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1. Wireless Temperature Analyser and Controller

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ABSTRACT

The system consists of a temperature collection node, a temperature concentrator, and a remote monitoring centre, all of which can perform temperature collection, wireless transmission, and online monitoring flawlessly. The temperature sensor measures the ambient temperature before sending it to a receiver. The temperature will be displayed on a liquid crystal display and portable computers at the receiver for ease of monitoring. This paper focuses on the design and verification method for ensuring the accuracy of data sensing and transmission. The current common problems in substation temperature measurement are analysed and controlled in this paper, and a transformer temperature measurement system is designed.

KEYWORDS

Wireless Network Technology, Wireless Temperature, Temperature Concentrator, Temperature Measurement System, Temperature Analyser and Controller,

Introduction:

The purpose of this paper is to achieve intelligent device control and secure working conditions by interfacing various sensors and devices to the AT89C51 microcontroller and RF modules with the Atmel controller for data transmission. Wireless industrial automation is a major concern in our daily lives. Industrial automations rely on power systems, which necessitate distance control and regulated systems. Wireless Control Networks (WCNs) have transformed the design of emerging embedded systems and sparked a new wave of potential applications. In addition to building automation, environmental surveillance, and military operations, WSNs are expected to greatly benefit industrial automation through faster installation and maintenance, cost savings, and easier plant reconfiguration. RF (radio frequency) is a new short-range, low-rate wireless network technology. RF also has some potentially interesting characteristics for supporting large-scale ubiquitous computing applications, such as power efficiency, timeliness, and scalability. It is clear that common wireless protocols such as Wi-Fi and Bluetooth can be used on the factory floor when managing the wireless transition. The challenge is to understand how to use wireless solutions designed for IT applications as wired system replacements in time-critical scenarios common on factory floors. Currently, the majority of wireless systems in production are focused on applications that require polling frequencies of seconds or longer. Again, technology standardisation is important for the globalisation of these high-profile developments. [1-3]

Electricity generation, transmission, and consumption are all instantaneous. As a result, the substation equipment cannot leave the system at will in order to operate. This necessitates the prediction of substation equipment failure, and the problem is averted. The traditional method is for substation operators to inspect the equipment, for example, by using a handheld infrared imager to measure the temperature of the equipment. This method has numerous flaws: (1) The operator has a limited regular inspection frequency, is unable to perform continuous monitoring for 24 hours, and it is difficult to detect unexpected problems; (2) When inspecting the equipment, the operator must be close to the live equipment, posing a serious safety risk. [4]

According to the demand analysis of the monitoring software for the substation's primary equipment temperature measurement system, the monitoring software should be divided into two parts. The first component is an application programme that is used for node configuration, data processing, data analysis, and data storage.

The other component is the database, which is used to store data information. The application programme and the database run concurrently, allowing it to fully meet the software design requirements. [5]

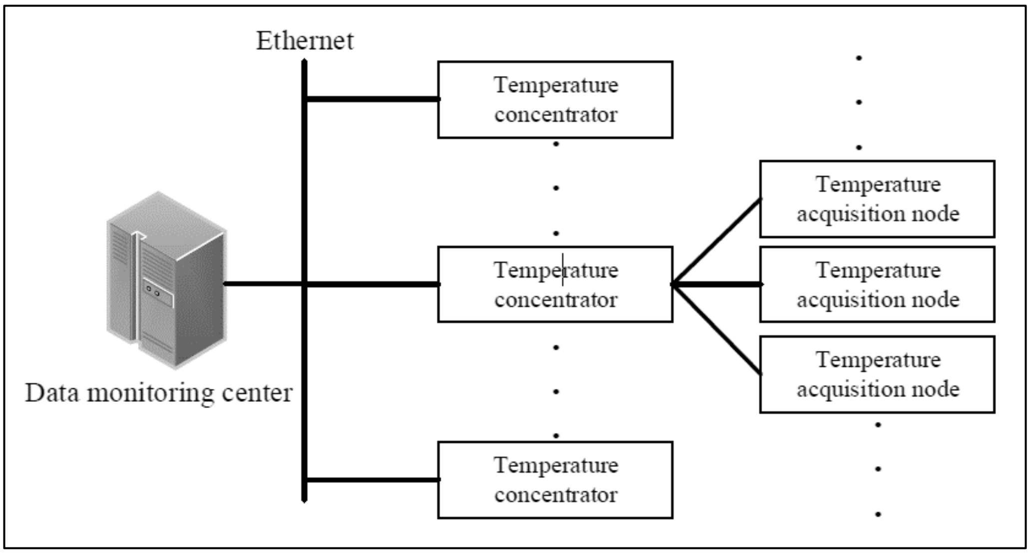


Figure 1: Wireless Temperature Detection System

There are numerous challenges to designing wireless sensor devices, such as measuring data accuracy and data loss during transmission. Building a wireless temperature monitoring system will be costly, particularly if continuous real-time monitoring is required. To transmit and receive data, a wireless sensor communication system can typically be designed using Zigbee, Sensor Tag [6], or Bluetooth devices.

Database Systems:

This design is primarily concerned with user and system operation and maintenance databases. The temperature data information collected by the temperature collection node layer can be stored in the user database, and the system operation and maintenance database can record the device number of each temperature collection node as well as the corresponding device details.

The data server decides whether to send data to the client based on the temperature value collected by its device and the change in the corresponding MySQL database table.

Database Access:

The database server must first process the information received by the network card, and then it must analyse which temperature concentrator the data comes from, and the storage concentrator can continuously send to update the collected information through a continuous process of writing in the corresponding table in the database server. The access process for the entire database is described above.

Review of Literature:

Because wireless technology is more convenient than wired-based systems, the market is shifting towards it [7]. This section will go over existing approaches to designing wireless temperature monitoring systems.

The application of temperature data acquisition and monitoring for a sensor network using ZigBee is discussed in reference [8]. A thermocouple is used as a sensor input in this work, which is connected to a cold junction compensator amplifier.

After passing through an amplifier, the signal is fed into the ZigBee module's analog-to-digital converter (ADC) port. Temperature data will be transmitted to a personal computer (PC) at a rate of four samplings per second using the Zigbee protocol.

A wireless sensor network for health monitoring is discussed in [9]. This system transmits data to the base server via a network and its subsystems before sending it to a PDA or personal computer. [10] discusses agricultural remote monitoring using a wireless sensor and short message service (SMS). When the temperature on the farm is too high or too low, this system sends an SMS message to the farmer.

The goal of [11] is to create a wireless body area network (WBAN) health monitoring system. ActiS sensors are used in this project to monitor a heart rate signal before transmitting it to a personal server via a wireless local area network (WAN).

The wireless temperature monitoring system discussed in [12] collects data from locations all over the world using an active RFID-based system. In this project, the sensor detects temperature and sends data wirelessly to the main server when the temperature is too high or too low.

Research Methodology:

The overall block diagram of the low-cost wireless temperature sensor system is shown in Figure 2. A microcontroller, an analogue to digital converter (ADC) temperature sensor, a transceiver, a receiver, an encoder, and a decoder are the main components used in this work. First, the temperature sensor will detect the ambient temperature and send it to an ADC. The ADC will convert the analogue signal to digital form so that the data can be processed by the microcontroller.

The processed data is then sent to an encoder before being transmitted. The encoded data will be received by the receiver and passed to the decoder, which will recover the original data. The microcontroller will be used. The overall block diagram of the low-cost wireless temperature sensor system is shown in Fig. 2. A microcontroller, an analogue to digital converter (ADC) temperature sensor, a transceiver, a receiver, an encoder, and a decoder are the main components used in this work. First, the temperature sensor will detect the ambient temperature and send it to an ADC. The ADC will convert the analogue signal to digital form so that the data can be processed by the microcontroller. The processed data is then sent to an encoder before being transmitted. The encoded data will be received by the receiver and passed to the decoder, which will recover the original data. The microcontroller will be used.

Result and Discussion:

In today's consumer market, wireless devices are the most popular applications. The purpose of this project is to create a low-cost, accurate wireless temperature monitoring system. The device can sense temperature and transmit and receive data. The results demonstrate that the wireless temperature sensor can perform accurately in a variety of conditions and over a wide range of distances. By using 5 volt input power, the temperature can be transmitted over a distance of up to 50 metres. The next stage of the project will look into reducing the device's size and operating voltage so that it can be used in a low-power environment.

Table 1: Components in Transmitter Part

No	Components (model)
1	LCD (DS-LCD-JHD162A)
2	Microcontroller board (P89V51RD2)
3	Temperature sensor (SN-LM35DZ)
4	Encoder (IC-HT-12E)
5	ADC (IC-ADC-0804)
6	Transceiver (RF-TX-433)
7	LED
8	Variable resistance (1 kΩ)
9	Antenna
10	Reset button

The experiment conducted to validate the wireless temperature sensor functionality is discussed in the following section. First, the temperature sensor calibration results will be discussed. Following that, the ADC functionality verification will be highlighted. The accuracy of radio frequency transmission will be presented next. Finally, the overall performance of the system will be discussed. Figure 2 depicts the temperature sensor's output voltage at various temperatures. At 28 °C, the output voltage is 284 millivolts. According to the data collected, every 1 °C change in temperature corresponds to a 10 mV change in output voltage. [13-14]

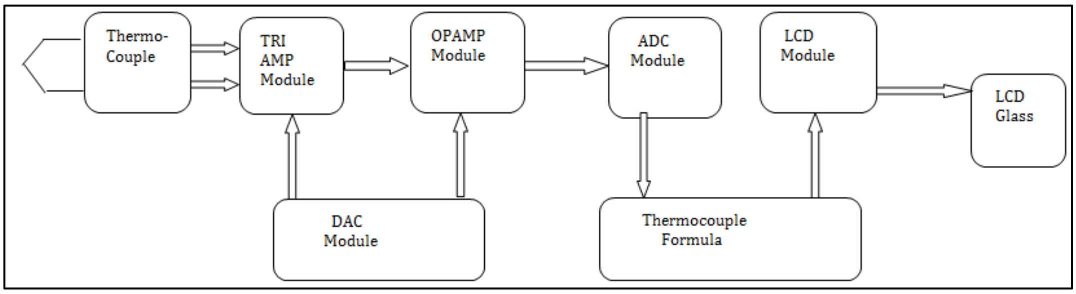
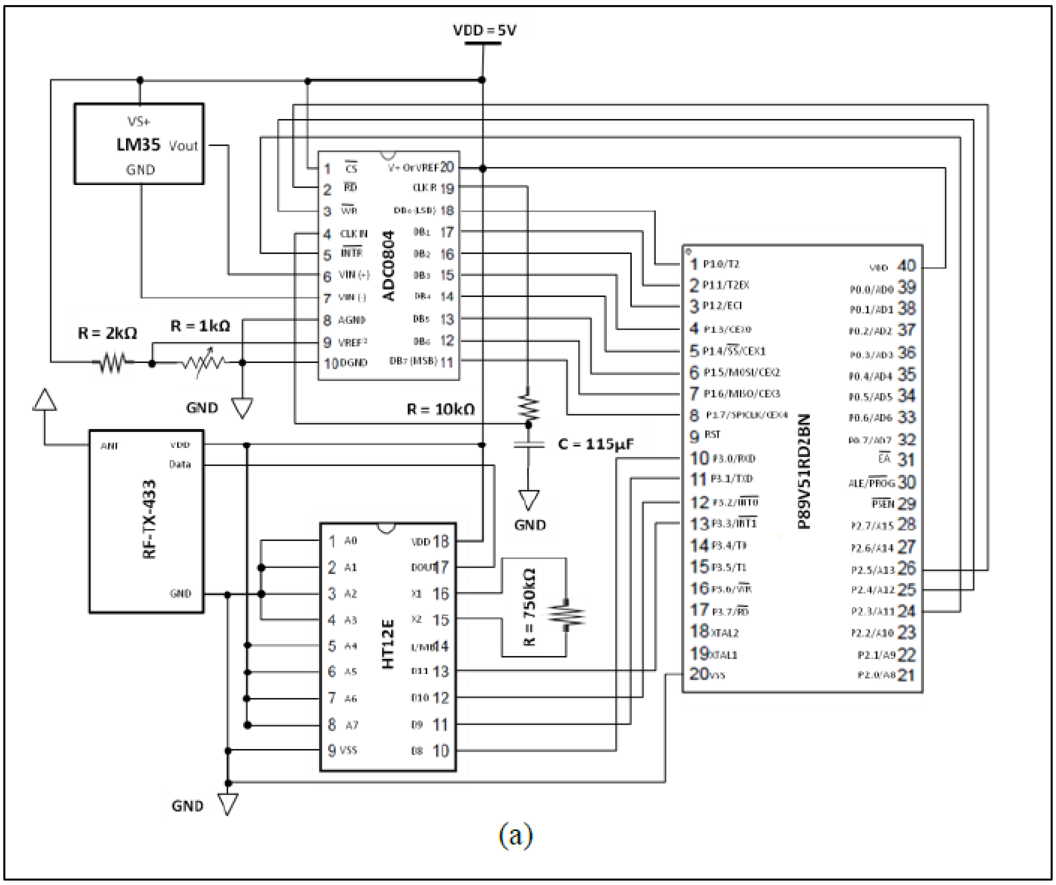
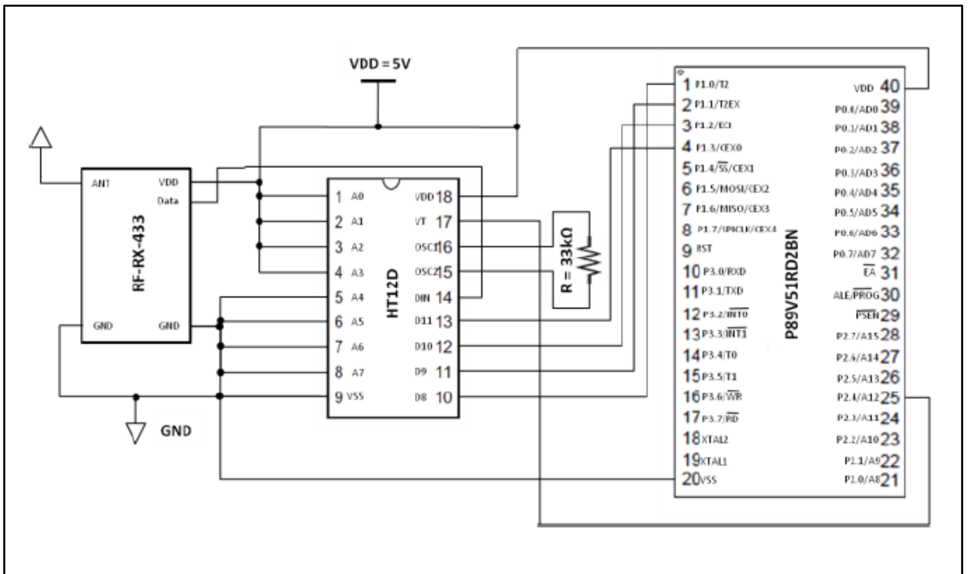


Figure 2: Block Diagram of The Wireless Temperature Monitoring System



(a)



(b)

Figure 3: Overall schematic diagram for the wireless temperature sensor system (a) transmitter module (b) receiver module.

Application of Temperature Measurement System:

A wireless temperature sensor network is created by deploying a single wireless temperature sensor. The wireless temperature sensor is directly installed on the primary equipment of the substation to be tested, and these scattered sensors are connected to form a wireless temperature sensor network via a wireless network. The use of monitoring software to record and analyse various collected data can assist substation operation and maintenance personnel in better understanding the legal status of various primary equipment, detecting heat-generating equipment in real time, and carrying out inspection and elimination work. The typical layout of wireless sensors in a 500kV substation is shown in Figure 4. It is confirmed that the browser interface for accessing the system can be displayed normally. [15-16]

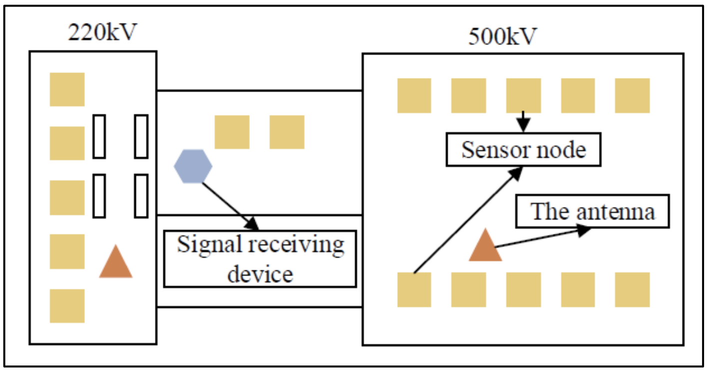


Figure 5: Wireless Temperature Sensor Network

Under the login test, users of all levels can successfully log in in the designed system. And can successfully add and delete power-saving devices while logged in, view and manage all power-saving devices under a concentrator, record the electrical equipment information monitored by each node, and monitor the temperature of a single sensor node. The threshold is transmitted and set.

Conclusion:

The temperature monitoring software described in this paper is intended to measure and monitor the temperature information of various primary equipment in real time. A database is created to manage and save various types of data, such as primary equipment name, temperature information, sampling time information, temperature abnormality information, and so on. In today's consumer market, wireless devices are the most popular applications. This project's goal is to create a low-cost, accurate wireless temperature monitoring system. The device can sense temperature and transmit and receive data. The results demonstrate that the wireless temperature sensor can perform accurately in a variety of conditions and over a wide range of distances.

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