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Automatic Classroom Lighting Controller and Energy Saving based on Microcontroller Unit

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Abstract: The rise in energy costs urged the need in minimizing the energy consumption. As significant amount of energy is used for illuminating in educational buildings such as lecture halls and lecture rooms, improvements is needed to avoid energy waste for unoccupied and daylight hour. The lighting will be controlled based on demand to save the energy costs Introduces the common existed problem that lights work in classroom with nobody, analyzes several traditional solutions and their deficiencies, then puts forward the energy-saving system for classroom based on campus card. The project is based on the Campus Card System, which is mature and has been widely used, in combination with Ethernet, RF wireless communications technology, as well as the development of campus card to achieve a complete classroom energy saving system. System controls the master classroom power on and off by detecting the presence of the card, and effectively solve this problem. This system is characterized by simple-use and low-cost renovation.

Keywords: Campus Card System, Energy Saving System, Ethernet, RF Wireless Communications Technology.

1. INTRODUCTION

Power saving have became a necessary thing in our day to day life. Many conventional power saving methods such as using electrical devices which consumes very less energy or cutting off the entire power supply for a scheduled time for a particular area are not efficient and there will be a lot discomforts to the users and cost may also increase to use a low power electrical device.

Buildings are responsible for up to 40% of energy usage. Most part of this energy is used mainly for maintaining good lighting such that the workers feel comfortable. Nowadays the newly constructed modernised or automated buildings may have lighting system to improve the comfort of occupants and to save the energy. But there are large number of old buildings which contains thetraditional lighting system. To reduce the energy consumption in those types of buildings and to help the owners of that building in terms of saving electricity bill an intelligent and an effective method is discussed in this paper. Because of advancement in Sensor technology a very cheap and portable methods to measure our surroundings are available.

The amounts of light required to for a good environment to work comfortably in various areas are shown in table 1 which is recommended by CIBSE lighting guidesMost schools, especiall1y colleges, there isa ubiquitous phenomenon that the room is brightly lit during the day although the daylight is good, meanwhile there is another similar situation that people leave classroom with the lights still on. These lamps lit uselessly until the duty to turn off when the building should be closed according to the school regulations, which consequently leads to a great waste of energy.

Classroom lighting controlling is never a new topic, there are many similar researches at home and in abroad. According to the information from the current perspective, there is still not a perfect solution. This "Lit waste" problem solving, daytime lighting problem solving, is relatively simple, the current domestic and international research bottleneck is how to detect accurately whether there is someone in the classroom with the lowest cost.

Table1 required intensity of light for various environments

Type of place and work	Intensity required
Filing – Office work	300 lux
General office (Typing and Writing)	500lux
Painting	750 lux
Classrooms	300 lux
Classrooms for evening class	500 lux
Auditorium	500 lux
Assembly (Industry)	1000 lux

2. EXISTING SYSTEM

This section describes about the most commonly used lighting control system used in buildings. Since this method is going to use wireless sensor network it is mandatory to know the operation of existing lighting control system. It can be decided that energy loss is occurred with a lighting system when the lighting system illuminates a light which is an area which is not being used

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currently at that particular time or when it illuminates a light even though sufficient lighting is available to work.
The most commonly used lighting systems are explained below.

2.1 A Switch operated manually:
In this method a user has to switch ON and OFF the required lights. Since the user can switch on and off the lights as per their preferences there is a chance of keeping the lights in on state even though it was not need during that time. This may occur because of carelessness of user and a large amount of power is wasted. The lighting system with occupant detection uses passive infrared sensor (PIR).
This PIR sensor detects any movement is present in that particular area. If any movement is there means then this system automatically switches ON the lights. If timers are not used in this type of system means then the lights will be kept in ON state even after the user left the place. Because of this fault also a large amount of energy can be wasted. Then another drawback about this type of system is, it will switch ON the lights when there is an occupant is present in that area. But there is a possibility of enough lighting will be there at that particular time.
This system is not going to check the intensity of light before switching on the lights. Because of this also a large amount of energy can be lost.

3. LITERATURE SURVEY

The 1st literature designs a light control system, which is mainly detects by the intensity of the outdoor light, without the consideration of the human indoor.
The 2nd literature introduces the system which is judges whether there are students or teachers in the room by the difference of numbers of people go inside and outside the classroom, to control the switch on or off.
The 3rd and 4th conferences mention the combination of pyroelectric sensor and light sensor and division areas of the classroom, which increases the system cost and the difficulty of the placement of the electrical wires.
Scheme in 5th literature uses the data collected through the cameras to analyze whether there is anyone working, but its shortcomings are the adjustability of the brightness and accuracy of the distinction.
The 6th, 7th, 8th and 9th conferences divide the light area in classroom, so that every lamp can be controlled independently, but causing the complex control and inconvenient operation.
According to the situation the conferences represented, the "daytime light" issue has many simple and effective solutions, but there have remained two problem, one is that how to detect whether there are someone in the classroom, another is the human-position preparing detection.

In this retrieval of literatures, human detection methods mainly include image processing method, a pyroelectric detection method. Image processing method includes dynamic and static methods. Human body recognition algorithm is complex and low accuracy, and has the bad adaptability of defects on the intensity detection, inaccurate detection and complex implementation scheme; because pyroelectric detection method can only detect the movement of the human body, when the teachers and students in the classroom still read a book or learning, which cannot be correctly detected, and its detection range is limited. A large classroom should be arranged more than a dozen or even dozens of sensors to cover, which causes high cost, complex wire placement, low detection accuracy and other issues.
Integrated data consulted, the current classroom lighting control system has the problems including complicate switching operation between automatic control and the manual control, and to some extent, the plan itself cannot solve the problem of "lighting waste" well.
With the development of Internet technology, all variety of campus basically are equipped with campus card system; the campus card system is greatly convenient for teachers and students, the school staff work on their study and life management.
Based on this platform, it can be easily extended for other functions, such as security, monitoring, energy saving etc. This essay combines with campus card system and network technology, and applies in classroom lighting control to design an intelligent classroom energy-saving system. Classroom lighting control power supply is controlled by whether there is a card or not, and realizes the function that when there are people as well as the card in the rooms, the light will be on, on the contrary, the light will be off. Through this kind of means, the present "lighting waste" problem can be effectively solved. In addition, it can reduce energy waste, improve all the electricity saving awareness, and reduce the energy consumption of the school

4. PROPOSED SYSTEM

System consists of information center, base station, sub control nodes. The Information Center is responsible for the management of the information in cards of students and staff. It can also update the data information and transmit to the base station through the network. The sub base stations are responsible for update of the information from the information center, and send to each classrooms -- its governs control nodes, each control node open or close the master switch of the lights in classroom according to whether it detects a effective card and the preinstall scheme.

Campus information center and sub base station information interaction methods as shown in figure 1. Information Center is responsible for the campus card information management, at the same time, the information can be updated to each base station through the communication networks (the the base station of teaching buildings). Information center and the base station use the communication network mode, mainly considering the teaching building distribution is relatively dispersed, and the distance is long, but generally each

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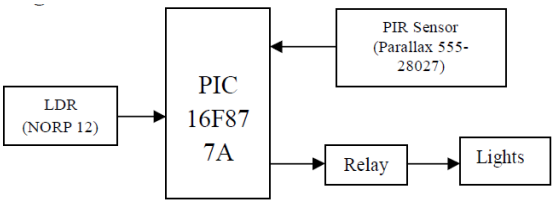
building has the communication interfaces directly linked with the information center, the apply of network communication mode can ensure the reliability of transmission, also can make full use of the original resources of the communication interfaces The communication between base stations and the sub control nodes in classroom of teaching buildings nodes are shown in figure 2. Sub base stations update the data information and transmit to each control node through the wireless communication.

The use of wireless communications mainly consider that the distance in the same teaching buildings distance is limited, and the wireless communication mode can ensure the effective transmission of data. In addition, its placement is flexible, which can minimize the wires reconstruction in each classroom and consequently reduce the cost.

5. THE HARDWARE DESIGN

The proposed system overcomes all the drawbacks of existing system. This system takes two things into account before taking any action, namely (1) human presence and (2) intensity of light. The system consists of a IR sensor (Parallax 555- 28027) and an camcas card). The PIR sensor is used to detect whether any occupants are there in that room and campuscard is used to detect the intensity of light in that room. Apart from this an algorithm can be implemented in our system which uses both the campuscard and IR sensor to decide whether to switch on the light or not. This system can be implemented using a PIC 16F877A, a LDR,



A IR sensor and the lights can be controlled by relays. The sensor will keep on sensing the intensity of light and sends it to the microcontroller. The PIR sensor will send a signal to the microcontroller if there is any occupant in the room. If anybody is present in the room then the microcontroller compares the sensed value of intensity in the room with the value already stored in the microcontroller. If the sensed value is less than the value stored in the microcontroller then the light will be switched on by connecting the relay.

6. CONCLUSION

Compared with the traditional energy saving control system for the lights in the classroom, allocating sensor nodes on the corresponding lights can help get the general position of the human body, and then turn on the corresponding lights to save the energy substantially on the premise of satisfying illumination demand. Besides, this design based on wireless sensor network can not only decrease the changes in the original lighting system, but also get prepared for the expansion of the intelligent classroom. By adopting B-S structure, the upper-computer can check the current status of the classroom online freely. It can also know if there are broken lights or sensor node in the classroom at any time, which would bring convenience for the maintenance work. In today's avocation of energy saving, such low-cost and convenient energy saving system would certainly be widely used.

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