Wireless Digital Thermometer Using PSoC1

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Abstract: -- **Today it is very complex taking care of small kids and elder people who suffer from fever. We have to measure the temperature at intervals of peoples. For that purpose, we need to Digital Thermometer to measure their body temperature. This paper presents Portable Wireless Biomedical Digital Thermometer System. In which we can measure the body temperature of the patient and transmit temperature using wireless Bluetooth communication.**

Keywords— Digital thermometer, PSoC1, LM35, Wireless Technology.

I. INTRODUCTION

This paper presents an embedded wireless sensor network prototype for remote Body temperature monitoring system. This system consists of PSoC family Programmable System-on-Chip User modules on Controller Chip. These PSoC devices are designed to replace multiple general microcontroller based system with one, low cost single-chip PSoC device. PSoC based data logger measuring Body temperature continuously [1].

The deployed system can be positioned by given below methods.

Oral Use: Place thermometer under tongue. Close your mouth and breathe evenly through the nose to prevent the measurement from being influenced by inhaled/exhaled air. Normal temperature is between 96.3°F to 99.1°F.

Armpit Use: Wipe armpit dry. Place probe in armpit and keep arm pressed firmly at side. From a medical viewpoint, this method will always provide inaccurate reading, and should not be used if precise measurements are required. Normal temperature is between 95.4°F to 98.1°F [2].

 The triangle shape is moving throughout the testing process on the screen of computer. When moving is stops and a red color arrow mark will displayed after 5 seconds to 8 seconds. The measured reading will appear on the display simultaneously. The displayed temperature will not change when thermometer is removed from its position.

If the measured temperature is less than 90°F, the display will readout in blue color, if the measured temperature is higher than 109.9°F, the display will be readout in red color.

II. PROPOSED METHODOLOGY

 Transmitter is located on the Body for transmission of temperature measurement. LM35 is interface with PSoC1 CY8C28433 and convert analog value of temperature sensor to digital using incremental ADC (Analog Digital Converter) ADCINCVR with the programmable system on chip controller PSoC1 CY8C28433 and transmitted via Bluetooth HC-05 using the specific frame.

Receiver is located near the relative where the reading takes place. Receiver receives the frames and decodes the value of temperature and displays it on GUI developed in processing software. In this GUI data is displayed graphically and shows the result in °F.

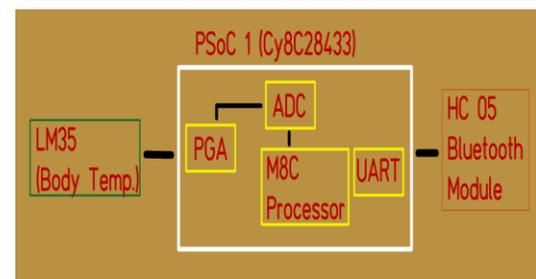The block diagram of the Wireless Digital Thermometer is given below:

Figure1. Block Diagram

III. HARDWARE IMPLEMENTATION OF PROPOSED SYSTEM

A. PSOC1 Microcontroller (CY8C28433 Development Board)
PSoC stands for Programmable System on Chip. PSoC device includes configurable blocks of analog circuits and

digital logic, as well as programmable interconnect. This architecture allows the user to create customized peripheral configurations, to match the requirements of each individual application. Additionally, a fast CPU, Flash program memory, SRAM data memory, and configurable input/ output (IO) are included in a range of pin-outs [3].
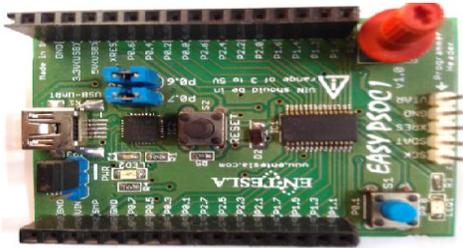

Figure 2 Development Board of PSoC1 (CY8C28433)

B. LM35 Temperature Sensor
The LM35 is precision integrated-circuit temperature devices with an output voltage linearly- proportional to the Centigrade temperature. It is low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. It is rated for a −40°C to 150°C range [4].

Figure 3 LM35 Sensor

In this system LM35 is used for measurement of Body temperature. The output is fed to the PGA (Programmable Gain Amplifier) and the analog value is provided to the 10 bit ADCINCVR and this analog value is converted in the digital value.

C. HC-05 Bluetooth Module
HC-05 module is an easy to use Bluetooth module, designed for transfer wireless SPP (Serial Port Protocol) serial connection. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation. The working frequency is 2.4GHz radio transceiver and baseband [5].
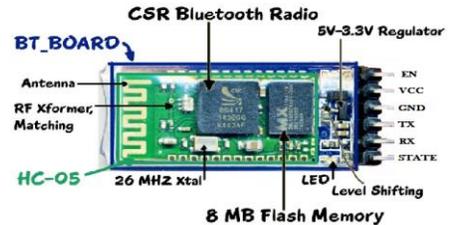

Figure 4 Bluetooth HC-04 Module

IV. SOFTWARE IMPLEMENTATION

A. PSoC Designer 5.0
PSoC Designer 5.0 is the revolutionary Integrated Design Environment (IDE) that can be used to customize PSoC for specific application requirements. IDE using a library of pre-characterized analog and digital peripherals in a drag-and-drop design environment. After that, it customizes our design dynamically generated API libraries of code. Finally, debug and test our designs with the integrated debug environment including in-circuit emulation and standard software debug features [6].

B. PSoC Designer Application Flow
Step 1: Create a new project in PSoC Designer 5.0
Step 2: Choose a base device CY8C28433 for work.
Step 3: Choose and configure user modules that give the PSoC device.

1) Configure Global resource-
Global resources are those shared by all user modules in a particular configuration. All the proper configuration of the project is given in the Global resources properties shown in the figure.

Figure 5 Global Resources

2) User modules-
There are number of User modules available in the PSoC device CY8C28433. In this project we configured following resources [6]. Resources are
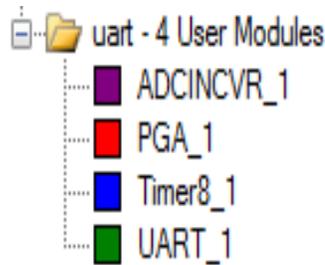
Figure 6 User Module

3) Programmable Gain Amplifier (PGA_1):

All PSoC Devices have thirty-three user-programmable gain settings with a maximum gain of 48.0. The PGA User Module implements an operational amplifier based non-inverting amplifier with user-programmable gain. In this project PGA_1 is configure as a buffer for the input of temperature sensor.

4) Integrating ADC (ADCINCVR_1):

The ADCINCVR is an integrating ADC with an adjustable resolution between 7 to 13 bits. In this project ADCINCVR_1 configure in 10-bit resolution. Sample rates from 4 to 10,000 sps are achievable depending on the selection of the resolution, DataClock, and CalcTime parameters.

5) Timer (Timer8_1):

The 8, 16, 24, and 32-bit Timer User Modules provide down counters with programmable period and capture ability. The clock and enabled signals can be selected from any system time base or external source. Once started, the timer operates continuously and reloads its internal value from the period register upon reaching terminal count.

In this project 8-Bit Timer is used to generate clock frequency for baud rate to UART serial communication module.

6) Universal Asynchronous Receiver Transmitter (UART_1):

The UART User Module is an 8-bit Universal Asynchronous Receiver Transmitter that supports duplex RS-232-compliant, data format serial communications over two wires. Received and transmitted data format includes a start bit, optional parity, and a stop bit. Programmable clocking and selectable interrupt or polling style operation is supported.

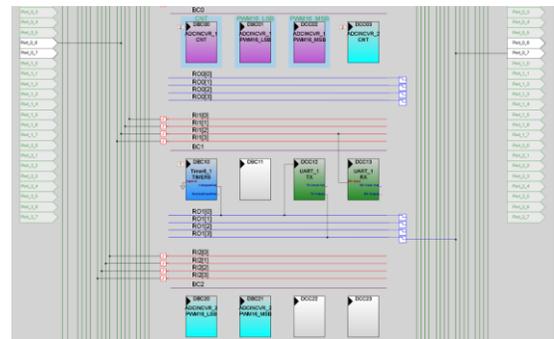Step 4: Connect the user modules to each other, as appropriate, and to the proper pins.
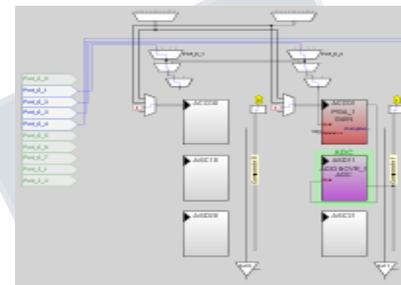

Figure 7 Digital I/O routing

Figure 8 Analog Input configurations

Step 5: Write firmware for project in C or assembly language.

Step 6: Program the PSoC device CY8C28433 and test the program.

C. Processing 3.2.4

Processing is a flexible software sketchbook and a language for learning how to code within context of the visual arts. It is open source interactive programming language with 2D and 3D integration for GNU/Linux, Mac OS, Windows, Android and ARM [7].

In this software we designed our GUI for Temperature monitoring system which is successfully interfaced with PSoC1 (CY8C28433) microcontroller and data is represented in the form of information and graph.

In the beginning software is configured with Bluetooth module. The processing GUI will provide the information of the com port available on the computer when software will run. Selects proper com port where Bluetooth module is connected on the laptop.
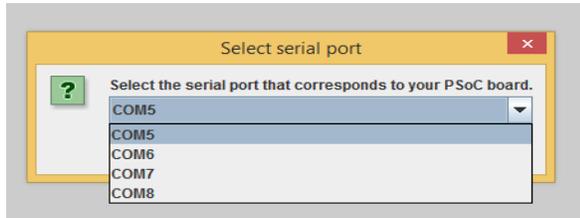
Figure 8 Serial Communication Selection
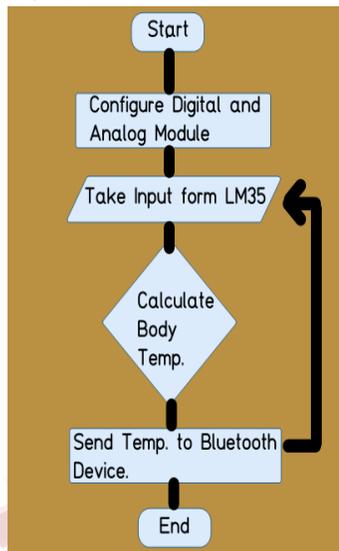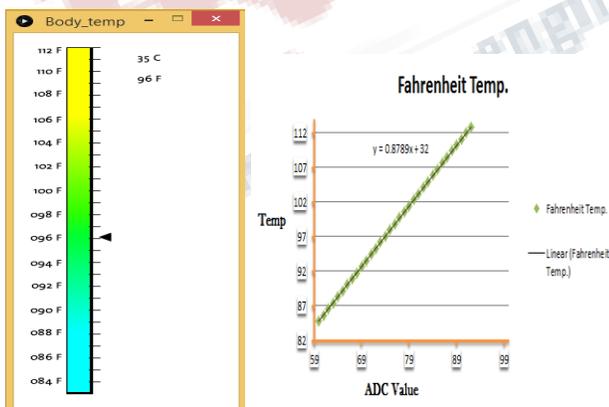
D. System Flow Chart

Figure 9 Flow Chart

V. RESULT

CONCLUSION

This paper describes temperature monitoring application on Laptop device. We have presented here a research on Advances in electronic technologies, PSoC microcontroller and sensors which offers researchers a variety of new and inexpensive sensing, monitoring, and control capabilities. The concept of open source software programs, and development efforts are made freely available to all, which helps to facilitate and expand the adoption of these capabilities. The final GUI is user friendly and successfully interfaced with PSoC1 Microcontroller.

REFERENCES

[1] Digital Thermometer Owner's Manual Model: MT-101.

[2] MariusMuresan, Gabriel Chindris.:"PSoC Dual Sensor for Pressure and Temperature Using Bipolar Junction Effects"Applied Electronics Department, Technical University of Cluj-Napoca, Cluj-Napoca, Romania.

[3] "PSoC Mixed Signal Array Final Data Sheet", Document 38-12013 Rev. H, February 15, 2007, available at: http://www.cypress.com/psoc

[4] LM35 Precision Centigrade Temperature Sensors SNIS159G –AUGUST 1999–REVISED AUGUST 2016.

[5] Mr.NiyazAgalave, Prof.UdayPatil, "Integration of Tire Pressure Monitoring System using PSoC" International Journal of Science, Engineering and Technology Research (IJSETR) Volume 4, Issue 4, April 2015.

[6] Robert Ashby, "Designer's Guide to the Cypress PSoC".

[7] Overview of Processing at http://processing.org