

Mechanical Engineering and Materials Science

Part 2

Edited by
M.R. Xue, K.M. Li, M.H. Lee and X.Y. Zhang



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Mechanical Engineering and Materials Science

PART 2

Selected, peer reviewed papers from the
2014 International Conference on
Intelligent Mechanics and Materials Engineering
(ICIMME 2014),
December 27-28, 2014, Shenzhen, China

Edited by

M.R. Xue, K.M. Li, M.H. Lee and X.Y. Zhang



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Preface

It is our pleasure to welcome you to the 2014 International Conference on Intelligent Mechanics and Materials Engineering (ICIMME 2014) in Shenzhen, China. ICIMME 2014 is the first conference dedicated to issues related to Mechanical Engineering, Mechatronics, Manufacturing, Power Systems and Electronics, Measurement, Monitoring and Control, Automation, Information technology, Communication and network, Civil and Structure Engineering, Architecture Science, Computing Methods and Algorithms, Electric Applications, Materials Science and Engineering, Chemical Engineering and Environmental Engineering, Projects Management and Industrial Engineering. A major goal and feature of it is to bring academic scientists, engineers, industry researchers together to exchange and share their experiences and research results, and discuss the practical challenges encountered and the solutions adopted.

We hope you will have a technically rewarding experience, and use this occasion to meet old friends and make many new ones. Don't miss the opportunity to explore in Shenzhen, China. And don't forget to take a sample of the many and diverse attractions in the rest of the China.

The program consists of invited sessions, and technical workshops and discussions with eminent speakers covering a wide range of topics in Mechanical Engineering, Mechatronics, Manufacturing, Power Systems and Electronics, Measurement, Monitoring and Control, Automation, Information technology, Communication and network, Civil and Structure Engineering, Architecture Science, Computing Methods and Algorithms, Electric Applications, Materials Science and Engineering, Chemical Engineering and Environmental Engineering, Projects Management and Industrial Engineering. This rich program provides all attendees with the opportunities to meet and interact with one another. We hope your experience with ICIMME 2014 is a fruitful and long lasting one. With your support and participation, the conference will continue its success for a long time.

We would like to thank the organization staff, the members of the program committees and reviewers. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra helps in the review process, and the authors for contributing their research result to the conference. Special thanks go to TTP Publisher.

We wish all attendees of the ICIMME 2014 an enjoyable scientific gathering in Shenzhen, China. We look forward to seeing all of you next year at the conference.

Organizing Committee

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The Research on the Target Tracking of Infrared and Wireless Temperature Measurement System

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Abstract: A set of integrated system of target location and tracking and temperature wireless transmission are designed through infrared tracking, wireless frequency identification and digital temperature sensor. Hardware composition and software design approaches of the system are elaborated and the system test results are also provided.

1. Hardware composition of the system

According to the target tracking of infrared and the hardware circuit of wireless temperature measurement system, the system function can be divided into receiving module A and transmitter module B. Transmitter module B is responsible for the acquisition and display of temperature data, preliminary data processing and the wireless transmission function of information. Receiving module A mainly responses for the wireless receiving, temperature display, voice and light alert and target location and tracking. The hardware functional block diagram of the system is shown as Figure 1.

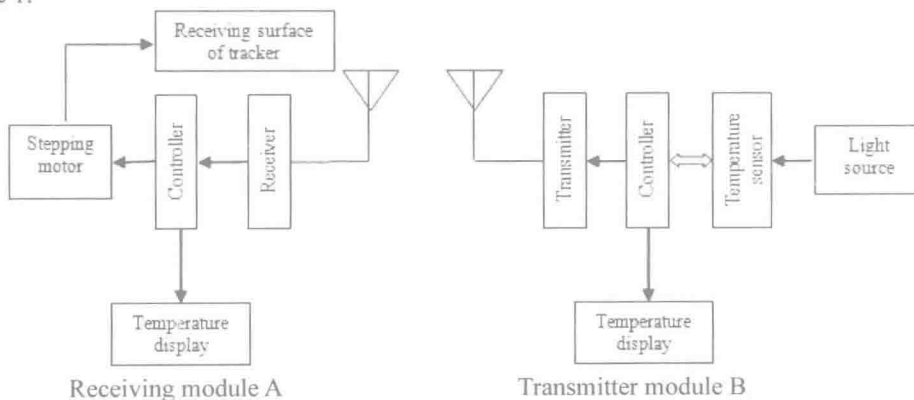


Fig 1 The hardware functional block diagram of the system

1.1 Transmitter module B

According to the system function completed implemented by transmitter module B, it can be subdivided into micro-controller, the power adjustment unit of light source, temperature display and radiating circuit. Among which, the micro-controller MC68HC908RF2 is the core part of control and data processing for transmitter module, radio frequency transmitter of the chip and the matching peripheral devices together form the radiating circuit.

1.1.1 Controller and transmitter

In order to reduce the size of PCB (printed circuit board) and connections, an integration chip MC68HC908RF2 of micro-controller and transmitter is selected. The transmitter radio frequency transmitter MC33493 integrated in the micro-controller MC68HC908RF2 is an UHF transmitter with low power turned by PLL (phase-locked loop). And the micro-controller inputting pins

through several figures to control different work patterns. Micro-controller MC68HC908RF2 connects sensor and transmitter, and which can test and transmit temperature data, and transmit data through 315 MHz and 434 MHz according to the different crystals.

1.1.2 Data display unit

The system adopts the LCD (liquid crystal display) module of graphic dot-matrix LCM12832ZK as the display module, the Chinese LCD Module can realize the Chinese characters, ASCII code and raster graphics on the same screen, the wide range of power operation (2.7V-5.5V) and low-power dissipation can meet the power saving of products, meanwhile the interface connected with micro-controller such as single chip is flexible.

1.2 Receiving module A

Receiving module mainly completes the functions as wireless receiving and display of temperature information, voice and light alert and real-time location tracking of Infrared tracker. According to the functions of receiving module, it can be subdivided into micro-controller, receiving circuit, electric motor control module, tracking circuit of infrared, display and sound-light hint circuit.

1.2.1 Controller and receiver

The micro-controller chip MC68HC908KX8 of receiving module A is same as the micro-controller chip MC68HC908RF2, they both belong to the micro-controller MC68HC908 in Free-scale, and they have the same MCU. And the radio frequency receiver MC33594 integrated in chip MC33594 contains IF band-pass filters of 660 KHz, the clock regeneration circuit of Manchester encoding and the intact SPI interface, and they can be used to design receiving circuit OOK/FSK of 315 MHz/434 MHz^{[5][6]}.

1.2.2 Voice and light display unit

The design principle of this unit is that, when module A positioning to module B, under the control of single chip program, A-side of the tracker will send voice and light alert, and meanwhile module A gives temperature transfer instructions, and begins to transmit temperature data. In the aspect of voice, buzzer is used to replace the ordinary speaker considering the volume and power consumption. And in the aspect of light, the common LED (light emitting diode) is used. The principle diagram of the voice and light alert is shown as Figure 2.

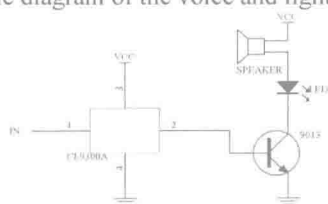


Fig 2 The principle diagram of the voice and light alert

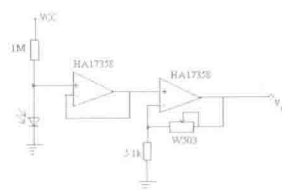


Fig 3 Infrared receiver circuits

1.2.3 Electric motor control module

The stepper motor is a execute component which transfers electrical impulses to angular or linear displacement. When a pulse signal is received, the motor will step forward, and turn in a fixed step angle. And the displacement of the stepper motor is controlled through the single chip outputting the impulse number; and the electric motor is controlled through the single chip controlling the frequency of the output pulses.

1.2.4 Infrared tracking the positioning unit

HA17358 operation, photosensitive diode and potentiometer are adopts in this paper to make infrared receiver modules, and this system uses 4 infrared receiver modules, among which the signals received by two infrared receiver modules control the position adjustment of tracker A's receiving surface around the X axis, and the receiving surface of other two trackers around the Y axis. Thus it can realize the infrared tracking and location. The module circuit diagram is shown as Figure 3.

2.The design of system software

As seen in the hardware functional block diagram, the design of system hardware can be divided into transmitter module and receiving module; and the system design is also divided into two parts: software design of transmitter module and receiving module. The functional block diagram of system software is shown as Figure 4.

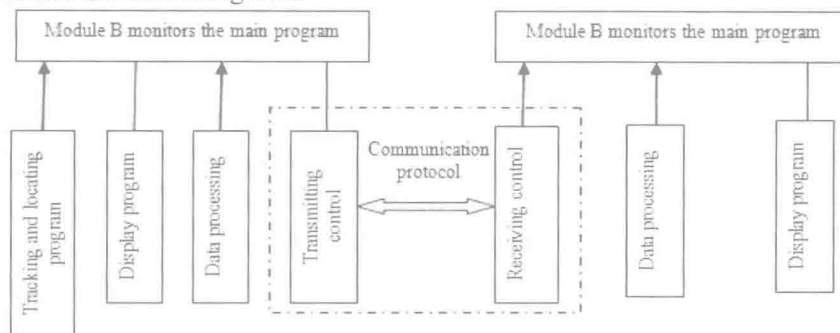


Fig 4 The functional block diagram of system software

2.1 Communication protocol

According to the features of hardware circuit, the system builds a communication protocol between transmitter module and receiving module: the data among modules should be sent in 9600 baud, and adopts the Manchester encoding modulated by OOK.

2.2 The transmission program design of transmitter module

When the system starts, the monitoring program will read the temperature measured by sensor chip, and then send out the temperature information through transmitter module. The program flow diagram is shown as Figure 5.

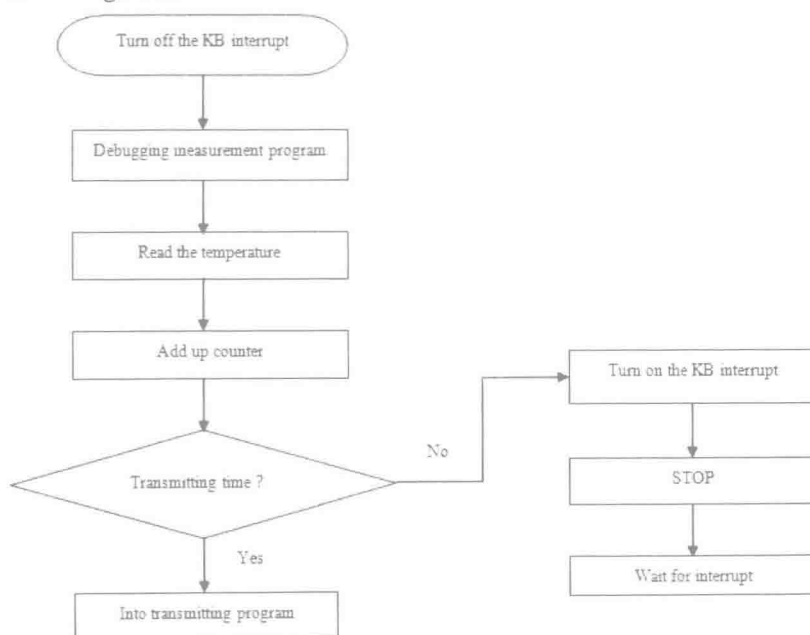


Fig 5 The program flow diagram of transmitter module

2.3 The receiving program design of receiving module

The software functions of receiving module are completing the reception, display and storage of temperature, the program flow diagram of receiving module is shown as Figure 6.