Automatic Flood Gate and Flood Control System with Power Generation using ARDUINO UNO

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Abstract - Autonomous dam and drainage system is a system which does not require to operate by hand. Nowadays water logging due to tide has become a great problem. In this paper, an automatic dam gate system has been proposed to automatically control dam gate without human effort. An autonomous dam gate system has been developed which can be used to protect the low-lying area from the tidal water as well as it can also be used in an irrigation canal, power plant, factories etc. The system is capable of sensing drain water and tidal water. By sensing drain water, it controls a pump to irrigate excessive water. DC motors are used to control the movement of dam gates. Arduino UNO is used as the processor. A control box is provided to control and observe the condition of the whole system.

Keywords—Autonomous Floodgate; Arduino Uno; Motor Driver Controller

INTRODUCTION

Water management system is currently an issue of growing concern. Reasonably limited water supplies, preservation and durability policies along with the infrastructure complexity for achieving consumer and irrigation requirements with quality levels help to make water management a challenging regulation problem. Water supply, treatment, transportation, and distribution are typically operated separately, by diverse authorities. Planning and managing of these subsystems have different objectives and timescales [1]. Faced with the rising demand in case of saving water, hydraulic engineers employ automatic control techniques to acquire a better performance in the real-time functioning of open-channel systems [2].

In recent years numerous cities in the world has been confronting extensive water logging, particularly for several tidal effects in addition to heavy rainfall. In order to get over this situation, this project is regarded as a valuable way to resolve water logging. After analyzing some paper structured on automatic dam gates, it is noticed that PLC was applied in those systems like [3] for regulating motors while some other systems [4] were designed with wireless sensors. But in practice, it is really expensive and complex for small-scale dam gate projects. However, in some system [5], three phase induction motor was utilized to use for gate movement which enhances the complexity of the system.

To overcome these problems, an autonomous dam gate system has been proposed and developed in this paper that will be able to open and close gates automatically when it is necessary and subsequently reduce tidal water effect. After taking into consideration all limitations, An Arduino based autonomous dam gate technique has been designed using a low-cost sensor which offered better water level detection as well as consequently will be utilized to protect lowland areas from tidal water or excessive water during the flood as well as proper drainage issue.

LITERATURE REVIEW

A PLC based rubber dam monitoring system has been presented in [3] by June Guo and Qingchun Chen using the fuzzy logic control to monitor the water filling and water releasing process as well as lock control system. The water filling and releasing process can be controlled remotely whereas the lock control system can be controlled by Distributed Control System (DCS).A wireless flood control system has been proposed in [4] by Indiana H. C. and Obama M. E. This micro controller based system comprises of water level sensors, wireless sensor network, water channel and supervisory components where SCADA system is used to prevent the incessant flooding and its hazardous impact on the population. A paper on automatic canal gate control using PLC and VFD has been presented in [5] by Mahesh Nandaniya which is an overview of canal automation. Variable Frequency Drive (VFD) is used to control the motor speed of the system while Programmable Logic Controller (PLC) is used to control the whole system automatically. A solar panel is also attached to the system to run it using solar power without using external power sources. And the whole system will be monitored by a supervisory control and data acquisition system which means SCADA package.

METHODOLOGY

The goal of this project is to develop an autonomous dam gate system and the main objective of this paper is to demonstrate a system to control the dam automatically so that it can control the water flow autonomously to make an effective use of water in the irrigation system as well as to control floods. Figure 1 shows the overall working process of the system where water level sensor is used to detect the level of water and provide a signal to the Arduino. As well as a micro switch has been incorporated here to detect the gate position, it is either open or close. Arduino UNO is used here as the main processor, which analyzes the data provided from the water level sensor and micro switch, and after completing the analysis process a signal is sent to the L293D motor driver, which controls the motor to open or close the dam according to the output. Water level sensor, which is situated on the drain side, detects the level of the drain water and this sensor again sends the level information to the processor.

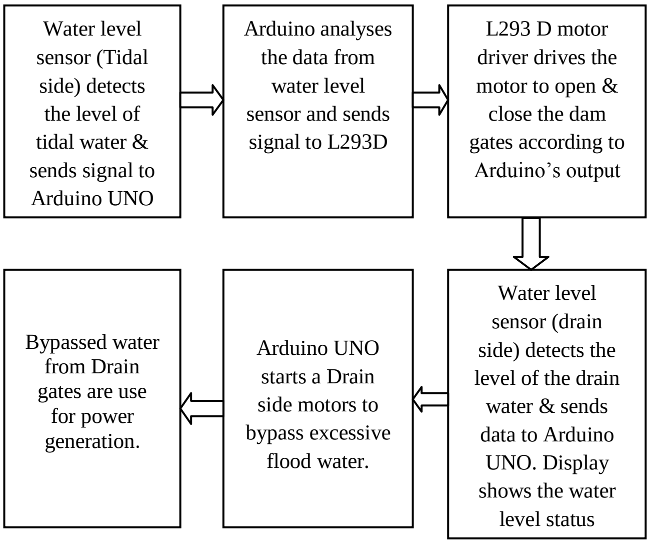


Fig. 1. Block Diagram of Methodology of the System

HARDWARE INTERFACING

In this project, Arduino UNO is employed as the processor. Water level indicator sensors are used to detect water level as well as DC motors along with gear rack system is implemented in the system to open or close gates. A DC pump has been utilized to use to pump water whereas Micro switch and push switches are used for switching operation.

The hardware interfacing is illustrated in figure 2. An LCD module is coupled with Arduino through parallel communication. The LCD is connected through Arduino's digital pin 2-5 and 11-12. Parallel communication is a method of offering multiple binary bits simultaneously which is fast, straightforward and comparatively easy to implement. The parallel interface typically controls the LCD through 8 data pins and 3 control lines.

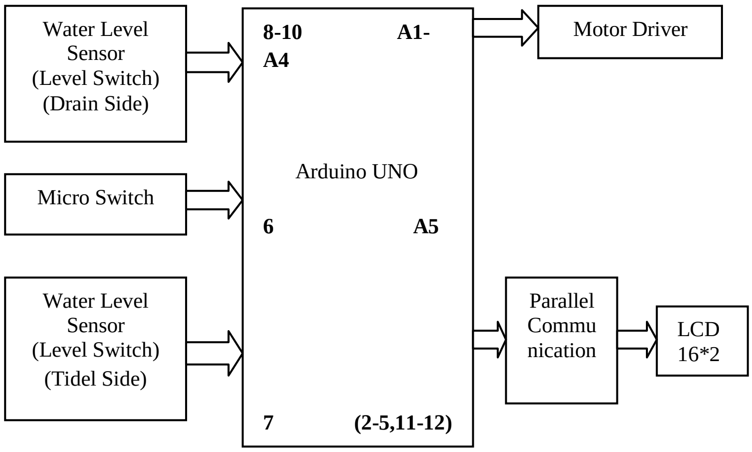


Fig 2: Functional block daigram of hardware interfacing

A water level sensor (level switch) for the drain side is attached to Arduino digital pin 8-10 and another water level sensor (level switch) for the tidal side is connected through Arduino's digital pin 7. The micro switch is connected to Arduino pin 6. Two motor drivers are attached to Arduino through analog pin A1-A4 and a relay is connected to analog pin A5.

PROGRAMMING

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
 LiquidCrystal_I2C lcd(0X3F,16,2);
 byte sensorPin[]={8,9,10};
 byte ledPin[]={11,12,13};
 const byte sensors=3;
 int level=0;
 int enA=3;
 int enB=6;
 int in1=2;
 int in2=4;
 int in3=5;
 int in4=7;
 int limitswA=0;
 int limitswB=0;
 int limitswC=0;
 void setup() {
  lcd.init();
  lcd.backlight();
```

```
lcd.setCursor(0,0);
lcd.print("water level\n");
pinMode(enA,OUTPUT);
pinMode(enB,OUTPUT);
pinMode(in1,OUTPUT);
pinMode(in2,OUTPUT);
pinMode(in3,OUTPUT);
pinMode(in4,OUTPUT);
digitalWrite(in1,LOW);
digitalWrite(in2,LOW);
digitalWrite(in3,LOW);
digitalWrite(in4,LOW);
for(int i=0;i<sensors;i++)
{
 pinMode(sensorPin[i],INPUT);
 pinMode(ledPin[i],OUTPUT);
}}
void loop()
{
 level=0;
 for(int i=0;i<sensors;i++)
 {
  if(digitalRead(sensorPin[i])==LOW)
  {
   digitalWrite(ledPin[i],HIGH);
   level= sensors-i;
  }else{
   digitalWrite(ledPin[i],LOW);
  }}
  lcd.clear();
  lcd.setCursor(0,1);
  switch(level)
  {
  case 1: lcd.print("L:H,G1:O,G2:O");
  hLevel();
 avDetect(limitswB);
 lvDetect(limitswA);
  break;
  case 2:lcd.print("L:A,G1:AO,G2:C");
 aLevel();
  break;
  case 3:lcd.print("L:Low,G1:C,G2:C");
  lLevel();
  break;
  default:lcd.print("No Water,");
  break;
}}
int lLevel()
{
 digitalWrite(in1,LOW);
  digitalWrite(in2,LOW);
  digitalWrite(in3,LOW);
  digitalWrite(in4,LOW);
  return 00;}
 int aLevel()
 {
  while (limitswC==0)
 {
  limitswA=1;
  limitswC=1;
 analogWrite(enA,255);
 digitalWrite(in1,HIGH);
 digitalWrite(in2,LOW);
 delay(1000);
 digitalWrite(in1,LOW);
 digitalWrite(in2,LOW);
 analogWrite(enA,00);
 }
 return limitswA=1;
 return limitswC=1;
}
int hLevel()
{
 do
 {
  limitswB=1;
 analogWrite(enA,255);
 digitalWrite(in1,HIGH);
 digitalWrite(in2,LOW);
 delay(1000);
 digitalWrite(in1,LOW);
 digitalWrite(in2,LOW);
 analogWrite(enA,00);

 analogWrite(enB,255);
 digitalWrite(in3,HIGH);
 digitalWrite(in4,LOW);
 delay(4000);
 analogWrite(enB,00);
 digitalWrite(in3,LOW);
 digitalWrite(in4,LOW);
 }while(limitswB!=1);
 return limitswB=1;
}
int avDetect(int limitswB)     {

 while(limitswB ==1 )
 {
  if(digitalRead(sensorPin[1])==HIGH)
  {
   limitswB=0;
   analogWrite(enA,255);
 digitalWrite(in1,LOW);
 digitalWrite(in2,HIGH);
 delay(1000);
analogWrite(enA,00);
digitalWrite(in1,LOW);
 digitalWrite(in2,LOW);
 analogWrite(enB,255);
 digitalWrite(in3,LOW);
 digitalWrite(in4,HIGH);
 delay(4000);
 analogWrite(enA,00);
 analogWrite(enB,00);
```

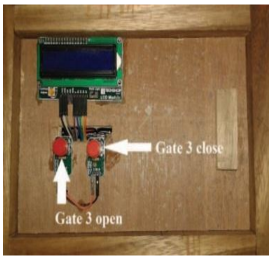
```
digitalWrite(in1,LOW);
digitalWrite(in2,LOW);
digitalWrite(in3,LOW);
digitalWrite(in4,LOW);
return limitswB=0;
 }}}
  int lvDetect(int limitswA)
{
while(limitswA ==1 )
{
 if(digitalRead(sensorPin[0])==HIGH)
 {
  limitswA=0;
  limitswC=0;
  analogWrite(enA,255);
digitalWrite(in1,LOW);
digitalWrite(in2,HIGH);
delay(1000);
analogWrite(enA,00);
digitalWrite(in1,LOW);
digitalWrite(in2,LOW);
analogWrite(enB,00);
digitalWrite(in3,LOW);
digitalWrite(in4,LOW);
return limitswA=0;
return limitswC=0;
 }}}
```

RESULT AND DISCUSSION

Gate movement

Figure below (a) and (b) shows the direction of opening and closing of the dam gate 3. Figure (b) shows the control box where push switches are used to open or close the manual gate 3.

(a)



(b)

LCD status

Figure below show the display of the gates and water . When the gate closes, the display shows the closing status and when the gate opens, the display shows the opening status in Figure below.

Fig: Opening and Closing of Gate

CONCLUSION

Design & implementation of an autonomous dam gate scheme is a difficult task due to certain limitation including accessibility of high-quality level sensor, good quality motor, complex hardware etc. Some difficulties had been faced during design and implementation of this dam gate system together with the problem of power for the whole system. The proposed system has the potential of sensing water level and at the same time taking decision for movement of dam gates. This system also can initiate a water pump to draw out the excess water from the drain and use it in the irrigation process. This system can be used to protect lowland areas from tidal water. It can also be utilized in an irrigation canal, power plant, industries etc. However, some others addition and modification of the system can be available for the further improvements. Nevertheless, Arduino based dam gate monitoring system has made our system more reliable and feasible due to low cost and at the same time great effectiveness of Arduino over microcontroller or PLC.

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BIOGRAPHIES

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