Design of new intelligent street light control system

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Abstract: In China, the methods of time-control, optical-control and time-optical-control are in common used to control street lamp, particularly in small and medium-sized cities. But the precision is bad, and the result of work is also poor. The main reason is the backward lighting control and administrative method.

Through many kinds of sensor combination sense environment's change, the multi-sensor exhibition can combinatory logically control the new intelligent street light controller system. And based on the degree of illumination control fixed time, in the automatic foundation fixed time, according to the multi-sensing exhibition survey data's special combination change, to control the street light nimbly; the system can also realize the automatic timing control, by the preinstall time to control street light switch, ultimately, to control the street light timed; Simultaneously can also realize the automatic sunshine control, which may act according to the actual determination the sunlight degree of illumination and the degree of illumination control criterion, automatic control street light.

On the basis of the merits both the regular control and the optical control, a new street smart controller is designed, with dual functions both timing control and automatic photoelectric control. It allows street lamps automatic lit in the evening, lighting the road for a few hours (adjustable time). After 0:00, when few vehicles or pedestrians go past, it turn off automatically. And terminal controller has wake-up function. After the street light turn out automatically, when the vehicles or pedestrians are going through, street light will be waken up by terminal controller, When the vehicles or pedestrians past, the light auto-off. Design of new intelligent street light control system does not only achieve energy-saving power but also extend the service life of lighting equipment. Moreover, it is controllable, ease of maintenance. At the same time, it is helpful to highlight the festive and other characteristics, and ultimately make street light network, intelligence, humanity and art.

Key words: Public street lighting; intelligent controller

0 Introduction

There are a small number of streets in the town or the city before, street lamps and management control is relatively simple, but as the country gradually into a well-off society, and with the development of urbanization, the rapid increase in the number of streets in the town, the control and management of street lighting become problems. At present, street lamps control at most of the urban is only by manual control, a control switch set in each of the street lamps, so-called this first generation of the original street light control, which is inefficient and a waste of manpower, and cumbersome to operate

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street light opening and closing time allowed a daily morning and evening, man-made factors too much. Or using optical-control method, set up optical control circuit, change the resistance by using of light-sensitive device to control street lamps light up automatically in the evening after dark, turn off automatically after dawn in the morning, but the low reliability of the method, vulnerable to interference, night street lighting is too bright and a waste of energy and other issues. The other is time-control method (that is, from time to time opening and closing control), and time-optical-control (that is, from time to time with light intensity control). This three street light control method can be attributed to the second generation of street light control. The second generation of street light control method achieved automatic control of street light, thereby reducing the labor intensity and lower labor costs and improves the efficiency of street lighting control. With the use of in-depth, but also exposed it can not meet the needs of the growing street lamp information and intelligent management. The time of lighting is not only lack of precision enough, many street lights control to use the mid-night lights strategy, energy-saving effect is poor. In short, the current street lighting strategy is simple and crude, lack of humane care of the car and human, can not achieve the sleep and wake-up call of the lamps in time, but some research for the city's festive lighting and landscaping is also lack of. An urgent need to develop a high degree of information, to facilitate the realization of network-based, highly intelligent automatic control system of street lighting, which is the third generation of intelligent street light control systems.

1 A new type of intelligent control systems

Intelligent street light control system uses the latest international intelligent street light energy-saving control technology. Through multi-sensor array, such as sound, light, infrared, vibration and other sensors, collect background information of the street environmental, and through a variety of strategies to control street lights, such as clock etc. to achieve energy saving and environmental protection, green lighting and festive lighting. The purpose of joyful festive atmosphere can be achieved at the same time. Intelligent Street light control system can switch lights reasonably, regulates voltage according to degrees of shine and runs in lower voltage in night .As a result, it largely saves electricity costs, prolongs the service life of street lamps and equipments, and significantly saves labor costs of maintenance and materials. By improving constitution of street light computer monitor system, working principle and function, intelligent street light control system adds different control maneuvers in different festival days .It also strengthen relevant energy saving technologies, highlight energy saving, environmental protection, control, ease of maintenance, festive, and other characteristics of the realization of intelligence, humanity and art in the new urban street light network.

2 Hardware of new intelligent street light control system

Public street light control and management system is made up of the computer network systems, communication systems and a number of spot intelligent control terminals. Each terminal control device provide power for one or more of the block street, every control terminal is called a sub-node. Light switches control is carried out by the two-way controlled silicon in control box. Terminal for the control of street blocks is two-distributed computer control system which is composed of host computer from the sub-node and host computer from central control room (master node) which offering

operating of engineers and computer stations (as a central control room), shown in Figure 1.It' s main completion is remote control, telemetry, remote hearing, failure analysis, data retrieval, system maintenance, electronic map display and print statements and other functions. As a contrast, sub-node computer is on-line real-time controlled, carries out remote communications, light switch and detection of current, voltage and other parameters. Three-tier control is used in node stations, that is instructions from the main first node (the central control room)is priority for control, such as rainy days, holidays, air defense and other situations under which special instructions are issued .Secondly, sub-node computer automatically control street light. 100 calendar and calculating program is in the memory of sub-node computer .As long as the personnel run the use of man-machine interface, key in parameters such as the local Latitude, the initial date and time of light switches, and it can automatically correct the time according to local season and day-night changing to achieve automatic control from time to time without a manager within 100 years after the local section. Thirdly, sub-node is a photosensitive control computer, when the system has not been placed time, or as a result of long-life rechargeable batteries has been that the system can not control the clock, that is light works.

Public street light intelligent control and management system is made up of a PC and a number of sub-note components PC is installed in the general management office of street lamp system, sub-node host computers are installed in the street management office (a transformer), and the guest computers are installed in every street lamp control box . PC bears general configuration of multimedia PC, with GPRS communication interface and broadband network interface. Each of the sub-node computers is made up of a host computer and a number of guest modules. The host unit of PC and the sub-node computer use GPRS communications which is low-cost due to the use of billing data flow, however, the host unit and several guest units of sub-node computer use power line carrier communications.

The host machine of lower unit shown in Figure 2, composed of ATmega8 single-chip systems, and the GPRS communication interface module, carrier communication module, voltage acquisition unit, photoelectric conversion unit, keyboard and display unit, and other peripheral equipments. The host unit to deal with large amount of data required for the host unit to expand the storage system. Keyboard unit with a direct line to the mouth of the single-chip, the unit also needs the definition of "setting the address of the host unit," "set GPRS communication interface module parameter"," open the manual system to slip all the street lights (exceptional circumstances) "and" manually shut down the slip system for all street lamps (exceptional circumstances) "function keys.

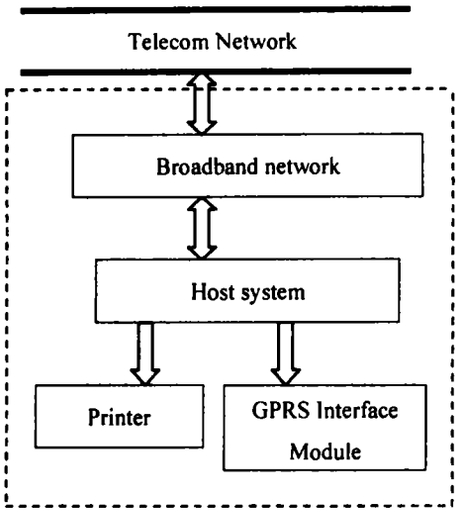

Figure 1 host system

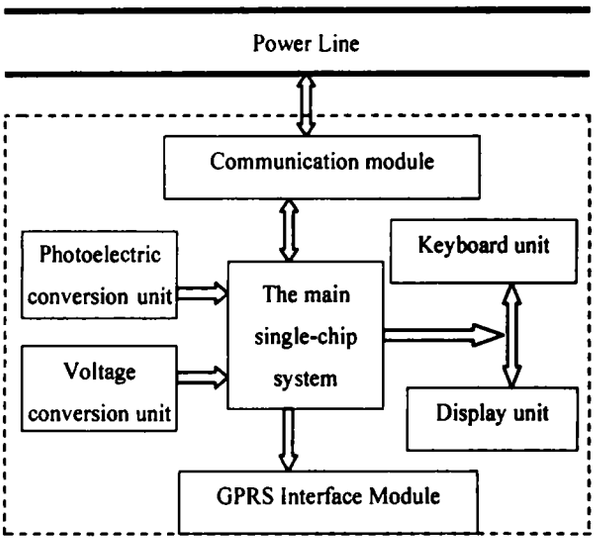

Figure 2 the host machine of lower unit

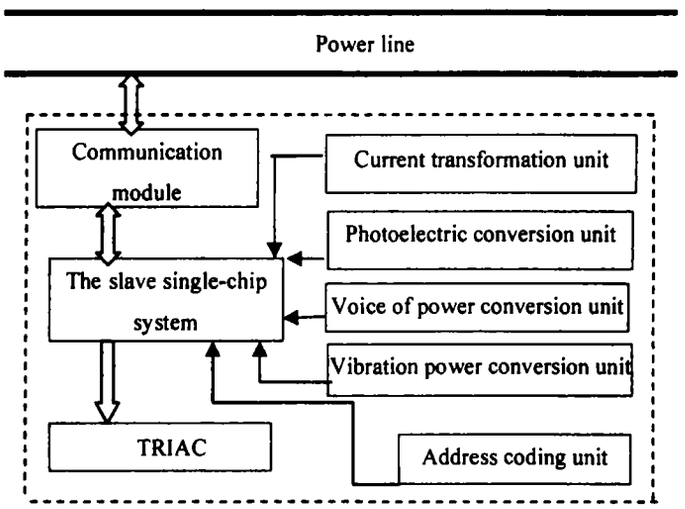

Figure 3 the slave machine system of lower unit

The slave machine of lower unit shown in Figure 3, composed of ATmega8 single-chip systems, and the current sensors, Media Converter, SSS(silicon symmetrical switch), communication module, and other peripherals. Slave unit hardware block diagram shown in Figure 2, current sensor in the street light series circuit, output signal of current sensors and photoelectric conversion unit, after signal conditioning, following the receipt of the single-chip systems, the address encoding unit from the slave machine by a group of switch settings, the use of single-chip set of the mouth line. If the number of street light is large, the addresses of the slave machine not enough, it can be expanded through the interface chip. The P15 mouth line of MCU çan open and close the street through drive unit (including opt coupler solid state relay). The selection of communication module related to the stability of system performance. Through the interruption of communication module, the host microcontroller and the slave exchange information.

3 system working principle

The working principle for public street light intelligent control and management system is that the host unit has received the GPRS packet from PC. After unpacking packet, according to the operator's request, distribute the address of slave machine unit

and the command which turned on or off the relay, to the corresponding slave unit by Communication module. Slave unit received, immediately implemented an order, and distribute the data to the host unit. the host unit received the data, then package the machine (that is the current slave machine) address, associated data (when the current value of the data back from the slave machine is less than a certain value, signs the street light have been bad) and voltage value the host unit collected, made up of the GPRS packet, distribute to PC machine. when the host unit is turned on all the street lights, if the operator once again in accordance with the address size, order the inspection made by the communication module to the corresponding slave unit from the machine, if the unit can be received back from the machine the correct information, the host unit on the real-time display of this unit from the machine-related information, inspection order will be made by communications modules corresponding to the slave unit, if received from the local unit returned to the correct information, real-time display on the host unit from the local unit of information, not any data packets distribute to PC; Otherwise, only package the slave unit address from the machine (this shows that there are problems from the slave machine unit, such as: line circuit) made up of the GPRS packet, distribute to PC machine. In accordance with PC street light management system to print statements of the situation, the operator can all stay at home to know from the work of the various local slave units, and to understand the good and bad online street light. Save time and manpower to achieve the purpose, and can easily control the opening and the sleeping lights. The local unit collected the signal from optical sensors, the optical signal converter, and then conditioning the signal, filtering software for the current value of the photoelectric conversion data from the machine and stored in the memory unit. when the photoelectric conversion data of the slave unit collected more than a given value (that is, the light can), if in the absence of signals from the host unit, the slave unit will automatically turn off street lights relay; at this time if the signal from the host unit, in accordance with the host unit order to open the corresponding street light relay, and data collected by the communications module sent to the host unit; when the slave unit run, if received by the host unit once again sent a signal to the closed street, the slave machine will automatically turn off street lights.

4 system software architecture

PC software is including the operating procedures such as a major, a batch, all, part of the street lamp on or off, GPRS communications procedures (including data packing, unpacking), real-time display and print statements procedures, and other procedures. PC has the entire electronic geographic distribution map of the management street. Administrators can in real time on the computer screen to see the work state of each and every street light, can easily control a single, single unit, single line of street lamps, and print their work, distribute data report to senior management through the broadband network.

The host machine of lower unit stored the entire addresses table from the local unit in memory within the host unit. First of all, scanning the keyboard, the keys pressed to implement the corresponding action; without key press, to see whether the GPRS packet over, the unpacking command will be implemented, carrier communication package for the new format of the data packets. According to the data information received from the

slave unit, and then packing GPRS packet, distribute to PC. In exceptional cases, host unit can open or shut down all the street lights by hand.

The slave machine work flow chart of lower unit shown in Figure 4, in accordance with the host unit demand, the main functions of slave unit is to open or close the streetlight, or inspection of the current value of sampling, and package sampling data back to the host unit.

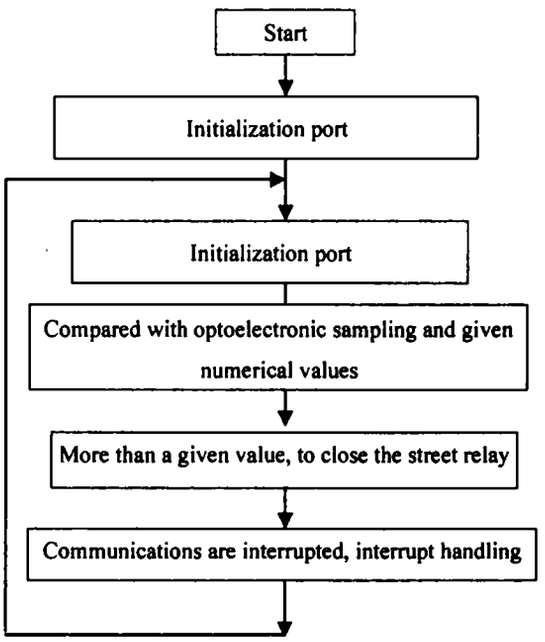

Figure 4 the work flow chart of the slave unit

5 slave unit working principle

In order to overcome the deficiencies of the circuit before, through the sensor array sensing environmental changes, to control or wake-up call the street light, so that " When people (vehicles) come, to light the street lights; people (vehicles) go, lights out. " Automatic adjustment voltage in accordance with illumination, electricity costs can be saved, to extend the service life of lamps and equipment, significant savings in labor costs and maintenance costs and materials. Designed circuit shown in Figure 5:

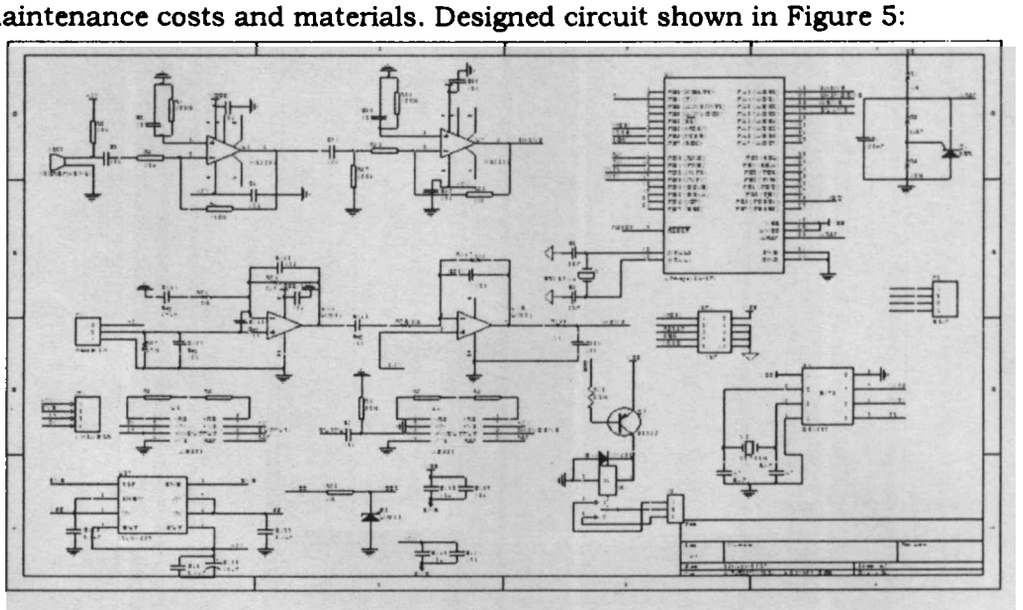

Figure 5

6 Conclusion

By improving street lighting control computer system composition, working principle and function, to increase of the different holidays of different control strategies, and to strengthen relevant measures for energy-saving technologies, to highlight such characteristics as energy-saving, environmental-protection, controllable, ease-maintenance and festive joyous characteristics, to achieve new type city street lighting system network-based, intelligence, humanity and art characteristic, thus compared with other control systems, it has better application prospects. The system is reliable, complementary, anti-jamming ability, well-structured, if applied to large, medium and small cities and towns, communities and various types of campus, it will have considerable economic and social benefits.

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