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Research Article

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Multisource data acquisition based on single-chip microcomputer and sensor technology

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Abstract: Today, data and information are flooded every day. Data are a reliable basis for scientific research. Their function is not only to clearly show real problems in various fields, but also to guide people to find the key factors that cause problems. The emergence of big data responds to this era of information explosion, and it is precisely by virtue of the accumulation of quantity that it presents the rules more clearly. No matter political, economic, cultural, and other fields are closely related to data. The application of microcontroller and sensor technology can help explore new branches of multisource data. However, the collection and analysis of multisource data only stays in the aspects of computer and communication technology. In view of the earlier problems, this article carried out scientific data collection and analysis of multisource data based on single-chip microcomputer and sensor technology. The research results showed that based on two algorithms, random early detection and weighted fair queuing, the analysis algorithm according to the Genetic Algorithm had a higher successful conversion rate. The power consumption of a node with better antenna performance was 9–10% lower than that of a node with poor antenna performance, which provided a basis for multisource data collection and analysis.

Keywords: multisource data collection and analysis, micro control unit, sensor technology, cyber physical systems

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1 Introduction

Single-chip microcomputer is produced according to the demand of industrial measurement and control; its structure and command function fully meet the requirements of industrial control, so it is also known as single-chip microcontroller. Microprocessor as the core of the application system is generally in the smallest system work; "single chip" is an important part of household appliances and intelligent instruments. Due to its small size, low cost, high integration, strong versatility, oriented to control, ease to expansion, high reliability, short application development cycle, and other characteristics, it has broad application prospects in household appliances, aviation, automotive, biological signal processing and so on. Modern society is a data society, and data have become an important strategic resource in social development, which is ubiquitous in life and society. It is small enough to affect people's daily life, and it affects the operation of enterprises and the security of the country. Therefore, multisource data collection and analysis are required to obtain and protect the data. To further understand and analyze the multisource data, this article analyzes the multisource data based on the single-chip microcomputer and sensor technology.

In this article, the research on multisource data is mainly analyzed from two aspects of single-chip microcomputer and sensor technology, and the composition and development of multisource data are explored from a novel perspective, and more branches are explored. In the aspect of a single chip, this article analyzes multisource data based on random early detection (RED), weighted fair queuing (WFQ), and genetic algorithms. In terms of sensor technology, this article compares the antenna performance through experiments and analyzes the node power consumption. The innovations of this article are (1) a new algorithm based on the RED and WFQ algorithms and the genetic algorithm as a reference is used; (2) four groups of simulated antenna parameters are compared and analyzed; (3) single-source data and multisource data are visually analyzed and compared.

2 Related work

Due to the increasing importance of multisource data, many scholars have conducted in-depth research on multisource data in recent years. Scholar Shi et al. used the earth detector method and multiple data sources to determine the factors that control the accumulation of heavy metals in urban topsoil [1]. Zhang et al. tried to build a carbon emission panel data model using nighttime lighting data and carbon emission statistics to simulate China's carbon emissions from 2000 to 2013 [2]. Liu et al. developed a comprehensive method to measure urban liveability from both objective and subjective perspectives based on statistical data, geographic data (such as points of interest), questionnaires, and social media data (Instagram) [3]. Tao et al. used remote sensing data to map crop distribution, which was of great significance for agricultural production, food security, and agricultural sustainability [4]. Bao et al. used deep learning methods to predict short-term demand for free-floating bike sharing [5]. The earlier research has carried out experiments and analyses on multisource data from various aspects and continuously improved the collection and analysis of multisource data. However, the above-mentioned research is only used for statistics and calculation; without in-depth and multiscale analysis, it is difficult to find its essence. Therefore, it is necessary to conduct research and analysis on multisource data from other levels.

In view of the above-mentioned problems, this article studied multisource data from the level of single-chip microcomputer and sensor technology. These two levels have long been widely used in other fields. Based on the field programmable gate array accelerator and the Cortex-M0 IP core, scholar, Jiang et al. proposed a wearable deep learning system that can process data locally on the terminal device [6]. Zhang et al. proposed a secure method for exchanging resources between heterogeneous IoT devices [7]. D'Ascenzo et al. reported a novel digital brain PET system based on plug imaging sensor technology [8]. Miller et al. explored the potential of the two sensor technologies in their ability to predict when a cow should shed a calf [9]. Dering et al. proposed a method for high-density, high-accuracy measurement of dam apertures in 3D. Semi-automatic mapping tools and emerging unmanned aerial vehicle sensing technologies, including hyperspectral and aeromagnetic sensors, were reviewed. Their potentially important contributions to the wider study of intrusive systems and volcanology were reviewed [10]. The above research shows the application of single-chip microcomputer and sensor technology in various fields. However, most of them are used in computer and image analyses, there is no innovation to make new discoveries and breakthroughs, and there is a lack of research and analysis on multisource data. Therefore, this article analyzed multisource data based on single-chip microcomputer and sensor technology, which could provide a theoretical direction for its subsequent development and lay the foundation for future practical applications.

3 Sensor-based multisource data acquisition method

3.1 Multisource data collection

3.1.1 Types of multisource data

The data contain the number that describes the single or multiple characteristics of an object, and its types are mainly ordinal, categorical, and numerical [11], as shown in Figure 1. For example, for a consumption record of a store, its name and customer information are of category type, while the price and sales time are of numerical type. There is a sequence relationship between ordinal data, which can be inferred from each other. Categorical data are generally represented by text. Numeric data are the most widely used and the easiest type to work with.

The multisource data contain two meanings: one is the multisource of the original data (i.e., the network attack data); the other is the multisource of the IP database data [12]. First, the raw data are obtained from different data collection servers. On the one hand, the original files are loaded into the HDFS file system through ETL, to archive and manage the original files. On the other hand, the data

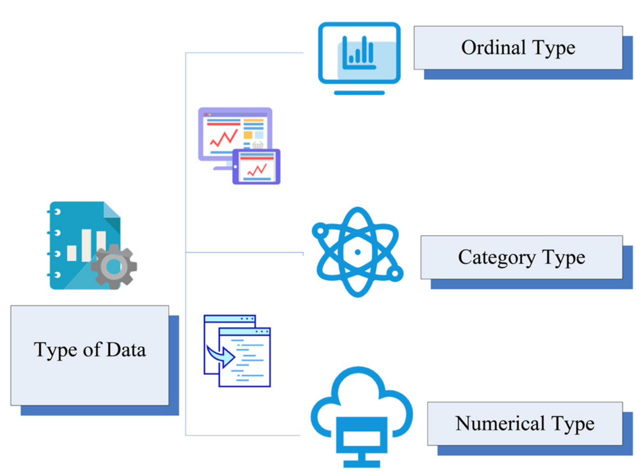

Figure 1: Data types.

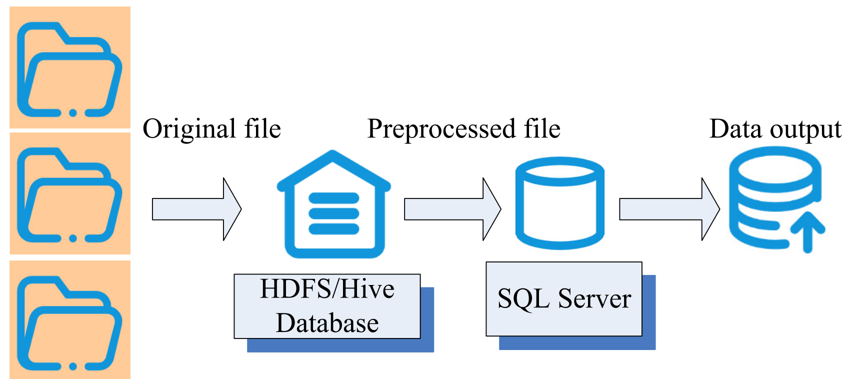

Figure 2: Schematic diagram of multisource data acquisition and analysis system data.

content in the file (called raw data) needs to be loaded into the Hive data warehouse. The purpose is to be able to access these raw data through HiveQL when the data of the Web system are traced. The multisource data acquisition system is shown in Figure 2.

Among them, there are many ways to collect data. The advantages and disadvantages of various data collection methods are shown in Table 1.

3.1.2 Multisource data cleaning and processing ideas

Data preprocessing includes denoising, cleaning, and feature extraction. The process of cleaning is to find outliers that deviate from most of the data, find the reasons, and determine whether to remove them. The third is the regular data format, and the visualization tool has requirements on the format of the processing object. Multisource data have different attributes. If they are integrated, like layer stacking, each "layer" data needs to have at least one common attribute.

During the process of data collection, due to some disturbances and equipment failures, the data are intermittently missing. However, due to the short time interval for data transmission and the high numerical density, there will be no wrong judgment on the movement path and stay position of the positioning label. Physical environment data also lead to delayed delivery or missing error data due to interference and weak signal strength. Therefore, when acquiring data, it is necessary to obtain denser data than postanalysis, to facilitate the investigation of some special values. In addition, the data were revised and supplemented according to the actual situation. For the sorting of questionnaire, data, content, and objects with incomplete information and special deviations will be eliminated based on experience.

3.1.3 Data analysis methods

Data analysis is constantly improving and changing with the development of time and technology. It has appeared in different times in different forms, but its core is the same. Figure 3 is a typical example of the data analysis process.

Multisource data analysis usually has three stages, instant visualization of multisource data, statistical analysis of multisource data, and pattern mining of multisource data [13], as shown in Figure 4.

Real-time visualization of multisource data is the most basic analysis method for multisource data, which shows its obvious laws and characteristics, such as the heat map of personnel distribution. Multisource data statistics are the most commonly used means. It sorts and

Table 1: Advantages and disadvantages of various data collection methods

Data collection method	Advantage	Disadvantage
Manual surveys	Motion capture	Very time-consuming and labor-intensive, limited to a certain period of time
Gps and cell phone (device based)	Dynamic data easy to use outside	Time and participants are limited
Indoor position system	Dynamic data (higher precision)	Anti-interference ability is generally weak

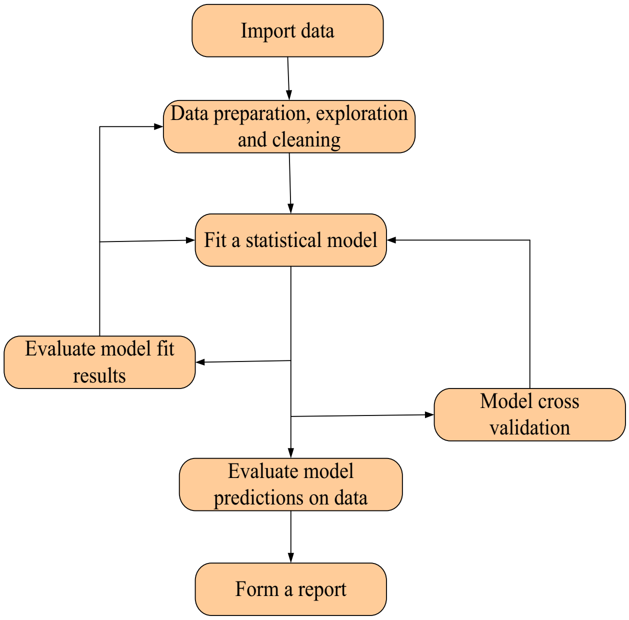

Figure 3: Typical data analysis steps.

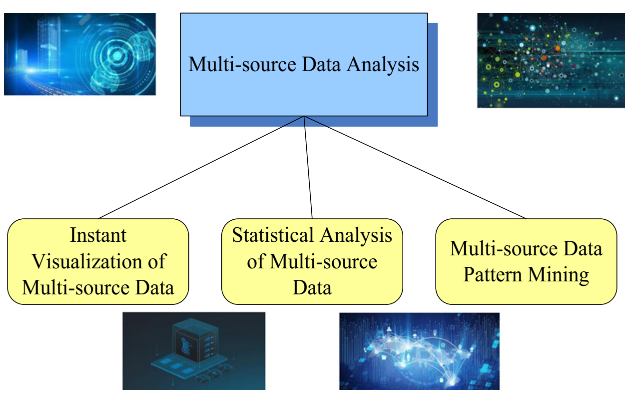

Figure 4: Multisource data analysis stage.

categorizes the accumulated data to a certain amount and analyzes its distribution law, central tendency, degree of dispersion, and correlation strength. The characteristics of multisource data are usually expressed through statistical analysis, and the overall state of the data is mainly described by extreme values, variance or mean, median, etc. [14].

3.1.4 Use of multisource data visualization

The point of visualization is that it can reflect some relationships at a glance. For example, it reflects the change of data over time, reflects the proportional relationship between data, and reflects the correlation between data or the correlation between data and other content. Today, the meaning of multisource data visualization is authenticity, clarity, and easy interpretation. Visualization is a process of presentation and inspiration, and it is equivalent to an intermediate step in research, which is different from the direct guidance of practice. The visualization and analysis of data are complementary to each other. The application value of visualization mainly exists in: the first is to realize the value of quantitative analysis; the second is to improve the accuracy of cognition, then discover relevant connections, reveal hidden laws, and predict trends and behaviors.

3.2 MCU

Since the birth of single-chip microcomputers, it has attracted widespread attention due to their obvious advantages such as low cost, strong adaptability to the environment, high reliability, flexible structure, and easy production. With its extremely excellent performance, it has been widely used in various industries such as robotics, aerospace, instrumentation industry, and telecommunications. However, in the process of using the single-chip microcomputer, it is often subject to an illegal invasion.

3.2.1 Embedded WEB server

The embedded WEB server can be divided into two types in the form of realization: the realization based on the embedded operating system and the direct realization with a simple microcontroller [15]. The embedded system implemented with a simple single-chip microcomputer as the core is an important part of realizing the communication process with the Internet, which is extensive and economical. The hardware structure of the scheme of directly realizing the embedded WEB server by using the single-chip microcomputer is very simple. The work of realizing various network communication protocols is extremely complicated, but the protocol can be appropriately cut and simplified, and then transplanted to an appropriate single-chip microcomputer.

3.2.2 Software design of CPS network nodes

The cyber-physical system realizes the interaction with the physical process through the human–computer interaction interface and uses the networked space to control a physical entity in a remote, reliable, real-time, secure, and collaborative manner. The connection mode between the traditional control system and the Internet is divided into two major parts, namely, the edge part and the core part. The edge part is composed of all devices connected to the network, that is, the so-called network nodes, which are what we usually refer to as the control end and the controlled end. The core part refers to the composition of a large number of networks and routers connecting these network nodes, and this part provides services for the so-called edge part [16], as shown in Figure 5.

3.2.3 Congestion control method in CPS network communication

In a communication network, if the resource requirements of a certain network for a certain period of time exceed the amount of existing network resources, congestion must occur in the network. The addition of a large number of devices in the CPS further increases the occurrence rate of congestion. Therefore, an effective and reasonable method is used to solve the network congestion phenomenon, which is an essential step to complete the CPS network communication.

Tail Drop Algorithm TD-FIFO (Tail-Drop-First In First Out) [17]: The TD-FIFO algorithm is a data packet scheduling method based on the FIFO strategy. When congestion occurs

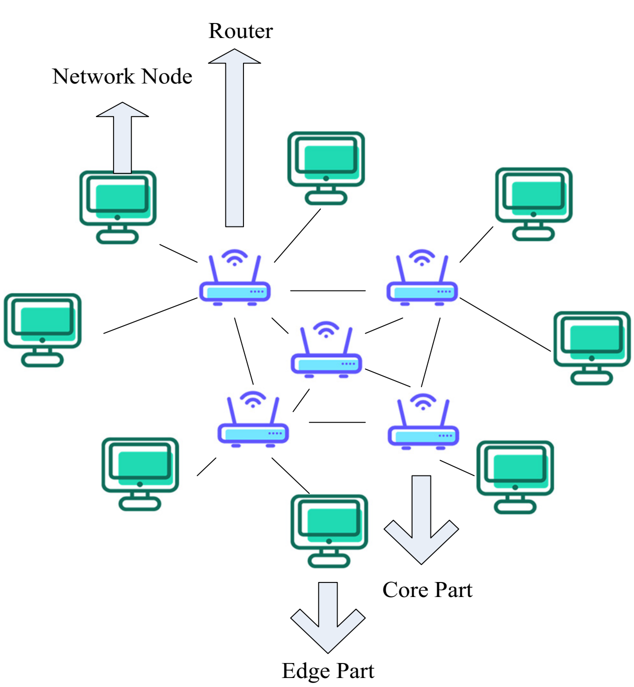

Figure 5: Connection patterns of traditional control systems and the Internet.

in the cache, a certain number of data packets are simply dropped from the tail of the queue according to the same probability, thereby reducing the length of the queue and solving the congestion problem. In this algorithm, the feedback signal of the system is realized by the ON/OFF controller; that is, the feedback value can only be 0 or 1. According to B (the size of the buffer), it is judged whether the congestion of the system occurs:

$$P_i = \begin{cases} 0, & \text{if } D_i \le B, \\ 1 & \text{if } D_i \succ B, \end{cases} \tag{1}$$

where P_i is the probability of packet loss, and D_i is the queue length of the buffer.

Random advance detection algorithm RED [18]: RED algorithm is a more commonly used congestion control algorithm. In the RED algorithm, several parameters such as the minimum threshold minth, the maximum threshold maxth, and the maximum probability maxp are used for control. The detection system of the algorithm is calculated using the "Proportional controller + low-pass filter" method. Proportional Controller is a controller with only proportional control. The control law is that the change of the controller action is proportional to the input deviation within a certain limit, and the response to the deviation is fast, but there is a static error (residual error) in the control result. The basic form of a proportional controller is as follows:

$$P_i = aD_i. \tag{2}$$

The length of the average queue in the cache is calculated using an exponentially weighted moving average:

$$q_{\text{ave}} = (1 - t)q_{\text{ave}} + tD_i, \tag{3}$$

where t is the calculated weight.

Genetic Algorithm [19]: Genetic algorithm replaces the parameter space of the research problem with the encoding space of the research object, takes the final function fitness as the basis for evaluation, and takes the encoding of the population as the basis for evolution. An iterative process is established by implementing selection and genetic mechanisms for the manipulation of each bit string in the entire study population.

The system structure is represented as a gene pattern; then, the system structure can be represented as a chromosome $B = \langle B_1, B_2, \ldots B_i \rangle$ of length L, and the expression is as follows:

$$\mu = B_1 \times B_2 \times \ldots \times B_L = \prod_{i=1}^{L} B_{\text{i}}. \tag{4}$$

According to the description of Formula (4), μ is the largest structural space that an organism may exist, and in most cases, the biological population that exists in reality is only its proper subset.

For the system structure $B(t)$ at the time t stage, the information provided by its environment $E(t)$ is $D(t)$, and the new system structure generated under the action of the adaptive plan y_t is as follows:

$$B(t+1) = y_t(B(t), D(t)). \tag{5}$$

Information provided by the environment historically is $M_E(t)$. Formula (5) can be rewritten as:

$$B(t+1) = y_t(B(t), D(t), M_E(t)). \tag{6}$$

On this basis, the system adaptation plan should provide a reasonable approach to the inheritance and rejection of environmental historical information:

$$M_E(t+1) = y_t(M_E(t), D(t)). \tag{7}$$

Its change can be seen as a random process throughout the adaptation plan. Formula (6) can be rewritten as:

$$P(t+1) = y_t(B(t), D(t), M_E(t)). \tag{8}$$

For the measure of the adaptability of the system structure $B(t)$ to the environment $E(t)$, most of them are represented by real numbers greater than or equal to 0, then:

$$\mu_E(B(t)) = \mu_{E,t}(B(t), E(t)). \tag{9}$$

On the basis of Formula (9), the environmental information at the stage of time t can be expressed as:

$$D(t) = \mu_{E,t}(B(t)). \tag{10}$$

When the system structure and its environment change, the adaptation plan should be adjusted accordingly. Only in this way can the system have the best adaptability. Generally, it can be expressed as follows:

$$y(t+1) = \omega(B(t), D(t), M_E(t), M_y(t)), \tag{11}$$

$\mu_{E.t}$ represents the degree of adaptation of the system structure $B(t)$ to the environment $E(t)$ at time t. As the system structure and surrounding environment change, its adaptive measure function must also change.

$$\mu_{E,t+1} = y_t(\mu_{E,t}, B(t), D(t)). \tag{12}$$

In the whole process of adaptation, the adaptive measure of the system structure is expressed as:

$$U(T) = \sum_{t=1}^{T} \mu_{E,t}. \tag{13}$$

The fitness measure of the whole adaptation process can be expressed as:

$$U(T, M_{yl}(T)) = \sum_{t-1}^{T} \mu_{E,t}(y_l(t)). \tag{14}$$

Based on Formula (8), the fitness measure of the whole adaptation process can be expressed as:

$$U(T) = \sum_{t=1}^{T} \sum_{j}^{R} \mu_{E,t}(b_j) \times p_j(t) = \sum_{t=1}^{T} \overline{\mu_{E,t}}. \tag{15}$$

3.3 Sensor technology

The Wireless Sensor Network (WSN) composed of miniature sensors is a large and complex system. From the micro definition, it is a small node and small system covering a large number of topological node sensors, data centers, and communication protocol modules. An intelligent network is formed through host deployment and self-organization, with the help of intelligent sensors with different built-in functions in each topology node. The information within the network coverage is collected and summarized and is transmitted to the system data receiving in real-time and stably through various wireless network methods [20].

WSN is composed of many independent sensors scattered in different areas. They communicate with each other and process information to form a wireless network composed of point-to-point intersection nodes. These nodes are the most basic factors that make up a WSN. These nodes are connected wirelessly, and information forwarding is accomplished by wireless communication in a specific environment.

In the research of WSN, it is often divided into several parts as shown in Figure 6. The main connection structure is the power module, and the intermediate transmission layer is the sensor unit, the information processing

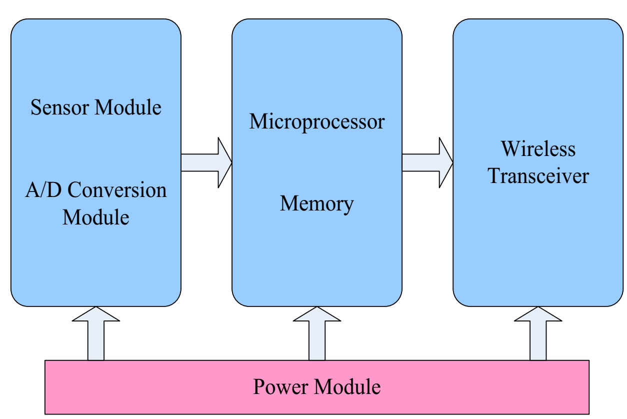

Figure 6: Wireless sensor node architecture.

unit, and the information transceiver unit. The core control of the entire research of WSN is the sensor. Without the sensor, this structure has no value. The sensor is the embodiment of its free value, and it is also the characteristic of the whole structure. The same requirement of the information processing unit is to process various information in a timely and effective manner. Large storage and high-efficiency processing are the difficulty and focus of all information processing structures. The information transceiver module is the means and carrier of the technical transmission of information, and it is the embodiment of the timeliness of the sensor network information. The four are interdependent and independent of each other, and jointly assist the sensor to transmit information and data, which is an integral part of the entire WSN.

3.3.1 WSN functional module

The processor module is the most important part of the node system and is the key to optimizing the low power consumption scheme of the whole system. According to the design requirements of low power consumption of WSN nodes, the current mainstream processor chips with low power consumption were selected for comparative analysis. According to the selection principles of low power consumption, low cost, reliability, and miniaturization, STM32L071 is selected as the processor for designing wireless sensor nodes. Its main characteristics are shown in Table 2.

The Si7006 module is used as the information acquisition module of the entire system node. The main functions and characteristics of the Si7006 are shown in Table 3.

Wireless communication is mainly responsible for completing the transmission and transmission of data collection to information, and the stability of information processing must be guaranteed. To ensure the reliability of the wireless communication module circuit, the two wireless communication chips that are most used in the market are compared. One is the SX1231 communication module of Semtech Company in the United States, and the other is the CC110X series wireless communication module of TI Company. The comparison parameters are shown in Table 4.

By comparison, it can be found that the power consumption of CC1101 is lower than that of SX1231 in transmit mode, but SX1231 is significantly better than CC1101 in terms of receiving sensitivity and transmit power. Considering that the receiving period of the node in the long-term work process is much larger than the transmitting period, and at the same time, to ensure the stability of the long-term operation of the system, SX1231 is selected as the wireless transmitting module for the design node platform.

Table 2: Main features of STM32L071

Item	Type
Core	M0 supports up to 33 Mhz
Voltage range	1.6–3.6 V
Memory	Up to 195 KB Flash memory
Power consumption	0.30 μA Standby mode 0.45 μA Stop mode
Operating temperature	−40 to +125°C
Interface definition	UART, I2C, SPI
Chip packaging	5 mm × 5 mm DFN package

Table 3: Main functions and features of Si7006

Item	Type
Power range	2–3.6 V
Measuring range	−10 to 85°C 0–91% RH
Measuring range	±1°C ±5% RH
Module interface	I2C
Module package	3 mm × 3 mm DFN Package
Power consumption	145 μA active current 65 nA standby current
Operation tem	−40 to +125°C

3.3.2 Wireless communication module design and power consumption

The wireless communication module of the node is the part with the highest power consumption in the hardware design. According to the wireless transmission distance formula, the calculation formula of the wireless action distance is expressed.

Table 4: Wireless communication module parameter comparison table

Wireless communication chip	CC1101	SX1231
Launch mode	26.5 mA and 10 dBm	32 mA and 10 dBm
Receive mode	15.5 mA	15 mA
Transmit power (Max)	15 dBm	16 dBM
Receive sensitivity	−115 dBm	−117 dBm

Assume that the input power of the transmitter antenna is W_t, the gain is R_t, and its maximum radiation direction points to the receiver with a distance of y. The power density it produces at the receiver is as follows:

$$S_i = \frac{W_y D_t}{4\pi y^2} = \frac{W_t e_y D_t}{4\pi y^2} = \frac{W_t R_t}{4\pi y^2}. \tag{16}$$

Assume that the antenna gain of the receiving end is R_r, and its maximum direction also points to the transmitting end, so the maximum received power it can obtain is as follows:

$$W_{RM} = A_e S_i = \frac{R_r}{4\pi/\lambda^2} \frac{\sigma_r S_t}{4\pi r^2} = \frac{W_t R_t R_r \lambda^2 \sigma_r}{(4\pi)^3 r^4}. \tag{17}$$

Assuming the minimum measurable power (receiver sensitivity) of the receiving end is $W_{F_{\min}}$, the maximum transmission distance $F_{\max}$ can be obtained according to Formula (17):

$$r_{\max} = \sqrt[4]{\frac{W_t R^2 \lambda^2 \sigma_r}{(4\pi)^3 W_{F_{\min}}}}. \tag{18}$$

3.3.3 WSN node antenna design

According to the microstrip antenna design rules, the PCB trace width of the antenna needs to be calculated. The effective dielectric constant ε_{eff} must be calculated first. Since the electric field generated by the conductor is partly in the air and partly in the dielectric material, it is necessary to obtain an effective permittivity. It can be calculated using the following formulas:

$$\frac{A}{B} < 1: \quad \varepsilon_{\text{eff}} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[\left(1 + 12\left(\frac{A}{B}\right)\right)^{-\frac{1}{2}} + 0.04\left(1 - \left(\frac{A}{B}\right)\right)^2\right], \tag{19}$$

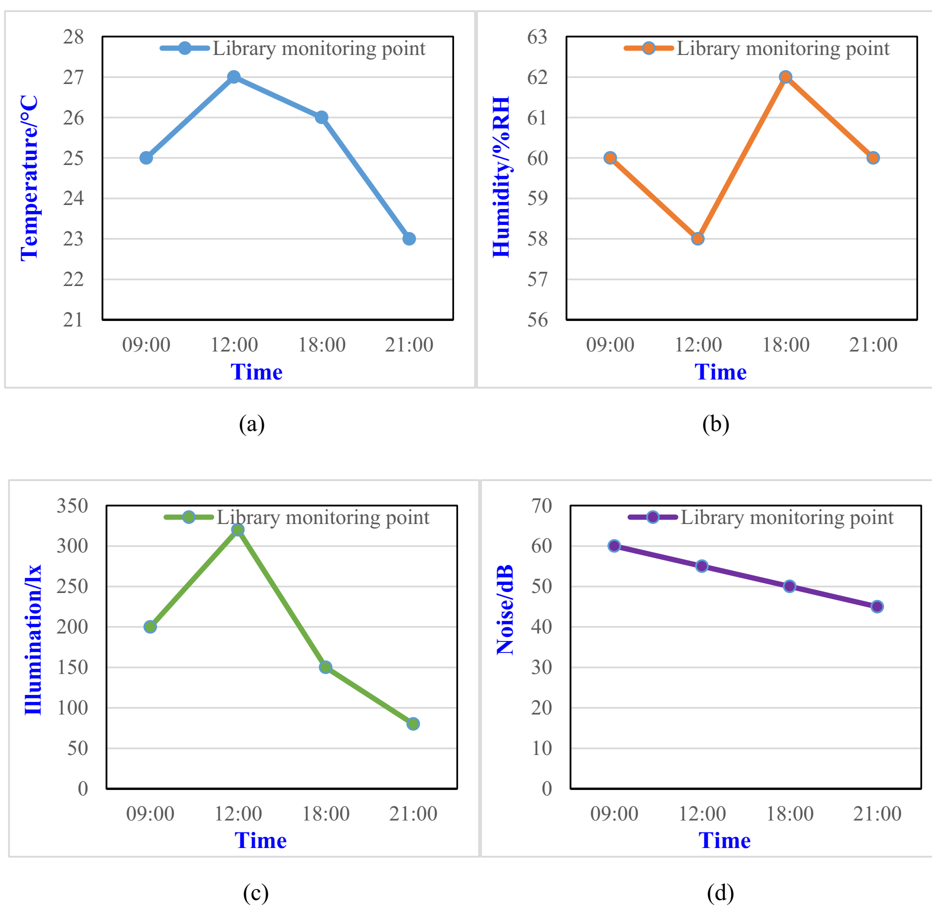

Figure 7: Monitoring results of temperature, humidity, light intensity, and noise at monitoring points in the library. (a) Temperature at the library monitoring point, (b) humidity at the library monitoring point, (c) light intensity at library monitoring point, and (d) noise at library monitoring points.

$$\frac{A}{B} > 1: \quad \varepsilon_{\mathrm{eff}} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[\left(1 + 12\left(\frac{A}{B}\right)\right)^{-\frac{1}{2}}\right]. \tag{20}$$

4 Multisource data experiment based on single-chip microcomputer and sensor technology

4.1 Experiments and results of multisource data

This experiment visualizes and analyzes single-source data and multisource data. That is, the spatial usage information reflected by the positioning data, physical environment data, and questionnaire data can be used to explore whether there is the same or contradictory relationship between pairwise comparisons or superposition. Finally, the data from various sources are summarized and discussed according to the analysis results of time, space, and data (Figures 7 and 8).

Through the superposition or comparison of the multisource data, it can be found that there are differences between the subjective physical feeling judgment and the physical environment data, which affects people's subjective judgment. The user's subjective noise perception, the user's subjective temperature perception, and the user's subjective tourism perception can all reach the highest under normal conditions and are all above 60.

4.2 Multisource data experiment and results based on single-chip microcomputer

The algorithm in this article is based on two algorithms, RED and WFQ, and is developed according to the analysis process of the genetic algorithm. During the continuous change of the network load rate of the client S7 = 1 Mbps, the successful forwarding rate curves of various algorithms and the algorithm in this article are shown in Figure 9.

The client S7 is at the fifth priority level, so in both the WFQ algorithm and the FCCA algorithm, a link bandwidth of about 0.6 Mbps can be obtained from the

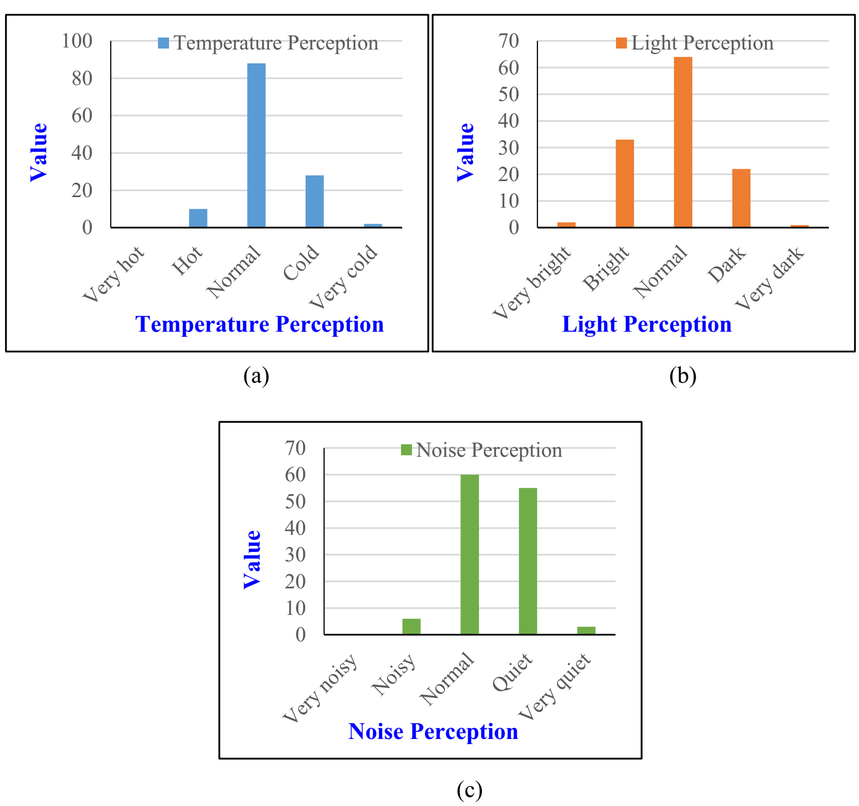

Figure 8: User's subjective perception of temperature, light, and noise. (a) User's subjective temperature perception. (b) User's subjective light perception. (c) User's subjective noise perception.

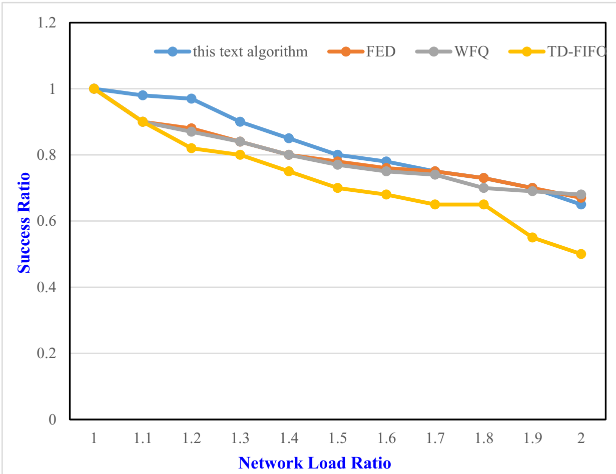

Figure 9: Simulation curve of the change of the transmission success rate of various algorithms with the increase in load when S7 = 1 Mbps.

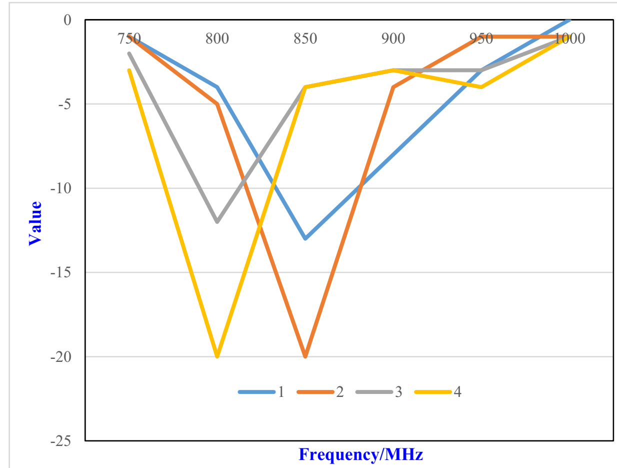

Figure 10: Four groups of antennas S11 before and after optimization.

forwarding egress of node N. Among them, the data transmission rate of S7 is 1 Mbps. From Figure 9, the increase of the network load rate has a certain impact on all algorithms, but the impact on the TD-FIFO algorithm is the most obvious. It is easy to come to the conclusion that since the TD-FIFO algorithm does not make any distinction between all data packet streams to be sent, it is implemented in a first-come, first-served method, so a better forwarding success rate cannot be obtained. For the other three different algorithms, it is obvious that the algorithm in this article obtains the highest successful forwarding rate.

4.3 Multisource data experiments and results based on sensor technology

This experiment proves that the antenna performance is related to the power consumption of the RF module. The power consumption of the RF module accounts for more than 80% of the power consumption of the entire node, which proves that improving the performance of the antenna can reduce the power consumption of the node. The four groups of antenna parameters after the simulation are extracted, and the specific data are shown in Figure 10.

The performance indicators of the four groups of antennas can be obtained from Figure 10 and the simulation results, as shown in Table 5.

Through the theoretical analysis of the microstrip antenna, the IFA antenna of the node is designed. And the simulation optimization is carried out by CST simulation software. According to the simulation results, the IFA antenna with the best antenna performance is selected, and the simulation results fully meet the design requirements. The power consumption of a node with better antenna performance is 9–10% lower than that of a node with poor antenna performance, which verifies that improving antenna performance can achieve the purpose of reducing power consumption.

5 Conclusions

A single-chip microcomputer uses static clock mode, which can greatly save power consumption, repeated erasure of read-only program memory, and random

Table 5: Comparison table of microstrip antenna parameters

Antenna number	Antenna efficiency (%)	Antenna gain	*S*-parameter (dB)	Antenna size
1	76.8	2.5	−15.62	37 mm × 9.8 mm
2	52.2	1.7	−10.56	38 mm × 9.8 mm
3	25.6	0.5	−4.52	39 mm × 10.8 mm
4	20.6	0.3	−2.6	40 mm × 10.8 mm

access data memory, suitable for more complex system control applications. This article studies multisource data acquisition and analysis based on single-chip microcomputer and sensor technology, which can provide a better foundation and method for the improvement and development of multisource data. In today's society, people's understanding of the composition and importance of multisource data is not sufficient and comprehensive, and there are great limitations. This article analyzes multisource data from two different and novel feature perspectives. Through technological and more efficient analysis methods, the collection and analysis of multisource data can continue to develop and leap forward, so that the public can have a deeper understanding of multisource data and achieve better understanding and integration. No matter what kind of single-chip microcomputer, and no matter what series of single-chip microcomputers, it has created an extremely powerful hardware environment for the development of new products, the development of application systems, and the research of intelligent controllers.

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