RFID SMART ROOM

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours

Faculty of Electronic and Computer Engineering
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FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

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To my beloved parents and family

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ABSTRACT

This project is about a smart room that uses the RFID system. The room system will adjust the room lighting and temperature according to the users' preferences. The system will identify different users and their preferences through the RFID technology. Each user will carry one tag that has different ID and preferences settings in it. One tag is limited to one user. RFID reader will read the tag according to the tag priority in case there are two tags in the RF field at the same time. The antenna would sense the tags and interact with the RFID reader to identify the user. This project has a RFID reader and a temperature sensor as its inputs and LCD, lamp and fan as its outputs. A microcontroller used to control all the inputs and the outputs of this project. The output from the temperature sensor which is the current room temperature will be displayed on the LCD. The main objective of this project is to help the old people and the disables especially people on a wheelchair.

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ABSTRAK

Projek ini adalah mengenai sebuah bilik pintar yang menggunakan sistem RFID. Sistem bilik ini akan menyelaraskan kecerahan bilik dan suhu mengikut kehendak pengguna. Sistem ini akan mengenali pengguna dan kehendak mereka yang berbeze-beza melalui teknologi RFID. Setiap pengguna akan membawa satu tag atau kad pintar yang mengandungi tetapan kehendak yang berbeza di dalamnya. Satu tag dihadkan hanya untuk satu pengguna sahaja. Pembaca RFID akan membaca dan mengesan kehadiran tag mengikut keutamaan tag sekiranya ada lebih daripada satu tag yang hadir dalam kawasan RF dalam satu masa yang sama. Antena akan mengesan tag dan akan berinteraksi dengan pembaca RFID untuk mengenali pengguna. Pembaca RFID dan pengesan suhu adalah input-input kepada projek ini manakala LCD, kipas dan lampu adalah output-output projek ini. Sebuah pengawal mikro digunakan untuk mengawal input-input dan output-output projek ini. Output daripada pengesan suhu yg merupakan suhu bilik pada masa itu akan dipaparkan melalui skrin LCD. Objektif utama projek ini adalah untuk membantu warga tua dan orang kurang upaya khasnya orang yang menggunakan kerusi roda.

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LIST OF ABBREVIATIONS

RFID	-	Radio Frequency Identification
ID	-	Identification
LCD	-	Liquid Crystal Display
DC	-	Direct Current
RF	-	Radio Frequency
MF	-	Mifare
LED	-	Light Emitting Diode
RWD	-	Readable and Writable Device
MCU	-	Microcontroller
I/O	-	Input and Output
CLKIN	-	Clock IN
CLKOUT	-	Clock OUT
CPU	-	Central Processing Unit
UID	-	Unique Identification
ADC	-	Analog to Digital Converter
Tx	-	Transmitter
Rx	-	Receiver

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CHAPTER 1

INTRODUCTION

1.0 Project Overview

RFID technology is quite similar with the well known bar codes technology that is based on light waves. Unlike light waves, radio waves readily penetrate most materials. They pass easily through paper, cardboard, wood, cloth, plastic, leather and corn flakes. This is the key advantage RFID tags have over barcodes. The RFID tags can be read without having to be within direct view of the reader. An RFID tag in a well-designed system can be read automatically as it passes by the reader, without human intervention.

RFID Smart Room system is a project that would adjust the room lighting and temperature settings according to the users' preferences. The system identifies different users through the RFID technology. Each user carries his or her own RFID tag. Whenever the RFID tag gains adequate power from the antenna, it will transmit specific ID to the RFID reader. The antenna placed at the room entrance would sense the tags and interact with the RFID reader to identify the users present and adjust the environmental settings when the users come into or leave the room. The RFID reader

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will communicate to a microcontroller which controls the room settings based on the ID information. Each ID will have its own user preferences for room lighting and temperature. The users' preferences are optional. For room lighting, the options are ON and OFF and for room temperature, the options are high, and low.

There is also a temperature sensor that will sense the current room temperature and display it on the LCD screen.

1.1 Problem Statement

There are many technologies used to create a better living environment, but most of them usually require actual contacts. This might be a problem for the disables and old people and also people on a wheelchair since they need to go to the appliances and turn it on themselves. RFID Smart Room is one of the solutions for this problem. This Smart Room will adjust the light and temperature settings according to the users' preferences without having contact with the appliances. The settings are controlled by the microcontroller that will be programmed to do so. Users have to carry a tag that has a specific ID, and when the reader detects the tag, it will get the information. The information then will be passed to microcontroller which will do all the other processes (controlling the temperature and lighting).

1.2 Project Objectives

For this project, there are two objectives. Firstly, is to design a system that will control the room settings by using RFID system and microcontroller. The RFID system which consists of a reader, antenna and a card (tag) will detect and read the ID from the tag. The reader then passes the information that has been read to the

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microcontroller that controls the fan and the lamp. A PIC program will adjust the room lighting and temperature according to each ID.

Second objective is to prioritize one user when reading he card and changing the room settings. This is to avoid reader collision in the RFID system. There is anti-collision algorithm included in the microcontroller programming.

1.3 Scope of Work

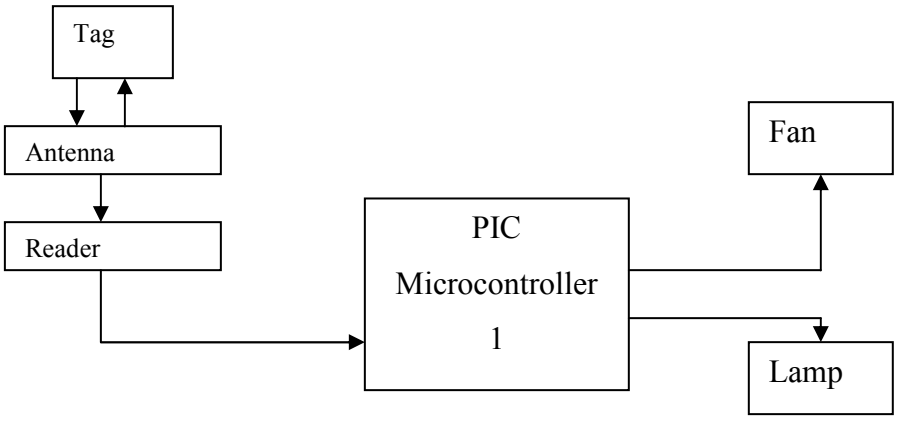

Figure 1.1 Project Block Diagram for RFID Reader

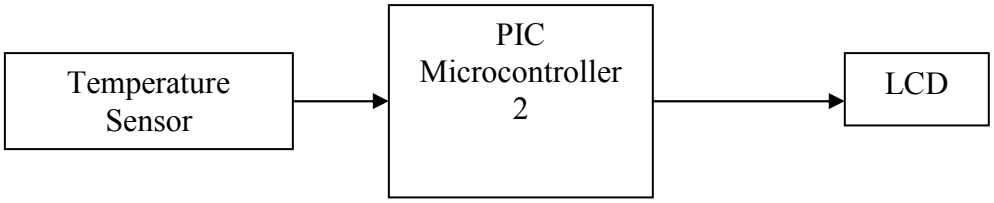

Figure 3.2 Project Block Diagram for Temperature Sensor

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The scope of work consists of RFID tags, antenna, RFID reader, temperature sensor, PIC Microcontroller, LCD, a fan (DC Motor) and a lamp.

The tag will interact with the reader through the antenna. Each tag will has its own ID number. Two tags will be used for two users. If both tags come within the read range simultaneously, only one tag will be read first according to the priority. The read/write device antenna connects along with the reader. The antenna will transmit signal and alternating power wave and receives a feedback from the tags. Antenna that used has a frequency of 13.56 MHz.

RS232 connection is used for the reader and microcontroller interface. Reader receives the information from the tag and it will pass the information to the microcontroller for processing.

Temperature sensor used in this project is LM35. It detects the current room temperature and passes the information to the microcontroller. The sensor interfaced the PIC Microcontroller using C language. PIC Microcontroller is the heart of the system. It controls all processes. Settings of all users will be stored in this microcontroller. It will control the outputs and receives information from the reader, and temperature from the temperature sensor. The outputs in this system are DC Motor, lamp and LCD. PIC Microcontroller is programmed using C language.

The purpose of the LCD is to display the current room temperature. The fan and lighting will function according to the settings. When the user touch the card at the reader another time, the lamp and fan will switch off.

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1.5 Methodology

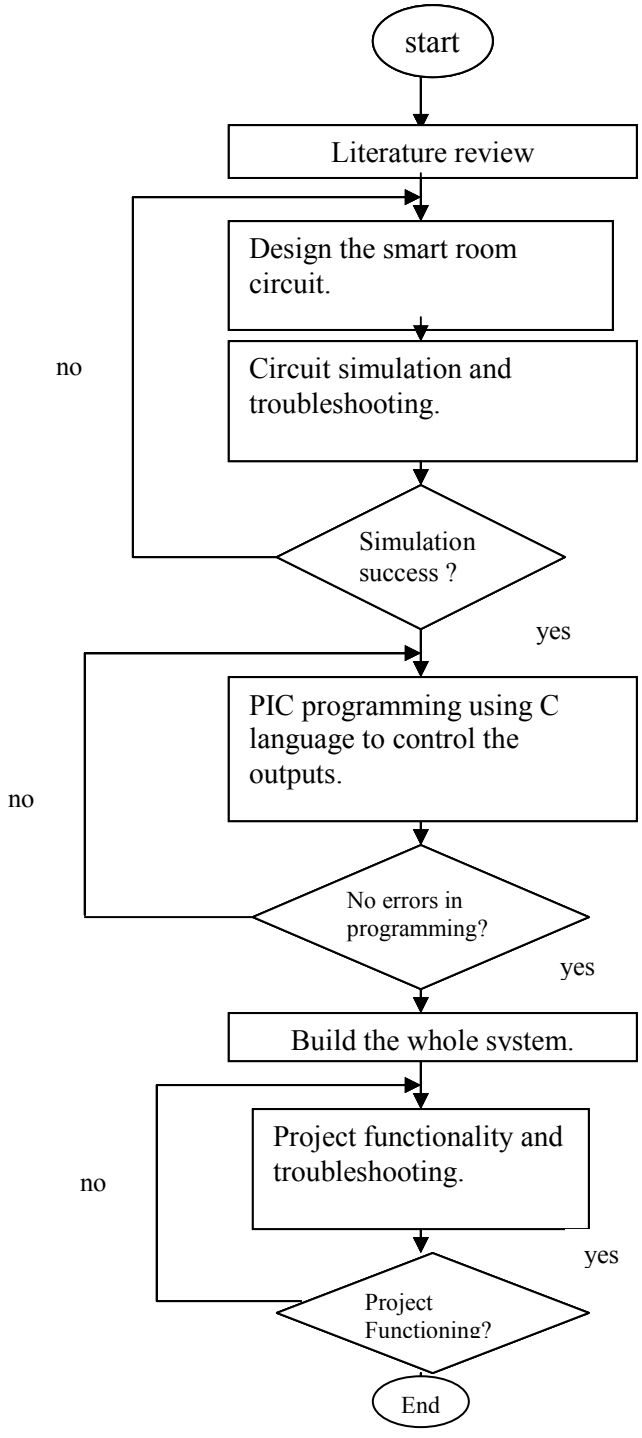

Figure 1.2 Project Flow Chart

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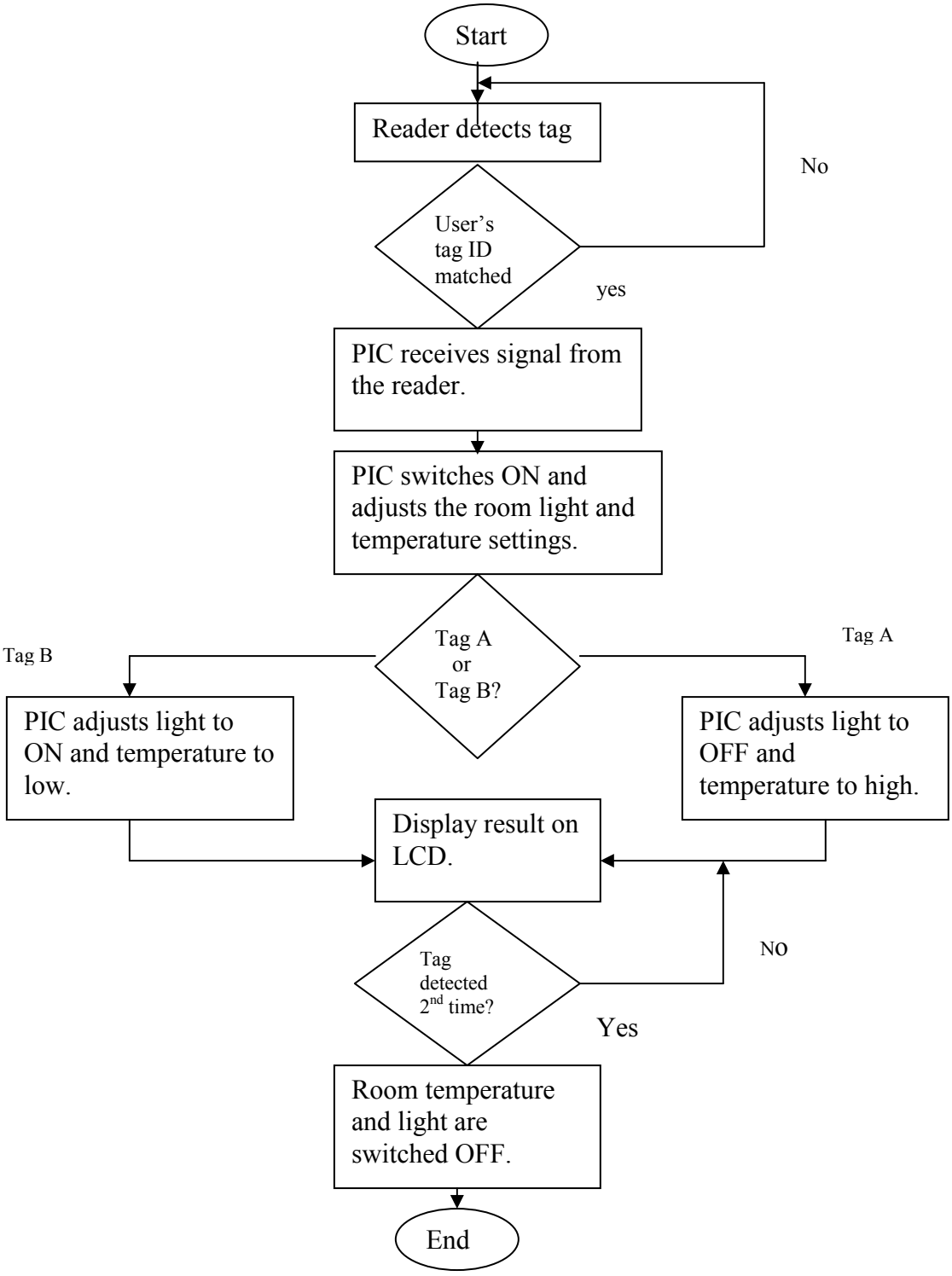

Figure 1.3 System Operation Flow Chart

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1.6 Report Structure

Basically, this report consists of 5 main chapters. The titles for each chapter are Introduction, Literature Review, Methodology, Results and Discussion, and finally Conclusion.

In Chapter 1, it mainly discussed about the project overview that will introduce reader to the project and what is the project is all about. It also stated the problem statement which is the problem that faced in daily life that has triggered this project implementation. The next things that have been stated in this chapter are project objectives, scope of work and methodology.

Chapter 2 explained about literature review that is all the theories and information that are related to the project. The theories might be from engineering journals, articles, magazines and books.

All the methods that used in order to achieve the project objectives are discussed in chapter 3. In chapter 4, the results obtained and their analysis and discussion are included. Finally in chapter 5, which is the last chapter, it concluded the project. It contains advantages and disadvantages of the project. Suggestions for future study also included for project improvement.

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