Intelligent Control of Urban Lighting System Based on Video Image Processing Technology

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ABSTRACT The rapid iterative development of information technology, computer technology and Internet of things technology promotes the construction of smart city, and the related concepts of smart city gradually move from theory to practice. As an important part of the development of smart city, the intelligent lighting and intelligent control of urban lighting system become increasingly urgent with the development of the latest Internet of things technology and video image processing technology. Based on the current Internet of things data communication and related processing technology as the background, this article constructs the overall control model of smart city lighting system, including GPRS wireless transmission technology and ZigBee technology. In the core algorithm, this article innovatively presents an improved video image processing technology based on Gaussian mixture algorithm, which mainly describes the background of a specific scene in multi-dimensional model, so as to improve the reliability of the whole scene judgment. At the level of noise suppression, the video image processing algorithm proposed in this article designs interference noise suppression technology based on the principle of mean filtering, so as to achieve the accuracy and integrity of urban traffic scene extraction. In order to solve the security problems of the whole video image processing technology in information extraction, storage and analysis, this article adds the electromagnetic information leakage prevention algorithm in the video image processing technology, which mainly processes the video image at the source, so as to reduce the electromagnetic radiation of the overall information. Based on this, this article completed the construction of the software and hardware of the city intelligent lighting system. On this basis, the software and hardware construction of urban intelligent lighting system is completed. At the same time, the experiment was carried out in a small-scale scene of a city. The experimental results show that the intelligent urban lighting system based on video image processing technology is feasible and can achieve the desired effect. At the same time, the lighting energy consumption level can be reduced by about 30%, and the corresponding failure rate can be reduced by about 30%.

INDEX TERMS Video image processing technology, smart city, Internet of Things technology, noise suppression, information leakage prevention technology.

I. INTRODUCTION

Smart city specifically refers to the city intelligent, energy-saving, its main purpose is to facilitate people's better life, while promoting the development of city more efficient environmental protection. The development of smart city promotes the renewal and iteration of urban infrastructure [1]–[3]. At the same time, the development of new Internet technology, computer technology and information technology makes the intelligent urban infrastructure possible. As an important part of smart city development, urban public lighting system is developing and progressing

in the direction of energy saving, environmental protection, high efficiency, low-carbon and intelligent [4], [5]. Urban intelligent lighting system is the most promising and potential intelligent energy-saving field in the world. In the layout of intelligent lighting system, it is mainly realized by reasonable and effective planning of street lamp layout, efficient and reasonable control of relevant street lamp and public lighting switching time. The corresponding detailed technologies include light control technology, flow control technology and scene segmentation analysis technology [6]–[9].

Based on this, a large number of researchers and research institutions have carried out a lot of research and Analysis on the smart city lighting system. The mainstream research mainly focuses on the rationalization of street lamp layout,

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the intelligent control of street lamp switching time and the realization of intelligent lighting technology based on scene analysis [10], [11]. Singapore, Switzerland and other countries related technical personnel first proposed to realize intelligent control of urban lighting based on computer technology. However, with the increasing expansion of the city and the diversified development of demand, this control strategy has been unable to meet the needs of the times [12], [13]; relevant German scientific research institutions have developed intelligent street lamp control system based on bus control, which can realize the collection of street lamps However, this kind of street lamp control mode can not realize the intelligent urban lighting [14], [15]; the relevant Japanese technical personnel developed the intelligent street lamp based on the HBS related protocol, which solved the intelligent lighting from the terminal, but it could not effectively match with the lighting system [16]–[18]. In terms of the construction of smart lighting system, France, as the first country to operate smart lighting system, uses power carrier technology and GPRS wireless communication technology to control the lighting equipment of each node in the city, and its corresponding lighting system reflects a certain degree of intelligence [19]–[21]; related countries in Eastern Europe adopt a large number of LED lighting technology in the design of smart city lighting system At the same time, solar panels, remote infrared cameras and wireless transmission technology are widely integrated into the corresponding lighting systems. In this context, the corresponding lighting systems realize energy conservation and reuse of lighting equipment, and realize the maximum integration of resources [22]–[24]. In the construction of smart city lighting system in the United States, a large number of IOT technologies are applied Such as ZigBee technology, WiFi wireless transmission technology, etc., to a certain extent, it realizes the intelligent layout of smart city lighting system [25]–[27]. The construction of smart city lighting system based on video image processing technology mainly focuses on the optimization and development of video scene recognition technology, but the technology is still relatively immature, and its corresponding anti-interference ability and noise suppression ability are still limited [28]–[31].

Based on the analysis and research of the above related background, this article will build the overall control model of the intelligent city lighting system based on the current data communication and related processing technology of the Internet of things. At the same time, in the core algorithm, this article innovatively gives the improved video image processing technology based on the Gaussian mixture algorithm, which mainly describes the background of the multi-dimensional model of the specific scene And improve the reliability of the whole scene judgment. In the aspect of noise suppression, the video image processing algorithm proposed in this article designs interference noise suppression technology based on the principle of image mean filtering, so as to achieve the accuracy and integrity of urban traffic scene extraction. In order to solve the security problems of

the whole video image processing technology in information extraction, storage and analysis, this article adds the electromagnetic information leakage prevention algorithm in the video image processing technology, which mainly processes the video image at the source, so as to reduce the electromagnetic radiation of the overall information.

In this article, the structure of the article is arranged as follows: the second section of this article will mainly analyze the research and analysis of key algorithms such as video image processing technology of smart city lighting system; the third section will mainly analyze and study the overall software and hardware design of intelligent lighting system; the fourth section is based on the smart city lighting system designed in this article to verify; finally, this article is summarized analysis.

II. IMPROVED VIDEO IMAGE PROCESSING TECHNOLOGY BASED ON GAUSSIAN MIXTURE ALGORITHM

In this section, the intelligent city lighting system is designed based on Gaussian mixture algorithm and information leakage prevention technology. The corresponding software and hardware architecture is shown in Figure 1 below. It can be seen from the figure that the corresponding core algorithm in this article is mainly concentrated on terminal processing equipment, and the corresponding processing equipment is such as centralized controller of various scenes and data processing and analysis server of various scenes.
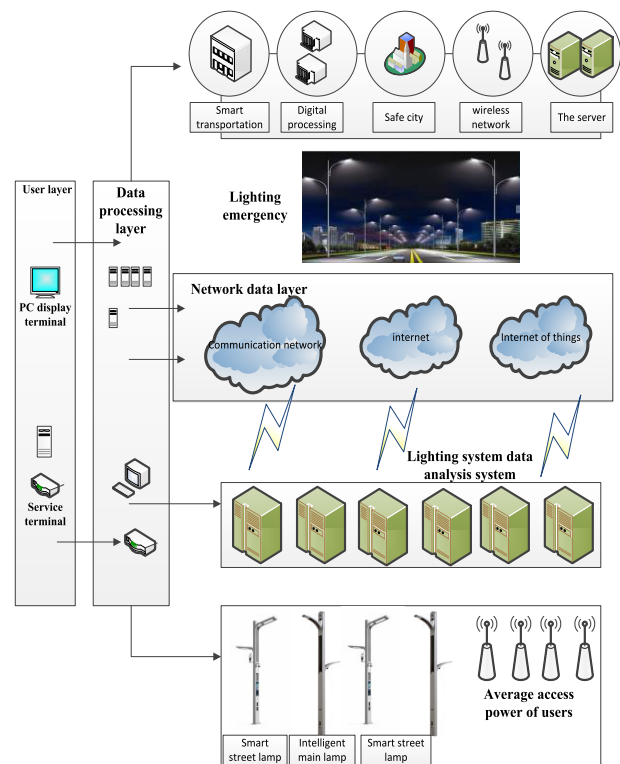

FIGURE 1. Design architecture of intelligent lighting system in smart city.

A. SCENE PROCESSING TECHNOLOGY BASED ON GAUSSIAN MIXTURE ALGORITHM

Urban scene is a relatively complex scene, including traffic scenes, life scenes and other scenes. In video image processing, the corresponding complex factors such as: the interference of non key factors of scene, the interference of natural factors of scene. The corresponding interference will make the corresponding pixels of the scene change repeatedly, and the corresponding characteristics are non unimodal. Based on this feature, this article proposes to use Gaussian mixture algorithm as the core algorithm of video image processing. The corresponding Gaussian mixture model is shown in Formula 1, where the corresponding M (x) represents the pixel probability at a certain time in the scene, the corresponding K value represents the number of single-mode Gaussian distribution corresponding to the corresponding pixel point, and the corresponding w represents the corresponding Gaussian function when describing the point In the case of weight, the corresponding weight reflects the reliability of the whole pixel.

$$M(X_i) = \sum_{i=1}^{K} w_{i,2} * G_i(Y_i, x_{i,2}, \sigma_{i,2}^2) \qquad (1)$$

Based on the above-mentioned Gaussian mixture model, the typical urban lighting scene is processed, and the corresponding scene individuals are distinguished. The corresponding processing steps are as follows: initialization of Gaussian mixture model, parameter updating of Gaussian mixture model, background updating processing, foreground detection and individual discrimination detection. The corresponding processing flow is shown in Figure 2. It can be seen from the figure that the initial value of the Gaussian model is mainly set in the initialization phase. In this article, the gray value and random value of the corresponding first frame image are taken as the average value and the initial value of variance of the Gaussian model. The corresponding variance is generally smaller, and the corresponding weight is designed as the equal value of 1 / N; the corresponding parameter update link of Gaussian model The main purpose is to update the new pixel value. The corresponding matching formula is shown in formula 2, the corresponding C corresponds to the variance constant value, and the corresponding parameter update formula is shown in Formula 3.

$$|X_i - x_{i-1}| \leq C * \sigma_{i-1} \qquad (2)$$
$$\sigma_i^2 = (1 - \rho)\sigma_{i-1}^2 + \rho(Y_i - x_i)^2 \qquad (3)$$

In the scene update level, the corresponding foreground model is shown in formula 4, and the corresponding gray value calculation is shown in formula 5.

$$\sum n_{k,j} > \tau \qquad (4)$$
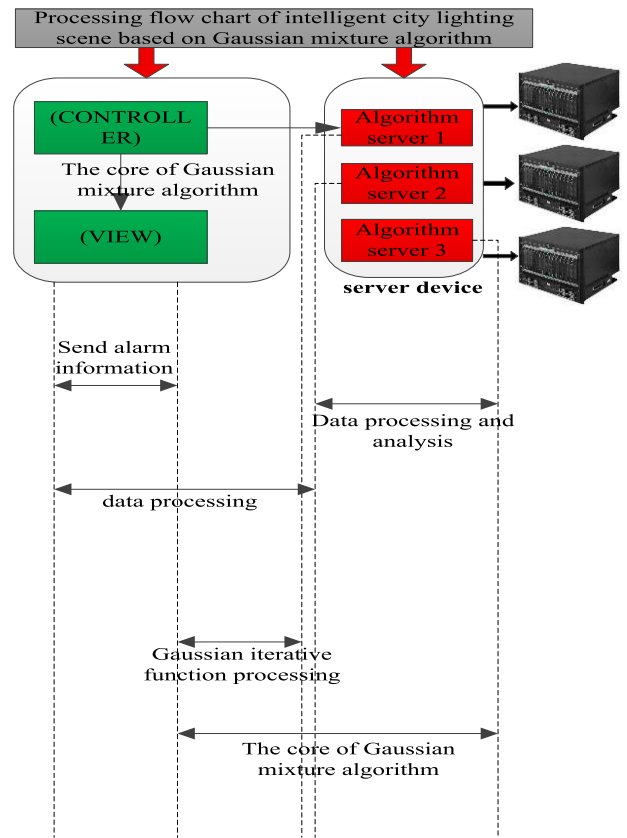
$$B(i, j) = \sum_{k=1}^{T} u_k * w_k \qquad (5)$$

FIGURE 2. Processing flow chart of intelligent city lighting scene based on Gaussian mixture algorithm.

In order to verify the scene discrimination of the corresponding Gaussian mixture algorithm in the smart city traffic scene processing, this section processes the classic scene as shown in Figure 3, and the corresponding processing results are shown in Figure 4. It can be seen from Figure 4 that the scene discrimination of the preliminary scene processing using the Gaussian mixture algorithm in this article is higher than that corresponding to the ordinary video image processing.

In terms of noise processing technology, it mainly solves the objective noise in the scene. The corresponding noise distribution is shown in Table 1, which is mainly divided into additive noise, multiplicative noise, corresponding quantization noise and salt and pepper noise.

In this article, the harmonic mean filtering technology is used in the actual noise filtering, and the corresponding filtering expression is shown in formula 6.

$$f(m, n) = 1/mng(a, b) \qquad (6)$$

B. RESEARCH AND ANALYSIS OF INFORMATION LEAKAGE PREVENTION TECHNOLOGY

In order to ensure the security of the corresponding image information in the process of video image processing, this article designs the information leakage prevention technology, which is mainly based on the principle of
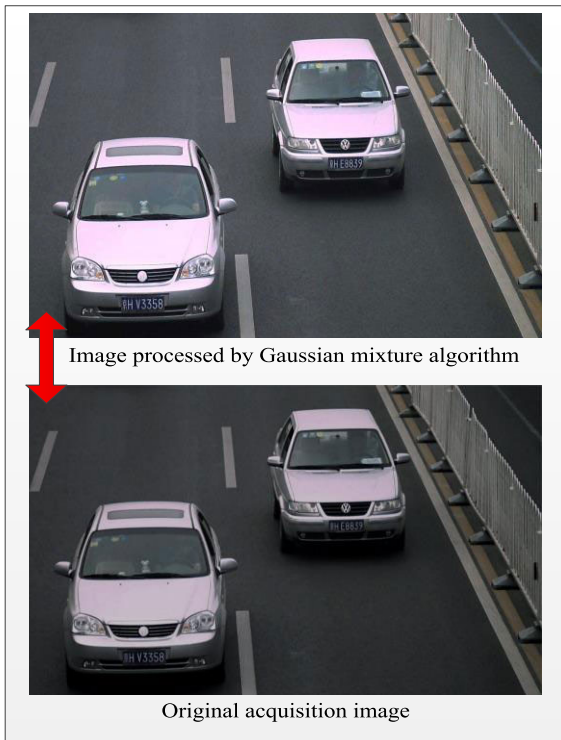
FIGURE 3. Smart city lighting scene - Classic traffic scene.

TABLE 1. Noise classification table of lighting scene in smart city.

Types of noise	Noise details
Additive noise	It is mainly caused by the system noise in the transmission process and other external objective factors.
Multiplicative noise	It has obvious correlation with the original target image, it will change with the change of the image, and it has a fixed expression.
Quantization noise	It is the main noise source of digital image, which is mainly generated by amplitude and time quantization in language coding communication.
Salt and pepper noise	It is mainly realized as high gray level noise and corresponding low gray level noise.

electromagnetic leakage prevention. In the process of processing analog video and digital video, the corresponding anti leakage methods are jitter pseudo emission image processing technology and digital image processing technology. The principle of the corresponding anti leakage technology of analog image is mainly based on the appropriate suppression of the corresponding high-frequency components in the image, and at the same time increasing the camouflage high-frequency component. The corresponding functions are shown in Table 2.

In the corresponding digital image leakage prevention technology level, it mainly uses parallel signal transmission when transmitting video information to the corresponding computer graphics card through the bus, and the corresponding links include random scrambling and corresponding complementary scrambling.
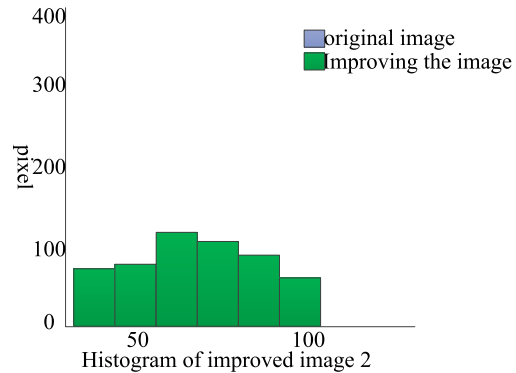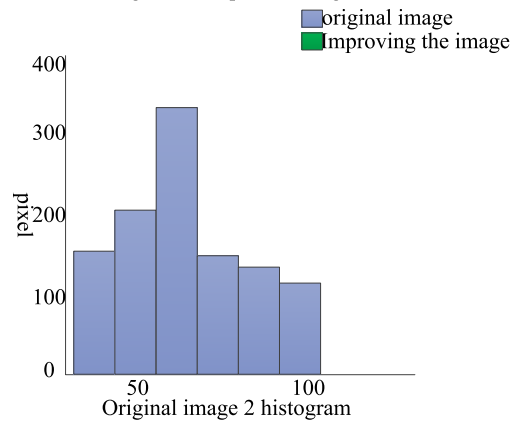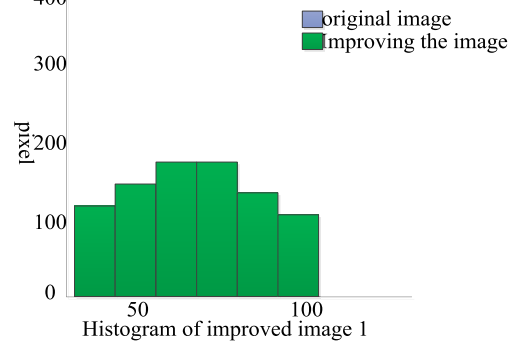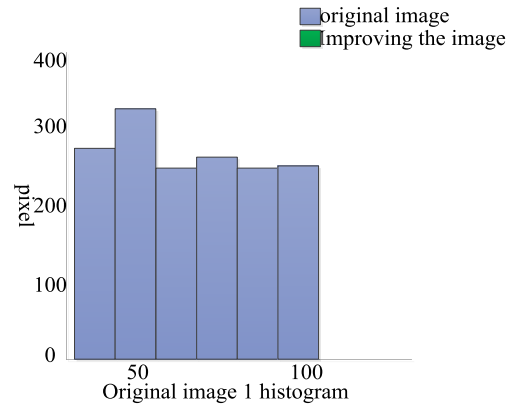

FIGURE 4. Comparison between Gaussian mixture algorithm and conventional algorithm.

C. ANALYSIS OF SCENE INTELLIGENT LIGHTING CONTROL ALGORITHM

Based on the algorithm analysis in 2.1 and 2.2 above, this section mainly presents the control algorithm of the whole

Function type	Peak value of side lobe	Width of transition zone	Minimum attenuation of stopband
Rectangular function	-13	2 π /N	-2.1
Trigonometric function	-25	4 π /N	-2.5
Hamming function	-31	4 π /N	-4.4
Blake function	-41	8 π /N	-5.3

intelligent lighting system, and the corresponding control system model block diagram is shown in Figure 5. The corresponding control system in Figure 5 needs to comprehensively analyze the traffic flow and sunshine in the scene.
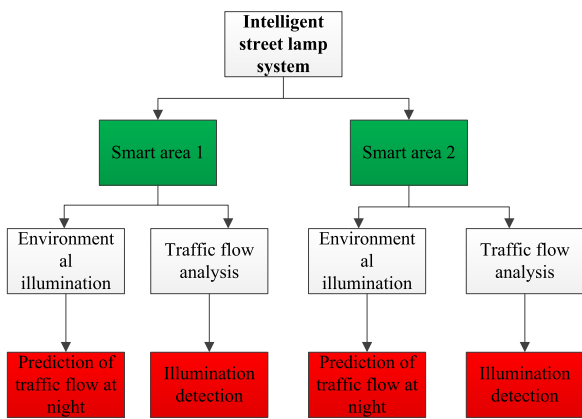

FIGURE 5. Control algorithm system model block diagram of intelligent lighting system.

In the whole system, the corresponding control algorithm flow is as follows:

1) SUNSHINE ANALYSIS IN THE LIGHTING SCENE OF SMART CITY

When the whole system is running, it is necessary to control and judge the operation time of the whole system first. Under the corresponding normal conditions, the operation time of the system should be controlled one hour before the sun goes down and one hour before sunrise the next day. In case of abnormal weather and equipment failure, the system will run in extra time. The system uses the API corresponding method to judge the special weather. If the system corresponding to the normal weather condition of the current city has a serious fault, the system will automatically upload the fault information.

2) LIGHTING CONTROL IN SPECIAL ENVIRONMENT OF SMART CITY

When the whole intelligent lighting system is in normal operation, the corresponding criterion for judging the opening and closing of the system is the situation before and after sunshine. In the case of reasonable sunshine, when the light intensity of the corresponding scene is low, the corresponding system will start to run. When the lighting of the whole environment system is too strong, the corresponding system will be turned off. When the whole controller runs normally, the current light intensity is taken as the input of the system illumination. The corresponding illumination condition is collected by the illumination acquisition module, and the corresponding change rate is obtained by the internal calculation module of the system.

3) OPERATION OF NIGHT SYSTEM CONTROL SYSTEM

When the system is running at night, the corresponding system will monitor the traffic flow in the corresponding scene in real time. At this time, the system will adjust the brightness of the lighting system based on the corresponding size of the traffic flow. The corresponding traffic flow controller will take the vehicle flow and the corresponding change rate of the traffic flow as the input.

In terms of illumination data processing algorithm, it is also the core algorithm of the intelligent lighting control algorithm. In the actual area division, every 20 street lamps are divided as a group and data processing is carried out. The corresponding processing steps are shown in Figure 6, and the detailed steps are as follows:

1) First of all, judge whether the corresponding city scene is a good weather scene, and based on this, remove the maximum and minimum value, and process the remaining data. In the actual processing, the algorithm mainly takes one hour before sunset and one hour after sunrise for data acquisition and processing, corresponding to processing once every 10 seconds. In the actual processing, we need to sort the corresponding data first, at the same time, we can get the median of the corresponding data and the average value of the upper and lower side numbers. In this step, we also need to remember the error of the corresponding data and take the average calculation as the illumination value of the area.

2) When the corresponding application city scene is in good condition, the corresponding illumination collection is collected once every 20 minutes and data transmission is carried out. The whole system processes and analyzes the corresponding illumination data, and gives early warning for the corresponding persistent abnormal values. The corresponding staff members need to check and handle the corresponding illumination at the same time. This kind of design is helpful to realize the false alarm of lighting equipment caused by foreign objects or equipment damage.

3) When the corresponding urban scene appears abnormal phenomenon, the corresponding 10 minutes of the corresponding scene area for data processing and analysis,
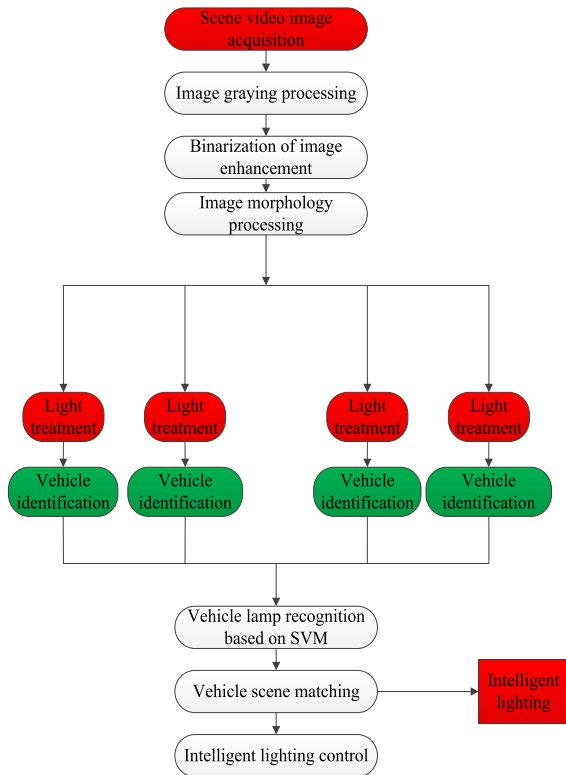
FIGURE 6. Intelligent algorithm control flow chart of intelligent lighting system.

FIGURE 7. (a)(b). Distribution of data acquisition and processing in intelligent lighting system.

the corresponding data acquisition for real-time transmission, when the corresponding adjacent area illumination is lower than a certain value, then turn on the system and carry out real-time control.

In the analysis of the traffic flow in the scene, this article uses the algorithm of lamp recognition, and uses the algorithm of support vector machine to identify the lights and judge the corresponding traffic flow. In detail, we need to preprocess and analyze a large number of images and videos, and at the same time, we need to extract the corresponding features in binary image processing, including the perimeter and area parameters of the reflector. The corresponding processing images are shown in Figure 7 (a) and Figure 7 (b). It can be seen from the figures that the SVM algorithm has high accuracy in judging the traffic flow in the scene, and the corresponding accuracy can reach about 97% The support vector machine algorithm used in this article has the characteristics of machine learning, which can improve the judgment in continuous training, and can upload and store the corresponding error data. With the operation of the whole intelligent system, the corresponding monitored indicators and data will be more and more, and the corresponding vehicle recognition accuracy and traffic flow prediction accuracy will also gradually improve.

In order to further accurately predict the traffic flow, this section further uses the multi model fusion prediction. Due to the complexity, nonlinearity and randomness of smart city
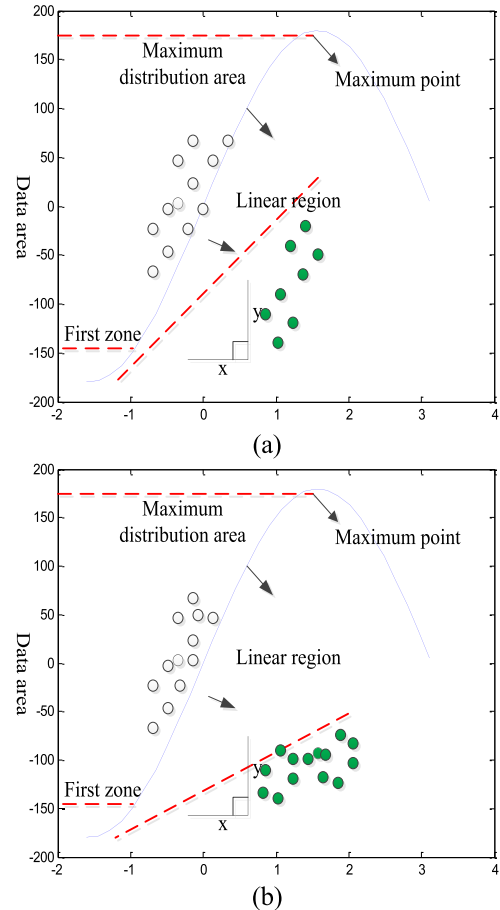
transportation system, the conventional operation system has been unable to meet the demand. In this section, when using the multi model prediction scheme, the model prediction and weight situation are combined to ensure the stability of the model prediction. The corresponding prediction process of traffic flow model is as follows:

1) The neural network is used to predict the corresponding three hours before sunrise, and the exponential smoothing model is used to predict the whole traffic flow at night.

2) In the corresponding night stage, this article uses the neural network prediction value of about 0.9 times and the exponential smoothing prediction value of 0.3 times for prediction.

3) In the actual prediction, the corresponding prediction is made every 15 minutes, and the corresponding data are adjusted and analyzed, and the corresponding prediction function is analyzed.

4) When entering the night smoothing mode, the corresponding prediction results are predicted in the opposite direction near the morning, and the corresponding data changes need to be recorded and stored in time.

In the corresponding part of neural network prediction, the corresponding application steps are as follows:

1) In the prediction, we need to collect and sort out the sample data of the lighting scene in advance, and process and analyze the corresponding original data, which involves a large number of video and image data.

2) Corresponding to the next neural network training, in the actual training need to constantly adjust the parameters, adjust to the final standard is to use the trained neural network model to predict the corresponding traffic flow.

3) The application of the training data is mainly applied in the intelligent lighting system. The system needs to be continuously stored in the actual operation, and the model is retrained at no interval. In this way, the best prediction effect can be achieved and the best effect can be obtained through continuous training.

The smooth mode prediction algorithm used at night is mainly used in the night when the traffic flow is relatively small, and the corresponding smart city lighting system is in the normal operation period. This article mainly uses the first exponential smoothing, the second exponential smoothing and the third exponential smoothing. The corresponding prediction formula is shown in formula 7, where the corresponding b represents the observed value during the operation of the corresponding system, the corresponding a corresponds to the smoothing coefficient, and the corresponding s represents the exponential smoothing average value.

$$b_t = ab_t + (1 - a)b_t \qquad (7)$$

In the corresponding short-term abnormal situation of night urban lighting scene, the corresponding nighttime traffic flow prediction system is mainly for the comprehensive inspection of traffic control, traffic guidance and traffic function. Its main prediction technology is the prediction mode of modern information processing technology, which mainly obtains the corresponding prediction linear curve through fitting. The corresponding prediction formula is shown in formula 8, and the corresponding M represents the corresponding prediction value at different times.

$$M = (M(t + 1) - M(t))/\Delta t \qquad (8)$$

After collecting the corresponding information, it is necessary to analyze and predict the traffic flow data under the corresponding urban background. The prediction data processing software used in this article is matlab, and the corresponding processing process is as follows: initialize the data and images under the background of the corresponding urban lighting system, and carry out image preprocessing, image graying processing and binary value for the corresponding images The corresponding image of the vehicle recognition and analysis, the corresponding traffic flow detection. After processing the above data, the corresponding data is output and stored in the database for storage.

The whole algorithm also needs error calculation. In this article, the primary smoothing error processing algorithm is mainly used in error control, which has obvious advantages compared with neural network and multi model prediction algorithm. The corresponding theoretical calculation

error also belongs to the minimum cumulative error. The corresponding cumulative error comparison table is shown in Table 3.

TABLE 3. Error AAE of optical flow obtained by two algorithms.

Prediction times	actual value	One time smoothing prediction value
1	23	23
2	23	22
3	27	26
4	24	24
5	25	23
6	32	31
7	33	32
8	21	21
9	23	22
10	24	23
11	25	23
12	27	25
13	25	24
14	26	25
15	28	22
16	31	31
17	33	32
18	35	34
19	36	35
20	38	32
21	39	38
22	40	39
23	31	30
24	33	32
25	34	33
26	32	31
27	21	21
28	23	22
29	25	24
30	23	22
31	32	31
32	22	21
33	21	20

III. DESIGN AND RESEARCH ON THE WHOLE SOFTWARE AND HARDWARE OF INTELLIGENT LIGHTING SYSTEM

Based on the above core algorithm, this section will focus on the hardware and software design of the corresponding smart city lighting system. As shown in Figure 8, the overall framework of the corresponding smart city lighting system is shown.

A Software Design: The software architecture used in this article is a three-tier architecture, corresponding to the interface layer, logical relationship layer and data layer. C++ is mainly used to write application level software, and MySQL is mainly used in database level. The corresponding logical relationship layer is mainly based on Mina as the infrastructure, based on which the communication interface is developed. The corresponding storm is the core data processing architecture of the whole software system, and the corresponding zookeeper is the core component of the unified management of the distributed cluster. The corresponding data system adopts mongodb. The corresponding software architecture is shown in Figure 9. It can be seen from the
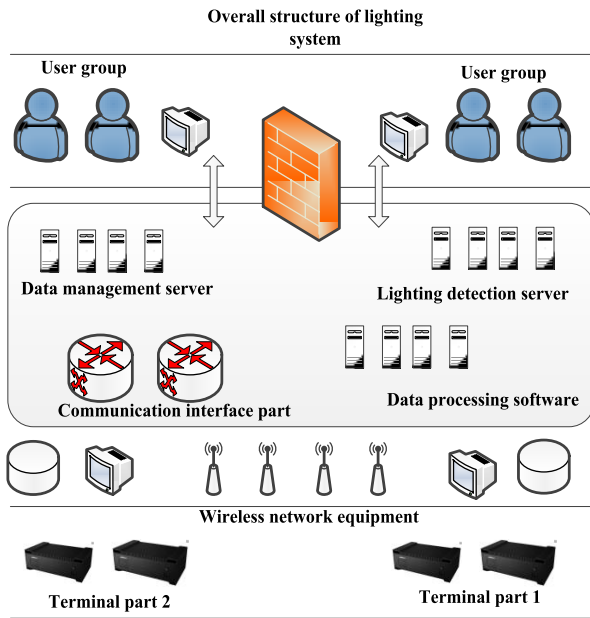
FIGURE 8. Software and hardware design framework of smart city lighting system.
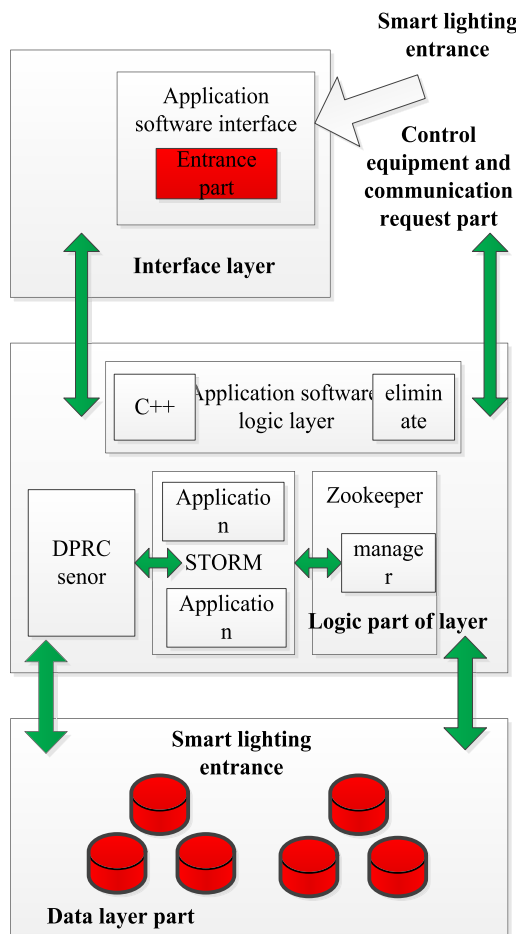

FIGURE 9. Software architecture design of lighting system in smart city.

figure that the TCP / IP protocol is mainly used in the communication protocol design level, and the long connection mode and the corresponding short connection mode are mainly
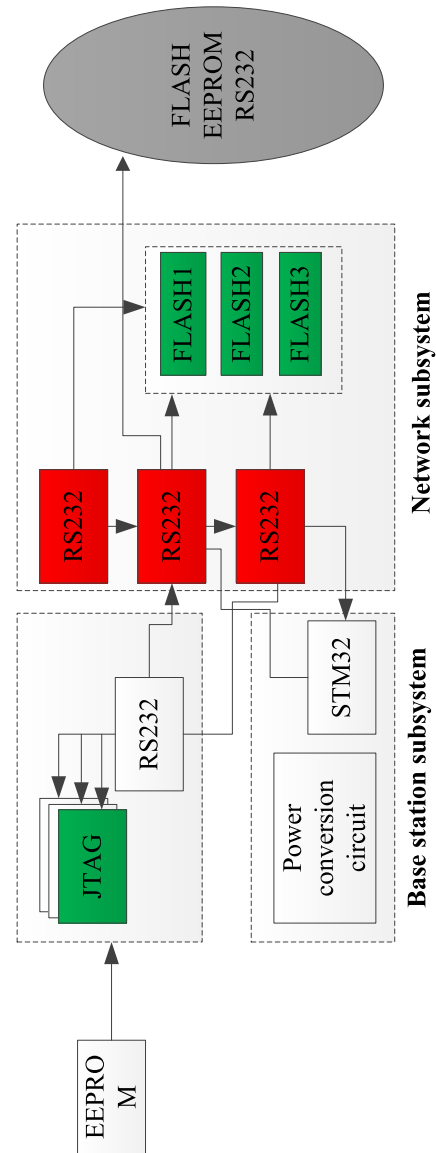

FIGURE 10. Structure block diagram of hardware centralized control module of intelligent city lighting system.

used in the upstream data transmission and downlink control data, and the corresponding short connection is mainly used between the interface software and the application system.

In the data storage structure design level, it is mainly composed of document, collection and database. The corresponding data model design level mainly considers the street lamp operation data set, which mainly includes the operation data, control terminal data and the corresponding street and state collection time data of each scene in the city; the corresponding operation data set mainly includes It includes three-phase voltage data, current, voltage, power and corresponding power factors.

The hardware design includes GPRS module design, centralized controller design, ZigBee networking design. In the corresponding GPRS module design level, it mainly designs
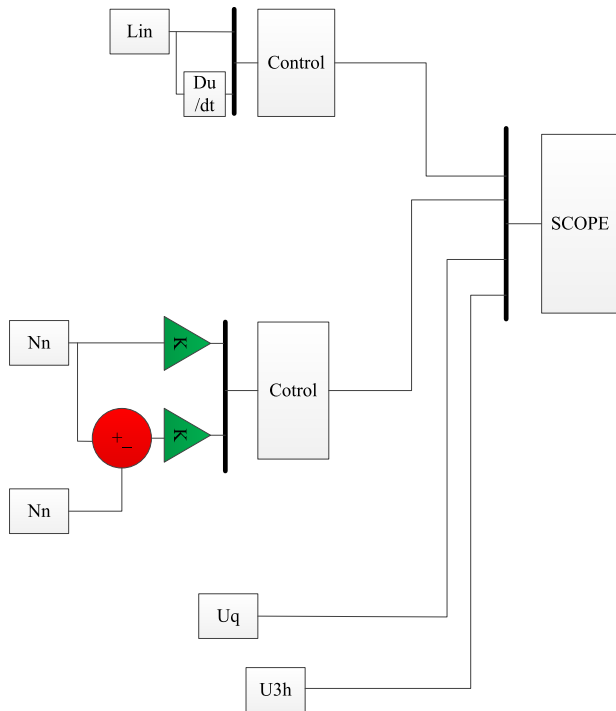
FIGURE 11. Simulation block diagram of intelligent city lighting system.

the wireless transmission module. In this article, usr-gm3 is selected when selecting the core module, which can realize the transparent transmission of serial GPRS, support the online connection of two networks, and support TCP and UDP. In the design level of centralized controller, it mainly includes power module design, JTAG debugging circuit design, EEPROM drive circuit design, level conversion circuit design, startup mode control circuit design and flash module circuit design. The corresponding centralized control module structure block diagram is shown in Figure 10.

Accordingly, STM32F103 is selected as the core control chip of the centralized controller; the corresponding JTAG debugging circuit can be directly connected with j-link and st-link; the corresponding EEPROM driver chip is AT24C512, whose corresponding working voltage is set at 1.8v-6v, which mainly realizes the communication with the outside world through I2C; the corresponding chip used in the flash circuit is w25q128bv, with the corresponding working power The voltage is 3.3V, which supports SPI communication. CC2530 chip produced by Texas Instruments Company is the main chip used in ZigBee networking design, which is mainly used to coordinate circuit design. At the hardware level, the terminal controller is also needed to design. Its main integrated functions are scene light acquisition, power acquisition, human vehicle induction, external storage acquisition, power conversion, power failure identification and circuit shutdown.

IV. VALIDATION ANALYSIS

Based on the above experimental principle, this article will simulate and verify the scene data provided by a local area of
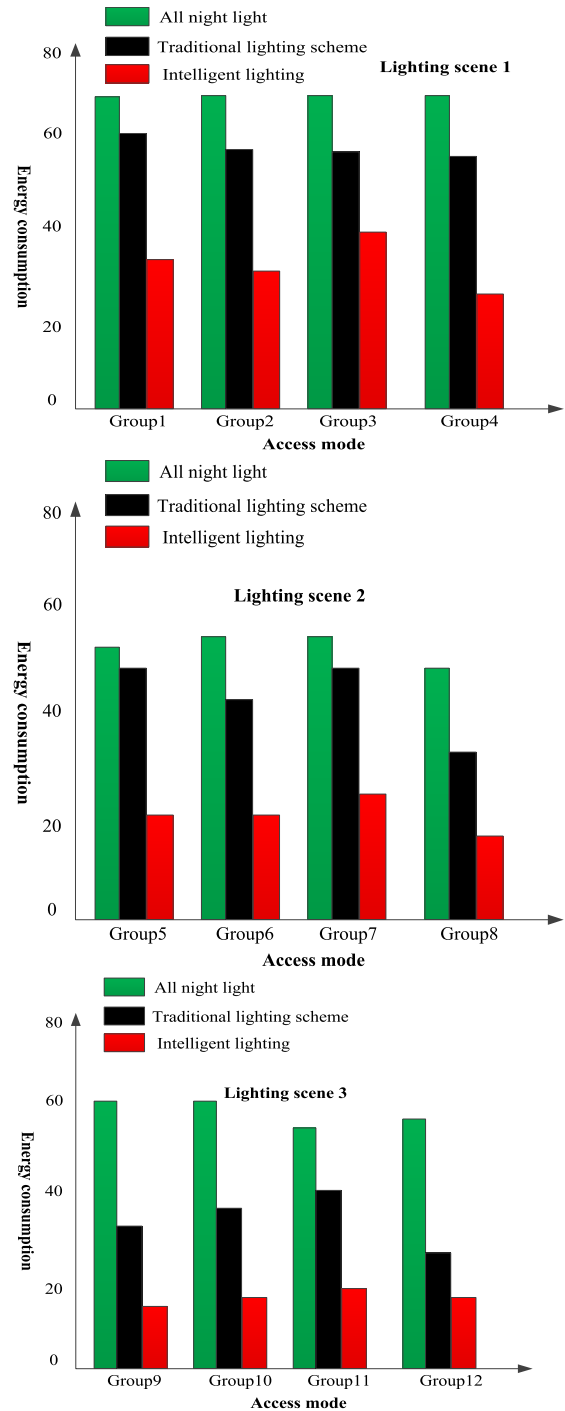
FIGURE 12. Power consumption comparison data chart of smart city lighting system.

a city based on the simulation framework shown in Figure 11. The main verification indicators include the power of urban lighting, the accuracy of lighting fault alarm, and the delay of system data processing. It can be seen from figure 8 that the simulation software mainly selects simulik in MATLAB, which mainly provides a dynamic simulation model for the whole lighting system.
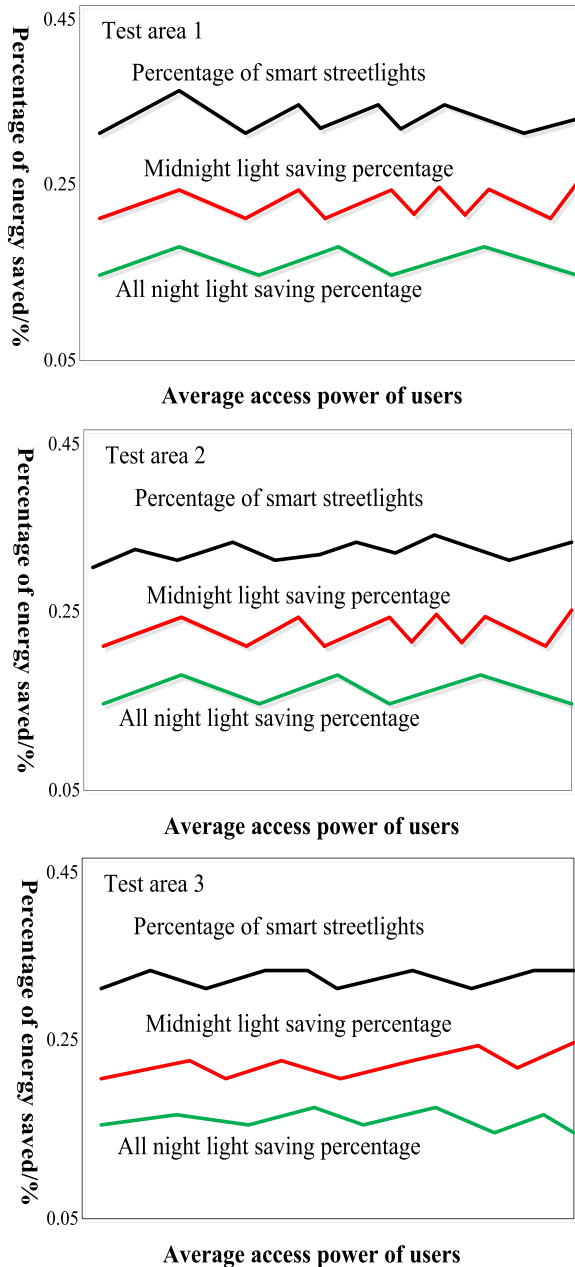
FIGURE 13. Power consumption comparison line chart of smart city lighting system under long time test conditions.

region	Is the fault accurate	Fault area
1	Y	Driving Avenue light pole
2	Y	Street lamp A
3	Y	Street lamp B
4	Y	Pedestrian light
5	Y	Pedestrian light
6	Y	Pedestrian lights
7	Y	Pedestrian lights
8	Y	Street lamp C
9	Y	Highway street lamp
10	Y	Highway street lamp
11	Y	Landscape lamp

FIGURE 14. Intelligent city lighting system fault alarm and accuracy comparison block diagram.

In order to verify the corresponding power consumption under long-term conditions, the simulation time is 30 days. The power consumption comparison curve between the corresponding traditional lighting control scheme and the lighting scheme in this article is shown in Figure 13. It can be seen from the figure that the proposed algorithm can save about 28% energy under long-term test conditions.

In the corresponding lighting fault alarm accuracy, this article compares it with the traditional lighting scheme, and the corresponding experimental data line chart is shown in Figure 14. It can be seen from the figure that the lighting control scheme proposed in this article can more accurately report the fault location and basic fault situation compared with the traditional lighting scheme in the case of street lamp failure.

In the lighting system background image data processing level, this article mainly considers the corresponding system data processing delay and the utilization of memory in the control system. The corresponding data delay situation is shown in Figure 15. It can be seen from the figure that the intelligent lighting system control scheme proposed in this article has lower delay and has obvious advantages in data processing response. On the level of corresponding system memory utilization, the corresponding line chart of memory utilization is shown in Figure 16. From the figure, it can be seen that the smart city lighting system used in this article has

In the corresponding lighting power comparison, this article selects the traditional lighting system power consumption data for comparison. Through the data acquisition and Simulation for 15 consecutive days, the corresponding energy consumption data histogram is shown in Figure 12. The corresponding straight square column in Figure 9 represents the power consumption of full-time open lighting system, the power consumption of traditional lighting system and the lighting power consumption of the algorithm in this article from left to right. It can be seen from the figure that the lighting power consumption of this algorithm is significantly reduced by about 25%, which has significant advantages.
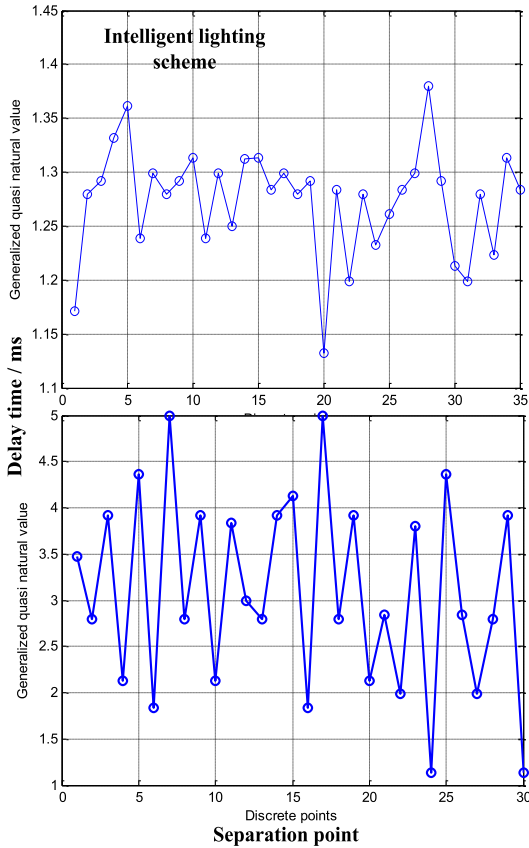
FIGURE 15. Data delay comparison line chart of smart city lighting system.

TABLE 4. Energy consumption table of two lighting schemes.

Test area	Traditional solutions	Smart solutions
1	2.3	1.5
2	3.1	2.6
3	7.2	6
4	4.9	2.8
5	2.9	1.6
6	3.6	2.4
7	7.2	5.9
8	4.9	2.8
9	2.5	1.6
10	3.1	2.5
11	7.2	5.1
12	4.9	2.8
13	2.3	1.5
14	3.3	2.3
15	4.1	2

higher memory utilization, so it requires higher chip capacity of the centralized processor, thus increasing the cost of the entire lighting system. This is the problem that needs to be solved in the future.

The corresponding lighting energy consumption, failure rate and corresponding response are shown in Table 4, table 5 and table 6. It can be seen from the table that the scheme proposed in this article has obvious advantages in terms of lighting energy consumption, and the scheme
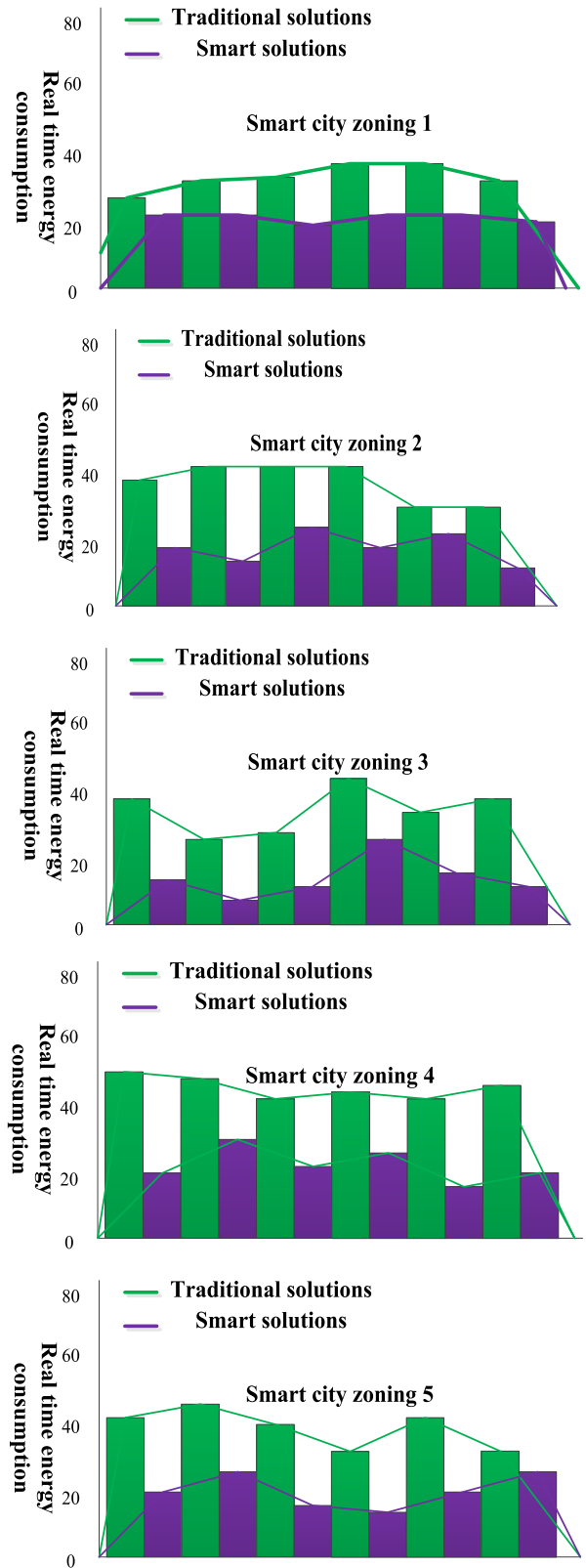

FIGURE 16. Line chart of memory utilization of smart city lighting system.

proposed in this article has more obvious advantages in the failure rate level. At the same time, by comparing the corresponding lighting energy consumption and failure rate under

TABLE 5. Comparison table of failure rate of two algorithms.

Test area	Traditional solutions	Smart solutions
1	0.792	0.966
2	0.831	0.971
3	0.692	0.944
4	0.835	0.903
5	0.732	0.946
6	0.851	0.961
7	0.792	0.974
8	0.835	0.953
9	0.832	0.946
10	0.842	0.981
11	0.772	0.954
12	0.815	0.953
13	0.822	0.976
14	0.831	0.971
15	0.692	0.944

TABLE 6. Response time comparison table of two algorithms.

Test area	Traditional solutions	Smart solutions
1	30.324	11.232
2	38.552	13.114
3	28.412	18.532
4	20.217	13.934
5	36.424	14.232
6	34.552	15.114
7	38.412	13.432
8	28.217	14.934
9	31.824	14.631
10	38.552	13.114
11	28.412	18.532
12	20.217	13.934
13	32.552	14.114
14	38.412	12.432
15	28.217	11.934

three different conditions, we can see the universality of this scheme.

Based on the above analysis and the corresponding experimental simulation, it can be seen that the intelligent city lighting control system proposed in this article has obvious advantages in energy consumption, fault alarm and data response compared with the traditional lighting control system, which has great significance for the rapid construction and development of smart city.

V. CONCLUSION

This article mainly analyzes the development status and research status of the corresponding intelligent lighting system in the current smart city system, and analyzes the existing technology of the corresponding smart city lighting system, and analyzes its advantages and disadvantages. Based on this situation, this article constructs the overall control model of intelligent city lighting system based on the Internet of things related processing technology, including GPRS wireless transmission technology and ZigBee technology. In the core algorithm, this article innovatively presents an improved video image processing technology based on Gaussian mixture algorithm, which mainly describes the background of a

specific scene in multi-dimensional model, so as to improve the reliability of the whole scene judgment. At the level of noise suppression, the video image processing algorithm proposed in this article designs interference noise suppression technology based on the principle of mean filtering, so as to achieve the accuracy and integrity of urban traffic scene extraction. In order to solve the security problems of the whole video image processing technology in information extraction, storage and analysis, this article adds the electromagnetic information leakage prevention algorithm in the video image processing technology, which mainly processes the video image at the source, so as to reduce the electromagnetic radiation of the overall information. In the follow-up research, this article mainly studies and analyzes its effectiveness in large-scale application scenarios and the corresponding anti-interference performance. At the same time, this article will focus on solving the energy consumption problem of the central chip corresponding to the centralized processor.

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