Correlation of Electronic conductive yarn resistance value and NTC-Temperature-sensor for Smart wear

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1. INTRODUCTION

The study on wearable computing or smart clothes which makes the users' activity free and computing action available has been performed actively through the integration of non-IT field and IT field. Especially, the bio-signal related clothes platform production becomes popular. It is expected that the measured value of bio-signal may be influenced by the electric characteristics of electricity conductive yarn utilizing the electricity conductive yarn in interconnecting out of the various interconnecting technologies of clothes and IT device. This study analyzes correlation between the resistance of electricity conductive yarn and thermo sensor in the production of smart clothes platform for measuring the temperature from the bio-signals.

2. EXPERIMENTAL

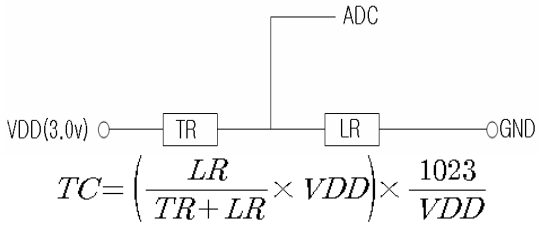
The electricity conductive yarn is so weak at the extension that it is not suitable for interconnecting and it was used by added mixing in the interconnecting available form. The silver coated nylon yarn which is used in domestic in popularity was used for electricity conductive yarn.

The thermo sensor has the high precision as the tolerance of B constant is small and its uniform shape is adaptable to vapor phase solder system and it was selected as a sensor of high reliability because it has a small diurnal variation. The thermo sensor used in the experiment at the final selection is the NTC-Temperature sensor in which NTC means the negative temperature coefficient. Namely, the NTC resistor's resistance value decreases as the temperature goes up and increases as the temperature goes down. It is called as heat-conductor because the conductivity on the wire is better in heated state than in low temperature.

The thermo sensor was selected in comparison and analysis of washability and durability which are most important to the application to smart clothes. And it is finally selected after examining whether it can be commercialized for clinical thermometer in terms of price and mass production and whether it is negative in shape when it attached on the clothes. .

3. RESULTS AND DISCUSIION

The change in temperature was distinguished easily as it varies on the equipment indicator according to the order that the resistance decreases when the temperature rises and the current drift becomes better in a certain voltage by utilizing the characteristics of NTC-Temperature sensor which has better conductivity in heated state than in cool state. The formula for precise temperature is as follows.



$$TC = \left(\frac{LR}{TR + LR} \times VDD \right) \times \frac{1023}{VDD}$$

1) VDD => 3V(3000)
2) 10bit ADC => 1023
3) LR(Load resistance) => 100k
4) TR(NTC Resistance)

No temperature difference was shown in between two thermometers at the range of 30°c - 40°c in comparison of normal thermometer and thermometer to be attached to smart clothes (NTC -thermometer).

The resistance loaded on the conductive yarn at each temperature was analyzed to examine the characteristics of resistor depending on the length and measured temperature of conductive yarn. In result, it showed that 161.9Ω at 0°c, 99.13Ω at 10°c, 62.38Ω at 20°c, 40.23Ωat 30°c and 26.58Ωat 40°c.

The characteristics of resistor at 30°c - 40°c which is near to body temperature was analyzed based on the derived resistance values from this result. The analysis result of resistor characteristics depending on temperature in each length of conductive yarn divided in 10, 20, 30, 100cm. It was 42, 78, 131, 381Ω, 30°c at the experiment condition of 20°c - 30°c and 40, 72, 120, 372Ωat 30°c - 60°c.

It does not make a big influence as it is shown below after the analysis whether the derived changes in resistance influence to the temperature of NTC.

Table 1. The NTC-temperature change vs. the resistance of electricity conductive yarn (at 30°c)

Resistance of electricity conductive yarn (Ω)	Changed resistance (Ω)	Changed temperature (°c)
42	40.230 -> 40.272	30 -> 30
78	40.230 -> 40.308	30 -> 30
131	40.230 -> 40.361	30 -> 29.997
381	40.230 -> 40.611	30 -> 29.8

4. CONCLUSION

It was revealed out that there was no co-relevance between the resistance of electricity conductive yarn and NTC-Temperature sensor, if the length of coated electricity conductive yarn is less than 100m and the resistance is less than 381Ωwhen it is connected to NTC-Temperature sensor. It means that temperature measuring is possible without modification on the temperature measuring software, if the length of coated electricity conductive yarn is less than 100m and the resistance is less than 381Ωin the production of smart clothes.

5. REFERENCES

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