International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 7 Issue 4 Ver. III || April 2018 || PP 56-59

A Road to Efficient Power Optimization System

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Abstract : *In today's era saving electricity is a very important topic of concern. Many times it has been observed that in college's classroom, the appliances of the classroom are left on even when the classroom is vacant, so there has been a need to develop such an automatic system which can turn the appliances on/off when the classroom is empty or filled. This paper proposes 'power optimization system' as solution to the problem of wastage of electricity .the system consists of microcontroller, RFID reader, relays and PIR motion sensors. To make system more convenient motion sensors are used as feedback element of the system for human presence detection. The microcontroller analyzes the data from RFID and motion sensors to perform switching action of appliances (fans, tube lights, etc.) using relay module. According to the analysis of system after the implementation for one classroom which consist of 3 fans and 8 tube-lights each of 70 watts and 40 watts respectively considering that average wastage of power for 2 hours per day, the total saving for one classroom is 1.05 kilo-watts of power which saves rupees 9.9225(per day). Hence the power misuse problem is solved using this system, which reduces the electricity bill.*

Keywords *–Automation, Electricity Saving, Motion Sensor, Power Optimization, Power Saving, RFID, Smart Technologies.*

Date of Submission: 31-03-2018 Date of acceptance: 16-04-2018

I. INTRODUCTION

The power optimization system is developed to reduce electricity consumption which has a microcontroller which is interfaced with RFID (radio frequency identification) reader [1][2] and number of motion sensors and relays. The system includes the RFID authentication of the person, that is to identify whether the person is faculty or a student and depending on the result system operates in two different modes which are discussed in section iv of this paper. The system is also equipped with the PIR (pyro electric infrared) motion sensor [3] which provides the feedback to the system that whether a person is present in the predefined area of coverage of that particular sensor or not and accordingly it switches the appliances of the same area which is associated with that particular sensor. Switching operation of appliances is done by relay module and microcontroller provide switching signal to relay module as per data from RFID reader and motion sensors. Connection of relays are made in such a way that it provides both type of operations that is appliances can be turned on or off automatically by the system or it can be operated manually as well. So the system continuously monitors the classroom and helps to save the electricity wastage.

II. LITERATURE SURVEY

By research made on the wastage of power in one class of college, the following conclusions are found:

- As it was being observed that the power wastage is increasing day by day there is a need to make a system or one can say a smart system which can reduce the power wastage.
- At the college level or at institute level one can save power by using this system to control the use of fans and light. Development of such a project is essential to save power which can automatically switch off the lights& fans when not required.
- It was been observed that the lights and fans of the classroom were left on after the lecture was over. To rectify the problem an automatic system is supposed to be made which should be smart & faster to recollect all the further steps.

So from the above discussed problem the decision were made to make very cheap, efficient, portable and automatic control system, which will be controlling all lights & fans of the classroom.

The system uses the RFID tag to identify the user. To make the system more convenient motion sensors are being used. To be at the safer side connection of the relay is made in such a way that the system can be manually as well as automatically operated.

In this project the literature survey was done on motion sensor, RFID reader, relays and a microcontroller. The present block diagram has been studied thoroughly with all the necessary information and algorithm was developed by considering both conditions when faculty enters& when student enters. The heart of the project, microcontroller Atmega2560 (used arduino mega) has been studied through arduino IDE (integrated development environment). Researched on how to read and analyze the digital data from any sensor using microcontroller. And how to make and control a count loop using microcontroller atmega2506.

III. PROPOSED METHODOLOGY

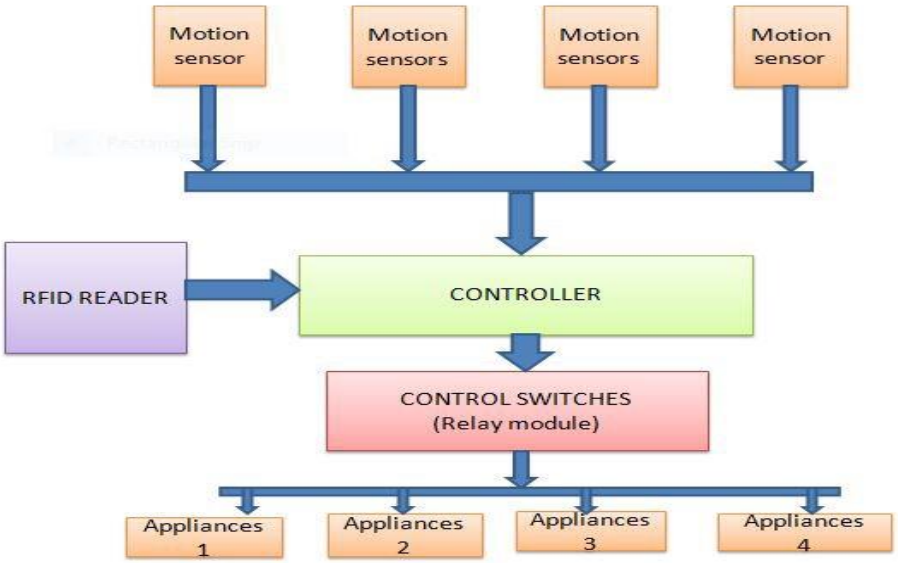

Figure 1: Block Diagram

IV. IMPLEMENTATION AND WORKING

As the system is made to make proper utilization &optimal use of power.the system consists of 2 practical based operation:-

1. Student enters the classroom.
2. Faculty enters the classroom.

Taking the first condition into account that if student enter the classroom the very first step he/she should do is tap his/her id card to the RFID detector. The system will turn on the appliances of one predefined area if and only if minimum 5 different students get detected by the RFID reader through their id card. After this the motion sensor which is being interfaced with the controller will get triggered and the motion sensor will check the motion of the student if motion gets detected than the relay will be given output as on as the lights & fan will be turned on of a particular area. Once the motion sensor is triggered it is not going to monitor continuously. If student left the classroom than the motion will not be detected so again the input is given to the relay, this will turn off the lights& fans. This procedure for students can be repeated and replicated also as the number of students scan the id for their groups which are more than five and number of students leaves at their own timings, so the system is capable to understand all the mentioned situations and work accordingly to save the power.

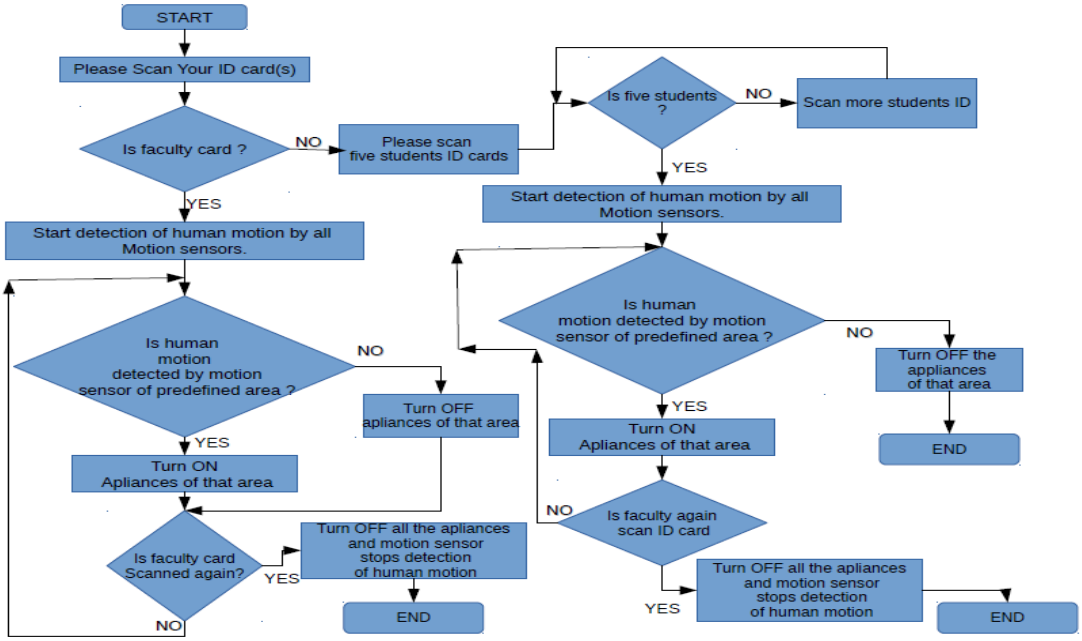

Figure 2:Flow Chart

Once if all students leaves the classroom then the system will again wait for the new faculty or a student card to be scanned and then again the system will work in two different ways i.e. student case and faculty case.

Second condition is when faculty enters the classroom, as soon as faculty enters the classroom and faculty taps his or her id card at the RFID detector then the lights & fans of the whole classroom will be turned on. Also all the motion sensors are triggered and all sensors will continuously monitor their respective areas. Here the actual algorithm will come into picture and turns on the appliances in the areas where faculty and students are supposed to be present or in simple words it continuously monitors the whole classroom and keeps the appliances on where humans are detected (i.e. faculty or a student) and turns off the appliances of areas where no one is appeared to be present. The system is flexible and smart enough that it would turn on the appliances whenever there is again detection of the students in the area which is associated with one of all the other sensor and if lecture is over and faculty knows that there will not be any lectures furthermore and also none of the student will be in the class then simply faculty can tap his/her id again then all lights and fans and other appliances will be turned off. And now system will wait for the other faculty or a student to scan their respective id cards and gain the access to the system.

Being an electronic device there is a possibility of some issues coming into picture while the system is in its operation and if in case any thing happens and the system is not working properly, then one can simply turn off the system by turning off only one switch from which the power is drawn by the system which is in a well secured place and it is only accessed by the authorized person. And its all done, after switching off that one switch whole system gets turned off and now all the appliances can be used as if they are used in the normal power distribution board i.e. by normal mechanical switches of the switch board so there is no need to do any modifications in the wiring system of the appliances which will be very tedious task if required every time during the system failure.

Many times there are different requirements needed in the classroom and according to the situations appliances should work. Some of these situations are discussed below.

Assuming that the light near the white board is on as per the decision made by the system but if faculty wants to turn on a projector on the same white board then there is a need to turn off that light which is on through the system as the sensor which is controlling that light is detecting the person or a student in the detection area, as a solution for this kind of situations the wiring of all the appliances is made in such a smart way that they can be turned on only automatically by the system according to sensor output but the particular appliance can be turned off manually simply by turning off the mechanical switch associated with that one particular appliance although it is on from the system. This is again helpful during the winter season where a light and a fan of the same region of classroom which are controlled by single sensor only, then it will turn on both light as well as fan as soon as it detects it but if someone is feeling cold and he/she wants to turn off the fan then he/she is allowed to do so manually by turning off the mechanical switch of that fan from the switch board.

Hence one can say that the system is smart enough to be implemented in a classroom and it can work efficiently in all the problems or a situation associated with the real time situations of life mentioned as in the above paragraph.

V. RESULTS AND DISCUSSIONS

Proposed calculation of the power saving for one classroom is as given below:

According to the analysis done earlier, the table shown below is prepared by considering two hours of average wastage of power by appliances in one classroom out of nine hours in a day. Considering ₹9.45 per unit cost.

Table 1: Calculations

Sr. No	**No. Of Fans**	**No. Of Lights**	**Power Consumed By Appliances(Without System In 9hrs)**	**Power Consumed By Appliances (With System In 9hrs)**	**Power Consumed By System (In 9hrs)**	**Total Power Saved**	**Total Money Saved**
1	3(70 Watts Each)	8(40 Watts Each)	4.77kw	3.72kw	0.045kw	1.05kw	**₹9.9225**
2	11(70 Watts Each)	22(40 Watts Each)	14.85kw	11.55kw	0.045kw	3.30 Kw	**₹31.1850**

VI. CONCLUSION

Hence, the system after RFID authentication of user starts monitoring of human presence and accordingly controller takes decision of turning the appliances on/off. Therefore unnecessary wastage of electricity is avoided. Finally consumption of electricity was reduced by using the power optimization system. As per the results shown in section V, we conclude that a classroom consisting of 11 appliances gives the saving of 1.05 kilo-watts power which saves ₹9.9225. The system reduces power consumption, saves money and reduces the pollution that is emitted from non-renewable sources of energy. The system not only used for classroom electricity saving but after some modification it can be applied to a public places like railway stations, bus stations, air ports, parks, at home ,etc.

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Patel Harsh Rajesh "A Road to Efficient Power Optimization System" International Journal of Engineering Science Invention (IJESI), vol. 07, no. 04, 2018, pp 56-59