SRWH System Based Sustainable Groundwater Development in India

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Abstract— Water plays a vital role in proper functioning of all Earth's ecosystem and human activities such as agriculture and other essential activities. Hence the water conservation ,has risen to be an important issue in today's society. Rainwater harvesting (RWH) is a simple method by which rainfall is collected and saved for future usage. The collected rainwater may be stored, utilized in different ways or directly used for recharge purposes. But there is no automated system for Rain Water Harvesting (RWH).Even though government takes many useful steps to increase ground water level by RWH, public's contribution is much lesser due to lack of facility and cost factor. Some people have implemented traditional RWH setup, but do not maintain properly. To solve this kind of issues, an automated system is proposed to increase rainwater and to increase ground water level. The proposed system consists of two sensors mainly, one is optical rain sensor to detect the occurrence of rainfall and another is cloud sensor to detect presence and nature of cloud. For this, a water level sensor is implemented in tank that continuously monitors the water level. If the output of water level sensor is reduced or maintains in a constant level, then the information will also be sent to monitoring sector through IoT. Hence the proposed system is implemented for efficient RWH which is simpler and cost effective.

Keywords: Buzzer, Microcontroller, Optical Rain Sensor, Cloud Sensor, Water Level Sensor, Water Flow Sensor, LCD, Power Supply

I. INTRODUCTION

Development of human societies is heavily dependent upon the availability of fresh water in adequate quantities and with suitable qualities . All sources of fresh water on e artho originate from rainfall. As accumulated surface un-off, rains feed the flow so most of the non-perennial rivers. When the surface un-off infiltrates into subsoil, it forms ground water. As the ground water level increases, it oozes out as springs. Perennial springs are the fountain head so many surface water bodies such a slakes, streams and perennial rivers. 'Total supply off resh water on earth far exceeds human demand. However, many region so the world constantly' face scarcity of water. Not very long ago, in some of the current water scarce regions, it was thought that water is abundantly available. Water scarcity is caused due to both quantitative as well as qualitative reasons. Quantitatively, availability of water in time and space is not equaly distributed. Poor quality fresh water limits its beneficial uses causing scarcity. In area of growing scarcity, environmental deterioration and capital constraints, the conventional approach of continuously expanding supplies is not well-suited.. Non-conventional water resource management strategies that lead to rational use of already available water and augmentation of existing fresh water sources are, the need of the hour.

II. METHODOLOGY

The block diagram of SRWH system is shown in Fig 1. It consists of two sensors mainly one is optical rain sensor to detect the occurrence of rainfall and another is cloud sensor to detect presence and nature of cloud. when rainfall begins an alert will be intimated by buzzer to person based on output of rain sensor and cloud sensor. When rainwater from terrace begins to flow through pipe, a water flow sensor implemented at the top of pipe, measures the flow level to detect whether any leakage occurs in pipe. This leakage checking is done by comparing the output values of two flow sensors. Rain does not alonely interface but also falls in surrounding of house.

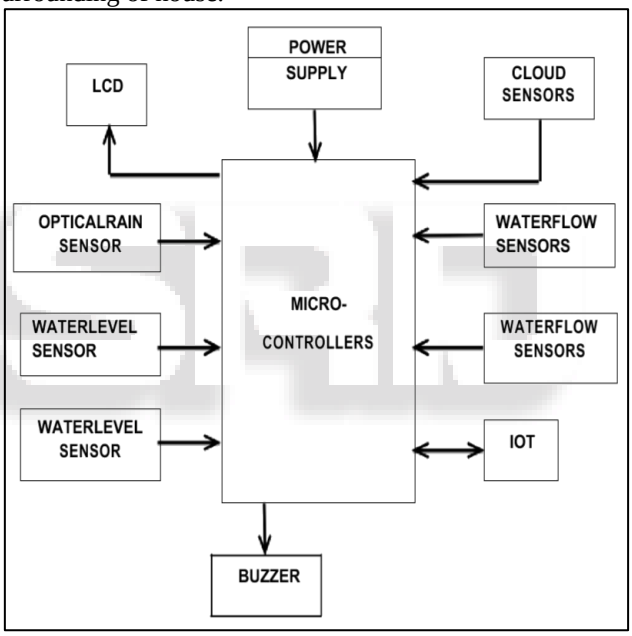


Fig. 1: Block diagram for SRWH

By chance of reaching threshold value, water sucking mechanism is activated to suck the stay water and fill to tank through pipe. There is another water level sensor in side the tank to the total quantity of water harvested. The quantity of water will be updated to monitoring sector through internet of things (IoT). Based on the quantity of water, certain amount of money will be credited to the person. To avoid some fraudulent activities done by public for money, back flow of rain water from tank to terrace should be monitored. For this a water level sensor is implemented in tank that continuously monitors the water level. If the output value of water level sensor is reduced or maintains in a constant level, then the information will also be sent to monitoring sector through IoT.

1) A power supply unit (or PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. Modern personal computers universally use switched-mode power supplies. Some

power supplies have a manual switch for selecting input voltage, while others automatically adapt to the main voltage.

2) The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.
3) Arduino is an open-source project that created micro controller board kits for building digital devices. The project is based on micro controller board designs, produced by several vendors, using various micro controllers. These systems provide sets of digital and analog input / output (I/O) pins that can interface to various expansion boards and other circuits.
4) Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices.
5) Rain detector: The rain detector will give you a heads-up the instant it starts to rain, hopefully giving you time to close windows and bring in possessions. The battery powered circuit draws virtually no current when the sensor is dry and the current consumption is low when the buzzer is activated so a couple of AA cells will last a long time.
6) Water flow sensor: water flow sensor consists of a plastic valve body. a water rotor, and a hall effect sensor.when water flows through the rotor, rotor rolls. It's speed changes with different rate of flow, The hall effect sensor outputs the corresponding pulse signal.
7) Water pump motor: A pump motor is a DC motor device that moves fluids. A DC motor converts direct current electrical power into mechanical power DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field experiences a torque and has a tendency to move this is known as motoring action

III. PIN DESCRIPTION AND ITS EXPLANATIONS

Pin No.	Name	Description
Pin no. 1	D7	Data bus line 7 (MSB)
Pin no. 2	D6	Data bus line 6
Pin no. 3	D5	Data bus line 5
Pin no. 4	D4	Data bus line 4
Pin no. 5	D3	Data bus line 3 (MSB)
Pin no. 6	D2	Data bus line 2
Pin no. 7	D1	Data bus line 1
Pin no. 8	D0	Data bus line 0 (LSB)

Fig. 2: Pin diagram of LCD module

A. *LCD module:*

The most commonly used character based LCDs are based on Hitachi's HD44780 controller.In this tutorial, we will discuss about character based LCDs, their interfacing with various micro controllers,various interfaces, programming, special stuff and tricks you can do with these simple looking LCDs which can give a new look to your application

B. *DC motor:*

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source.

IV. SOFTWARE REQUIREMENTS

A. *EMBEDDED C*

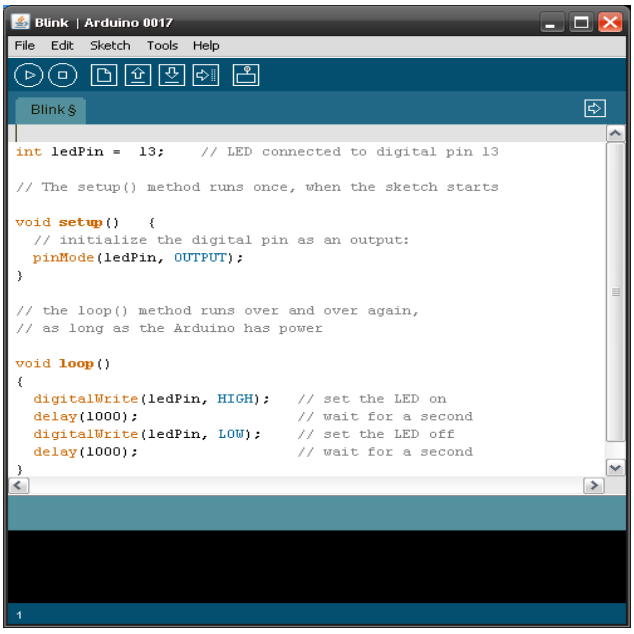
High-level language programming has long been in use for embedded-systems development. DSPs are often programmed in assembly language by programmers who know the processor architecture inside out. The key motivation for this practice is performance, despite the disadvantages of assembly programming when compared to high-level language programming.

B. *MPLAB IDE*

MPLAB Integrated Development Environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchips PIC and dsPIC microcontrollers. MPLAB IDE runs as a 32-bit application on Microsoft Windows, is easy to use and includes a host of free software components for fast application development and super-charged debugging.

V. VERIFICATION AND RESULTS

A. *Simulation Results Snapshots*



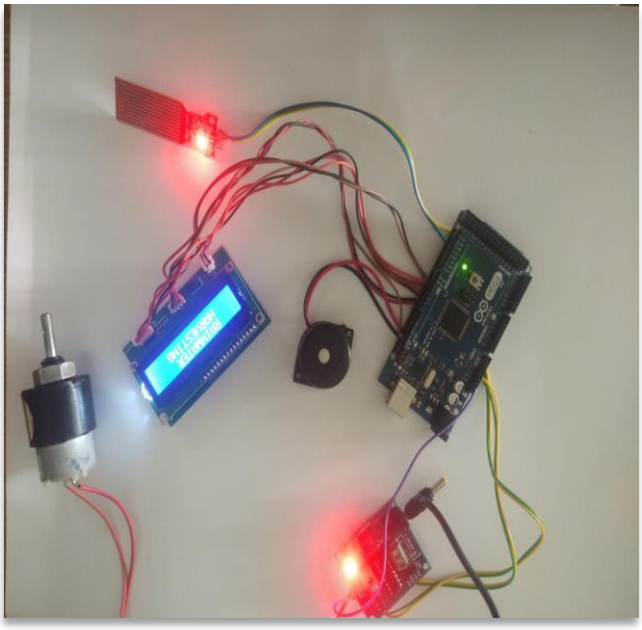


Fig. 4: Output for SRWH

VI. SAMPLE CODING

```
#include <SoftwareSerial.h>
#include <LiquidCrystal.h> //Load Liquid Crystal Library
LiquidCrystal lcd(7, 6, 5, 4, 3, 2);
int r=8;
int m1=10;
int m=11;
int b=13;
int buzz;
int ope;
int clo;
 int s=1;
void setup() {
  // put your setup code here, to run once:
    lcd.begin(16,2); //Tell Arduino to start your 16 column 2 row LCD
lcd.setCursor(2,0);   //Set cursor to first column of second row
lcd.print(" RAINWATER        "); //Print blanks to clear the row
lcd.setCursor(2,1);   //Set cursor to first column of second row
lcd.print(" HARVESTING       "); //Print blanks to clear the row
   delay(2000);
lcd.clear();
pinMode(r,INPUT);
pinMode(m1,OUTPUT);
pinMode(m,OUTPUT);
pinMode(b,OUTPUT);
   Serial.begin(9600);
   digitalWrite(buzz,LOW);
digitalWrite(m1,LOW);
digitalWrite(m,LOW);
   }
   void loop()
{
  int rain=digitalRead(r);
  lcd.setCursor(0,0);   //Set cursor to first column of second row
  lcd.print("RAIN:"); //Print blanks to clear the row
  if(rain==HIGH)
  {
   if(s==1)
    {
  lcd.setCursor(6,0);   //Set cursor to first column of second row
  lcd.print("yes     "); //Print blanks to clear the row
  digitalWrite(b,HIGH);
  digitalWrite(m1,HIGH);
  delay(2000);
  digitalWrite(b,LOW);
  digitalWrite(m1,LOW);
    s=2;
    }
  }
     if(rain==LOW)
  {
    if(s==2)
    {
  lcd.setCursor(6,0);   //Set cursor to first column of second row
  lcd.print("no    "); //Print blanks to clear the row
  digitalWrite(b,LOW);
    digitalWrite(m,HIGH);
delay(2000);
digitalWrite(b,LOW);
digitalWrite(m,LOW);
s=1;
  }
  }
}
```

VII. CONCLUSION

The world is facing various challenges related to water sustainability and to save rain water. Hence with the advancement in the field of embedded systems and IOT many ideas have been proposed related to rain water harvesting and water sustainability. Hence in this paper efficient system is designed using sensors to detect water level and save water and IoT is used along with sensor nodes to give information to the control section for further action.

Preliminary results have shown a fully operational prototype system capable of measuring the water flow comparing the data and reproduce if with a minimal error. This will result in better customer satisfaction with reduced maintenance cost. The proposed system revealed results with discrete and reliable values which allow measurements of other parameters besides the water flow. Thus the system proves to be a efficient prototype which attracts public to install this system with low cost. It is convenient to be implemented in urban development as it reduces operational and maintenance cost.

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