

TO REVIEW ON TEMPERATURE SENSING ROBOT

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ABSTRACT

Earlier studies show that organic and inorganic semiconducting materials are the most promising materials for use in temperature sensors. In this brief review, attention will be focused on temperature sensors and its applications in various fields. A temperature sensing mobile robot via Bluetooth is proposed as an alternative solution for temperature measurement. In this project, a prototype mobile robot with simple locomotion mechanism and temperature sensor has been developed to measure human and environment temperature. The mobile robot can move around and measure temperature according to the command or instruction of the user using mobile Bluetooth and it can measure temperature in °C.

Keyword: temperature, robot, sensor, junction, thermocouple.

I. INTRODUCTION

Temperature is the most often-measured environmental quantity. This might be expected since most physical, electronic, chemical, mechanical, and biological systems are affected by temperature. Some processes work well only within a narrow range of temperatures; certain chemical reactions, biological processes, and even electronic circuits perform best within limited temperature ranges. [1]

Thermocouples, temperature dependent resistance elements (RTDs and thermistors) and semiconductor elements (diodes) are widely used to electrically measure temperature. Digitizing the electrical signals of these sensor elements requires significant expertise in a number of areas: sensor behaviour, analog circuit design, and digital circuit design and firmware development. The LTC2983 packs this expertise into a single IC and solves each of the unique challenges associated with thermocouples, RTDs, thermistors and diodes. It combines all analog circuitry necessary for each sensor type with temperature measurement algorithms and linearization data to directly measure each sensor and output the result in °C. [2]

Nowadays application of Bluetooth wireless technology has become popular among the collaboration between short range communications such as computing, mobile phone and automotive markets. A device must be able to interpret certain Bluetooth profiles in order to use Bluetooth technology. Hence, a KC-21 Bluetooth module is used as a Bluetooth transceiver between microcontroller unit and mobile phone. The user can use the mobile phone to send all the instructions to the mobile robot. When the temperature sensor detects the temperature, the measurement will be send to the mobile phone through the microcontroller unit and Bluetooth module. [3]

II. TEMPERATURE SENSORS

The some temperature sensor may be described here:

2.1 Contact Temperature Sensors

Contact temperature sensors measure their own temperature. One infers the temperature of the object to which the sensor is in contact by assuming or knowing that the two are in thermal equilibrium, that is, there is no heat flow between them. Many potential measurement error sources exist, as you can appreciate, especially from too many unverified assumptions. Temperatures of surfaces are especially tricky to measure by contact means and very difficult if the surface is moving. It is wise to be very careful when using such sensors on new applications. However, all sensors have their own set of complexities. [4]

2.2 Thermocouples

Thermocouples generate voltage as a function of the temperature difference between the tip (thermocouple temperature) and the electrical connection on the circuit board (cold junction temperature). In order to determine the thermocouple temperature, an accurate measurement of the cold junction temperature is required; this is known as cold junction compensation.

The cold junction temperature is usually determined by placing a separate (non-thermocouple) temperature sensor at the cold junction. The LTC2983 allows diodes, RTDs, and thermistor to be used as cold junction sensors. In order to convert the voltage output from the thermocouple into a temperature result, a high order polynomial equation (up to 14th order) must be solved (using tables or mathematical functions) for both the measured voltage and the cold junction temperature. [5]

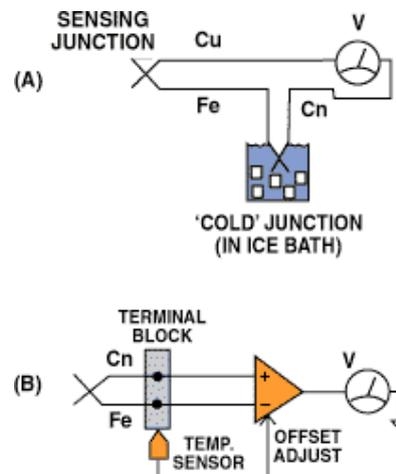


Fig.2.1. Thermocouples

2.3 Acoustic and Ultrasonic based Temperature Sensors

Several groups have exploited the concept of measuring temperature in a gas by measuring the speed of sound in that gas. Another variation on the same idea has been to send ultrasonic pulse down a rod of known expansion and propagation properties. By placing slots in the rod at known and calculable distances from the excitation position, one could immerse the rod in a medium of high temperature and then measure that temperature by measuring the reflection times of the pulses from the notches.[6]

III. METHODOLOGY

3.1 Control System Overview

Mobile robot consists of one MCU as the main brain of the control system. The MCU gathers the temperature measurement from LM35z (temperature sensor). The system has a serial communication with the KC-21 Bluetooth module. The user will communicate or control the robot using this communication link. One of the outputs links is used to control the motor via H-bridge motor driver. A brief explanation for each of the robot component are described and summarized.

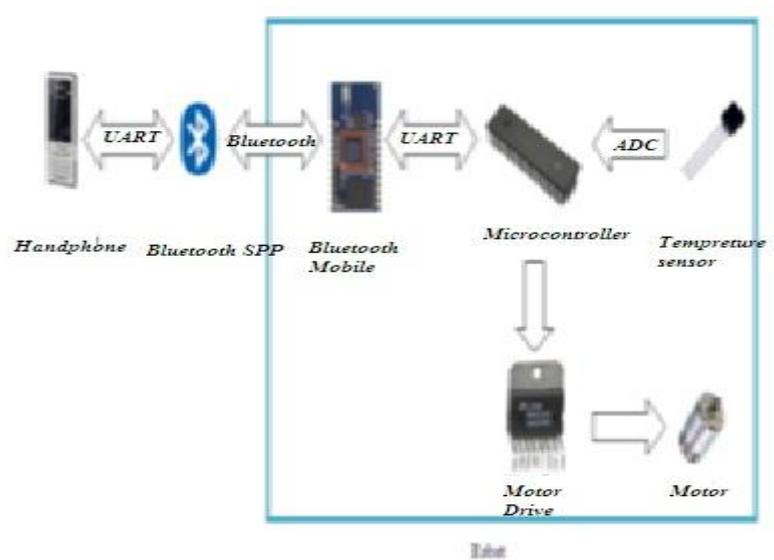


Figure3.1. Block Diagram of Overall System

TABLE 1 : Material Specification

System Module	Material	Specification
Temperature sensor	LM35z	Ranging from -55 ⁰ C to 155 ⁰ C at room tem., linearly propotional to Celsius tem with -10mv/ ⁰ C scale factor
Motor drive	L298	2.5v to 46v dual full bridge driver , 100 saturation voltage over heat protection
DC motor	C365	Speed (sec/60deg.):0.16/4.8V Torque (Kg-Cm) : (3.50/4.8V)
Bluetooth Module	KC wireless Bluetooth module starter kit SKKCA-21	5V UART interface, Range upto 20 m.
Indicator	LED	3mm
Power supply	LM7805	Output Voltage 5V
MCU	PIC16F877A	20 MHz operation speed , PWM module consist of UART

3.2 Software Development

The developed Java coding has to be installed in the mobile phone so that it can communicate with the Bluetooth module. The first step is to click the connect button in the mobile phone, so that the mobile phone will communicate with the Bluetooth module. After the mobile phone is successfully connected, the user can start to control the robot. Button “1” is used as a temperature controller while the other buttons are used for navigating the robot. [6]

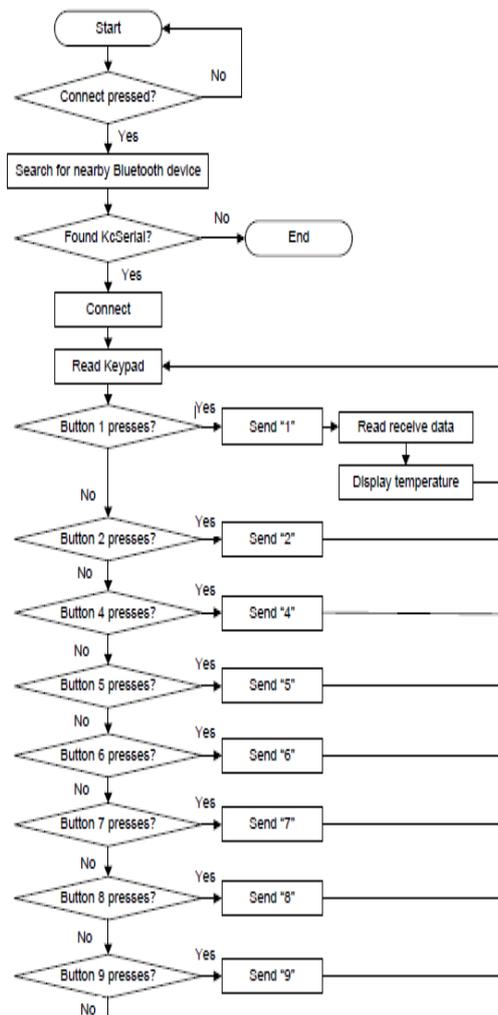


Figure3.2. Flowchart for Java Coding

IV. APPLICATION OF TEMPERATURE SENSORS

4.1 Food Applications

The temperature of food plays a big role in assuring that certain products are well enough cooked to kill harmful organisms like bacteria. Similarly, many foods, including cooked food, become breeding grounds for other harmful organisms if unrefrigerated too long or even if left in a refrigerated environment for too long a time. Certainly, in the cooking area it is quite straightforward to monitor the internal temperature of meats and other foods to assure that the proper minimum temperature has been attained before it is considered safe. [7]

4.2 Steel and Metals Applications

- Taconite temperatures in pelletizing operations
- Sinter temperature
- Coke oven temperature measurements and transfer belts protection
- Thermocouples in Blast Furnace Environments
- Stove Domes and Bustle Pipe Temperatures
- Temperature Measurement of Liquid Iron, Liquid Steel and other molten metals
- Slag detection in steel pouring streams and detection of Iron in slag streams
- IR Radiation Thermometers for oxidized steel objects in cooler surroundings
- Non-Contact measurement of steel surface temperatures in Reheat Furnaces
- IR Radiation Thermometers used in Continuous Anneal Furnaces
- Non-contact temperature measurement on Coating Lines, e.g. tin, zinc, plastic film
- Measuring steel sheet surface temperatures in the Galvanneal process.

4.3 Medical Applications

Ever since one's first experience with a fever thermometer, almost everyone has known what it means "to have a temperature". The fever thermometer is still in abundant supply and still the second most frequent test used (after a hand on the forehead) to indicate the presence of an infection in the human body by noting an elevation in body temperature. Human and animal body temperatures are so important to the well being of warm-blooded animals, that the nominal body temperature indicated by a fever thermometer or similar device is used as one of the vital signs routinely monitored as an indicator of a state of a person or animal's health. [8]

V. CONCLUSION

This review summarizes the types of temperature sensors and their applications in various fields. It describes the significance of temperature as the most often-measured environmental quantity, types of temperature sensors and their applications. Contact temperature sensors measure their own temperature. Thermocouples are among the easiest temperature sensors to use and are widely applied in science and industry. The locomotion system was implemented using PIC 16F88A microcontroller while the control system is via Bluetooth module. User can control the movement of the robot using a mobile phone which has been installed with the developed Java code and existing Bluetooth application. Bluetooth technology can be used to perform various applications.

The prototype of this project has been successfully completed where the mobile robot can move and measure according to the user instructions from the mobile phone. The idea of implementing Bluetooth technology is for safety purpose and is very useful especially in application where risk is a concern.

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