KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING

EMBEDDED SYSTEMS

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DESIGN OF DIGITAL THERMOMETER

ABSTRACTION

In our current technology age automation is the new trend. We are trying our best to save time to do things which can be done with technology. The world of digitization has made our lives very easier. It has reduced so much human efforts to carry out tasks.In this project I made a digital thermometer by using a MEGA8-P microcontroller.The other components are LM50 temperature sensor and a LCD display to the value of the temperature sensed.

INTRODUCTION AND METHOLOGY

Many chemists and other professions which use thermometer always use the mercury in glass thermometer.This thermometer comes with its disadvantage.These thermometers are easily breakable; prone to reading errors, contain hazardous material(mercury) that can burn the skin, eyes, and respiratory tract if spilled.Again the readings on these thermometers cannot be fully trusted due to the nature of the mercury.

In this project I try to eliminate these problems by designing a digital thermometer.The used components are

- MEGA8-P MICROCONTROLLER

The reason for the choice of these microcontroller is due to its inbuilt Analog-Digital Converter(ADC) for this reason we will not need an ADC.The features of this controller:

8 Kbytes FLASH, 1 kbytes SRAM, 512 bytes EEPROM, USART, 4-channel 10 bit ADC, 2-channel 8 bit ADC
Pin compatible with Atmega48, ATMega88, ATMega168
Source: avr.lbr

Footprint: DIL28-3 (Version 1)

Dual In Line 0.3 inch

- LM50 THERMOMETER SENSOR

The sensor chosen for this project is the LM50 because of its output is directly proportional to the centigrade temperature.It was also chosen for its low output impedance, linear output, and precise inherent calibration that make interfacing very easy.

Features:

Vout = (10mV/°C x Temp °C) +5mmmV
Source: http://cache.national.com/ds/LM/LM50.pdf

Footprint: SOT23 (Version 1)

SMALL OUTLINE TRANSISTOR

reflow soldering

- EA_DIP DISPLAY

This is LCD display chosen for the project.It is a 16 X 2 display meaning it can display the output on two screens but we will only need our results to be display on only one screen

Features:

LCD-MODUL 2x16 - 6,68mm, INKL. KONTROLLER HD44780

Method: The LM50 reads the temperature when someone touches it.The programmed microntroller interfaced with the sensor which comes with an inbuilt ADC converts the analog signals to digital ones and zeros and then interpreters the signal and displays the results on the LCD display.

BLOCK DIAGRAM

```
┌──────────┐        ┌──────────┐        ┌──────────────────────┐
│          │        │          │        │                      │
│  SENSOR  │───────▶│  MICROC  │───────▶│     LCD DISPLAY      │
│          │        │  ONTROL  │        │                      │
└──────────┘        │  LER     │        └──────────────────────┘
                    │          │
                    │     ▲    │
                    └─────│────┘
                       ┌──┴──┐
                       │ ADC │
                       └─────┘
```
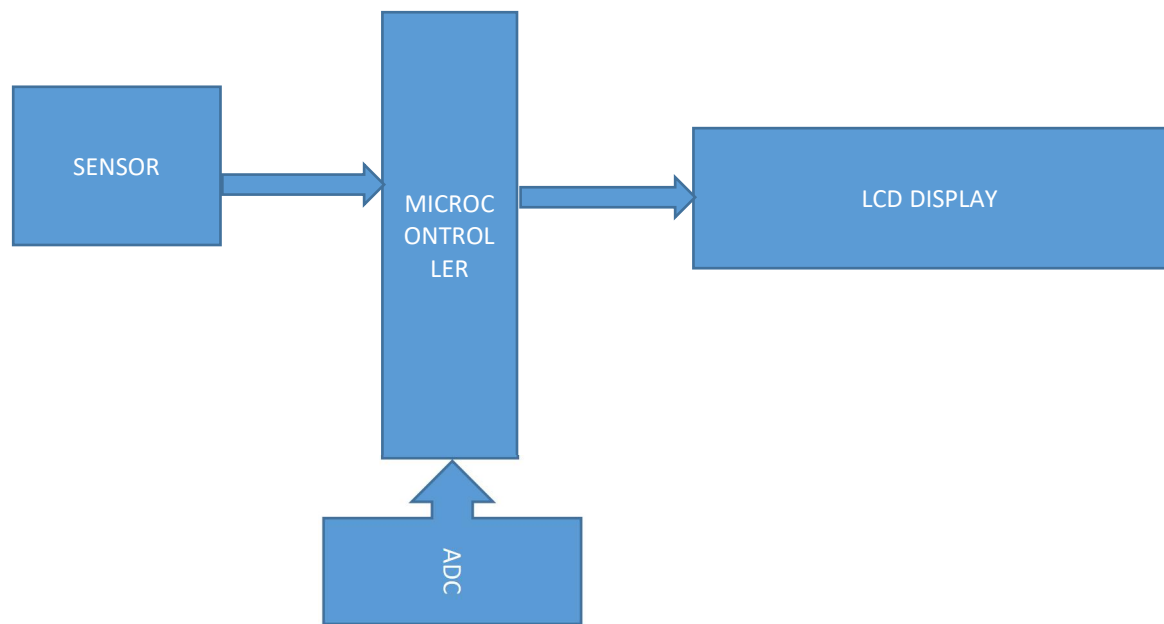
The microcontroller already has an inbuilt ADC

FLOWCHART

```
        ┌──────────────┐
        │    START     │
        └──────┬───────┘
               ▼
        ┌──────────────┐
        │ Globally enable
        │  interrupts  │
        └──────┬───────┘
               ▼
        ┌──────────────┐
        │ Initialize variables │
        └──────┬───────┘
               ▼
        ┌──────────────┐
        │ Initialize LCD │
        └──────┬───────┘
               ▼
         ╱──────────╲
        ╱    Take     ╲
        ╲   reading   ╱
         ╲──────────╱
               ▼
         ╱──────────╲
        ╱   Output    ╲
        ╲   readin    ╱
         ╲    g      ╱
          ╲────────╱
               ▼
        ┌──────────────┐
        │     END      │
        └──────────────┘
```