DIGITAL THERMOMETER USING Atmega328

ABSTRACT

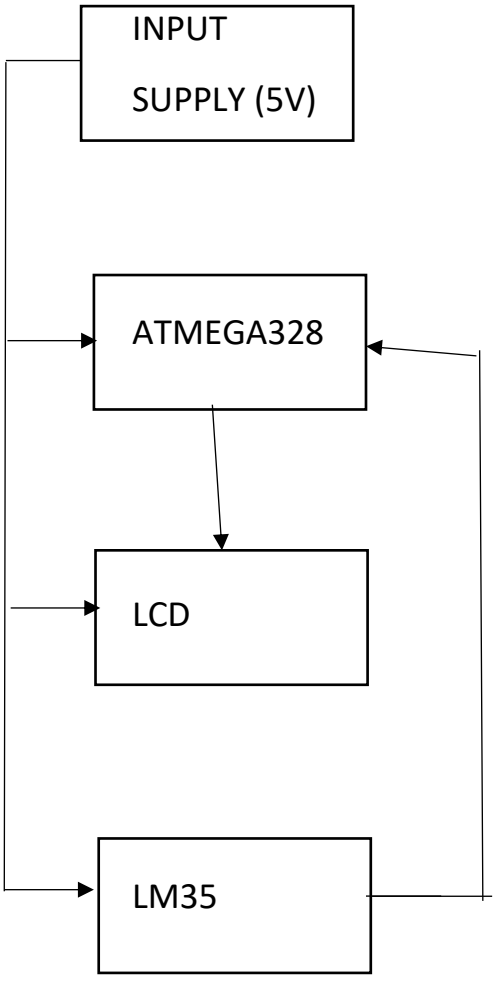
In this project we are going to design a circuit for measuring temperature. This circuit is developed using "**LM35**", a linear voltage sensor. Temperature is usually measured in "Centigrade" or "Fahrenheit". "LM35" sensor provides output based on scale of centigrade.

LM35 is three pin transistors like device. It has VCC, GND and OUTPUT. This sensor provides variable voltage at the output based on temperature.

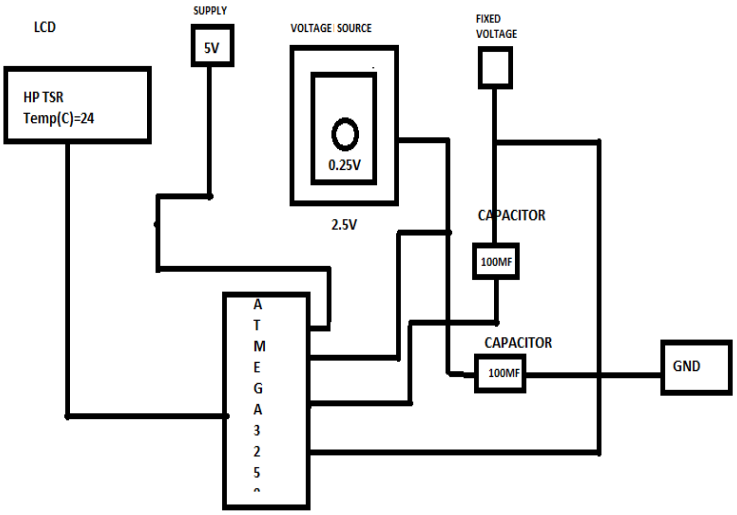
for every +1 centigrade raise in temperature there will be +10mV higher output. So if the temperature is 0◦centigrade the output of sensor will be 0V, if the temperature is 10◦ centigrade the output of sensor will be +100mV, if the temperature is 25◦ centigrade the output of sensor will be +250mV.

So for now with LM35 we get temperature in the form of variable voltage. This temperature dependent voltage is given as input to ADC (Analog to Digital Converter) of ATMEGA32A. The digital value after conversion obtained is shown in the 16x2 LCD as temperature.

BLOCK DIAGRAM



SCHMEATIC DIAGRAM

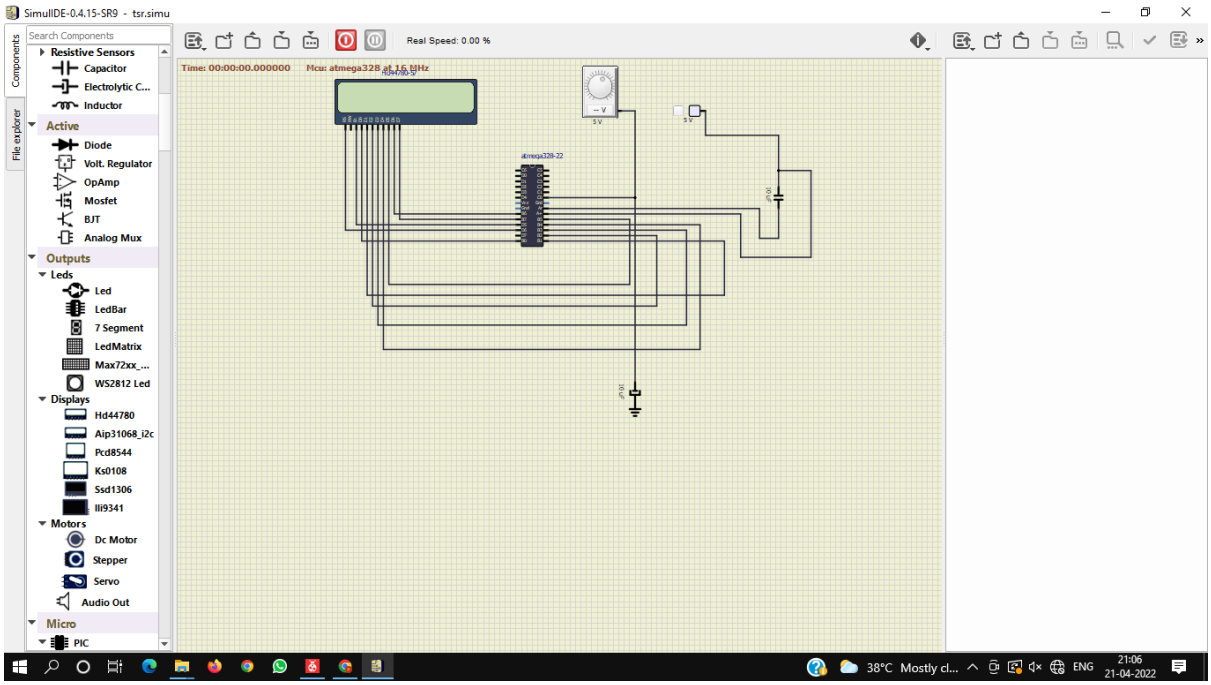


WORKING

Thermometers are the device we use to measure the temperature in any desired scale and we all will be quite familiar with the analog thermometers. There are some disadvantages in analog thermometers and this can be overcome by using this digital thermometer using avr. The above embedded system shows the design and implementation of a simple Digital Thermometer using Atmega16 (AVR), LM35 & 16×2 LCD.

LM35 is a Precision temperature sensor IC with its output proportional to the temperature (in degree Celsius). LM35 is capable of giving accurate temperature readings compared to thermistor. The senor is sealed to avoid the effects of oxidation and other factors. It operates at a temperature range of -55°c to 150°c. The output voltage varies by 10mV in response to every °C rise or fall in atmospheric temperature

IMPLEMENTATION



CODE

```
#ifndef __AVR_ATmega328__
#define __AVR_ATmega328__
#endif
#include <avr/io.h>
#define F_CPU 1000000
 #include <util/delay.h>
 #include <stdlib.h>
#define enable  5
#define registerselection 6

void send_a_command(unsigned char command);
void send_a_character(unsigned char character);
void send_a_string(char *string_of_characters);

int main(void)
{
DDRB = 0xFF;
 DDRC = 0;
 DDRD = 0xFF;
_delay_ms(50);

ADMUX |=(1<<REFS0)|(1<<REFS1);
ADCSRA |=(1<<ADEN)|(1<<ADATE)|(1<<ADPS0)|(1<<ADPS1)|(1<<ADPS2);
```

```
int16_t COUNTA = 0;
char SHOWA [3];

send_a_command(0x01); //Clear Screen 0x01 = 00000001
_delay_ms(50);
send_a_command(0x38);
_delay_ms(50);
send_a_command(0b00001111);
_delay_ms(50);

ADCSRA |=(1<<ADSC);
while(1)
{
COUNTA = ADC/4;
send_a_string ("HP TSR");
send_a_command(0x80 + 0x40 + 0);
send_a_string ("Temp(C)=");
send_a_command(0x80 + 0x40 + 8);

itoa(COUNTA,SHOWA,10);
send_a_string(SHOWA);
send_a_string ("    ");
send_a_command(0x80 + 0);

}
}

void send_a_command(unsigned char command)
{
PORTB = command;
PORTD &= ~ (1<<registerselection);
PORTD |= 1<<enable;
_delay_ms(20);
 PORTD &= ~1<<enable;
 PORTB = 0;
}

void send_a_character(unsigned char character)
{
PORTB = character;
PORTD |= 1<<registerselection;
 PORTD |= 1<<enable;
_delay_ms(20);
PORTD &= ~1<<enable;
PORTB = 0;
}
void send_a_string(char *string_of_characters)
{
```

```
while(*string_of_characters > 0)
{
send_a_character(*string_of_characters++);
}
}
```

ADVANTAGES

Accuracy: The temperature reading doesn't depend on scale reading and instead shown directly on the display. Hence temperature can be read exactly and accurately.

Speed: Digital thermometers can reach a final temperature in 5 to 10 seconds compared to conventional thermometers.

Safety: Digital thermometers don't use mercury, hence the hazards of the mercury is eliminated in case the thermometer breaks.

Strong: The thermometer doesn't need to be shaken for the proper mercury level, hence the risk of the tube getting broken is eliminated

APPLICATIONS

Medical Applications: The digital thermometers are used to measure human body temperature around 37ºC. These thermometers are mostly probe type or ear type. It measures oral, rectal, and armpit body temperature.

Marine Applications: Digital thermometers with a high-temperature exhaust gas sensor as the temperature sensor can be used in marine applications for measuring the local temperature.

Industrial Applications: Digital thermometers are also used in power plants, nuclear power plants, blast furnaces, shipbuilding industries, etc. They can measure temperature from -220ºC to +850ºC.

REFERENCE

https://lastminuteengineers.com/lm35-temperature-sensor-arduino-tutorial/

https://www.instructables.com/Measuring-Tempurature-Using-AVRATmega32-MCU/