

ANALOG ELECTRONICS LAB PROJECT REPORT

FIRE ALARM WITH INTENSITY METER

(GROUP-6)

AIM :

To design a fire alarm circuit that detects fire through temperature change and simultaneously show the temperature/intensity of the fire using an LED meter.

COMPONENTS REQUIRED :

(Resistors)

- R1,R2,R3,R4,R5,R6,R7,R8,R9,R10 - 1.2k
- R11 - 4.7k
- R12 - 69.3k
- R13,R17 - 33k
- R14 - 44k
- R15 - 22k
- R16 - 66k

(Capacitors)

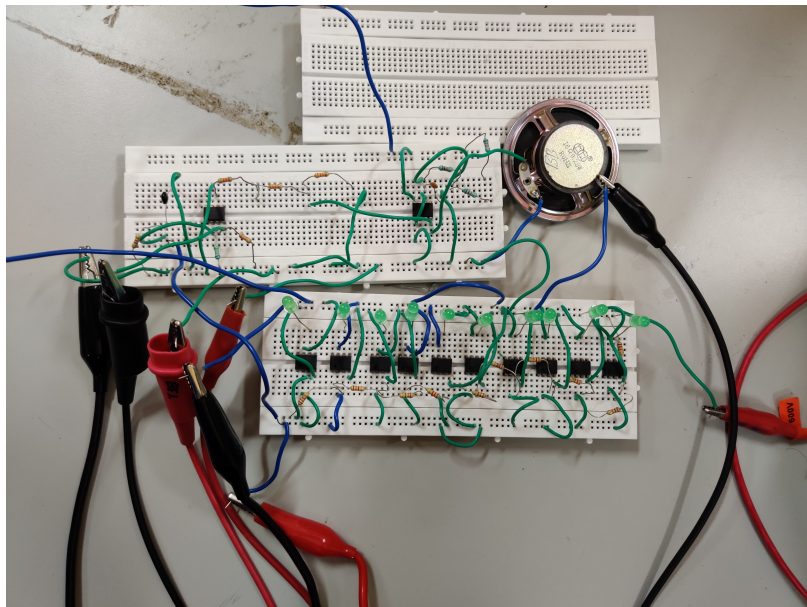
- C1 - 0.01 μ F

(Power Supplies)

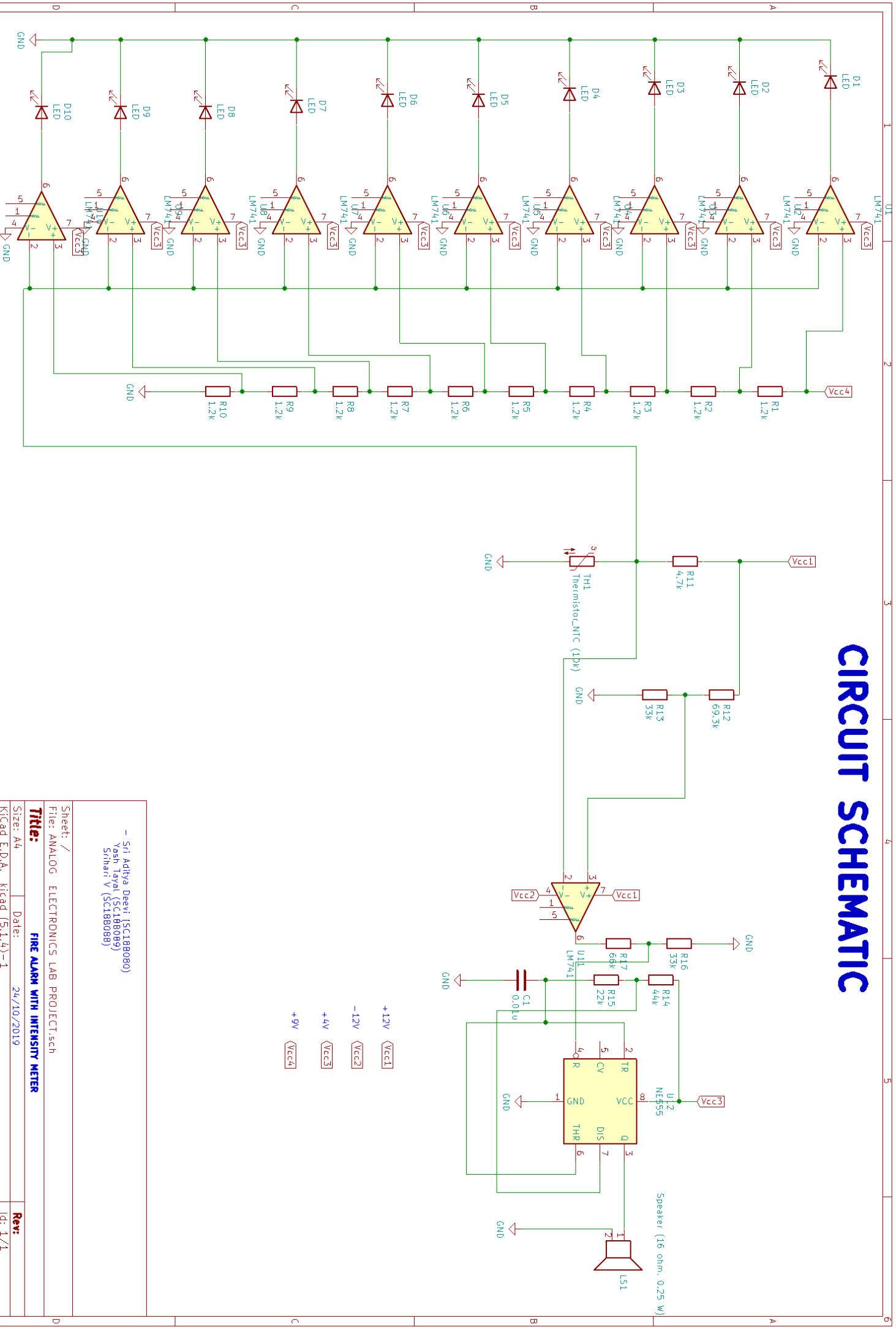
- Vcc1 - +12 V dc
- Vcc2 - -12 V dc
- Vcc3 - +4 V dc
- Vcc4 - +9 V dc

(Other Components)

- Speaker (16 ohm, 0.25W)
- 10 Green LED's
- NE555 Timer
- 11 IC741 operational amplifiers
- NTC Thermistor (10k at room temp.)
- Connecting Wires
- Soldering Iron (For Testing)



CIRCUIT SCHEMATIC



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Title: FIRE ALARM WITH INTENSITY METER

Size: A4 Date: 24/10/2019

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Id: 1/1

WORKING :

The circuit basically senses the temperature using a special type of resistor, NTC (Negative Temperature Coefficient) thermistor whose resistance decreases in a pre-specified manner as the temperature increases. (Datasheet of the thermistor used is attached at the end)

When fire breaks out, the temperature increases and thereby voltage at thermistor's node decreases (as resistance drops) . The circuit is designed in such a way that if the temperature increases beyond 50 deg C, the output of IC741 used as a comparator goes high, thereby giving the reset pin of the 555 Timer a logic high (after passing through a voltage divider). The 555 timer circuit is designed to operate as an astable multivibrator (Frequency = 1.64kHz, Duty Cycle - 75%) whose output is connected to the speaker. Until the reset pin goes high, the configuration doesn't start oscillating, thereby functioning as a triggered astable multivibrator. As the temperature increases beyond 50 deg celsius, due to the oscillating circuit, an alarm is triggered and doesn't stop until the temperature goes below 50 deg.

Simultaneously, as the voltage at the thermistor node drops , there are various reference levels set using a series of IC741's functioning as comparators, which indicate the temperature of fire i.e. its intensity. At room temperature (30 deg celsius), three LED's are ON and the circuit is designed in such a way that one LED lights up per 10 deg gradation in temperature.

This is the way in which the whole circuit functions.

TESTING AND DEMONSTRATION :

The working of the circuit was tested and demonstrated using a soldering iron for temperature rise. The video footage of the complete demo is attached with the email.

Group Members:

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REFERENCES :

Datasheet of Thermistor -

<https://eecs.oregonstate.edu/education/docs/datasheets/10kThermistor.pdf>