# Design of Self-study Classroom Monitoring System Your Paper's Title

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## Abstract

**The system detects the air temperature and relative humidity through temperature and humidity sensors, and uses infrared emitting and receiving tubes as counting detection devices to monitor the environmental parameters and free positions of the self-study classroom. The system displays the temperature and humidity, number of people and number of free positions through LED display screen, and sends them to the main engine of the hall to facilitate students to select positions. This system has the advantages of simple development, low cost, precise calculation, etc., and is worth popularizing.**

## Keywords

**Automatic Counting; Temperature and Humidity Monitoring; Single Chip Microcomputer 51; Multi Terminal Display.**

## 1. Introduction

Students have a great demand for self-study classrooms because they do not know whether there are vacant seats in each classroom. Pushing the door for observation not only wastes energy and time, but also affects students studying in the classroom. In addition, different students may want different temperatures. Therefore, we hope to design a real-time monitoring system for the status of the self-study classroom, which can monitor the temperature and humidity inside each self-study classroom at any time, as well as the remaining vacant seats, so that students can find the corresponding self-study classroom according to their own conditions.

## 2. Scheme Design of Self-study Classroom Monitoring System

The self-study classroom monitoring system needs to achieve the following specific objectives:

(1) The number of people statistics system is designed to judge, count, display and transmit the corresponding information to the host computer.

(2) Monitor the temperature and humidity of the self-study classroom in real time and transmit the information to the host computer.

The overall block diagram of the design system is shown in Fig. 1. The infrared sensor is used to monitor the number of people, the temperature and humidity sensor is used to monitor the environmental parameters, the collected information is transmitted to the microcontroller for processing, the remaining vacant seats in the classroom are counted, the vacant seats and the classroom temperature and humidity are displayed, and sent to the switchboard through the 485 data bus.
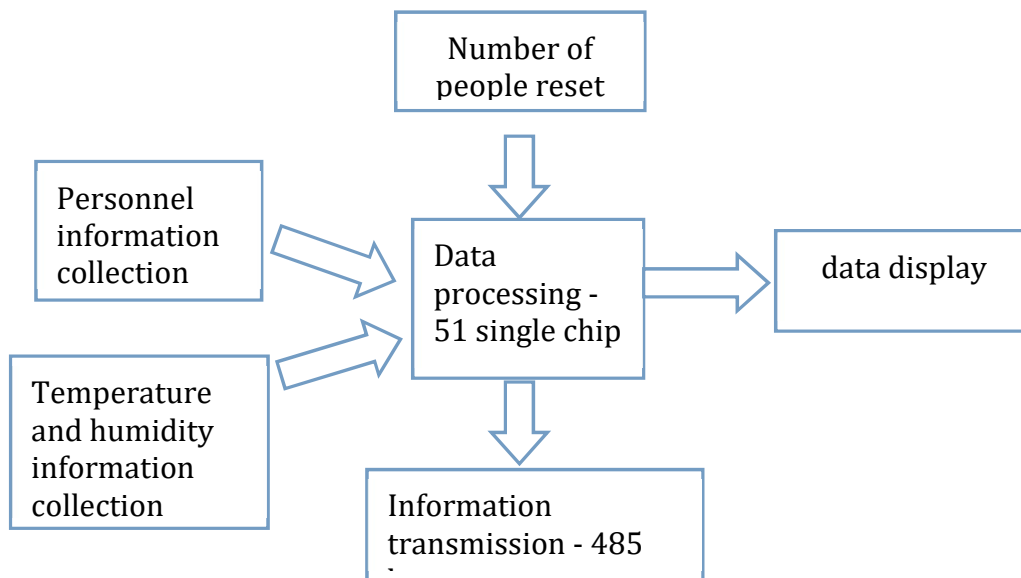
**Fig. 1** Overall scheme design block diagram of self-study classroom monitoring system

## 3. Hardware Circuit Design

The hardware circuit of the self-study classroom monitoring system includes the number of people information acquisition circuit, temperature and humidity information acquisition circuit, microcontroller main control circuit, display circuit, data transmission circuit, etc. The details are as follows.
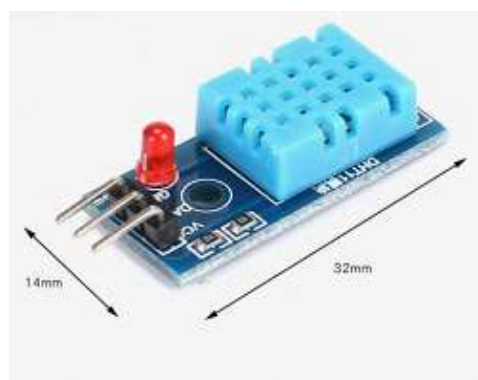
### 3.1. Personnel Information Collection

The human body infrared sensor counting function is used to monitor the number of people, The shape of the human infrared sensor module is shown in Fig. 2, The working power supply is 3.3V-5V, and the working current is below 10mA, The sensor has the following advantages: the detection distance can be adjusted by the potentiometer, the disturbance generated is small, it is easy to install and use, etc, It is widely used in many scenes, such as personnel detection and positioning, obstacle avoidance vehicles, assembly line measurement and tracking of black and white negative films.

When the infrared sensor module detects the front obstacle signal, the OUT port continuously outputs the low-level signal. The detection distance of the module is 2-30cm, and the maximum detection angle is 35°. The detection distance can be adjusted through the potentiometer. Adjust the potentiometer clockwise to increase the detection distance; Adjust the potentiometer counterclockwise to reduce the measuring distance. The output port OUT of the sensor module can be directly connected to the IO port of the microcontroller.



**Fig.2** infrared sensor

**Fig. 3** Temperature and humidity sensor

## 3.2. Temperature and Humidity Information Collection

DHT11 temperature and humidity sensor is used to monitor the ambient temperature and humidity. DHT11 is a temperature and humidity integrated sensor with calibrated digital signals. As shown in Figure 3, it makes the product have high accuracy and excellent long-term reliability by applying the proprietary big data module collection technology and temperature and humidity sensor technology. The sensor consists of a resistive humidity sensor and a NTC measuring device, which are connected with a high-performance 8bit microcontroller. DHT11 has very low power consumption. Under 5V power supply voltage, the average maximum working current is 0.5mA.

The technical parameters of DHT11 are as follows:

Operating voltage range: 3.3V-5.5V.

Working current: 0.5mA on average.

Output: single bus digital signal.

Measuring range: humidity 20~90% RH, temperature 0~50 ℃.

Accuracy: humidity $\pm$ 5%, temperature $\pm$ 2 ℃.

Resolution: humidity 1%, temperature 1 ℃.

## 3.3. Main Control Circuit

It is realized by 52 series single chip microcomputer. The minimum system of single chip microcomputer includes keyboard circuit module, clock circuit module and crystal oscillator circuit module. Two human body infrared sensor modules are respectively connected with P1.0 and P1.1 ports of the microcontroller. One sensor detects the number of people entering the classroom, and the other sensor collects the number of people leaving the classroom, When two sensors detect people at the same time, the order in which people cannot be detected by the two sensors can be used to determine people's access. The output of the temperature and humidity sensor is connected to the P1.7 port of the microcontroller. The data format of DHT11 is: 8bit humidity integer data+8bit humidity decimal data+8bit temperature integer data+8bit temperature decimal data+8bit checksum. The checksum data is the sum of the first four bytes. The sensor data outputs uncoded binary data. Data (humidity, temperature, integer, decimal) should be processed separately.

## 3.4. Display Circuit

Select LCD display, which has large amount of information, long service life and can be driven under low voltage. The D0-D7 port of the LCD1602 is connected with the P0 port of the microcontroller to transmit data signals, and P2.0, P2.1, and P2.2 ports are used as RS, RW, and E control lines of the LCD1602 to transmit control signals to the LCD1602.

## 3.5. System Overall Circuit Design.

The overall circuit of the system includes human infrared sensor module,temperature and humidity detection module,minimum system module of single chip microcomputer, 485 bus module, LCD1602 circuit,etc.,as shown in Fig.4.
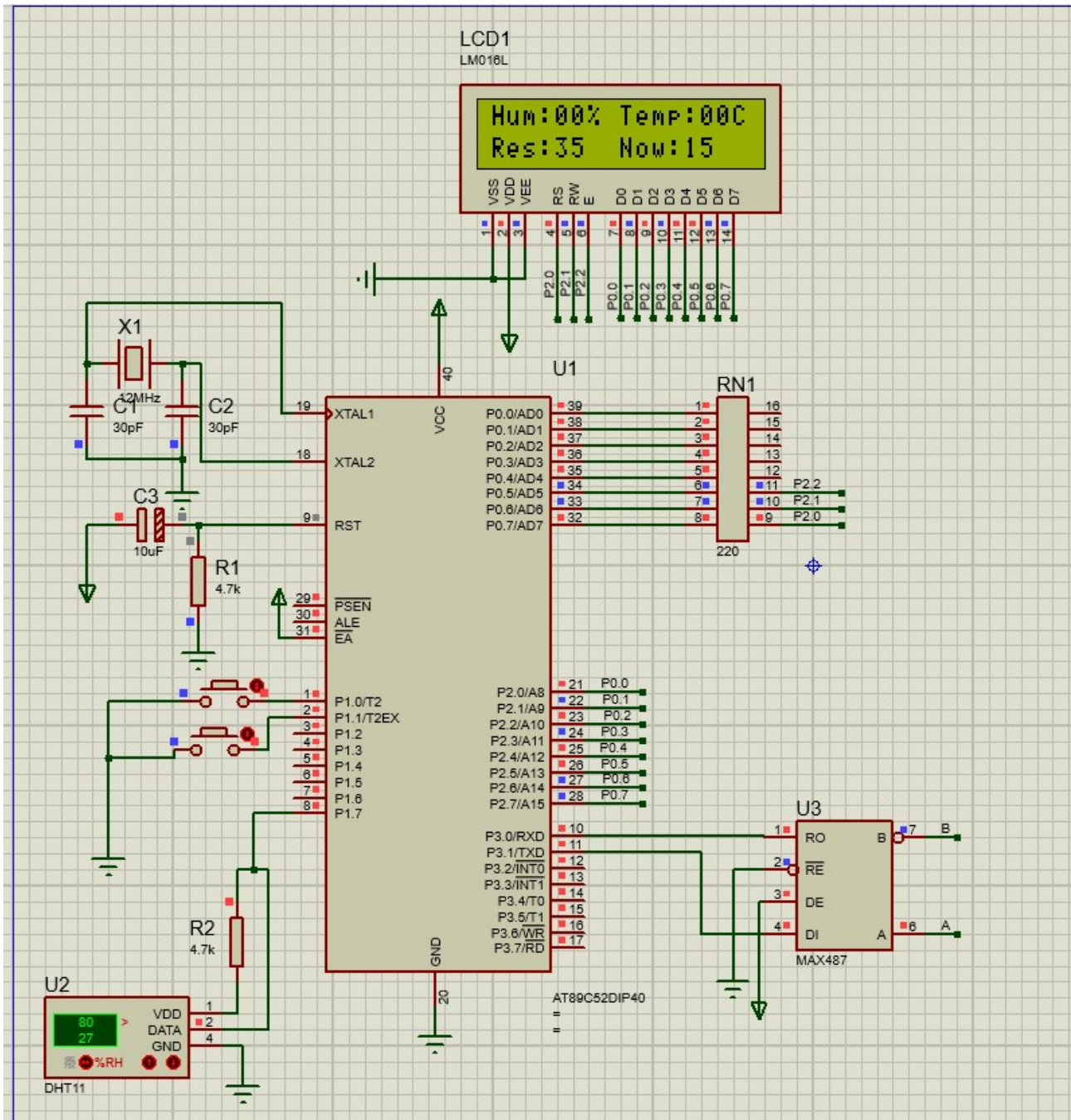
**Fig. 4** Overall Circuit Design of the System

## 4. Program System Design

### 4.1. Overall Process Design of the System

The main task of the main function is to initialize the power on, and constantly check the status of keys and perform related functions during program execution. After receiving the information that a person has passed through the door, the information will be sent to the personnel access status being processed by the microcontroller, and finally the personnel access status will be displayed on the LED or LCD. The main flow chart of the flow of people in the self-study classroom is shown in Fig. 5.
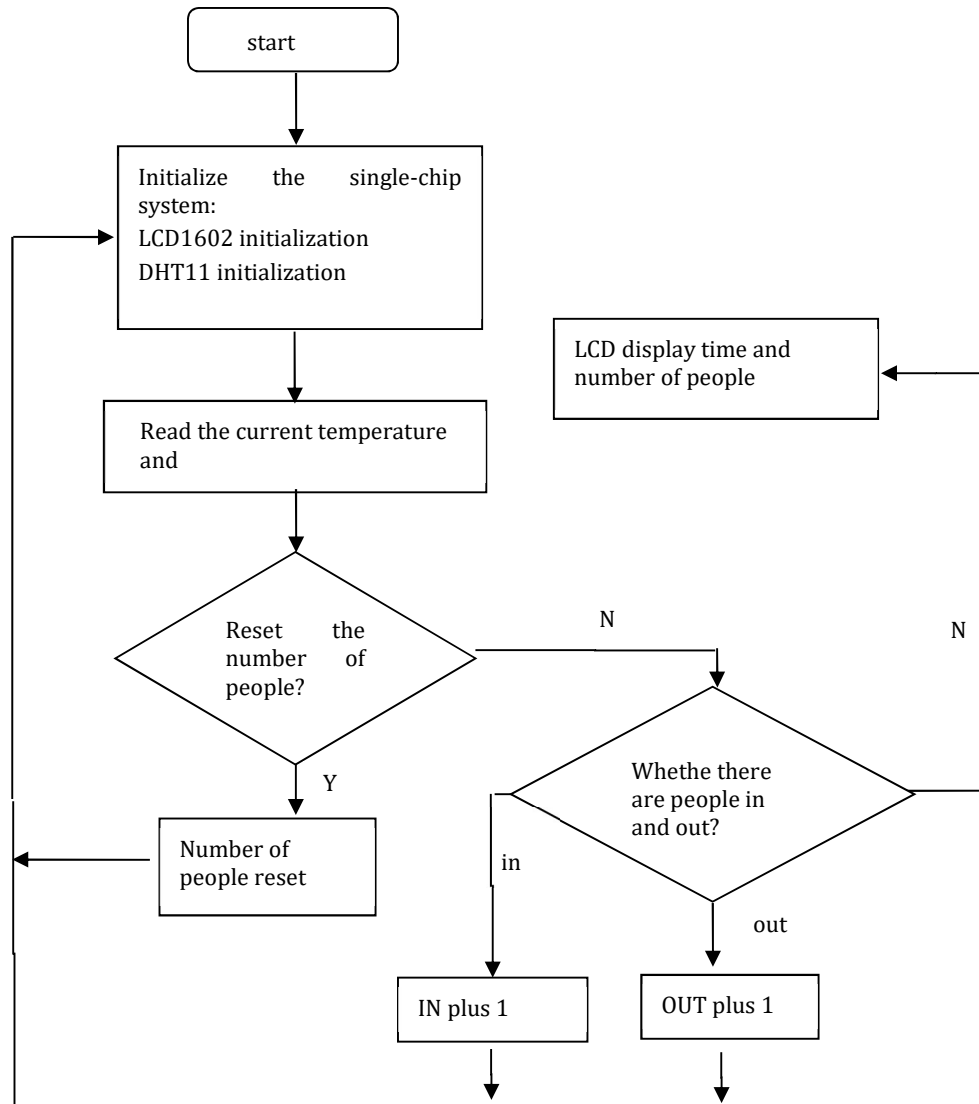
**Fig. 5** Main program flow chart of self-study classroom monitoring system

## 4.2. Flow Design for Judging the Number of People

The control system uses the infrared sensing function to judge whether there is a person coming in or out. When the sensor detects a person coming in, it will generate a high level. At this time, the sensor is only in a continuous triggering mode. During the delay period, the sensor will also generate a continuous high level until the worker is out of the monitoring range, and the automatic delay will become effective as a low level. In the non continuous trigger model, only when the delay time is up, it will immediately switch to a lower voltage, and the delay time is usually adjustable from 0.5S to 200S. The non continuous trigger mode is selected in this setting. However, in the continuous trigger mode, when the sensor detects that a person has passed through the door, it must delay accordingly before sending the data to the LCD display, which causes a slow prompt process.

The rule for two sensors to judge people's access is: when people pass through the door, that is, when both sensors detect that people are still near the door, people continue to move. If the sensor behind the door cannot detect people, but the other sensor still detects the presence of people, it means that people have entered, and at this time, the IN door is increased by one. On the contrary, it means that people go out, and the OUT door is increased by one. However, fully considering that the number of people stepping out of the room cannot be more than that entering the room, when the OUT value is equal to the IN value, the number of people displayed by the two doors will be equal if the OUT value is less than the IN value, as shown in Fig. 6.
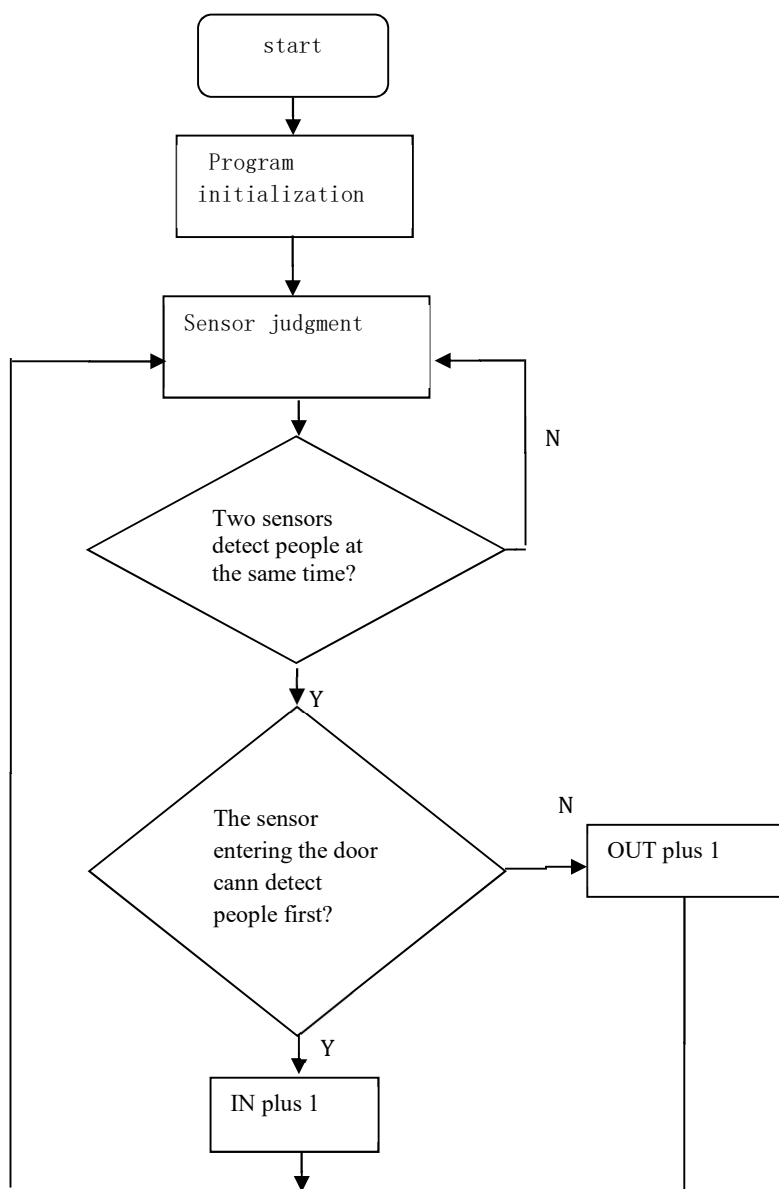
**Fig. 6** Flow chart of judging the number of people

## 5. Conclusion

After repeated design and debugging, this system has strong anti-interference ability compared with the high specification and high quality monitor, and the number of people, temperature and humidity data monitoring results are more accurate, and it is convenient to use and cheap. It is a good choice for self-study classroom management in schools.

## References

[1] Liu Pan. The Hardware Design of the Monitoring System for the Number of Students in the Self study Room of a University[J].Electronic Technology & Software Engineering, 2016(10):259-259.

[2] LAN Yu.Design of automatic tracking car based on infrared sensor ST188[J].Electronic Design Engineering, 2013(3):64-66.

[3] REN Weihong1, SHI Juncheng. Temperatureand Humidity Control System Design Based on SCM [J]. MACHINERY&ELECTRONICS, 2021(6): 48-51.