

Water Level Indicator with Temperature Sensor

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Abstract: In the power generation industry, centralising to thermal application for energy generation, the effect of control systems plays a vital role in this controllers are required to meet the energy, environmental and safety standards of the power plant. Hence, monitoring controllers are required in these systems. For an instance in thermal powerplants, there is requirement for steam flow regulation, temperature regulation etc. There comes the need of water level indicators with temperature sensor for monitoring safety limit temperature. Hence, an automated water level indicator is designed in a way that it monitors all the levels of water to be fed into the crucible for heating water. If it exceeds the crucible limit the sensor breaks the circuit for overflow alert. Similarly the temperature sensor is the safety device used in the heat tank to monitor the specified limit of temperature up to which the water has to be heated for steam generation.

Keywords: LED, 16x2 LCD, Temperature Sensor (LM35), BUZZER, PUSHBUTTON, ARDUINO UNO

I. Introduction

Science has given the art of designing systems that has helped in reducing human efforts. With growing prospects of technology, we also have gained the control over energy generation, conversion, transmission etc. But as it is that handling energy with proper protection is the need of the day to fully master any energy, hence protection systems have to be designed well to prevent any disasters that can be localized or nuclear. The automatic water level indicator with a temperature sensor is a safety device that is used in energy generation industry that requires hydrothermal energy for power generation. The water level indicator is used in crucibles to monitor the level of water that has to be fed in it to convert the water to superheated steam. Along with this temperature monitoring is very essential. To counter this issue, the temperature sensor is used to check whether the temperature limit is reached or not. If the temperature limit is exceeded, the safety valve is automatically opened to prevent crucible from bursting out.

1. LED

A **light-emitting diode (LED)** is a two-lead semiconductor light source. It is a PN Junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

Why LED? LED indicate water level. The terminals of LED is inserted in the water tank. When water rises to different levels it make a connection and thus it turn ON the LED. If only one LED is glowing it indicate that water is at level 1 marked on tank. Similarly if two LED glows it indicate water on tank is at level 2. And if all the LED glow it indicates that water has reached maximum level and the motor needs to be turned off show that water doesn't overflow from the tank.

A Resistor is used with LED which **limit the current** in the LED to a safe value. The value of the resistor can be determined by ohms law.

Calculation –

The voltage drop across LED = 2V (STANDARD)

Current for better brightness = 20mA (STANDARD)

Apply Voltage = 5V

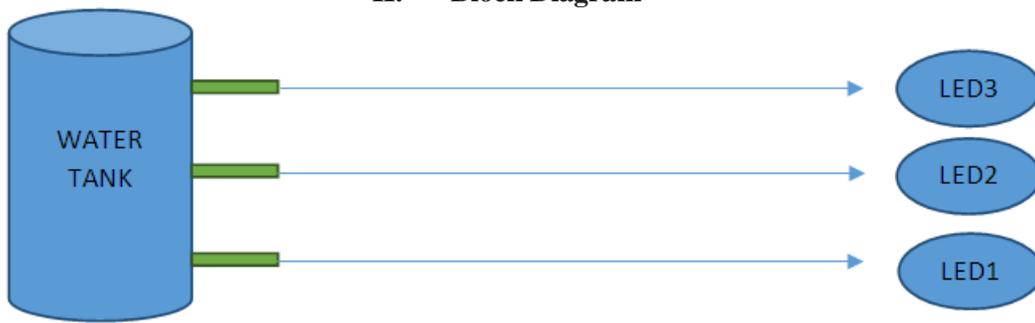
Using ohms law –

$V = I * R$

$R = (5-2) / 20 \text{ Ma}$

$R = 150 \text{ ohm}$

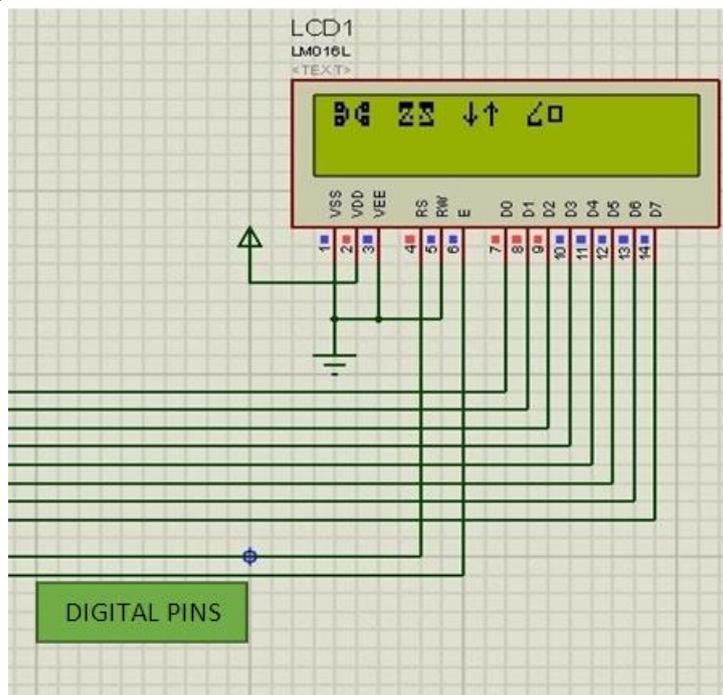
II. Block Diagram



2.16x2 LCD

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. This LCD has two registers namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. Now why LCD is used here? The answer is it provide a GUI through which user will able to know the current temperature and if the temperature exceed the threshold temperature then user will know it time to limit the fuel supply. A **16x2 LCD** is used as it is economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments).

2.1. Circuit Diagram



PIN Configuration:-

7.Program Code

III. Temperature Sensor (LM35)

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With **LM35**, temperature can be measured more accurately than with a thermistor. It also possess low self-heating and does not cause more than 0.1°C temperature rise in still air. The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every °C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/°C.

Why Temperature Sensor? The temperature sensor senses the temperature of the boiler at regular intervals and provides a continuous track of the temperature variations. As soon as temperature rises above a particular threshold it gives the indication that the temperature has reached maximum value in the boiler and needs to be switched off.

LCD show both Temperature in °C and °F. The conversion formula for °C to °F is given by –
 $^{\circ}\text{C} \times 9/5 + 32 = ^{\circ}\text{F}$

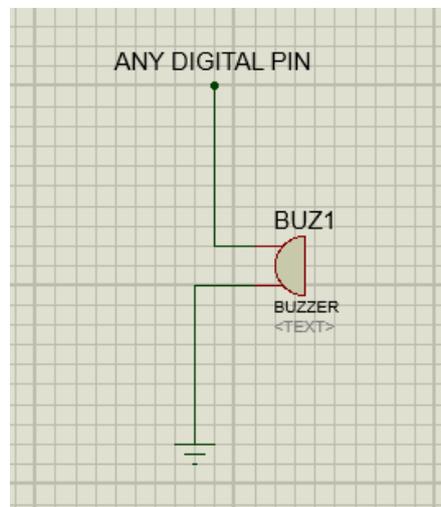
3.1. Circuit Diagram

IV. Buzzer

A **buzzer** or **beeper** is an audio signaling device which may be mechanical, electromechanical. It has two terminal device. One terminal is GND and the other terminal is VCC (+5v) and requires a current of 10 mA and 30 mA (buzzer consumption depends mainly on the voltage used). An electric buzzer uses an electromagnet to make a loud repetitive sound. Some beepers or buzzer "electronic" with integrated oscillator, producing a continuous sound, while others produce a sound interrupted (chopped).

Why BUZZER? Buzzer is used as an indicator. The buzzer employed in the arrangement indicates that the overflow of water has taken place and the tank should no longer receive the water from supply for that purpose motor needs to be turnoff.

4.1. Circuit Diagram



V. Push Button

The **pushbuttons** is electrical or electronic component designed to interrupt or divert the flow of electric current or other signals in an electrical circuit devices.

Why Pushbutton? It provide user to see temperature in °F from °C and When the pushbutton is not pressed the LCD will show the temperature in centigrade. When user will press the button, the LCD now will show the temperature in Fahrenheit. Also a PULLUP Resistor of 10k is used to ensure that the signal will be a valid logic level if external devices are disconnected or high-impedance is introduced.

5.1. Circuit Diagram:-



VI. ARDUINO Uno

The Arduino Uno is a microcontroller board based on the ATmega328. ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, and a reset button. It can be powered via the USB connection or with an external power supply. The power source is selected automatically. The power pins are VIN, 5V, 3V3, GND, IOREF. Why Arduino UNO? It provides an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

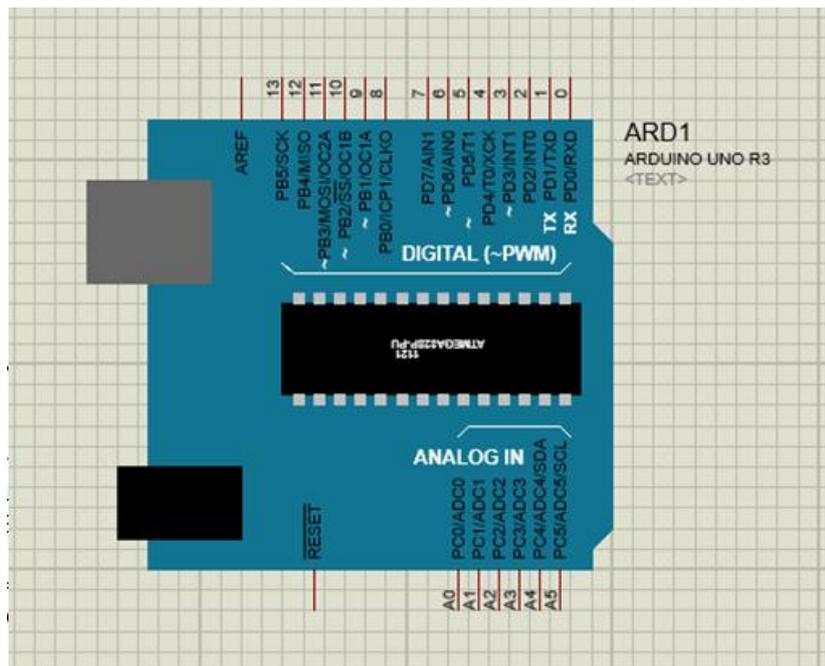


Fig 6.1: Arduino UNO in Proteus [IDE]

Source Code

```
#include <LiquidCrystal.h>
LiquidCrystal lcd (12, 11, 10, 9, 8, 7, 6);
int a=0,b=1,c=2,d=3;
int switchpin=4;
boolean lastbutton=LOW;
boolean currentbutton=LOW;
int sensorPin = 0;
void setup()
{
  pinMode(a,OUTPUT);
  pinMode(b,OUTPUT);
  pinMode(c,OUTPUT);
  pinMode(d,OUTPUT);
  Serial.begin(9600);
  lcd.begin(16,2);
  pinMode(switchpin,INPUT);
}

boolean debounce(boolean last)
{
  boolean current = digitalRead(switchpin);
  if(last!=current)
  {
    delay(5);
```

```

current= digitalRead(switchpin);
    }
return current;
}
void loop()
{

digitalWrite(a,HIGH);

digitalWrite(b,HIGH);

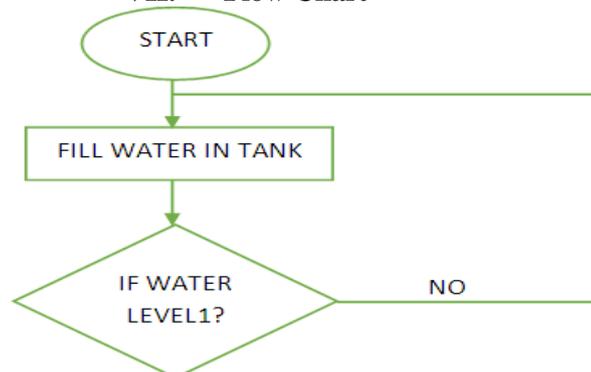
digitalWrite(c,HIGH);

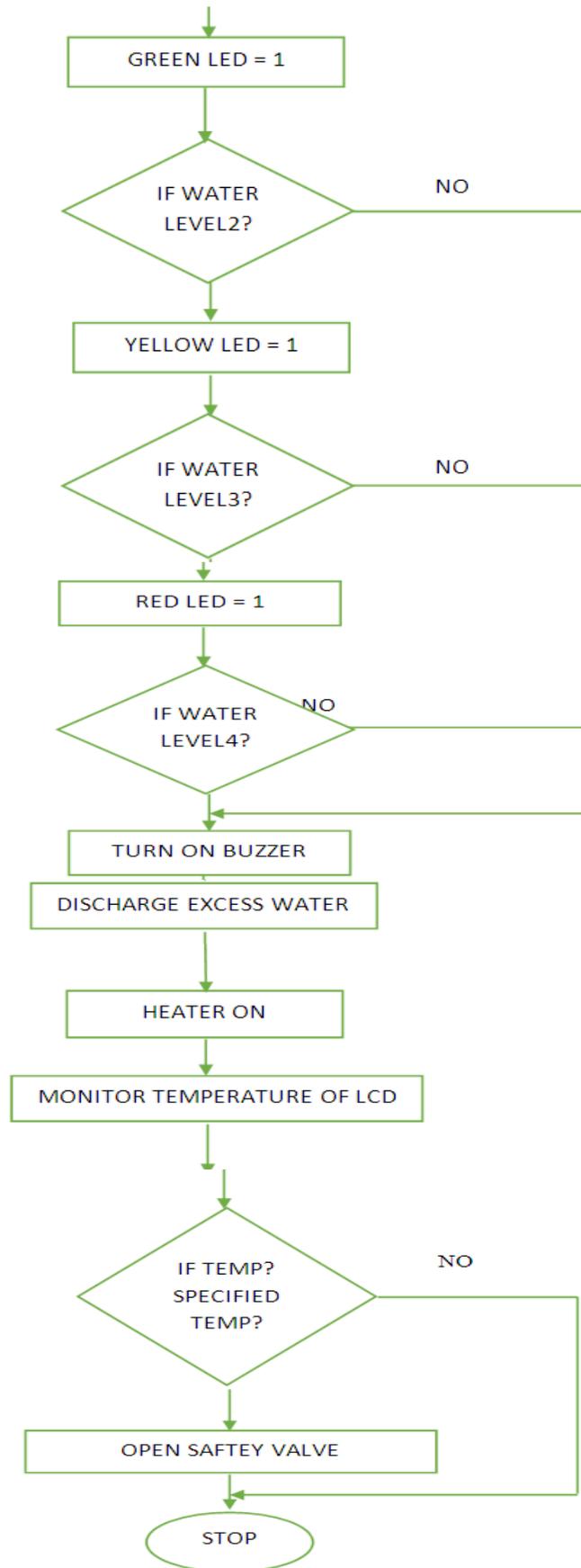
digitalWrite(d,HIGH);
Serial.print(digitalRead(switchpin));
    currentbutton=debounce(lastbutton);
int reading = analogRead(sensorPin);
float voltage = reading * 5.0 / 1024;
float temperatureC = (voltage) * 100 ;
float temperatureF = (temperatureC * 9 / 5) + 32;

if( lastbutton==LOW && currentbutton== HIGH)
    {
delay(1000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Temperature");
lcd.setCursor(0,1);
lcd.print(temperatureC);
lcd.print("Celcius");
Serial.print(temperatureC);
Serial.print("Celcius");
    }
else
    {lastbutton=currentbutton;
delay(1000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Temperature");
lcd.setCursor(0,1);
lcd.print(temperatureF);
lcd.print("fahrenheit");
Serial.print(temperatureF);
Serial.print("fahrenheit");
    }
}

```

VII. Flow Chart





VIII. Conclusion

Thus this project is a very essential protection circuit that can be implemented in a wide range of systems ranging from home appliances to large scale power generation. It can be used in household water tanks to prevent water shortage or overflow. The temperature sensor though trivial in this case can also help in sensing temperature. The other large scale application is that in thermal power plants where the crucibles need to be on the safety scale in real time. If the water level in the crucible is exceeded, it can result in wastage of water. The temperature sensor on the other hand is used to measure the safety limit temperature to prevent excessive temperature and pressure development in the crucible that can lead to serious accidents.

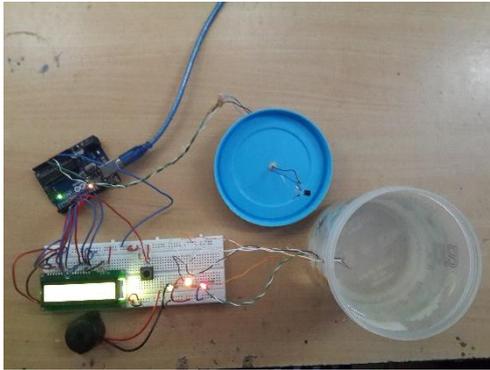


Fig: 7.1

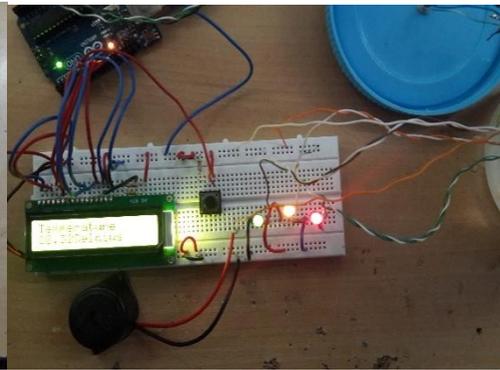


Fig: 7.2

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References

- [1]. **Journal Papers:**
 1. S.Jatmiko, A B.Mutiara, Indriati —Prototype of water level detection system with wirelessl Journal of Theoretical and Applied Information Technology Vol. 37 pp 52-59, 2012
 - [2]. S. Mahata, A. Maiti, and C. K. Maiti, —Cost- EffectiveWeb-Based Electronics Laboratory Using NI MultiSim, LabVIEW and ELVIS III, IEEE Journal, pp 242-243, 2010
 - [3]. P. Dietz, W. Yerazunis, D. Leigh, Very Low-Cost Sensing and Communication Using Bidirectional LEDs, UbiComp 2003: Proceedings, vol. 2864, pp. 175-191, 2003.
 - [4]. Shandong Jianzhu "Design of intrinsically safe intelligent water-level monitor used in coal mine
- [5]. **Books:**
 - [6]. Embedded System by Raj kamal.
- [7]. **Web Support:**
 - [8]. Robomart (<http://www.robomart.com>)
 - [9]. Robosapiens (<https://robosapi.com>)
 - [10]. Electroncomponents (<http://www.electroncomponents.com>)
 - [11]. Frontiers in Robotics Automation and Control – Alexander Zemliak.