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# Automatic Control System for Modern Class Room

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**This research is to construct the automatic control system for modern classroom for installing in 120 $m^2$ sized classroom to control operation of necessary electrical devices such as sound amplifier, computer, visualizer, projector, lighting system and air conditioning system. The proposed control system is functioned to determine the operation of defined devices in the room depending on number of people in the room and to control switch turning on and off before and after use of the room. The proposed system operates by Microcontroller PIC# 16F877A that is able to be supported programming development with Basic, C+ and in/out port application within 8 ports. The operation is followed the programming conditions of received signal of infrared sensors that can operated even no illumination. The proposed system will supply the power to electrical devices depending on number of student in the classroom. The operation conditions will be set as following; (1) if no students are in the classroom, then, all electrical devices will be turned off. (2) If in the room has at least one student inside, then, number 1 set of lighting, media aid devices, and electric fans will be able to control to turn on and off. (3) If in the room have at least 20 students inside, then, number 1 and 2 sets of lighting, media aid devices, and electric fans can be controlled to be turned on and off. (4) If in the room have at least 29 students inside, then, number 1 and 2 sets of lighting, media aid devices, and air conditioners can be controlled to be turned on and off. Moreover, the system can be optional set to protect the trespasser with sound alarm and can control turning on and off conveniently by IR remote control that applied from general TV remote control or called manual control but must be operated as automatic control condition settings. To evaluate the proposed system, the prototype system will be set at Boromratchonni Nursing College Udon Thani on the classroom to test system performance during 6 months by getting data 4 times a month. The electrical energy unit after installed the proposed system is collected. From the results, the devices can be operated smoothly and the electrical energy was decreased under the same as previous requirement of electrical devices use without the proposed system.**

***Keywords:***Automatic control, Modern class room, Microcontroller, PIC#16F877A

## 1. INTRODUCTION

Energy is the most important. All life on the earth needs the energy for daily life. From the report from IEA of base case scenario, the simulation of need of the energy in the future was introduced and mentioned that in next 20 years or in year 2030, the energy will be increasing needed to 40% and 90% of this will come from the underdevelopment countries. Especially, the countries from South East Asia will need 76% of increasing. Almost of the energy will come from the fossils that have 77% of all energy need of the earth in year 2030 and have 75% of increasing energy. The needs from India and China have ratio over than 50% of predicted energy consumption. In this analysis from IEA, all people should concern in high ratio of fossil use that will affect to global warming problem and the earth temperature will be increased 6◦ C in year 2030. By this temperature the world's weather will be largely changed that will affect to whole ecosystem of the earth.

The electrical energy is an energy that is necessary to human life but in nowadays this electrical energy has large request that will be increasing in every year. Thailand is a developing country that requires more energy consumption for residents and industries. Boromratchonni Nursing College Udon Thani is an academic institute that also requires the electrical energy. The college sets classroom having goal of high quality nurse for taking care people healthy. Thus, the facility equipments for supporting education such as amplifier, computer, visualizer, video projector, air conditioners, and electric fans must be installed in the classroom.

The air conditioner is a tool to support students learning effectively. In nursing learning management that has both theory and practice studies, the classroom must install supporting equipments as previous mentioned that these equipments must consume more energy. Therefore, the college defined the criteria to use energy effectively such as define turn on and turn off the lighting or air conditioner before and after class. To serve the mission of the college, the automatic system for controlling all systems in the classroom for energy management should be introduced in this paper. The proposed system will design to control equipment in the classroom automatically by microcontroller.

## 2. SYSTEM DESIGN

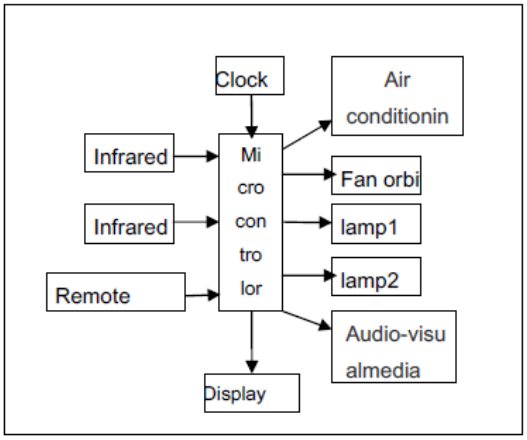


**Fig. 1** System configuration of proposed system.

The proposed system will supply the power to electrical devices depending on number of student in the classroom. The operation conditions will be set as following; (1) if no students are in the classroom, then, all electrical devices will be turned off. (2) If in the room has at least one student inside, then, number 1 set of lighting, media aid devices, and electric fans will be able to control to turn on and off. (3) If in the room have at least 20 students inside, then, number 1 and 2 sets of lighting, media aid devices, and electric fans can be controlled to be turned on and off. (4) If in the room have at least 29 students inside, then, number 1 and 2 sets of lighting, media aid devices, and air conditioners can be controlled to be turned on and off. Moreover, the system can be optional set to protect the trespasser with sound alarm and can control turning on and off conveniently by IR remote control that applied from general TV remote control or called manual control but must be operated as automatic control condition settings. System configuration was shown in Fig.1.

**Table 1.** Operational functions

| Electrical equipment installed in the room | The number of peopletopower the device | | | | |
|---|---|---|---|---|---|
| | 0 | 1-19 | 20-29 | 30-49 | 50 up |
| lamp1 | OFF | ON | | | |
| lamp2 | OFF | | ON | | |
| A/Vmedia device | OFF | ON | | | |

To design the operational functions of the proposed system, the table.1 was used. The infrared sensors usedto detectpeoplecoming into the classroom. The microcontroller will comparethe number of peopleinthe conditionin the program. Tosupply power todevices, it can be done by remotecontroltoturnon/ off set electrical equipments in the room.

To design the program for the microcontroller, the system simulation was applied as shown in Fig. 2.

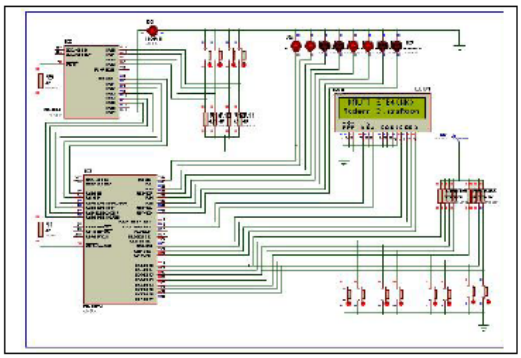

**Fig. 2** System simulation.

By this simulation, the system hardware and program of microcontroller were yielded. The program assigned the turning on and off of classroom lighting in automatic based on people amount and based on time period in a day. The system has 8 output ports relating with semi automatic control function. For controlling other equipments such as air conditioners, the semi automatic control by infrared remote with 8 output ports was set by remote control relating with automatic control mode. The automatic control was set as operation in table.1. The remote control was designed to control the system when amount of people in classroom is following the condition in table 1. All operation modes can be shown by LCD display.

## 3. SYSTEM IMPLEMENTATION

To implement the proposed system, the design in Fig. 2 was applied. The hardware parts of the proposed system were built as shown in Fig.3. In the figure, the circuit implementation of the proposed system in the box is shown. To test performance of the proposed system, it was installed as shown in Fig. 4 and 5. The proposed system can automatically control by setting the parameters on the program of Microcontroller PIC# 16F877A.The programming was development on C+ programming language.

**Fig. 3** Hardware for proposed system.

**Fig. 4** System installation with remote control.

**Fig. 5** Lighting test by the proposed system.

The small display was installed on the proposed system box. By testing the system performance, the smooth system operation was found.

## 4. SYSTEM EVALUATIONS

To evaluate the proposed system, energy saving assessment was applied. The proposed system was installed at 120 $m^2$ sized classroom that used for evaluating the system. The kilowatt-hour of the evaluated classroom was recorded for 6 months. The spent kilowatt-hours were recorded before and after installing the proposed system. This evaluation was done during March, April, and May for before installation and June, July, and August for after installation at Boromratchonni Nursing College Udon Thani, Udon Thani province, Thailand. During the evaluation, the lecture classes were had as every day.

| Month | Starting Units | Ending Units | Unit used (kWh) |
|---|---|---|---|
| Before installingtheequipments | | | |
| March | 1,654 | 2,196 | 542 |
| April | 2,196 | 2,556 | 360 |
| May | 2,556 | 3,071 | 515 |
| Averaged Unit | | | 472.33 |
| After installingtheequipments | | | |
| June | 3,071 | 3,558 | 487 |
| July | 3,558 | 3,964 | 406 |
| August | 3,964 | 4,460 | 496 |
| Averaged Unit | | | 463 |

The total of kilowatt-hours for before and after installing the proposed system were applied to determine percentage of different as following

((472.33 - 463) / 472.33) = 2%

From the determination, by using the proposed system, the electrical energy was reduced to 2%.

## 5. CONCLUSIONS

The automatic control system for modern

classroom was proposed. The proposed system was installed in 120 $m^2$ sized classroom to control operations of necessary electrical devices such as sound amplifier, computer, visualize , projector , lighting system and airconditioning system.

The proposed system was functioned depending on number of people in the room and to control switch turning on and off before and after use of the room.

The proposed system operated by Microcontroller PIC# 16F877A with input and output ports application within 8 ports. The operation was followed the programming conditions of received signal of infrared sensors that can operated even no illumination.

The proposed system will supply the power to electrical devices depending on number of student in the classroom. The operation conditions will be set as following; (1) if no students are in the classroom, then, all electrical devices will be turned off. (2) If in the room has at least one student inside, then, number 1 set of lighting, media aid devices, and electric fans will be able to control to turn on and off. (3) If in the room have at least 20 students inside, then, number 1 and 2 sets of lighting, media aid devices, and electric fans can be controlled to be turned on and off. (4) If in the room have at least 29 students inside, then, number 1 and 2 sets of lighting, media aid devices, and air conditioners can be controlled to be turned on and off. Moreover, the system can be optional set to protect the trespasser with sound alarm and can control turning on and off conveniently by IR remote control that applied from general TV remote control or called manual control but must be operated as automatic control condition settings. To evaluate the proposed system, the prototype system will be set at Boromarajonani College of Nursing ,Udon Thani on the classroom to test system performance during 6 months. The electrical energy units after installed the proposed system was collected. From the results, the devices can be operated smoothly and the electrical energy was decreased to 2% under the same as previous requirement of electrical devices use without the proposed system.

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