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DESIGN AND IMPLEMENTATION OF A NOVEL IRRIGATION WATER PUMP CONTROL SYSTEM FOR DELTA FORMERS

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Abstract- **A novel Irrigation Water Pump and field valve Control system for Delta Farmers. The aim of this project is to provide an efficient solution for automatic and manual control of irrigation motor, power status and field status for Delta Farmers. This basic idea gave origin to the project GSM based, irrigation monitoring and controlled system. In this research we have to use soil moisture sensor, GSM modem, power monitoring circuit and power relay etc. Here the automation process is done through the micro controller based technology. In our task we make use of one Arduino controller, which is dedicated at the water pump, GSM, sensors and relays. The Arduino controller forms the mind of the Project. A relay switch to which irrigation motor is connected which is operated through microcontroller. This is fully real time based on the instantaneous moisture values. Suppose if farmers want to manual operation they can choose manual mode. Thus by providing right amount of water we would increase the efficiency of the farm. The farmer can also look at the sensory data and decide course of action himself. We have made the interface of our project keeping in view the educational and financial background of average Indian farmer. In this paper we are proposed a low cost and efficient wireless controlled and irrigation monitoring system to acquire the soil moisture sensor from various locations of field and power finding circuit based, ON or OFF the main motor and OPEN or CLOSED the solenoid water flow valve. The SMS send from received the pump section to farmers mobile phone, if farmers need what is the status of all valves and irrigation pump.**

Index Terms**: Soil moisture sensor, GSM, Power monitoring circuit, Arduino controller**

I. INTRODUCTION

Nowadays farmers takes various crops in his field like paddy, gingerly, ground nut or black gram as like older methods, so in this way very significant factor to the farmer is like time, water, and also the money are get wasted. And also the farmers are revenue crops which is totally depends on the meteorological conditions or expected conditions. That is if the Rain fall or Slush fall is present then crops will be totally spoiled. At the same time power shut down also one of the major problem of Delta formers. Water is a basic factor of all known life on Earth. Water is both withstand life in correct measures and threaten life when it is not available. Water is a result is a limited natural resource that must not be wasted. If too little water is applied different problems arise such as field exhaustion.

The most important in irrigation is striking to correct balance for best plant life with best use of water. The irrigation controller is a device to operate programmed irrigation systems such as grass sprinklers and dribble irrigation systems. Many of the controllers have a means of setting the regularity of irrigation, the start time, and the period of watering. So, by focusing on this above glitches we are familiarizing the new notion in the Agriculture that is Automation in Agriculture. To develop

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a device that permits for a former to remotely control and monitor various field actions collecting data from various sensors and using a GSM communication. This system will be a controlling and elastic tool that will offer this service at any time and from anywhere over the world. That is we are attracted to make the GSM based scheme to reduce the important factor to the farmer is wastage of time, cash, manpower and also the mistakes which made by the humans. To do this a large amount of data is captured by using the sensors and conveyed to the controller for the further processing.

Need for meteorological conditions observing system:

Sensor Linkages have been organized for a wide variety of applications [1] and consciousness has increased with regards to applying technology into an agricultural environment [2]. Manual collection of data for selected factors can be infrequent and produce variations from improper measurement taking; this can reason complications in controlling any important factors [2] Wireless sensor nodes can decrease effort and time required for checking a particular environment. Watching systems can ensure faster response to roll factors and conditions, better quality control of produce and lower labor.

The utilization of equipment would allow for remote measurement of issues such as temperature, humidity, soil moisture, water level, sunny detection and greenhouse gases content. Today's technology motto is wireless. Wireless technology is one that is attractive all prevalent. When generating the idea for this project, the likely development considered was deployment of wireless technology for communication and control in agriculture as a part of up-to-date farming techniques. The wireless sensor network explores being a moderately self- forming system [2].

II. DESIGN STRATEGY

A. Arduino controller:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED. Arduino was born at the Vireo Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a circumstantial in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

All Arduino boards are completely open-source, authorizing users to build them independently and eventually adapt them to their particular needs.

The software, too, is open-source, and it is growing through the charities of users worldwide. Thanks to its simple and accessible user experience, The Arduino software is easy- to-use yet flexible enough for advanced users. It runs on Mac, Windows, and Linux... Inexpensive
- Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than

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$50

- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

SPECIFICATIONS

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED BUILTIN	13

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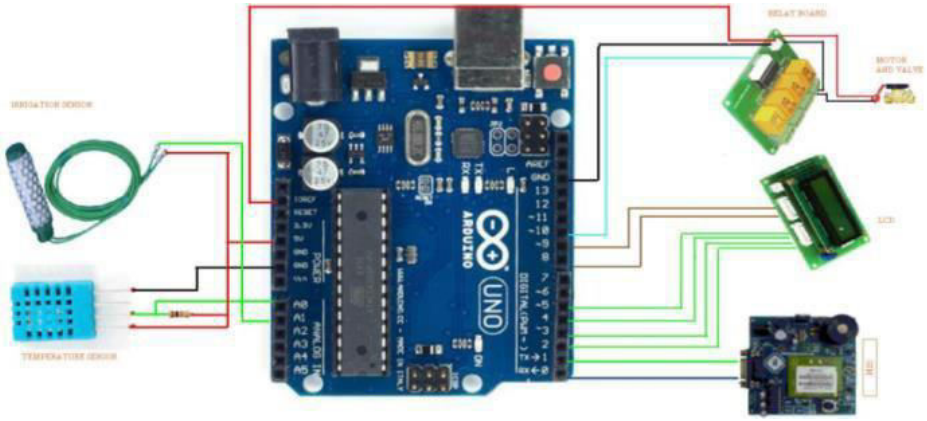

Fig (1) Main Controller and Interface Module Connection Diagram

Moisture Sensor

Most soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be thought of as the soil's ability to transmit electricity. The dielectric constant of soil increases as the water content of the soil increases. This response is due to the fact that the dielectric constant of water is much larger than the other soil components, including air. Thus, measurement of the dielectric constant gives a predictable estimation of water content.

Modern impedance dew point sensors are typically constructed using state-of-the-art thin and thick film techniques. Operation of the sensor depends upon the adsorption of water vapor into a porous non-conducting "sandwich" between two conductive layers built on top of a base ceramic substrate. The active sensor layer and the porous top conductor, that allows transmission of water vapor into the sensor, are engineered very thinly. Therefore the sensor responds very rapidly to changes in applied moisture, both when being dried (on process start-up) and when called into action if there is moisture ingress into a process. Despite this extreme sensitivity to changes in moisture content, the Impedance Moisture Sensor can be incredibly rugged due to the nature of its construction. To protect the sensor further against contaminants and pipe sward it recommended that the sensor is housed in a protective sintered stainless steel guard.

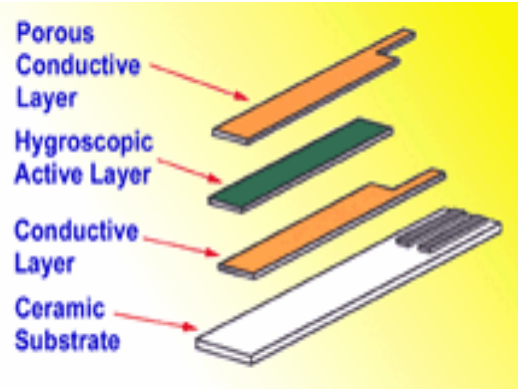

Fig (2) moisture sensor parts

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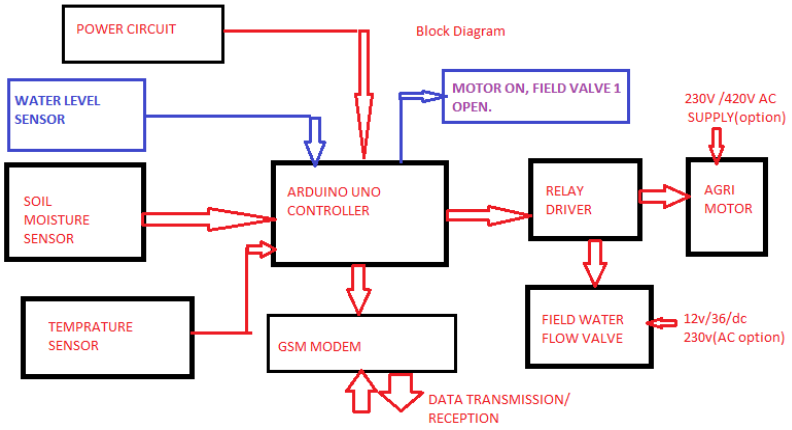

Fig (3) system Block Diagram

B. Temperature Sensor

The movement of molecules and atoms produces heat (kinetic energy) and the greater the movement, the more heat that is generated. Temperature Sensors measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to "sense" or detect any physical change to that temperature producing either an analogue or digital output.

There are many different types of Temperature Sensor available and all have different characteristics depending upon their actual application. A temperature sensor consists of two basic physical types:

- Contact Temperature Sensor Types – These types of temperature sensor are required to be in physical contact with the object being sensed and use conduction to monitor changes in temperature. They can be used to detect solids, liquids or gases over a wide range of temperatures.
- Non-contact Temperature Sensor Types – These types of temperature sensor use convection and radiation to monitor changes in temperature. They can be used to detect liquids and gases that emit radiant energy as heat rises and cold settles to the bottom in convection currents or detect the radiant energy being transmitted from an object in the form of infra- red radiation (the sun).The two basic types of contact or even non-contact temperature sensors can also be sub-divided into the following three groups of sensors, Electro-mechanical, Resistive and Electronic.

The following thermistor has a resistance value of 10KΩ at 25oC and a resistance value of 100Ω at 100oC. Calculate the voltage drop across the thermistor and hence its output voltage (V_{out}) for both temperatures when connected in series with a 1kΩ resistor across a 12v power supply.

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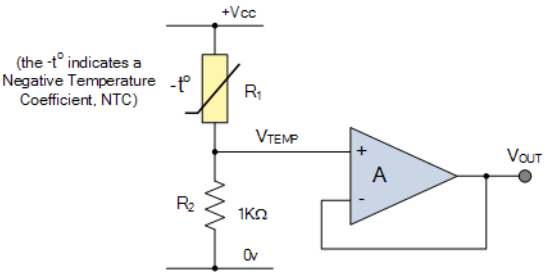

Fig (4) Temperature sensor circuit at 25°C

$$Vout = \frac{R_2}{R_1 + R_2} xV = \frac{1000}{10000+1000} x12v = 1.09v$$

At 100°C

$$Vout = \frac{R_2}{R_1 + R_2} xV = \frac{1000}{100+1000} x12v = 10.9v$$

By changing the fixed resistor value of R2 (in our example 1kΩ) to a potentiometer or preset, a voltage output can be obtained at a predetermined temperature set point for example, 5v output at 60oC and by varying the potentiometer a particular output voltage level can be obtained over a wider temperature range. It needs to be noted however, that thermistor's are non-near devices and their standard resistance values at room temperature is different between different thermistor's, which is due mainly to the semiconductor materials they are made from. The Thermistor, have an exponential change with temperature and therefore have a Beta temperature constant (β) which can be used to calculate its resistance for any given temperature point.

Temperature range: -40 degrees C to 150 degrees C / -40 degrees F to 302 degrees F **Output range:** 0.1V (-40 degrees C) to 2.0V (150 degrees C) but accuracy decreases after 125 degrees C

Power supply: 2.7V to 5.5V only, 0.05 mA current draw

Sample coding for Motor and GSM

```
#include <LiquidCrystal.h> const int buttonPin = 8; const int motorPin = 13;
LiquidCrystal LCD (12, 11, 5, 4, 3, 2); int buttonState = 0;
Void setup ()
{Delay (1000); Serial.write (0x1A); delay (1000);
 }
 Else
 {lcd.noDisplay (); lcd.noBlink (); digital Write (motorPin, LOW);}
}Lcd. Begin (16, 2); pin Mode (motorPin, OUTPUT); pin Mode (buttonPin, INPUT);
  }Void loop ()
{ButtonState = digital Read (buttonPin); if (buttonState == HIGH)
 {Lcd. Print ("MOTOR ON, VALVE1 OPEN");
```

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```
lcd.setCursor (0, 0); lcd.display (); digitalWrite (motorPin, HIGH);
Serial. Begin (9600); //Baud rate of the GSM/GPRS Module
Serial. Print ("AT"); Serial.write (0x0D); delay (1000); Serial. Print ("AT+CMGF=1");
Serial.write (0x0D); delay (1000); Serial. Print ("AT+CMGS="); Serial.write (0x22);
delay (1000);
Serial. Print ("9751002516"); //Number to which you want to send the sums
Serial.write (0x22); Serial.write (0x0D); delay (1000);
Serial. Print ("MOTOR ON, VALVE1 OPEN ");
//The text of the message to be sent
```

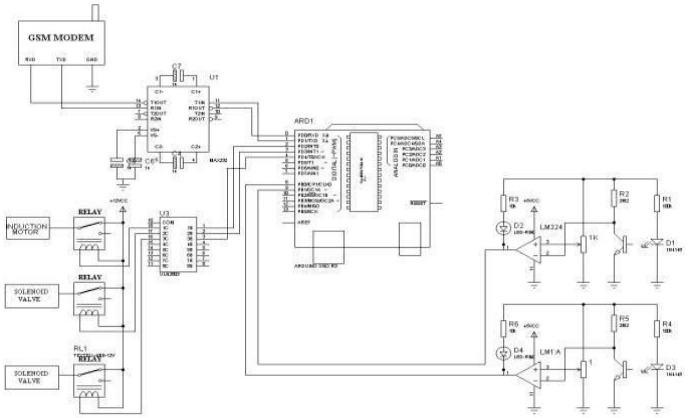

Fig (5) Circuit connection Diagram

2.4 WATER SOLENOID VALVE

Water solenoid valves are available in Brass, Stainless Steel and Plastic and would all be described as for general purpose applications as all three materials are suitable for mains water use but attention needs to be given to the water application parameters. System working pressures for water solenoid valves. Mains water is typically 2 or 3 bar, but in some areas such as in Cornwall the pressures are pumped and can exceed 10 bar, which can problems when using plastic solenoid valves that typically are limited to a maximum working pressure of 10 Bar, unlike Brass or Stainless Steel solenoid valves that typically work up to 15 bar or more.

2.5 WATER SOLENOID VALVES OPERATION

Weather it is a plastic, brass or stainless steel solenoid valve there are typically two different solenoid valve methods of operation, see below.

2.5.1 **Assisted Lift water solenoid valves** Assisted lift, direct acting or hung diaphragm solenoid valves do not require a pressure differential to operate i.e. a pressure difference between the inlet and outlet ports and are ideally suited for most mains water

applications, offering high flow rates. No consideration needs to be given to pressure differential and engineers can fit these solenoid valves in the safe knowledge of a positive opening and closing function regardless of system pressures. These are ideal for low pressure, vacuum,

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gravity fed and closed loop systems however typically they can operate up to 10 bar or more.

Helpful hint: Coil typically mounted centrally.

Typical pressure ranges: 0 to 10 Bar

Typical sizes ranges: 3/8 to 2″ thread and flange DN10 to DN300

2.5.1 Servo Assisted water solenoid valves

Pressure assisted or floating diaphragm solenoid valves for water require a pressure difference between the inlet and outlet ports to open and close. These are ideal for most mains water supply because they provide a high flow rate and typically mains water will supply sufficient pressure differentials for operation. These are ideal for open to atmosphere tank refill systems and systems that will offer the required pressure differential. Another benefit is that this design of water solenoid valve is typically less expensive than as assisted lift deign.

2.6 RELAY OPERATION

We know that most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of an n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.

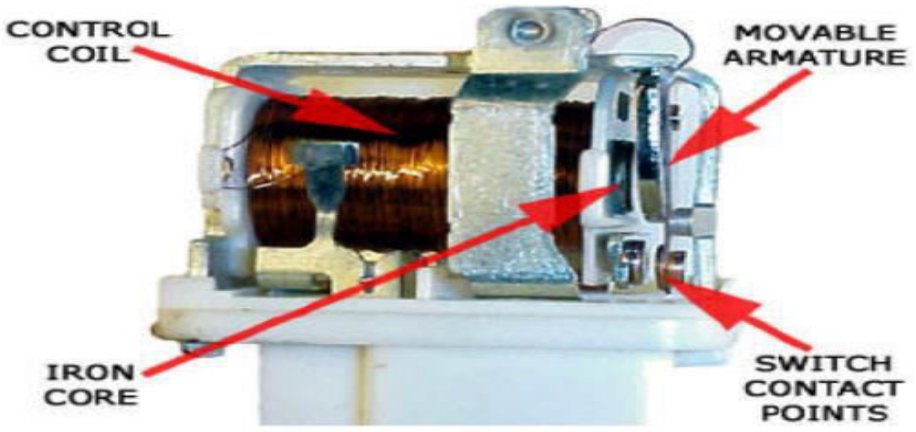

Fig (6) Relay Diagram

Why is a relay used?

The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits. The application of relays started during the invention of telephones.

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They played an important role in switching calls in telephone exchanges. They were also used in long distance telegraphy. They were used to switch the signal coming from one source to another destination. After the invention of computers they were also used to perform Boolean and other logical operations. The high end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors.

S.No	Soil moisture sensor Digital value (our option)	Power monitor Send to controller	Water flow valve status	Agriculture Pump
1	0-250	1 (or) 0	closed	off
2	255-500	1 (or) 0	closed	off
3	505-1000	1	open	on
4	505-1000	0	closed	off

Table (1) Table for pump operation based on sensor data and power status

WORKING, DISCUSSION AND RESULT:

In this research, above block diagram or circuit diagram working function is purely based on farmer's choice, if it is working automatic or manual. In this project the main control unit is Arduino controller. Various data's collected from the moisture sensor, temperature sensor, and main power available status from the power detecting circuit and water flow valve status everything send to the controller. If the former send the SMS to particular field control unit (i.e.) control Unit installed at agriculture pump shed, that system reply to the same mobile number what is the status of field? .the formers operate the pump and other interface modules based on the result of reply.

From the table (1), the moisture sensor value from 0 to 500(farmers choice), power monitor circuit data 1 or 0, the water flow valve closed and agro pump is OFF state. If the moisture sensor value from 505 to 1000(farmers choice), power monitor circuit data 1, the water flow valve is open and agro pump is ON state. . If the moisture sensor value from 505 to 1000(farmers choice), power monitor circuit data 0, the water flow valve is closed and agro pump is OFF state. This process continuously run every day when the main system on state. therefore the result of this research is fully automated field control system working is fine and reduced the man power, efficient operation increase the life span of the whole system and avoid the formers death etc..

III. CONCLUSION AND FUTURE WORK

Irrigation has been the backbone of Delta formers since man has started agriculture. As the generation progressed, man developed many approaches of irrigation to supply water to the land. In the present situation on conservation of water is of high importance. Present work is attempts to save the natural resources available for human kind. By continuously monitoring the status of the soil, electrical power availability, temperature monitoring the field etc. We can control the flow of water and thereby reduce the manpower. By knowing the status of moisture, power availability, valve status and

temperature through GSM with the use of moisture and temperature sensors, water flow can be controlled by just sending a message from our mobile. Conservation of water and labor: Since the systems are automatic, they do not require continuous monitoring by manual labor. System and operational flexibility:

As desired, any valve can be controlled along with the pump and increases the efficiency of water use. If water is stored in tanks at irrigation lands, one can get the status of the status of the water level, temperature sensor and moisture content in soil through SMS generator by intelligent device present at the irrigation field. The design is low power, low cost, small size, robust and highly versatile and complement to Delta formers. Thus, this method avoids above irrigation, below irrigation, highest soil erosion and reduce the wastage of water.

The main benefit is that the method's action can be reformed according to the situation (crops, weather conditions, soil etc.). By implementing this arrangement, agricultural, horticultural parks, gardens, commons, golf courses can be irrigated. Thus, this system is cheaper and efficient when compared to other type of automation method. In large scale applications

In future work we can find the wind, metrological status and motor protection circuit will be implemented in this research.

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