UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ENERGY SAVING CONTROL BY USING ARDUINO SYSTEM

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Engineering Technology (Industrial Power) with Honours.

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by

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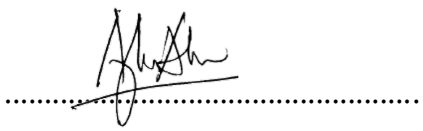

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I hereby, I declared this report entitled ENERGY SAVING CONTROL BY USING ARDUINO SYSTEM is the results of my own research except as cited in references.

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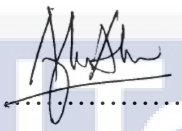
This report is submitted to the Faculty of Electrical and Electronics Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

Signature: 

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ABSTRAK

Projek ini dilaksanakan dengan menggunakan prototaip adalah bertujuan untuk menbangunkan sebuah sistem lampu koridor yang menjimatkan tenaga. Secara amnya, kebanyakan sistem lampu di koridor yang sedia ada akan dihidupkan bermula pada waktu petang sebelum matahari terbenam dan akan dimatikan pada keesokan hari apabila matahari terbit dan terdapat pencahayaan yang mencukupi di luar. Banyak tenaga dibazirkan apabila lampu dibiarkan terbuka tanpa ada seseoarang pun yang melalui koridor itu. Oleh itu, projek ini menjimatkan tenaga di mana kecerahan lampu dikawal secara automatik menggunakan mikrokontroler Arduino Uno. Sistem ini akan dihidupkan secara automatik semasa persekitaran gelap dan dimatikan pada siang hari. Selain itu, pencahayaan lampu juga akan mengikut kehadiran manusia yang melalui koridor tersebut dan cahaya sekeliling. Sistem ini memerlukan dua sensor untuk menjadikan sistem ini berfungsi sepenuhnya, iaitu sensor IR dan LDR. Sensor IR adalah digunakan untuk mengesan kehadiran manusia sementara LDR digunakan untuk mengenal pasti keadaan pencahayaan di luar. Faktor keselamatan pengguna pada waktu malam juga diambil kira apabila lampu masih berfungsi tetapi didalam keadaan meredup. Bukan itu sahaja, sistem keselamatan bagi mengesan kehadiran api juga dilaksanakan di dalam projek ini dengan menggunakan sensor api IR dan juga pembesar suara (buzzer). Setelah api dikesan di koridor atau dalam bangunan tersebut, Arduino akan memproses data dan GSM SIM900A akan mengahntar SMS ke telefon yang telah ditetapkan untuk memberi amaran tentang api yang dikesan di dalam bangunan itu. Untuk sistem ini, Arduino IDE digunakan untuk merangka program yang membolehkan untuk mengawal dan memberi tindak balas kepada sistem.

ABSTRACT

This project is using a prototype that aims for developing a corridor lighting system that can conserve energy. Most of existing corridor lamps will turned on starting from evening and will be turned off on the next morning and when there is sufficient surrounding the outside light. There are a lot of energy waste when the light at the corridor are left without no one passing through the corridor at the night. Therefore, this project is implemented to provide the best solution to overcome the way to save the energy where the intensity of the lamp is varied automatically by using microcontroller. This system is programmed so that the lamp will be turned on automatically when the dark is detected and will be turned off during daytime. Besides, the intensity of light will be controlled when there is human presence detected at the corridor. This system uses two sensors that are IR and LDR sensor. IR sensor is used to sense the attendance of human while the LDR sensor is used to identify surrounding light. The user's security at night also be taken the count so the light is programmed to turn on in dimmed state. Not only that, the security system is advanced by detecting the flame by using the IR Flame sensor and will trigger up the buzzer. When the flame are detected, the Arduino will process the signal and GSM SIM900A will send the SMS to the selected phone to alert people of that fire. For the software system, an Arduino IDE software is used to create a program that will enable the hardware to perform control function and give feedback to the system.

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DEDICATION

I would like to convey my greatest appreciation to my project lecturer and supervisor, Mr. Azhar bin Ahmad, for his persevering and unending advice, motivation, feedback and support to the implementation and until the completion of this project.

I am also would like to convey here my sincere appreciation to all the lecturers and fellow friends who were always helped me directly or indirectly through this research project.

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LIST OF ABBREVIATIONS

LDR	Light Dependant Resistor
IR	Infrared Sensor
LED	Light Emitting Diodes
CFL	Compact Fluorescent Lamp
SSR	Solid State Relay
IDE	Integrated Development Environment
ROM	Read-Only Memory
RAM	Random Access Memory
CRI	Colour Rendering Index
IoT	Internet of Thing

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CHAPTER 1

INTRODUCTION

1.0 Background

The project is about developing the energy-saving corridor lighting system. Lighting is important for any building where the major function is to illuminate the building or corridor during the dark. In the beginning, the corridor light system is manually controlled where a control switch was fitted in every corridor. The light were kept turning on with full intensity even when there is no one passing through the corridor and sometimes the light is turning on even there is enough surrounding light to illuminate the corridor when we forgot to turn it off. Thus, it may lead to energy wasting to keeping these lights constantly working without no one need and use it. Automatic corridor lighting system and energy management is the perfect solution for saving energy. The lights at the corridor will automatically switch on during the night when there are human presence passing through and automatically turned to dimming state when no one passing through.

This project intends to built an automatic and programmed lighting system that can control the intensity of the light based on the detection of human while the switching on and off of the lights are controlled based on surrounding lighting condition. Besides, this project also will implement the fire alarm notification to the phone when the fire is detected by using GSM SIM900A module.

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1.1 Project Objectives

The main objectives of this project are presented below:

a) To study and learn about an automatic corridor light control based on the human motion and daylight presence.
b) To develop an automatic corridor lighting control by using Arduino microcontroller, Light Dependent Resistor (LDR) and Infrared (IR) sensor .
c) To provide the right usage of light.
d) To promote energy saving and reducing energy wasting.
e) To prove the usage of LED is more efficient in energy saving.
f) To trigger fire alarm if the fire detected at the corridor.
g) To send the SMS on the phone to alert the user that the fire detected.

1.2 Problem Statement

The electricity is very important to our lives as it may help us at heating, cooling, lighting, running machines, and others. However, the cost of using it is high and we need to spend more of our money to pay for the bills. We use electricity without knowing that we can minimize its usage when it is not used. For example, the light in the corridor is still turn on brightly even though there is no one passed by at that time especially at late nights and sometimes even in the daytime. It may cause more electrical wasting and energy usage.

The standard corridor lights that are being used to lighten walkways at night have to be turned ON in the evening and OFF in the morning at appropriate times after there is enough illumination outside. For most of the developing countries,

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switching has been handled manually, which usually prone to human error and thus provides the cause either before the stipulated time or after that time. This causes unwanted usage of lights and thus cost to the customer. (Singh and Aggarwal, 2017).

Besides, there is a low level of awareness towards energy saving among our society that is responsible for. For example, people tend to let the light turn on even there is enough illumination from outside and sometimes let the lights turn on when there is no one at the room or when they leaving the room. These bad attitudes may lead to high energy wasting.

Other than that, most of the fire accidents that were happened because of lack of early detection to prevent the fire from spreading. It might give the serious damage or destruction to the buildings or even our home. Sometimes the fire alarm in the building has triggered to notify the person, but not all the time that the person is there at the building to prevent the fire from spreading.

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1.3 Scope of Research

The scope of this project is limited to the construction of the controller board and the small-scale prototype for the proposed energy-saving corridor lighting system. The corridor light controller which is Arduino Uno with IR sensor and LDR sensor would be installed in the light pole. The prototype of this project will be designed that LED light is used as the corridor light and is controlled by the controller and any motion that can light up the light. The human motion will be sensed by

a IR sensor. This project saves the energy used by the corridor lights by adjusting the intensity of the emitted light which will be increased only if the human motion is detected and will be dimmed if there is no motion detected during the night. It will not be completely off for the security and safety of the building. During the day, when there is enough illumination detected, the light will completely off. The fire alarm will triggered if the fire has been detected and a SMS will be send to the phone to notify the user about the fire.

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CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

There are varieties of sources and journal which related to the field of the corridor lighting system. This chapter will be discussed about these researched journals and summarize the proposed corridor lighting system. Details of this project can be simply understood after studying the related journal.

2.1 Microcontroller

In a programming context, a controller controls or manages the flow of data between two objects. In other words, a controller is just something or someone who interfaces between two systems and manages communications between them. (Margaret Rouse, 2017)

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Microcontrollers typically required low power because most of the devices they control are powered by batteries. Microcontrollers are used in many electronics projects, automotive motors, computers and measurement devices. (Tarun Agarwal, 2020)

Usually, the type of microcontroller used in many projects is Arduino. It is an open-source of electronics framework suitable for prototype based on flexible and also easy to be use hardware and software. It is designed for creators, programmers or anyone involved in creating projects. It is easier to be used as the user can load some coding and the Arduino can read sensors, execute button input acts, control motors, and embrace shields to further extend your capabilities. Arduino boards are designed utilizing the vocabulary that

extracted from C and C++ language in Arduino's Integrated Development Environment (IDE). (Bboyho, 2015). There are many types of Arduino.

- Arduino Uno (R3)
- Red Board
- LilyPad Arduino
- Arduino Mega (R3)
- Arduino Leonardo

Figure 2.1 below shows the diagram of Arduino Uno and Table 2.1 shows its pins description. The Arduino Uno R3 is an ATmega328 based microcontroller board. It has 14 digital input/output pins

- 6 of which can be used as PWM outputs)
- 6 analog inputs, 16 MHz crystal oscillator
- a USB interface, a power jack, an ICSP header and also a reset key.

It provides all you need to operate the microcontroller by simply attach it to a USB-cable device or power it with an AC-to-DC. (Arduino, 2018).

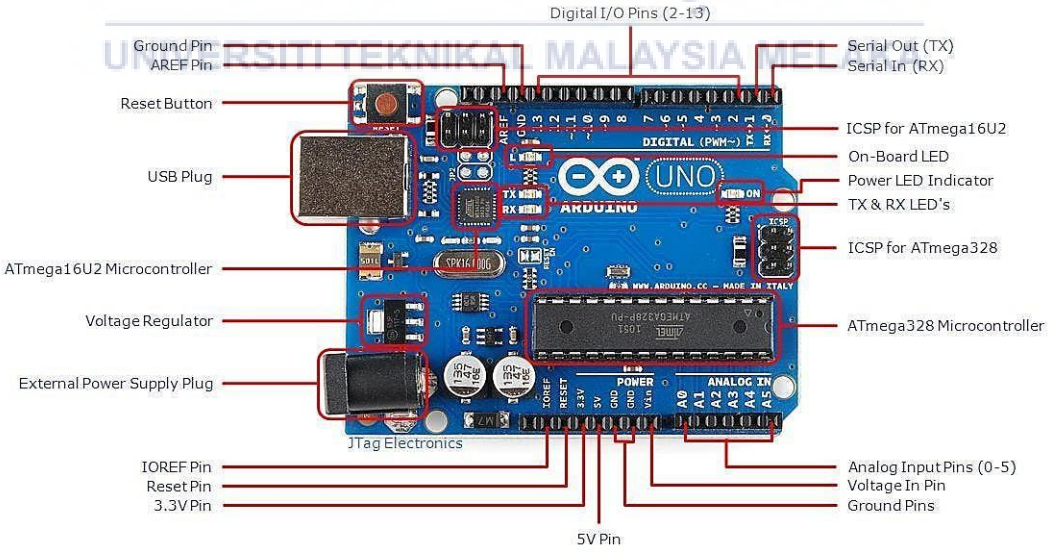

Figure 2.1: Arduino Uno

Table 2.1: Arduino Uno Pin Description

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power supply. 5V: Power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Used to resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in range of 0-5V
Input/Output Pins	Digital Pins 0 - 13	The pins can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

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2.2 Human Detector

Human detection and tracking is a task that is needed to track the presence of human beings that can make the electricity and energy saving for this project. There is an extensive scope of sensor technologies accessible for human detection. Different type of human detectors is selected by the researchers based on the proposed system.

2.2.1 Infrared Sensor

From the article made by Alexander Chilton (2015), it is stated that the infrared sensor is an electronic tool that is basically used to detect several parameters of its surroundings. It is either to releases or to absorbs infrared radiation. Infrared sensors are often has the ability to detect the heat generated by the object and of sensing motion.

There are two types of the infrared sensors, that are active and passive. The active infrared sensor both emit and detect the infrared radiation and it has two parts that are LED and a receiver. When the onjects comes closer to the IR sensor, the infrared light from the LED will reflects back and detected by the receiver. Diagram below shows the active IR sensor.

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Figure 2.2: IR Sensor