TESTING AND IMPLEMENTATION DOCUMENT INTELLIGENT POWER SAVING SYSTEM

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Chapter 1

Introduction

1.1 Purpose

The purpose of this document is to detail the methods employed for testing of product. This testing document provides a complete description of the testing methods of Intelligent power saving system.

1.2 Scope

Nowadays, electricity is the one of the important energy in human life. The usage of electricity in this world is increasing because we do not have the awareness of the importance of electricity. This is the reason of the increasing cost of managing, conserving and distributing. The level of electricity usage is high especially at the libraries and lecture halls. Students do not aware that how important for them to reduce the cost of electricity. Thus, this energy saving project will be created. Sometimes we forget to switch off the lighting system and fan. This will increase the waste of electricity. Based on this problem, this energy saving project will be created.

1.3 Definitions,Acronyms & Abbreviations

1.3.1 Abbreviations

- **PIR**:-Passive Infrared Sensor
- **LDR**:-Light Detecting Resister
- **LCD**:-Liquid Crystal Display

1.4 References

- **Wikipedia**, *http://www.wikipedia.org/*
- **Software Engineering**, *A Practitoners Approach, Fifth Edition Roger S Pressman*
- **Software Engineering**, *Sixth Edition, Ian Sommerville*

Chapter 2

Testing And Implementation

2.1 Test cases

NO	ACTION	INPUT	OUTPUT
1	POWER ON	Power	Idle(Checks for human presence)
2	Human detection in low heat illuminated room	IR radiation, Light, Low temperature	Human presence detected, But fan and light in off state.
3	Human detection in low heat non-illuminated room	IR radiation, Low temperature, No light	Human presence detected, But fan in off state and light ON with adjusted intensity.
4	Human detection in high heat illuminated room	IR radiation, Light high temperature	Human presence detected, But light in off state and fan ON with adjusted speed.
5	Human detection in high heat non-illuminated room	IR radiation, high temperature, no light	Human presence detected, but light and fan On with controlled intensity and speed.
6	No human presence	Light, Low temperature	Idle
7	No human presence	Low temperature, No light	Idle
8	No human presence	Light high temperature	Idle
9	No human presence	high temperature, no light	Idle

2.2 All the possible testing methods done for the project

2.2.1 Black Box Testing

Black-box testing is a method of software testing that tests the functionality of an application as opposed to its internal structures or workings (see white-box testing). Specific knowledge of the application's code/internal structure and programming knowledge in general is not required. The tester is only aware of what the software is supposed to do, but not how i.e. when he enters a certain input, he gets a certain output; without being aware of how the output was produced in the first place[1]. Test cases are built around specifications and requirements, i.e., what the application is supposed to do. It uses external descriptions of the software, including specifications, requirements, and designs to derive test cases. These tests can be functional or non-functional, though usually functional. The test designer selects valid and invalid inputs and determines the correct output. There is no knowledge of the test object's internal structure.

This method of test can be applied to all levels of software testing: unit, integration, system and acceptance. It typically comprises most if not all testing at higher levels, but can also dominate unit testing as well.

In our project we applied decision table technique to do black box testing and the outcome is shown below.

Condition Stub		Condition Entry			
IF	Human presence is detected	Y	N	N	N
	PIR Sensor is on	N	Y	N	N
	Intensity of light is low	N	N	Y	N
	Temperature is high	N	N	N	Y
THEN	PIR sensor is activated	X	.	.	.
	Checks temperature & intensity of light	.	X	.	.
	Glows bulb	.	.	X	.
	Fan speed increases	.	.	.	X

2.2.2 White Box Testing

White-box testing (also known as clear box testing, glass box testing, transparent box testing, and structural testing) is a method of testing software that tests internal structures or workings of an application, as opposed to its functionality (i.e. black-box testing). In white-box testing an internal perspective of the system, as well as programming skills, are used to design test cases. The tester chooses inputs to exercise paths through the code and determine the appropriate outputs. This is analogous to testing nodes in a circuit, e.g. in-circuit testing (ICT).

While white-box testing can be applied at the unit, integration and system levels of the software testing process, it is usually done at the unit level. It can test paths within a unit, paths between units during integration, and between subsystems during a systemlevel test. Though this method of test design can uncover many errors or problems, it might not detect unimplemented parts of the specification or missing requirements.

Divide the whole code into several segments.

Code segment	Code

A	if(temp>20&&temp<35)
	for(i=0;i<100;i++)
	{
	portb.f4=1;
	delay_us(300);
	portb.f4=0;
	delay_us(700);
	}

B	if(temp>=35&&temp<45)
	for(i=0;i<100;i++)
	{
	portb.f4=1;
	delay_us(450);
	portb.f4=0;
	delay_us(550);
	}

C	if(temp>=45&&temp<55)
	for(i=0;i<100;i++)
	{
	portb.f4=1;
	delay_us(550);
	portb.f4=0;
	delay_us(450);
	}

D	if(temp>=55&&temp<65)
	for(i=0;i<100;i++)
	{
	portb.f4=1;
	delay_us(700);
	portb.f4=0;
	delay_us(300);
	}

E	if(temp>=65)
	{
	por15tb.f4=1;
	delay_ms(100);
	}

F	if(light>=650) pwm_change_duty(x/250);
G	if(light>=500&&light<650) pwm_change_duty(x/5);
H	if(light>=350&&light<500) pwm_change_duty(x/2);
I	if(light>=200&&light<350) pwm_change_duty(x);
J	if(light<200) pwm_change_duty(x);

K	if(COUNT>150)
	{
	lcd_cmd(lcd_clear);
	lcd_out(1,1,"ABSENCE OF HUMAN");
	lcd_out(2,1,"S/M DEACTIVATED ");
	delay_ms(500);
	portb=0;
	pwm_change_duty(x/250);
	porte.f0=0;
	} else
	{
	porte.f0=1;
	lcd_cmd(lcd_clear);
	lcd_out(1,1,"HUMAN PRESENCE ");
	temp=adc_read(2)/2;
	inttostr(temp,txt);
	lcd_out(2,1,"TEMP:");
	lcd_out(2,7,txt);
	light=1024-adc_read(0);

As part of white box testing, assessment of code coverage was tested and verified. The test cases executed to ensure maximum code coverage. In our project we applied control flow testing technique to do white box testing and the outcome is shown below.

TC ID	TC Name	Code segment	TC description	TC precondition	Steps	Expected result	Tc result	Remarks
TCA01	Decision coverage	A	Check the pulse width to the portb.f4 and speed of fan	Closed room with a thermostat and gas stove.	Set the room temperature at 25°C,observe the speed of fan.	Fan on, with normal speed	Fan on, with normal speed	Working code segment A
TCA02	Decision coverage	B	Check the pulse width to the portb.f4 and speed of fan	Closed room with a thermostat and gas stove.	Set the room temperature at 38°C,observe the speed of fan.	Fan on, Increase the speed of fan than TCA01	Fan on, Increase the speed of fan than TCA01	Working code segment B
TCA03	Decision coverage	C	Check the pulse width to the portb.f4 and speed of fan	Closed room with a thermostat and gas stove.	Set the room temperature at 50°C,observe the speed of fan.	Fan on, Increase the speed of fan than TCA01 and TCA02	Fan on, Increase the speed of fan than TCA01 and TCA02	Working code segment C
TCA04	Decision coverage	D	Check the pulse width to the portb.f4 and speed of fan	Closed room with a thermostat and gas stove.	Set the room temperature at 50°C,observe the speed of fan.	Fan on, Increase the speed of fan than TCA01 , TCA02 and TCA03	Fan on, Increase the speed of fan than TCA01 , TCA02 ans TCA03	Working code segment D
TCA05		E	Check the pulse width to the portb.f4 and speed of fan	Closed room with a thermostat and gas stove.	Set the room temperature at 70°C,observe the speed of fan.	Fan on, Increase the speed of fan than TCA01 , TCA02 , TCA03 and TCA04	Fan on, Increase the speed of fan than TCA01 , TCA02 , TCA03 and TCA04	Working code segment E
TCB01	Decision coverage	F	Check the intensity of bulbs	Closed room with laptop for change the brightens.	Adjust the brightness of laptop at 85% and face it on LDR sensor. Read the current on output bulb circuit.	Light on. Current 5V	Light on. Current 5V	Working code segment F
TCB02	Decision coverage	G	Check the intensity of bulbs	Closed room with laptop for change the brightens.	Adjust the brightness of laptop at 75% and face it on LDR sensor. Read the current on output bulb circuit.	Light on. Current 3.5V	Light on. Current 3.5V	Working code segment G

TCB03	Decision coverage	H	Check the intensity of bulbs	Closed room with laptop for change the brightens.	Adjust the brightness of laptop at 55% and face it on LDR sensor. Read the current on output bulb circuit.	Light on. Current 2.75V	Light on. Current 2.75V	Working code segment H
TCB04	Decision coverage	I	Check the intensity of bulbs	Closed room with laptop for change the brightens.	Adjust the brightness of laptop at 35% and face it on LDR sensor. Read the current on output bulb circuit.	Light on. Current 1.75V	Light on. Current 1.75V	Working code segment I
TCB05	Decision coverage	J	Check the intensity of bulbs	Closed room with laptop for change the brightens.	Adjust the brightness of laptop at 15% and face it on LDR sensor. Read the current on output bulb circuit.	Light on. Current . 0.75V	Light on. Current . 0.75V	Working code segment J

TCC01	Statement coverage , Decision coverage	K	Detect the human presence	Closed room with living human body	a)Move the human body in front of PIR sensor	Whole circuit activated	Whole circuit activated	Check the TCC02 to complete the human presence testing
TCC02	Statement coverage , Decision coverage	K	Detect the human presence	Closed room	b)don't move the human body in front of PIR	Whole circuit deactivated	Whole circuit deactivated	Working code segment K

2.3 Advantages and limitations

2.3.1 Advantages

- The aim and main advantage of using this system is to save energy.
- There is no need of switches for each fan and bulb, which reduces the hardware cost.
- The power consumption of the system is negligible compared to the enery that can be saved by using the system.
- Size and cost of the system is considerably less.

2.3.2 Limitations

- The system entirely depends on a timer because of which the system will be deactivated after a fixed time interval after the person leaving the room.
- The PIR sensor needs a warm up time of 2 minutes, only after which the system will start working.
- PIR sensor cannot detect a stationary or very slowly moving body - if the sensor was set to the required sensitivity, it would be activated by the cooling of a nearby wall in the evening, or by very

small animals. Similarly, if someone walks straight towards a PIR sensor, it will not detect them until they are very close by.

- PIR sensors are temperature sensitive - they work optimally at ambient air temperatures of around 15-20 degrees Celcius. If the temperature is over 30 degrees, the field of view narrows and the sensor will be less sensitive. Alternatively, if the temperature is below 15 degrees, the field of view widens and smaller or more distant objects will activate the sensor.

2.4 Future extensions if possible

- We except that our next generation will develop this energy saving system with wire less network. In our project we connected all the sensors to micro controller with the wires. This can be developed with wire less such that we can place different sensors in different places. This sensor will activate the micro controller with the signals instead of using wires.
- Another increment possible is including an air conditioner to the system. The air conditioner can set the temperature in the room as needed.
- Another increment we are planning to form a PC interface which will be more users friendly. It can display the details about the temperature and lighting status of the room and the user can interactively adjust the temperature and intensity ranges.
- Another one is to implement the system successfully in any shopping malls or factories. It will help to save large amount of energy by reducing wastage.

Chapter 3

Conclusion

This project aims to implement Intelligent power saving system. Intelligent power saving system can be used in places like where lighting is very important. The libraries will be well illuminated with many lamps. When people are not present at a reading place the lighting can be made OFF and when they are present, the lighting made ON. All these can be done through by Dimming circuit and PIR sensor. Intelligent power saving system is not limited for any particular application, it can be used any where in a process industries with little modifications in software coding according to the requirements. This concept not only ensures that our work will be usable in the future but also provides the flexibility to adapt and extend, as needs change.