted area, which promotes water Conservation.

II. SOFTWARE AND HARDWARE PLATFORM USED

Hardware Used

- Soil moisture Sensor (SMS),
- PIC16F877A,
- Encoder and Decoder,
- RF Transmitter and Receiver,
- Relay Driver Circuit,
- Submersible Motor.

Software Used

- MikroC PRO,
- Power software 16f87x.

III. SYSTEM DEVELOPMENT

A. Overall Block Diagram

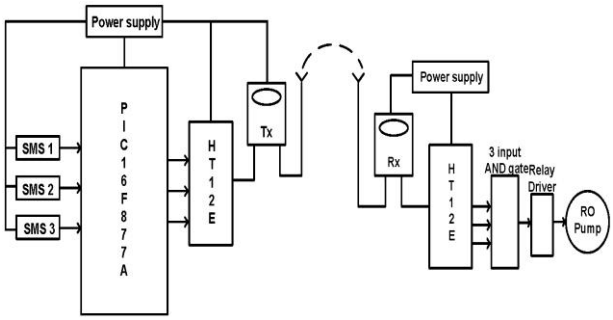


Fig.1. Overall Block Diagram

B. Senor

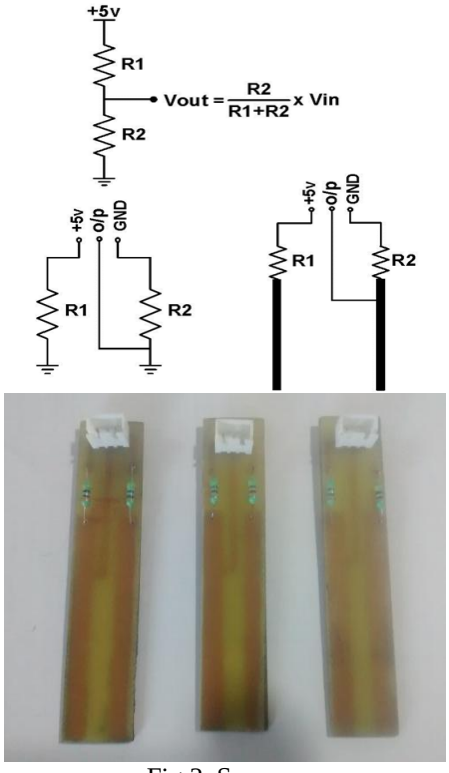
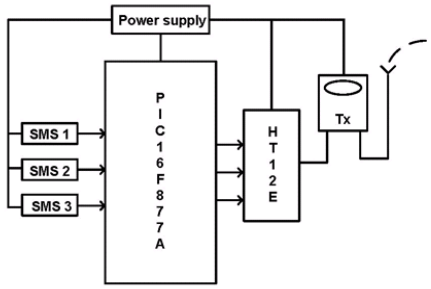


Fig.2. Sensors

The moisture probe detects the amount of water present in the soil. This helps in maintaining the amount of water in the soil there by not over flooding the field or not causing intense dryness, in case of negligence. Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently.

Not only are farmers able to generally use less water to grow a crop, they are able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages. Besides agriculture, there are many other disciplines using soil moisture sensors. Golf courses are now using sensors to increase the efficiencies of their irrigation systems to prevent over watering and leaching of fertilizers and other chemicals offsite.

C. Agriculture Transmitter Section



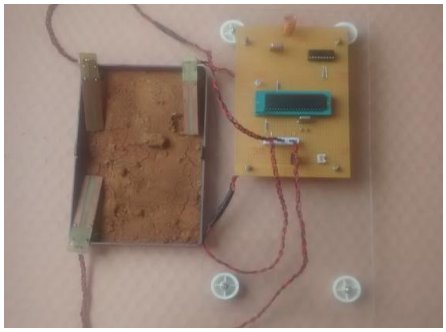
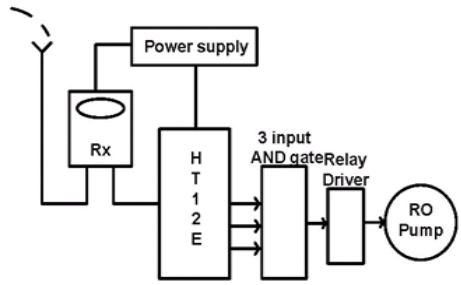


Fig.3. Transmitter section.

Here, we have used four switches SI, S2, S3 and S4 to give 4-bit parallel data (DO-D3). Since the switches are in active low state we need to add external pull-up resistors as shown, so as to provide a high signal by default. The Transmitter Enable (TE, pin 14) pin is an active low pin. Thus, it is permanently grounded, so as to enable the transistor always. The output serial data DOUT is fed to the RF Transmitter Module directly. The most important thing lies in the address pins (AO-A7, pinl-8). Suppose you have two wireless devices (A and B) in your house, both have different remote controls (AA and BB) and both implement the same type of RE module (say 433 MHz). There are 8 address pins, thus giving you an opportunity to have 8! (8 factorial) different and independent ways to connect to a device, so that there is no interference. The address pins MUST have the same address in both transmitter and receiver, or else the data won't be transferred.

D. Agriculture Reciver Section



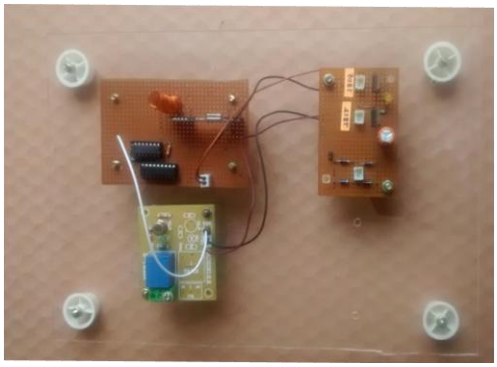


Fig.4. Reciever Section.

Now make the following circuit on a different breadboard. As mentioned earlier, you are requested to implement the following circuit at your own risk! We will NOT be responsible for any damages caused due to implementation of the circuit, physically, mentally or financially. The circuit of the receiver is also quite simple. Capacitor Cl is used between Vcc and GND for noise filtering Apart from that, all the address pins (AO-A7, pin 1-8) are grounded, just as in transmitter. This is to ensure that the transmitted data is being received. Both the transmitter and the receiver must have the same address pins configuration. Pin 17 (VT) is enabled whenever the receiver receives any data. So now that all the connections are made, you must choose an antenna for signal transmission. Usually, a 20-30 cm wire serves best. It is sufficient to give a range of 80 meters in open region. To improve the efficiency, you can also use a coiled wire (take a wire and make it into a coil). It increases the signal strength.

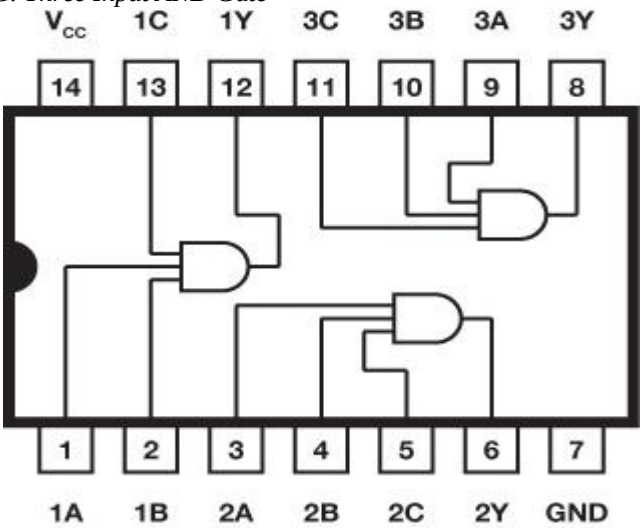
E. HT12E Encoder

The next IC is HTI2E. The HT12E is an encoder. It converts digital signals into suitable form to be transmitted through EM signals. It is an 8-bit Encoder. The HT12E is usually used for 433 MHz wireless modules. It is an 18 leg IC. The pin configurations are as follows: Here, we have used four switches SI, S2, S3 and S4 to give 4-bit parallel data (DO-D3) Since the switches are in active low state (i.e low signal is sent when the switch is pressed), we need to add external pull-up resistors as shown, so as to provide a high signal by default. A resistance as high as ohm is required in between OSC1 and OSC2 pins. The Transmitter Enable (TE, pin 14) pin is an active low pin. Thus, it is permanently grounded, so as to enable the transistor always. The output serial data DOUT is fed to the RF Transmitter Module directly. The most important thing lies in the address pins (AO-A7, pinl-8). Suppose you have two wireless devices (A and B) in your house, both have different remote controls (AA and BB) and both implement the same type of RE module (say 433 MHz). A4 is the remote control of A and BB is of B. Now, you obviously wouldn't want A to control B (which is the most probable case since both the devices use same kind of RE module, having same frequency!). This is where address pins come into play. There are 8 address pins, thus giving you an opportunity to have 8! (8 factorial) different and independent ways to connect to a device, so that there is no interference. The address pins MUST have the same address in both transmitter and receiver, or else the data won't be transferred. Refer to the receiver circuit for more details

F. HT12D Decoder

The next IC is HTI2D. The HTI2D is a decoder. It decodes signals into suitable form to be transmitted through EM signals. It is an 8-bit Encoder. The HT12D is usually used for 433 MHz wireless modules. It is an 18 leg IC.

G. Three Input AND Gate



Pin Number	Description
1	A Input Gate 1
2	B Input Gate 1
3	A Input Gate 2
4	B Input Gate 2
5	C Input Gate 2
6	Y Output Gate 2
7	Ground
8	Y Output Gate 3
9	A Input Gate 3
10	B Input Gate 3
11	C Input Gate 3
12	Y Output Gate 1
13	C Input Gate 1
14	Positive Supply

Fig.5. Pin diagram of 3input AND gate

H. Relay

We have a 24v motor but our controller provides us only 5v logic with microamperes current so we need the isolation between the motor & microcontroller. The relay or optocoupler can do the job. Among them we have used relay it is electromagnetic switch & can be switch on by applying the 6v on its control input. Again the output of the controller cannot be used for triggering the relay. We must amplify the current required for triggering the relay.

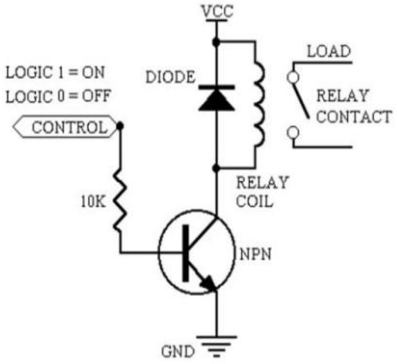


Fig.6.Relay Diagram

In market we can find different types of the relay they are single pole single through double pole double through. According to our requirement we can use any of them. But we also have to consider the voltage & current ratings of the relay.The relay's switch connections are usually labelled COM(POLE), NC and NO:

COM/POLE=Common, NC and NO always connected to this, it is moving part of the switch.

NC= normally closed, COM/POLE is connected to this when the relay is NOT MAGNETIZED.

NO= Normally Open, COM/POLE is connected to this when the relay is MAGNETIZED and vice versa.

I. Units

POWER: Safe operation with low energy (24 watts), low voltage (12-24V) motors. Can be used with compatible transformers (100VAC, 120VAC, 230VAC), to be ordered separately.

ENVELOPE DIMENSIONS: Approximately 3"x 4"x 7", 6 lbs.

MOUNTING: Our patented "flex-mount" base plate significantly dampens vibration and reduces noise. Other steel mounting base plates and "universal" base plates are available at no additional cost. Pump performance may be affected by location and positioning.

CONTROL OPTIONS: Internal Bypass (20-200 psi)

FITTINGS: Available options include built-in 3/8", 1/4", or 5/16" John Guest half cartridges

IV. APPLICATION

PIC 16F877A are for the most part utilized as a part of constant applications. Physically, inserted frameworks range from convenient gadgets, for example, computerized watches and MP3 players, to extensive stationary establishments like movement lights, industrial facility controllers, and to a great extent complex frameworks like mixture vehicles, MRI, and flying. Intricacy fluctuates from low, with a solitary microcontroller chip, to high with different units, peripherals and systems mounted inside a huge case or nook.

A. Motor Technical Specification

- Power: Safe operation with low vitality (24 watts), low voltage (12-24V) engines. Can be utilized with perfect transformers (100VAC, 120VAC, 230VAC), to be requested independently.
- Envelope Dimensions: Approximately 3"x 4"x 7", 6 lbs.
- Mounting: Our patented "flex-mount" baseplate significantly dampens vibration and reduces noise. Other steel mounting baseplates and "universal" baseplates are available at no additional cost. Pump performance may be affected by location and positioning.
- Control Options: Internal Bypass (20-200 psi)
- Fittings: Available options include built-in 3/8", 1/4", or 5/16" John Guest half cartridges

B. Adavantage

S78xx arrangement ICs don't require extra segments to give a steady, managed wellspring of force, making them simple to use, and additionally conservative and effective employments of space. Other voltage controllers might require extra parts to set the yield voltage level, or to help with the regulation procedure. 78xx arrangement ICs have worked in security against a circuit drawing a lot of force. They have security against overheating and short circuits, making them very strong in many applications. Now and again, the present restricting elements of the 78xx gadgets can give assurance to the 78xx itself, as well as for different parts of the circuit. They are dependable Failing of PIC rate is less. Execution of the PIC is quick in view of utilizing RISC design. Power origination is likewise less when contrasted with other small scale controllers. When we find in the developer perspective interfacing is simple.

C. Features

Range in open area (popular conditions):100 Meters
RX Receiver Frequency: 433 MHz
RX regular Sensitivity one zero five Dbm
RX IF Frequency 1MHZ
Low electricity consumption o smooth For software
RX working Voltage: 5V
TX Frequency range 43392 Mt-tz
TX supply Voltage: 3V - 6V
TX Output strength 4-12 Ubm

V. CONCLUSION

The irrigation in agriculture with a view of conserving water manually is not an easy task since the humans tend to make mistakes. This can lead to the wastage of water and electricity which is getting scare every day. In order to overcome this drawback, here we have implemented an automatic irrigation system for farmers which keep track of

the water level in the farm land which makes it possible to save electricity and control the wastage of water. This work is also aimed reducing the human effort and increasing the human comfort by the automated process.

VI. FUTURE WORK

Water resources can be utilized efficiently and effectively based on various other parameters so that Agricultural Sector becomes more productive. Optical irrigation at different seasons is another future scope. Water is allowed to the field of crops depending upon the particular season. Some more parameters such as plant growth at different stages whether condition are to be taken into account to determine the water requirement for the crop This will improve agriculture leading to economical development of our nation.

Acknowledgment

The Author is very grateful to the HOD M.JAGADESAN M.E, Ph.D, Internal Guide V.PRABHAGARAN.M.TECH and other authors, who has been provided valuable guidance, ideas and encouragement for successful completion of this project.

REFERENCES

[1] Mr. Prakashgoud Patil, "Intelligent Irrigation Control System by Employing Wireless Sensors", International Journal of Computer Applications (0975 – 8887) Volume 79 – No 11, October 2013.
[2] M.Lincy Luciana, "Automatic Drip Irrigation Unit using Pic Controller" International Journal of Latest Trends in Engineering and Technology (IJLTET).
[3] PIC MICROCONTROLLERS-Dr. Ramani Kalpathi, St. Joseph's College of Engineering, Chennai.
[4] John k. Peatman: DESIGN with PIC MICROCONTROLLERS, Georgia Institute of Technology.
[5] http:/www.sunrom.com- website for Electronics and Electrical Components
[6] Mr. Prakashgoud Patil, "Intelligent Irrigation Control System by Employing Wireless Sens
[7] International Journal of Computer Applications (0975 – 8887) Volume 79 – No 11, October 2013.
[8] M.Lincy Luciana, "Automatic Drip Irrigation Unit using Pic Controller" International Journal of Latest Trends in Engineering and Technology (IJLTET).

