BilkeyJ Week 4 Lab Modified - Fever Detector

Sunday, August 23, 2020 10:19 AM

This uses the LM 34 and MSP 432 to check for fever temperatures. Accurate to 1 degree F.

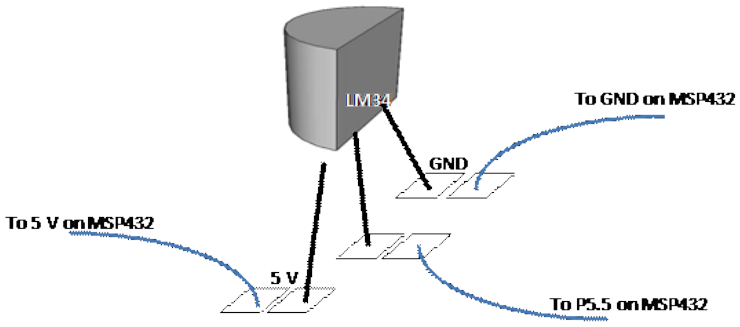
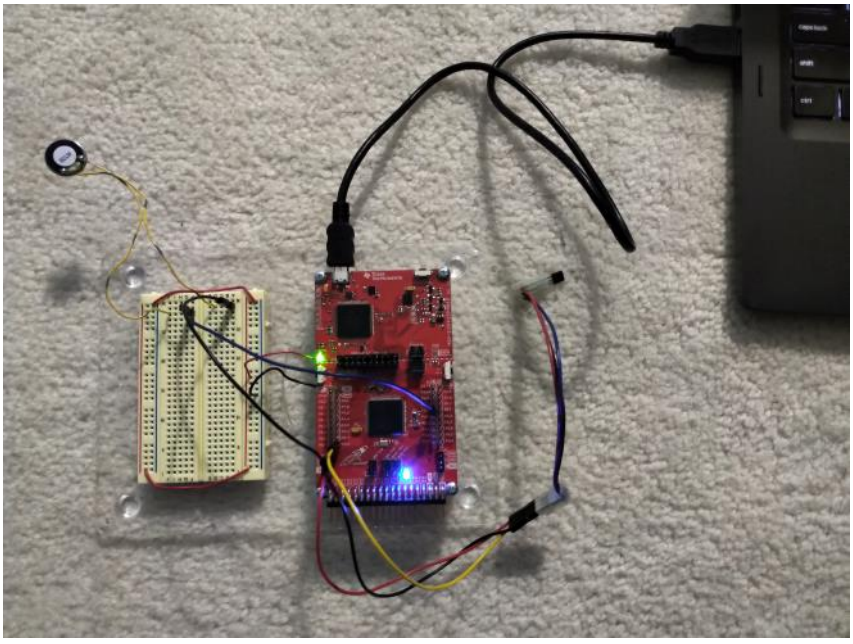


Diagram by Dr. Ross

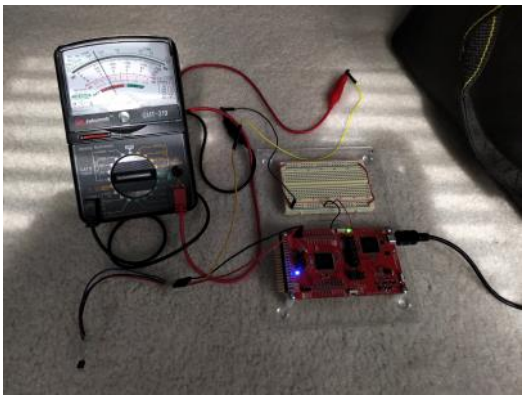


How to use:

1. Connect LM 34 to MSP 432 board as shown in the diagram above. Use jumper wires to give yourself room to move the temperature sensor around.
2. (Optional) You can connect a speaker across pin 6.6 and ground for auditory feedback.
3. Install Code Composer Studio on your PC, import the CCS project, build and click debug, then click the green arrow / "play" icon.
4. Insert the LM 34 in your armpit. Wait until the LED stays green, then wait another 20 seconds. You will hear a one pitched beep when the temperature is considered stable. You may hear multiple beeps if your body temperature is a little too low. If the LED turns red (and you hear constant high pitched beeping), your temperature is too high.
5. Hit the reset button on the MSP 432 (top right) to test another person.
6. You no longer need your PC to test your temperature. Connecting the MSP 432 to any power source will run this program. If you connect the MSP 432 to your computer and have Code Composer Studio running, you can hit the right button on the MSP 432 to output the exact temperature in the console. The LED will turn yellow in this mode.

Notes: The LM 34 sensor is only accurate to 1 degree Fahrenheit, and this project cannot replace a medical thermometer. I still think it is useful for EE students at the Milwaukee School of Engineering who have all these parts already or can easily get them.

You do not need a MSP 432 board to interface with the LM 34 at all. Simply connecting 5v power and the middle pin to a voltmeter will give you a temperature reading. The LM 34 outputs 10mV / degree F.



Using the LM 34 with
a voltmeter

```
#include "msp.h"
#include "ee1910delay.h" // Delays execution of further code by a fixed number of milliseconds
#include "ee1910analog.h" // The program uses ee1910analog.h for analog to digital conversions - input and output
#include "ee1910music.h" // sound output
#include <stdio.h> // Necessary for non-janky printf

#define LB 0x02
#define RB 0x10

/*
This program will read the output of a LM34 temperature sensor and accordingly light up an LED or print the temperature to co nsole.
The LED color will be blue for a temperature below normal body temp, green for normal body temp, and red for a fever.
By John Bilkey, modified from Lab 4 from Dr. Ross's EE 1910 Class.

  Required Hardware:
  * MSP 432 Board
  * Breadboard
  * LM 34 Sensor connected to pin 5.5
  * Speaker connected to pin 6.6 (optional)
 */

void main(void)
{
    P1->DIR &= ~(LB | RB);  // Buttons are use Port 1 Pin 1 (Left) and Port 1 Pin 4 (Right).  The direction of a button pin is input (0).
    P1->REN |= (LB | RB);  // Set pull-up resistor for button
    P1->OUT |= (LB | RB);   //Set out register for 1 (input)
    P2->DIR |= 0b11111111; // Set up LEDs
    P2->OUT &= 0b00000000; // Set up LEDs
    analogSetup();
    int PM = 0;   // Selects between printing to console (1) or LED output (0)
    int stable = 0;
    float temp = 0;
    float last = 0;
    while(1){
     // PRINT TO CONSOLE *OR* OUTPUT TO LED BASED ON IF STATEMENTS
    last = temp;

    temp = analogRead();  //  float temp is set to analogRead - making sure decimal calculations don't have issues
    temp = ((temp*3.3)/(40.95));  // Convert analogRead output to degrees Fahrenheit

        // CONTINUE IF PRINT TRUE
    if (PM == 1){
        analogWrite(0,50); // R
        analogWrite(1,50); // G
        analogWrite(2,0); // B
            printf("Degrees F: %f\n",temp); // Print conversion output to console
            delay(500); // Wait 500ms
    }

   // CONTINUE IF PRINT FALSE
   if (PM == 0){

        //BEGIN LED OUTPUT
         // Temp comparison is done in degrees F
        if (temp<97){ //  Colder than body
```

```
            analogWrite(0,0); // R
            analogWrite(1,0); // G
            analogWrite(2,100); // B

            stable = 0;
        }

        if ((temp>=97) & (temp<99)){ // Normal Body Temp
            analogWrite(0,0);
            analogWrite(1,100);
            analogWrite(2,0);

            if ((abs(temp-last) < 0.05) && (stable == 0)){
                make_music(200); // play 200 Hz low pitch tone when temp is stable
                delay(500);
                stop_music();
                stable = 1;
            }
        }

        if (temp>=99){  // Fever
            analogWrite(0,100); // Red LED
            analogWrite(1,0);
            analogWrite(2,0);
                while(1){
                make_music(800); // beep 800 Hz high pitch tone on and off forever
                delay(500);
                stop_music();
                delay(500);
                }
        }
    }

        // EXECUTE REGARDLESS OF PM VALUE
        delay(500); // 500 ms delay

        // RIGHT BUTTON - Sets PM to 1 or 0.
        // 1 = Print Temp to Console 0 = LED Color Output (Default)
        if ( (P1->IN & RB) == 0) {
            if (PM == 1) PM=0;
            else {
                analogWrite(0,0);
                analogWrite(1,0);
                analogWrite(2,0);
                PM=1;
            }
            while((P1->IN & RB) == 0){}
        }
    }
}
```