ADVANCE SYSTEM CONTROLLING AND WATER SAVING IN AGRICULTURE

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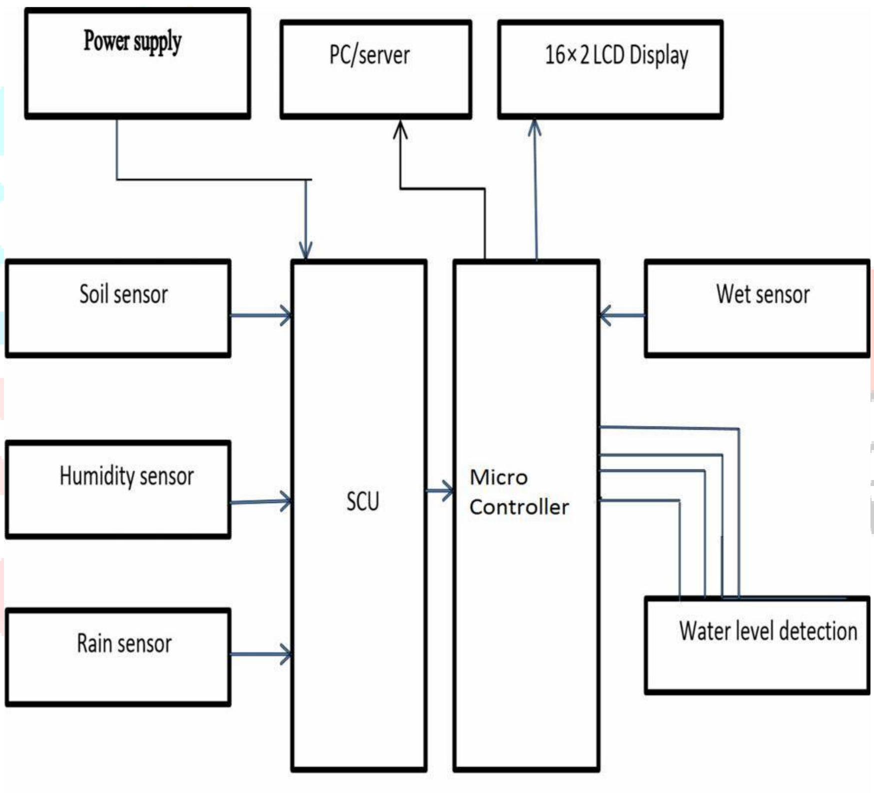
ABSTRACT

At present water saving in most important in every place, especially in agriculture, because water content in river and lake are low. So we have to use our water source effectively this will tend to best grow thing for corps and avoid losses. This system design with multiple effective sensors for different type of parameters read for water saving and good plant grow thing, like humidity and rain sensor and Soil sensors are placed. These are find exact water requirement and season based water requirement for the agriculture management in this project we active effective water flow technical so we can watering only dry place the system monitored and control helps user friendly environment and decision make control. Overall this system help to save water 95% and maintain the growth condition with healthy agriculture.

I. INTRODUCTION

According to the 2002 farmers of Texas State Water Plan the demand for irrigation water is expected to fall by 12 per cent Fifty years. However, it will remain the largest water user the state's total land area is 42% needed. Between1986 and 2000, 7 to 10 million acres Water was used for irrigation for one year.80% of farming Texas water usage comes from underground distribution, and will be Groundwater supply is expected to be reduced by 18% by 2050 Ogallala Aquifer, is an important source from the Texas area Irrigation water for agricultural Panhandle / South Plains In 2050, 24% is expected to be reduced Texas is one of the top 100 US Districts in farm sales. Most of these districts depend on irrigation More than 30 percent of income comes from agriculture. Texas' economy it relies on sustainable reliability of agriculture Reliable water sources. Security meeting is an important part Agriculture needs water in the next fifty years. Agricultural water use the productivity can be reduced significantly without diminishing improved irrigation technologies and efficient water management Procedures. Precision accurate water measurement and soil moisture monitoring efficiently important components of agricultural water management practices. Irrigation flow meter can be used to help calculate performance In irrigation systems, water loss from leaks will be identified Settings, and apply only the required amount of precision Water based on moisture and weather conditions of the soil. Soil Moisture monitoring is used in conjunction with weather data Crop purification skills are needed to plan irrigation. Fields Must be designed Efficient water Use in rankings Laser land Equipment, Creating furrow Need to save Rainwater, and Keep the soil Moisture through Security Tillage.

II. SYSTEM ARCHITECTURE



III. IMPLEMENTASTION

SENSING MODULE:

Containing humidity sensor, wet sensor, soil sensor, rain sensor and SCU comparator (Signal Condition Unit)

- **Humidity sensor:**

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The humidity sensor is connected to the signal conditioning unit. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, **humidity sensing** is very important, especially in the control systems for industrial processes and human comfort. Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications. In semiconductor industry, humidity or moisture levels needs to be properly controlled & monitored during wafer processing.

Various terms used to indicate moisture levels are tabulated in the table below:

S.No	Term	Definition	Unit
1	Absolute Humidity grams/m3	Ratio of mass (vapour) to volume.	(Vapour Concentration)
2	Mixing Ratio OR Ratio	of mass(vapour) to mass	(dry grams/m3 Mass
3	Relative Humidity	Ratio of mass (vapour) to mass (saturated vapour) OR ratio of actual vapour pressure to saturation vapour pressure.	%
4	Specific Humidity	Ratio of mass (vapour) to total mass.	%
5	Dew Point	Temperature(above 0°C) at which the water vapour in a gas condenses to liquid water)	°C
6	Frost Point	Temperature(below 0°C) at which the water vapour in a gas condenses to ice	
7	Volume Ratio	Ratio of partial pressure(vapour) to partial pressure (dry gas)	% by volume

Moisture level

Most commonly used units for humidity measurement are Relative Humidity (RH), Dew/Frost point (D/F PT) and Parts per Million (PPM). RH is a function of temperature, and thus it is a relative measurement.

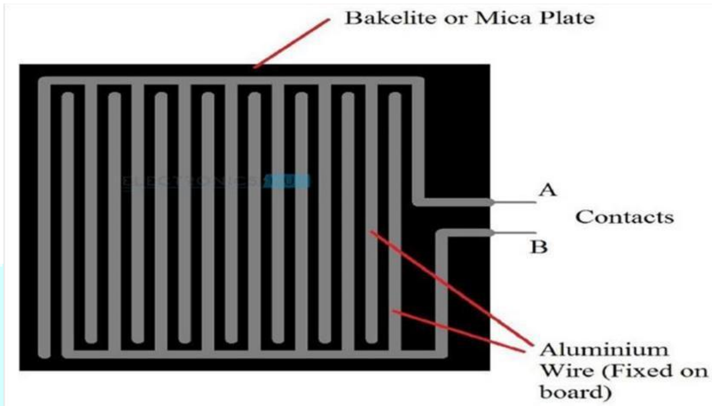
Dew/Frost point is a function of the pressure of the gas but is independent of temperature and is therefore defined as absolute humidity measurement. PPM is also an absolute measurement. Dew points and frost points are often used when the dryness of the gas is important. Dew point is also used as an indicator of water vapour in high temperature processes, such as industrial drying. Mixing ratios, volume percent, and specific humidity are usually used when water vapour is either an impurity or a defined component of a process gas mixture used in manufacturing.

Raisensor:

Rain Alarm Project is a simple but very useful project that detects Rain (Rain Water) and automatically triggers an alarm or buzzer. Water is a basic need in every one's life. Saving water and proper usage of water is very important. Here is an easy project which will give the alarm when there is rain, so that we can make some actions for rain water harvesting and also save the rain water for using it later. With the help of saving this rain water through rain water harvesting, we can increase the levels of underground water by using underwater recharge technique.Rain water detector will detect the rain and make an alert; rain water detector is used in the irrigation field, home automation, communication, automobiles etc. Here is the simple and reliable circuit of rain water detector which can be constructed at low cost. The Rain Water Sensor used in this project is shown

in the image below. It is a simple sensor and it is an easy to use tool for detecting rain. It can act as a simple switch, where the switch is normally open and when there is rain, the switch closes. Even though Rain Water sensor is the main component in the circuit. We need not to go and buy in the market or online.

We can do it ourselves just by taking the piece of Bakelite or Mica board and aluminium wire. Bakelite or Mica board should be made completely flat and aluminium wire should be pasted on the flat board as shown in the figure below. Care should be taken that there should be no spaces between the wire and board.When the rain water sensor is completed, it should get connected to the circuit and voltage should be passed through the wires.



If there is no rain, the resistance between the contacts will be very high as there will be no conduction between the wires in the sensor. If there is rain, the water drops will fall on the rain sensor, which will form a conductive path between the wires and it also decreases the resistance between the contacts.

Soil moisture sensor:

This is checking the both wet and dry condition with connected to the SCU comparator. Use the Soil Moisture Sensor to:

- Measure the loss of moisture over time due to evaporation and plant uptake.
- Evaluate optimum soil moisture contents for various species of plants.
- Monitor soil moisture content to control irrigation in greenhouses.
- Enhance your Bottle Biology experiments.

Data-Collection Software

- **Logger *Pro*** This computer program is used with Lab Quest, Lab Quest Mini, Labra, or Go! Link.
- **Logger Lit** This computer program is used with Lab Quest, Lab Quest Mini, Labra, or Go!

Link.

- **Lab Quest App** This program is used when Lab Quest is used as a standalone device.

- **Easy Data App** This calculator application for the TI-83 Plus and TI-84 Plus can be used with CBL 2, Labra, and Venire Easylink. We recommend version 2.0 or newer, which can be downloaded from the Venire web site, www.vernier.com/easy/easydata.html, and then transferred to the calculator.

See the Venire web site, www.vernier.com/calc/software/index.html for more information on the App and Program Transfer Guidebook.

- **Data Mate program** Use Data Mate with Labra or CBL 2 and TI-73, TI-83,TI-84, TI-86, TI-89, and Voyage 200 calculators. See the Labra CBL2 Guidebooks for instructions on transferring Data Mate to the calculator.
- **Data Pro** This program is used with Labra and a Palm handheld.
- **Lab VIEW** National Instruments Lab VIEW™ software is a graphical programming language sold by National Instruments. It is used with Sensor DAQ and can be used with a number of other venire interfaces. See www.vernier.com/labview for more information.

Wet Sensor:

This sensor is directly connected to the SCU – comparator (Signal Condition Unit) Also included in our product range is the WET sensor, to measure pore water conductivity and temperature in the top layer of a soil. The measurement values are shown on the display of the hand held meter and can be stored in the memory (including time and sensor location).These data can be read on a PC. The WET sensor measures three vital soil properties directly within the soil: Water content, Electrical conductivity and Temperature. The sensor is unique in its ability to measure pore water conductivity, which is the EC of the water that is available to the plant. Traditionally this measurement has been made by the time- consuming and error-prone method of extracting pore water from the soil by suction, before measuring it with a standard conductivity meter. In contrast, the WET sensor is simply pushed into the soil (or other growing medium) and then read directly using the hand held meter. The standard set includes: the WET sensor, a hand held meter, the software and a carrying case.

SCU-comparator:

It's used for sensing the signals from sensors and the information passed to the microcontroller. The input receiver is connected with comparator. The comparator is constructed with LM 358 operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal. The non-inverting input terminal is connected sensor. The sensor is not conducting. So the comparator non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +12V. This voltage is given to base of the transistor Q1. Hence the transistor is conducting. Here the transistor is act as switch so the collector and emitter will be closed. The output is taken from collector terminal. Now the output is zero.

Then sensor sense the signal that given to non-inverting input voltage is lower than inverting input. Now the comparator output is -12V so the transistor is cut off region. The 5v is given to 40106 IC which is the inverter with buffer. The inverter output is given to microcontroller or PC. This circuit is mainly used to for counting application, intruder detector etc.

TRANSMITTING AND RECEIVING MODULE:

RFtransmitterandreceiver:

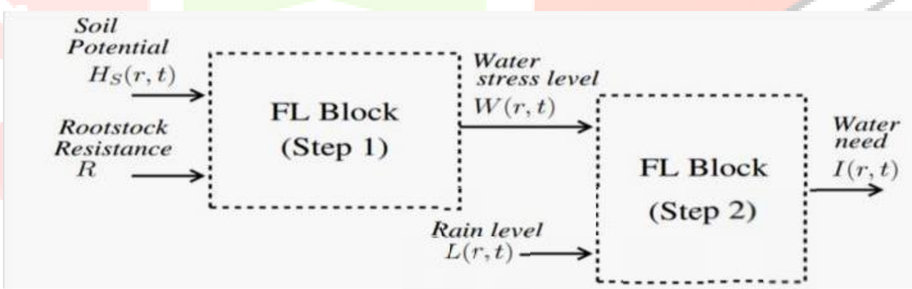
Signals were transmitting and receiving using RF module. Radio frequency, or RF, is a frequency or rate of oscillation within the range of about 3

Hz and 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate that most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits. Electrical currents that oscillate at RF have special properties not shared by direct current signals. One such property is the ease with which it can ionize air to create a conductive path through air. This property is exploited by 'high frequency' units used in electric arc welding. Another special property is an electromagnetic force that drives the RF current to the surface of conductors, known as the skin effect. Another property is the ability to appear to flow through paths that contain insulating material, like the dielectric insulator of a capacitor. The degree of effect of these properties depends on the frequency of the signals. RF transmitter and receiver are available for operation in the 868-870MHz band in Europe and the 902–928MHz band in North America, both modules combine full screening with internal filtering to ensure EMC compliance by minimizing spurious radiation and susceptibility.

These RF transmitter & receiver will suit one-to-one and multi-node wireless links in such applications as car and building security, EPOS and inventory tracking, remote industrial process monitoring and data networks. Because of their small size and low power requirements, both Modules are ideal for use in portable, battery-powered applications such as handheld terminals.

FUZZY LOGIC

Fuzzy Logic Control (FLC) system is based on fuzzy set theory. This set theory is advanced version of classical set theory called crisp theory. In crisp set theory, an element either belongs to or does not belong to a set. But fuzzy set supports a flexible sense of membership of elements to a set. Many degrees of membership, between 0 and 1, are allowed. The membership function is associated with a fuzzy set in such a way that the function maps every element of the universe of discourse or the reference set to the interval [0, 1]. In crisp logic, the truth values acquired by propositions or predicates are two-valued, namely TRUE or FALSE which may be treated numerically equivalent to (0, 1). However, in fuzzy logic, truth values are multi valued such as absolutely true, partly true, absolutely false very true, and so on and are numerically equivalent to any value in the range 0to1. Fuzzy logic allows inclusion of expert knowledge in control system. Fuzzy logic concept used to decision making in this project by on- off condition through water flow control. A fuzzy logic system contains sets used to categories input data (fuzzification), decision rules that are applied to each set, and a way of generating an output from the rule results (defuzzification). Inference unit is the core of the fuzzy controller. It generates fuzzy control actions applying the rules in the knowledge base to the current process state. It determines the degree to which each measured valued is a member of a given labelled group.



$$I(r,t) = \begin{cases} 1 \rightarrow (yes), & if\ I(r,t) > I^{th} \\ 0 \rightarrow (no), & otherwise \end{cases}$$

Fig: The Structure of FLC System

Design of fuzzy controller:

In the irrigation system, plant take varying quantities of water at different stages of plant growth. Unless adequate and timely supply of water is assured, the physiological activities taking place within the plant are bound to be adversely affected, thereby resulting in reduced yield of crop. The details of various parameters used in our proposed work are explained below.

Irrigation Parameters for Efficient System Operation

To ensure proper design and operation of an irrigation system, the following parameters should be considered: Rooting Depth for Plant

1. Sand Texture and Water Storage Capacities of Soil

2. Plant Water Use Capabilities based on the type of plant

3. Field Soil Moisture Content

4. Leaf Wetness, Environment Temperature and Relative Humidity.

Step 1: *Identification and Declaration of Inputs and Output*—in the first step, we have identified inputs and outputs and linguistic variables. The process of declaring the values of input and output called universe of discourse and are shown in the following tables.

Crop Name	***Rooting Depth***	***Linguistic Variable***	***Range***
Cabbages, Cauliflowers, Clover (Ladino), Cucumbers, Lettuce, Onions, Pasture, Grasses, Radishes, Turnips	1.5 ft	Shallow	[0 0 1 1.5]
Beans, Beets, Blueberries, Broccoli, Carrots, Celery, Potatoes, Peas, Strawberries	2 ft	Medium Shallow	[1 1.5 2 2.5]
Brussels Sprouts, Cereals, Clover (Red) Corn (sweet), Eggplant, Kiwifruit, Peppers, Squash	3 ft	Medium Deep	[2 2.5 3 3.5]
Alfalfa, Asparagus, Blackberries, Corn, Grapes, Loganberries, Raspberries, Sugar Beets	4 ft	Deep	[3 3.5 4 4.5]

Table: Effective routing depth

Crop Name	***Plant Water Use Capabilities (%)***	***Linguistic Variable***	***Range***
Peas, Potatoes…	15	Low	[0 0 10 15]
Tree Fruits, Grapes, Tomatoes…	30	Medium	[10 15 20 25]
Other crops…	35	High	[20 25 40 40]

Table : AWSC: Available Water Storage Capacities of Soil

Table 6.4: Soil Moisture Content in Centi Bars Reading Obtained from the SoilMoisture Sensor

Sensor Moisture Sensor Reading	*Soil Moisture Level (CentiBars)*	*Linguistic Variable*	*Range*
Field Sensor Moisture Sensor Reading	10	Saturated	[0 0 6 12]
	20	Adequately Wet	[6 12 18 24]
	30	Normal	[18 24 30 36]
	40	Dry	[30 36 60 60]

Table No: 6.4 Indicates the maximum percentage of moisture

Table6. 5: Environment Relative Humidity (RH) in Percentage Obtained from Sensor

Relative Humidity Sensor Reading	*Soil Moisture Level (CentiBars)*	*Linguistic Variable*	*Range*
Environment Relative Humidity in percentage	10	Low	[0 0 10 20]
	20	Medium	[10 20 30 40]

	30	High	[30 40 50 60]
	40	Extremely High	[50 60 60 60]

Table : Humidity levels

Step 2: *Identification of Control Surfaces*—In this step, the linguistic variables are identified and membership values for each linguistic variable are calculated. The input and output variables are represented by fuzzy membership functions .

Step 3: *Behavior of Control Surfaces*—The fuzzy inference system consists of fuzzy rules (IF antecedent THEN consequent) that are devised by an expert knowledge base or through system input-output learning. Gaussian, triangle, and trapezoid functions are the most commonly used membership functions. In the fuzzy rules, triangular and trapezoidal-shaped membership functions are used for the variables to simplify the computations.

Step 4: *Fuzzy Inference System and Decision Making*—The core of fuzzy system is the rule base system which mimics human reasoning. The most commonly used fuzzy inference technique is Mamdani method. Fuzzy rule base drives the inference system to produce fuzzy outputs, which are defuzzified to get system outputs. In this case, we have considered 7 input variables and each consists of fuzzy linguistic variables.

Step 5: *Defuzzification*—The transformation from a fuzzy set to a crisp number is called defuzzification. For any given crisp input value, there may be fuzzy membership in several input variables, and each will cause several fuzzy output cells to fire or to be activated. This brings the process of defuzzification of output to crisp value. There are many kinds of defuzzification methods, usually maximum membership and centroid techniques are used. In practice, defuzzification is done using centroid method.

ANALYZE AND CONTROL MODULE:

Relay unit:

This relay gets signal from PIC16F877.The relays are connected with the power supply line of the trains. If it gets 5volts signal from PIC16F877 the relay works. For relay driving here use BC 547 transistor as a switch, for on and off the relay. The relay coil work with 12v dc supply.

LCD display:

LCD display is used to display distance between the trains. It also displays status of the trains. Train means Status of the each sensor levels (land, humidity and wet) are display.

LCD module:

LCD (Liquid crystal display) is used to display the Characters, We are using the LCD which is 16 X 2, That is it will display the 16 characters in two rows. It has command for control the controller which is in LCD.

System analysing

Display the analysing unit

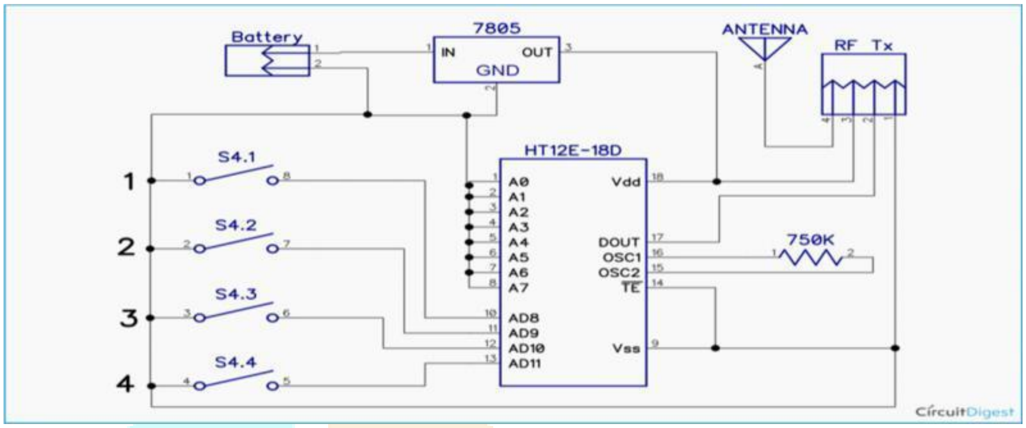
Microcontroller unit:

The micro controller used in the part of controlling the signals and avoid to overflow of the water using flow control mechanism. It's connected to the LCD display. A micro controller is a true computer on a chip. The design incorporates all the features found in a microprocessor such as CPU, ALU, PC, SP and registers. It also has some added features needed to make a complete computer ROM, RAM, parallel I/O, serial I/O, counters and clock circuit. The prime use of a micro controller is to control the operation of a machine using a fixed program that is stored in ROM and that does not change over the life time of the system. The architecture and instruction set of the micro controller are optimized to handled data in bit and byte size. The areas if applications of micro controllers include control process, manufacturing process, medicine, instrumentation etc.**IC:**

PIC stands for Peripheral Interface Controller as coined by microchip technology inc., USA

- PIC is a very popular microcontroller world wide
- Microchip is the first manufacturer of 8 pin RISC MCU. Microchip is the world's second largest chip manufacturer.
- Focus on high performance cost-effective, field programmable embedded control solutions.
- Variety of end-user applications-specific standard products (ASSP) &application specific integrated circuits.
- Global network of manufacturing and customer support facilities.

SCU connecting with micro controller and also connected to the RF modules .Then RF fetch the information from the antenna because of network coverage.



SCU connecting with microcontroller

CONCLUSION AND FUTURE ENHANCEMENT

In this paper, a wireless decision support system for the optimized management of the irrigation in agriculture has been presented. The properties of the WSAN technology have been exploited to acquire heterogeneous environmental parameters and to control the functioning of the irrigation system. The FL-based methodology has been designed and calibrated according to the indications of the farmers in order to mimic the human experience and to properly understand the status of the crop. The innovative integration of the low-cost WSAN architecture and the FL-based DSS has led to the following advantages of the proposed smart irrigation technique:

- A high practical value of the suggestions given to the farmers, which are directly supported in the daily irrigation schedule without any specific input or calibration required by the proposed methodology;
- A completely autonomous wireless system, thanks to the sensor lifetime higher than 1 year and the integration of the control algorithm directly in the gateway unit.

Current research activities are focused on the integration of additional sensors for the measurement of physical quantities required to support the farmers also the agrochemical application, and on the customization of the FL-based strategy in order to support multiple decision support functionalities. When the rain water is excess on the land its alert to the user interface. They are saved the excess rain water to using rain water harvesting by manually or automatically using pumps.

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