MEASUREMENT OF TEMPERATURE HUMAN BODY
WITH SPEAKER OUTPUT BY USING FPGA

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ABSTRACT

Nowadays, people widely use thermometer. Generally, thermometer was designed for they who have normal physical condition, especially in seeing ability. Blind people have difficulty in using that thermometer. Refers to this condition, this paper explains about design of thermometer which can be used by blind people. Generally, this thermometer, which is equipped by sound output, uses LM35D sensor, ADC0804, FPGA Spartan II and ISD 25120. Measurement range of this thermometer is 30°C – 42°C.

Keywords: thermometer, FPGA Spartan II, ISD 25120

ABSTRAK


Kata kunci: termometer, FPGA Spartan II, ISD 25120
INTRODUCTION

Thermometer is invented to measure instrument’s temperature, but it’s especially used for measuring human’s temperature. Most of thermometers, which have been made, have their certain size of measurement. For instance thermometer in number display, those who have eyesight trouble or the blinds might find difficulties in using this appliance. Therefore, thermometers which can be used by these people are invented. Generally, the thermometer is equipped by sound output.

The existence of these thermometers is not only used by normal people to measure their body temperature, but the eyesight trouble owners, especially the blind one, can also use the thermometer. Besides, the existence of these sound output thermometers will make a splash of many in using this appliance. Factually this appliance is specially designed for those who have eyesight trouble like the blind person so that they can measure their body temperature by themselves, without other’s assistance. Thermometer in sound output is designed by using LM35 censor and the supporter component like ADC0804. As the controller is FPGA Spartan 2 and the voice releaser is IC ISD25120.

Design System

In this paper will be explained that design system is classified into two kinds of bodyworks. They are hardware design and software design. All of these designs are used by blind person.

Hardware Design

Generally, hardware diagram block of the “sound output human-measurement” shall be as follows:

![Diagram](image-url)

Figure 1 Hardware design
Module FPGA

FPGA Type Spartan XCS10 / xl have module - module in it, port parallel, LED, Power Input, Push Buttons, Slid Switches, Seven - displays segment, Clocks, XCS10 PLCC, Test Point Headers, PS2, Audio, BNC, RS232, and VGA Port. Research [done/conducted] for the system of in only by using two modules, that is Push Button module and Seven module – Segment Display

Module Push Button used as to enter to system manually to designate that the FPGA will start to execute program to control IC ISD which later will give instruction to voice then pass to speaker. The Module Push Button by using BTN1.

![Figure 2 Push Button Circuit at FPGA](image)

ADC Circuit

ADC which is used in module is ADC type 0804. The usage of ADC 0804 as analogous data changer into digital data. This 0804 ADC has eight bit input. It is able to be accessed with give of address at ADC, and it is easy, effective and economic to be used.

![Figure 3 Circuit ADC 0804](image)
This 0804 ADC is activated by 500 KHZ clock signal which will be activated by Zero and Span circuit. The Result obtained from measurement of temperature sensor represent analogue which in the form of voltage and will be converted by ADC 0804 becoming digital data. All changes in address sensor temperature hence data in the form of seven bit will become to include to FPGA through LD2 to LD8 pin, where functioning LD2 pin as MSB (Most Significant Bit) and functioning LD8 pin as LSB (Least Significant Bit).

**Zero and Span Circuit**

Zero and Span circuit used to accommodate range result of conducted by voltage at LM35 temperature sensor, where voltage ranges in module range from 0-5 volt.

![Figure 4 Zero and Span Circuit](image)

**Sensor Temperature Circuit**

Used sensor Temperature is IC LM35 having output in scale degree of Celsius. At temperature 0°C, output sensor LM35 release 0 volt. Each; Every go up 1°C, output sensor LM35 will go up equal to 10 volt. The IC LM35 related with Op-Amp (Operational Amplifier) to strengthen obtained by output current is IC LM35. Besides also function as anti bouncing and function as LPF network (Low Pass Filter) with aim to stabilize tension by overcoming just low tension signal.

![Figure 5 Temperature Censor Circuit](image)
ISD Circuit

In this system we use voice IC of IC ISD 25120. IC ISD 25120 the accept bit – bit from FPGA which later bit - bit from the FPGA will release address found on IC ISD 25120 to release output signal which in the form of voice to be released to through speaker. IC ISD 25120 the have depository ability of voice during 120 second which is operated in address bite mode with the meaning that each; every word which is kept in the IC have separate address. There is 18 on file word in the IC ISD as according to its.

Figure 6 ISD 25120 Circuit

Table 1 IC ISD 25120 Address and Word

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Software Design

In FPGA attached a functioning button as sign that program are started reading data from proportionate ADC with output sensor LM35 and generally flowchart from program which is the following design (Figure 7). The reading of Data from ADC is conducted by delivering start signal to ADC0804 to convert to input from LM35 sensor and then activate ADC output so that data
result of conversion can be read by FPGA. Data from the ADC then kept and converted to become temperature. Conversion process is conducted by comparing data from ADC with body temperature data. Result of conversion is then presented in the form of voice.

Examination System

Examination System as a whole covers some part that is examination sensor LM35 and mercurial thermometer, examination of Correctness sensor LM35, and examination of speaker output.

Examination Sensor LM 35 with Mercurial Thermometer

This Examination is conducted as a mean to test response time from LM35 sensor with mercurial thermometer. This examination is conducted by doing measurement of time needed by LM35 sensor and mercurial thermometer to reach measurement of body temperature around 36.8°C from room temperature early around 27.8°C. In this implementation phase, measurement conducted by counted 3 times to get correct data, so that got time flattened - flatten required by mercurial thermometer and sensor to get correct normal body temperature. Every result of got by measurement at the sensor then returned to room temperature.

Figure 7 Software Design
From data result of above mentioned measurement, hence can be concluded that time required by mercurial thermometer to get normal body temperature tend to longer. Than existing data during 5 minute, mercurial thermometer scale newly reach output temperature about 36.5°C, while for same output, LM35 temperature sensor only requiring time 3 minute. While to get body temperature about 36.8°C, LM35 temperature sensor only requiring time about 5 minute, while mercurial thermometer require time about 8 minutes for the reach of the temperature.

**Examination of Correctness Sensor LM35 with mercurial thermometer**

This examination is conducted to test correctness sensor LM35 temperature to mercurial thermometer. This examination is conducted by measuring body temperature concurrently between LM35 temperature sensors with mercurial thermometer, where this examination is conducted by different room temperature.
Examination of Speaker Output

This examination is conducted to test accuracy of voice released by system. It is conducted by rerunning all word which has been recorded in IC ISD 25120. From result of the examination, where all the word can be rerun better without there mistake, but there a time gap in each is final of uttering a word. The sound of the voice is broken. This matter is caused by system used to rerun voice which has been recorded by giving time delay as distance between words.

CONCLUSION

The result showed that this thermometer has time response faster than mercury thermometer. It only needs 5 minutes to reach normally body temperature with output error is 0.19 0C. The sound output is very clear. Therefore this tool is good enough to be used as a clinical thermometer. Generally, this thermometer, which is equipped by sound output, uses LM35D sensor, ADC0804, FPGA Spartan II and ISD 25120. Measurement range of this thermometer is 30 0C – 42 0C.

REFERENCE


