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Thermocouple Based Temperature Measurement using Microcontroller

Aletwad Harshwardhan .H. [1], Arbad Nikhil .S.[2], Mane Manish..R.[3] , Pagalwad Ritesh .G.[4], Prof. S.G.Kadam[5]

[5] Guide
Department: Electrical Engineering
Institute: Government Polytechnic
City: Nanded , State: Maharashtra ,
Country: India

ABSTRACT :

Temperature dimension is a essential thing of commercial,environmental,and,domestic,programs. This paper gives a microcontroller-based totally temperature dimension,device that employs sensors to come across temperature versions and provides real-time monitoring thru a display interface.The system utilizes an LM35 temperature sensor linked to a microcontroller, processing the statistics and showing the temperature on an LCD. Various temperature sensors, their accuracy, and suitability for extraordinary,applications,are,discussed.Additionally, it highlights how microcontrollers enhance the efficiency and precision of temperature size systems.

Keywords : Temperature sensor, Microntroller, Embedded System , Digital Thermometer , IOT Calibration.

Introduction

Accurate temperature measurement is important Industries like healthcare, meteorology, food Storage, and, automation. S, while useful, is the lack of automatic capacity Data logging and remote monitoring. Microcontroller-based growth The temperature measurement system is capable More accurate, with more real -time monitoring Flexibility and integration with IOT platforms. This paper discovers various microcontroller-Based temperature measurement technique, Function of normal temperature Sensor, and potential application.Temperature monitoring is required in various Healthcare, Industrial IndustriesAutomation, Food Processing and Meteorological. Traditional measurement methods often decreaseMonitoring accuracy, stability and real -time Captains. By integrating microcontrollers with Temperature sensors, these limitations can beEffectively addressed. This paper is different Types of temperature sensors, including thermists, RTD, and infrared sensors, and their applications Microcontroller-based measurement system.

Methods And Material

Temperature measurement system The following major components include:
1. Temperature Sensor: LM35, DS18B20, or Thermocaple sensors detect temperature Change and convert them into electricity Signal.
2. Microcontroller: Arduino, Pic, or ESP32 Microcontrollers Processionor Data and control output equipment.
3. Performance Module: LCD or LED display Show real -time temperature reading.
4. Power Supply: A 5V or 3.3V power Source Microcontroller and Operates Sensor.

A. **Temperature Sensor:** There are different types of temperature sensors Available, each with its advantages and boundaries. Usually used sensors There are microcontroller-based systems:
- LM35: Providing analog sensor Liney voltage output proportional temperature.
- DS18B20: Digital sensor with a wire Communication, suitable for remote Sensation.
- Thermocols: Used in high- The environment of temperature due to Stability.
- Infrared Sensor: Non-Commerce Measurable Application.

B. **Microcontroller selection**
Selecting a suitable microcontroller depends on it Factors like power consumption, number/O pin, ADC resolution and communicationInterface. General options include:
-Rarduinouno: Easy-to-use, popular for Prototiping.
- ESP32: Wi-Fi supports connectivity for IOT application.
- pic16F877a: Common in industrial Automation

Results and Discussion

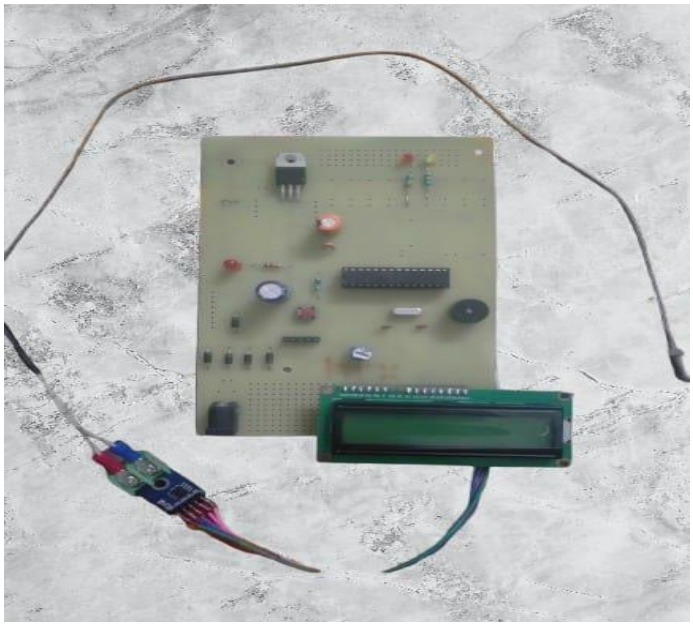
Proposed temperature measurement system It was applied using an LM35 sensor and one Arduino Microcontroller. System Successfully measured and displayed real time Temperature reading. The calibration tests were Conducted to compare the reading Standard thermometer. Performed results Accuracy of ± 0.5 ° C. Pursue Can include:

- Wireless Communication: Using IOT platforms Such as MQTT, the system can send real -time Temperature data to cloud server for remote access.
- Multiple sensors integration: multiple sensors Can measure temperature variation Various places.
- Data Logging: SD Card Module or Database Can store temperature data for analysis and The future maintenance.

A. Experimental Setup Was developed using a prototype LM35 sensor, an arduinouno, and a LCD Display. Calibrated using the sensor Precise thermometer for accuracy Verification. The system was tested Separate environmental conditions Assess its reaction time and stability.

B. data analysis and accuracy data Was collected from the system Compared with standard laboratory equipment. Microcontroller-based The system showed accuracy of ° 0.5 ° C, It is suitable for non-mating Application. The response was time 2-3 seconds found.

Circuit :



Conclusion :

A microcontroller-based temperature The measurement system provides a reliable and providesCost- Effective solution for real-time monitoring. With progress in IOT and Wireless Communication, these systems may be more Customized for smart applications in healthcare, Agriculture, and industrial automation. Future Work can focus on increasing accuracy, may reduce Electric consumption, and integrate AI-based .Future analysis.Future work To enhance the capabilities of the system,

The following improvements can be made:

- Machine Learning Integration: Future analysis for temperature trend.
- Extended wireless capabilities:

Including Lora or NB-IOT for a long time-Range Monitoring.

- Multi-Sensor Network: To deploy many Sensor for wide-area monitoring.

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