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Effective Water Distribution by MIS and Canal Automation

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Abstract: ***Canal irrigation system is the tool for monitoring and optimising water flow in irrigation project. Managing canal irrigation system to achieve efficiency, equity and sustainability is a difficult task. Irrigation water is an input for agricultural production. The objective of this study is to analyse an automation system in an irrigation system to control the water distribution throughout the area. Efficiency can be improved by scientific water management techniques. The irrigation system is to be studied based on different automation techniques. By management of irrigation system predictable and equitable water is to be distributed to beneficiaries in time.***

Keywords: Canal irrigation, Water management, Automation system, sustainability, beneficiaries

1. Introduction

Water is an essential input for crops. About 85% of freshwater is used for agriculture. It essential that irrigation canals are to be operated to their maximum efficiency by minimizing the wastage of water and maximizing flexibility of its resources. High-efficient irrigation systems require a flexible and stable water supply. For optimum amount of water resources water management strategies have to be developed. There are many systems to achieve water savings in various crops, from basic ones to more technologically advanced ones. The yield of crops depends on the quantity of water available to meet the demand at various stages of crop growth. Variable rate irrigation is very essential not only for the improvement of irrigation system but also to reduce the irrigation cost and to increase crop yield. The heart of automatic irrigation system (fixed rate or variable rate) is its control unit: as it controls irrigation time and water flow. Intelligent control based irrigation is necessitated to maximize the efficiency and production. The factors affecting different parameters of operation and the time requirement for collection and processing of data like canal, land, and crop are so large, that effective monitoring and evaluation of the project operation is not possible manually. Canal automation as a key tool, implies that, once set control structure are able to maintain desired flow rate or water flow in the canal without manual intervention. With the availability of personal computers and telecommunication networks, it is now possible to manage large irrigation system from remote locations effectively by updating and processing data in real time field data, such as canal status, flow and crop conditions, rainfall and other data through communication networks and processing them in computers to support the operational.

2. Irrigation Canal System

Irrigation is the artificial application of water to the land or soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall. During water distribution many areas are having rainfall and these rain fed areas do not require irrigation water. So large quantity of water is being lost due to inadequate communication. Most of the reaches are earthen canals, all the possibility of canal breaches and which leads to heavy water losses and crop damages due to insufficient communication system. The daily data from the remote areas regarding rainfall, canal discharge, crop details, shutter positions etc. are collected by the canal watchmen at the end of the day and he transfer these data's to his immediate supervisor . This causes delay of the corrected data and satisfactory monitoring and evaluation of project cannot be possible. Hence predictable reliable and equitable water cannot be supplied to the consumers as the water management implies.

3. Irrigation canal Automation

An automated irrigation system refers to the operation of the system with no or just a minimum of manual intervention beside the surveillance. Almost every system can be automated with the help of timers, sensors or computers or mechanical appliances. It makes the irrigation process more efficient and workers can concentrate on other farming tasks. An automation of irrigation system has several positive effects. Once installed, the water distribution on fields is easier and does not have to be permanently controlled by an operator. There are several solutions to design automated irrigation system.

The proposed system is to be designed to overcome the limitations of the present system and to provide additional facilities to the user. An automated irrigation system is developed to optimize water use for agricultural crops. In the automation system Arduino software and Bluetooth based android software is used. The system is designed as it is required at present as well as that may require in future. Fully automatic canal system needs automatic water distribution to the irrigation system.

3.2. Block Diagram

For proposed new system the soil moisture sensor is functional component of the system. The system uses Arduino board which is programmed using ARDUINO IDE software. The measured soil moisture from the soil moisture sensor is in the form of electric voltage level will fed to ADC

(Analog to Digital Converter) of our microcontroller this microcontroller will analyze the voltage level and provide the water content in the soil. The high-performance Atmel 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.Fig.1 shows the block diagram of the proposed system.

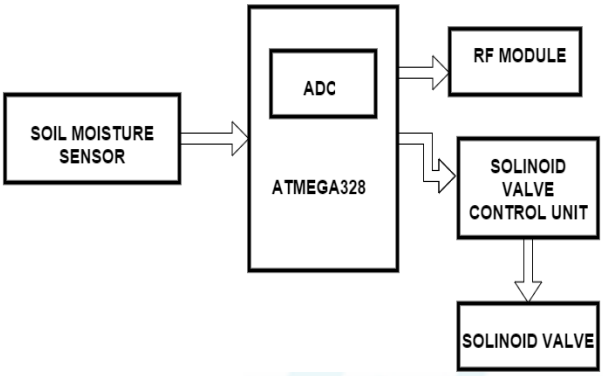

Figure 1: Block Diagram

4. Algorithm for Canal Automation

An algorithm is a step by step instruction given to complete specific task. Algorithm for the proposed system is made using embedded C language.

Step 1: Start
Step 2: Crop select A
Step 3: Initialize on time = off time – init on = init off = fi off = fi on =0, c1 =0, c2 =0
Step 4: If crop A is selected, go to Step 5
Else, go to Step 46
Step 5: Initialize day D =1, hour H =0
Step 6: If day >= 15, go to Step 7
Else, go to Step 8
Step 7: Reset day =1
Step 8: If day < 8, go to Step 9
Else, go to Step 36
Step 9: Initialize hour H =0
Step 10: Select field A and start hour timer counter.
Step 11: Check for manual control.
Step 12: If command receiver == ON, go to Step 13.
Else, go to Step 14.
Step 13: Pump ON, For off time calculation go to Step 15.
Step 14: Pump OFF, For on time calculation go to Step 22.
Step 15: c1 = ON
Step 16: If c2 == 0, go to Step 17.
Else, go to Step 21.
Step 17: init on = millis () /1000, Start counter and assign value to init on.
Step 18: fi off = init on.
Step 19: off time = fi off – init on.
Step 20: Increment c2.
Step 21: Display off time, go to step 34.
Step 22: c2 = ON
Step 23: if c1 ==0, go to Step 24.
Else, go to step 28.
Step 24: init off = millis () /1000, Start counter and assign value to init off.
Step 25: fi on = init off.
Step 26: increment c1.
Step 27: on time = fi on – init on.
Step 28: Display off time, go to step 34.
Step 29: Initialize analog pin A0 and digital pin D11.
Step 30: If sensor value > moisture value, go to step 41.
Else, go to step 33.
Step 31: If rainfalls, go to step 34.
Else, go to step 32.
Step 32: Pump ON, For off time calculation go to Step 15.
Step 33: Pump OFF, For on time calculation go to Step 22.
Step 34: If H < = 24, go to step 30.
Else, go to Step 35.
Step 35: Increment day and go to Step 6.

4.1 Program using Arduino

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
unsigned int ontime=0, offtime=0, initon=0, initoff=0, fion=0, fioff=0;
int c1=0, c2=0;
const int ledPin =8;
int sensorValue;
char incomingByte;
void setup()
{

  lcd.begin(16, 2);
  Serial.begin(9600);
  lcd.print("welcome....!");
  lcd.clear();
  pinMode(ledPin, OUTPUT);
  millis();
}
void on()
{  c1=0;
  if(c2==0)
  { initon= millis()/1000;
  fioff=initon;
  offtime=fioff-initoff;
  c2++;
  ontime=0;
  }
  digitalWrite(ledPin, HIGH);
  lcd.setCursor(12, 0);
  lcd.print("ON");
  lcd.setCursor(0, 0);
  lcd.print("OFF time=");
  lcd.print(offtime);
  digitalWrite(ledPin, HIGH);
  lcd.setCursor(12, 1);
  lcd.print((millis()/1000)-initon);
  Serial.println("LED ON. Press 1 to LED OF!");
}
void off()
{ c2=0;
  if(c1==0)
  {
```

```
    initoff=millis()/1000;
    fion=initoff;
    c1++;
    ontime=fion-initon;
    offtime=0;
   }
   digitalWrite(ledPin, LOW);
   lcd.setCursor(12, 0);
   lcd.print("OF");
   lcd.setCursor(0, 0);
   lcd.print("ON time=");
   lcd.print(ontime);
   lcd.setCursor(12, 1);
   lcd.print((millis()/1000)-initoff);
   Serial.println("LED OFF. Press 1 to LED ON!");
}
void loop()
{
 if (Serial.available() > 0)
 {  // if the data came
 incomingByte = Serial.read
 (); // read byte
 int sensorValue = analogRead(A0);
 delay(100);
 lcd.clear();
 lcd.setCursor(0, 1);
 lcd.print("ADC=");
 lcd.print(sensorValue);
 if(incomingByte == 'b')
   {
    digitalWrite(ledPin, HIGH);
    Serial.println("Motor ON");
    on();
   }
    while(incomingByte=='a')
    {
       if (Serial.available() > 0)
       {
       incomingByte = Serial.read();
       }
            int sensorValue = analogRead(A0);
            if(sensorValue>850)
            {
             Serial.println("LED ON. Press 1 to LED OFF!");
             on();
            }
            else
            {
             Serial.println("LED OFF. Press 1 to LED ON!");
             off();
            }
            delay(100)  }
}}
```

5. Conclusion

Canal automation is an implementation of control system that upgrades the conventional method of system operations. It is a method used to regulate a system by mechanical or electrical equipment that takes the place of human observation, effort and decision. Different methods are used for effective distribution by canal .The automated irrigation system implemented is found to be feasible and cost effective for optimizing water resources for agricultural production by using Arduino software.

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