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Smart Lighting System for Library Using IoT Technology

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Abstract

Libraries in Universities and College utilize the traditional lighting systems need the switch to have the control of lighting. This will cause unnecessary waste of electricity. Therefore, a system that promotes efficient energy usage by automatic controlling the light in the library using Internet of Things (IoT) technology is proposed in this paper. The system uses Arduino with motion sensor to detect the motion of human to control the lights for particular areas in the library. This system enable organization to have a better lighting management for library and improve the efficiency of energy. This creates a more environment friendly and provides convenience to an organization by using this system.

Keywords

Smart lighting system, Arduino UNO, IR sensor, Library, LEDs

Introduction

The issue of smart lighting system is one of the issue discussed and debated today (Castro, M., et al, 2013; Mironichev, S. Y., et al., 2012; Müllner, R., & Riener, A., 2011). Correct lighting makes users feel good and comfortable in their surroundings. While bad lighting creates problems for users when they are looking through the stacks and keep their visit to the library short. The lighting can even have a negative impact on the staff, who works there. If the lighting harms the ability for the staff to function, which can happen if lighting creates glare and heavy shadows, then the library will have less productivity. All in all, the library, with incorrect lighting would not be welcoming. Therefore, the developer decided to implement the smart lighting system for library (Castro, M., et al, 2013).

A Smart Lighting System (SLS) is an automatic and intelligent lighting control system that is managed in a centralized or distributed way by different IoT communication protocols, devices, and their sensors. Efficient illumination system and energy consumption control in homes, offices, and streets are the key concepts in an SLS. An IoT-enabled SLS can be utilized as a solution to reduce the wastage of electricity in a smart city environment. Sensors integrated into the light nodes provide automatic control based on the human presence which is motion sensors. With IoT communication

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protocols, these light nodes can forward sensor data and communicate with each other. A management system is needed for analyzing provided data and taking autonomous decisions to ensure efficient power management (Sikder, A. K., et al., 2018; Martirano, L., 2011).

Methodology

This study on the implementation of this system, two methods were carried out. The first method using questionnaire where a form of feedback were gathered from various user of a particular field of interest. This questionnaire is a feedback from a group of people to analysis the results. The results is presented into chart which can help the author to analysis large number or responses into a single table form. Secondly, interview was conducted between the system analyst and users to collect the data and information. It helps to gather the information and data from the interviewee which allows to improve the proposed system depends on the user requirements.

The diagram below is a rich picture diagram (figure 1) and it consist of object, IR sensor, Arduino, LED, Software and users. When there is an object inside the IR sensor detectable range, the IR and sensor will be able to detect the object. The sensors will read the IR sensors values and send it back to the microcontroller. The microcontroller receives the sensor status and will start to control the lights where it will on the lights when it detected the object. The PLX-DAQ will collect the data from the microcontroller. These data will be displayed in the Microsoft Excel for users to view. This enable the user to save the data through excel file.

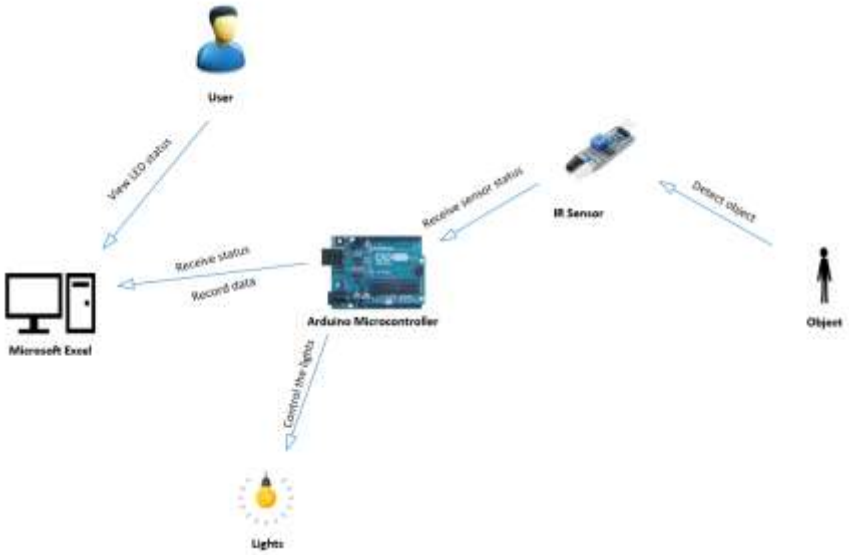


Figure 1. Rich Picture Diagram

The circuit for the proposed system consist of Arduino UNO, IR Sensor and LED. Figure 2, the Arduino UNO is a microcontroller board using the ATmega328 as the microcontroller. This microcontroller is developed with some basic parts that can ease in utilization. These basic parts

are 14 digital I/O pins,6 analog inputs,16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The most common ways to connect the microcontroller with computer using the USB cable. Besides that, it tends to be power up with a battery or the AC-to-DC adapter (Badamasi, Y. A., 2014).

The IR sensor is implemented in the system is shown in figure 3. The figure shows the image of the IR sensor and the function of module pin outs, controls and indicators. The VCC, Gnd and Out are connected to the Arduino UNO board to detect objects. This connection enable the Power LED to sense objects. If there is an object within the range of the IR Emitter LED, the IR Emitter LED will sent the rays from the object body surface to the IR Receiver. At the same time, the obstacle LED would be on.

Figure 2. Arduino UNO Figure

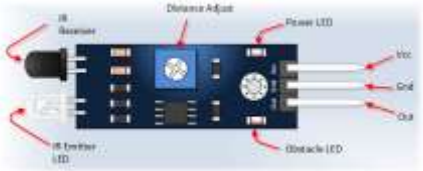


Figure 3. IR sensor

LED used in this smart lighting system to represent the light in the library is as per figure 4. The LED light have anode long lead and cathode short lead. Anode represent positive and cathode represent negative [Gageik, N., Benz, P., & Montenegro, S. (2015)]. Figure 5 shows the circuit diagram for the proposed system. The proposed system consists of 4 IR sensors, 4 LEDs and Arduino UNO. This system works well in detecting the motion. Each of the IR sensors and LEDs is assign properly to avoid overlapping and ensure that the hardware is work as expected. The output pins of the IR sensor are wired separately on the Arduino UNO board. For example, IR sensor 1 connected to the A1 on the Arduino UNO board.

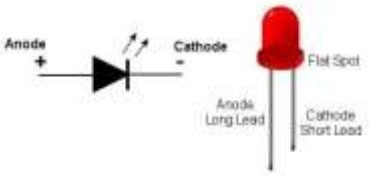


Figure 4. LEDs

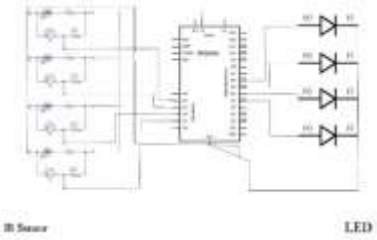


Figure 5. Circuit Diagram

Results and Discussion

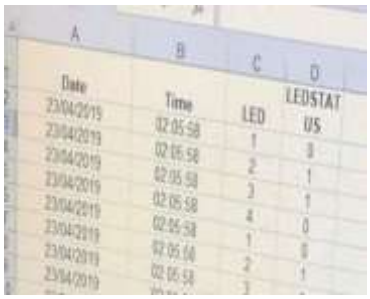
The prototype modal of this system is shown in figure 6. There are 4 sensors in this system. One is at the top left, two in the middle and the other one is at the right. When the Arduino UNO is connected to the PC/laptop, the sensor will start detecting the motion and control the lightings in the library. If there is no motion detected, the LEDs will remain off as shown in figure 7. The LEDs will turn on as shown in figure 8 if a motion is detected. At the same time, the figure 9,

PLX-DAQ will record the LEDs status such as date and time in the excel format when it is connected to the Arduino IDE.

Figure 6 : Prototype model

Figure 7 : LEDs off

Figure 8 : LEDs on



	A	B	C	D
	Date	Time	LED	LEDSTAT US
	23/04/2019	02:05:58	1	0
	23/04/2019	02:05:58	2	1
	23/04/2019	02:05:58	3	1
	23/04/2019	02:05:58	4	0
	23/04/2019	02:05:58	1	0
	23/04/2019	02:05:58	2	1
	23/04/2019	02:05:58	3	

Figure 9 : Data in PLX-DAQ

Conclusions

This system is suitable for the usage in the library due to usage and also the size. This is a powerful, dependable system and useful in order to increase the power efficiency. It fulfills the goal of energy saving and helps in achieving the efficient use of energy resources. The system can further enhance of artificial intelligence due to power efficient, cost efficient and automated system. This system is an effort towards the goal of increasing the technological advancement.

Acknowledgements

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