

Online Automatic Switch of Appliances

Lorissa Joana E. Buenas*, Enrico M. Dalangin, Erwin Gabriel Masipag

Batangas State University ARASOF Nasugbu Campus, Nasugbu, Batangas, Philippines

*joan.esguerra@gmail.com

Abstract

The ONLINE AUTOMATIC SWITCH OF APPLIANCES enhances the traditional way of plugging and unplugging of appliances in certain location where the user can access the appliances online. It is composed of a desktop or laptop computer- that were used by the user in accessing the project, relay switches- which were used to convert small amount of current to trigger a large amount of current, router or modem - which were used to transfer internet signals, Arduino board- which were used to connect the switch to the server and the extension cord with sockets as the primary outlet. This study aimed to a better way to turn on or turn off the appliances. The Prototyping method served as the paradigm of the study.

The project yielded from different findings, for the development and completion. The study revealed that the project is much better compared to the traditional way of plugging and unplugging of appliances. With the proper instruction, guidance and setting up the project, two hundred sixty four respondents were selected to evaluate the project. The overall impression of the respondents as evaluated that result to very satisfactory in terms of acceptability.

Keywords: online, automatic switch, switch, appliances, arduino

1. Introduction

Through technology, many products and services are improved rapidly and it makes life easy and comfortable. One example of this event is the automation of appliances by controlling their power supply. Home automation rapidly spreads around the modern world. Triggering devices and modules like sensors and timers give people ease to manipulate their appliances and it helps them a lot. After a while, knowledge about Information Technology gives automatic switches enhanced features and the most specific enhancement is the controlling appliances remotely.

With the use of embedded systems, microcontrollers help users to turn on/off appliances using codes developed by programmers with the use of specific programming languages. The concept of putting embedded microcontrollers to the circuitry of the appliance specially on the power supply part makes the world of manual system go crazy because a simple chip makes a simple appliance turn on or off on its own.

With the emergence of cell phones and SMS texting, Information Technology specialists developed a new concept on how to control appliances remotely. Through the help of SMS, controlling appliances is now more convenient. Information Technology developers built a module that will transfer text codes into program code to trigger the appliance. By this method, the user will just type the proper code set by the programmer and afterwards send it to the module, then the module will automatically process the code and execute the instruction. Because of this event, the world of automatic switching is enhanced to a different level.

Another thing that helps automatic switching is the developing of computers. Personal computer is a necessity nowadays and almost majority of the people in the world know how to use this device. A concept is

made that a simple computer can be a module itself. Through installing the right hardware and software, the users can make a simple automatic switching system without buying complicated microcontrollers.

Another event also catches the eye of the Information Technology world, the abundance of the internet in the whole world.. In the case of automatic switching, a concept of integrating the Ethernet and use network signals as triggers to activate or deactivate appliances remotely is a big concern.

In the world of networking, different devices such as servers and routers take place in controlling the flow of network signals. Many protocols like Transmission Control Protocol/Internet Protocol and Ethernet Protocol is the responsible of transferring network signals through IP addresses. These addresses determine the location of the information about the source and destination of the network signal to be transferred. When it comes to automatic switching, networking can help to improve the method of controlling appliances remotely.

With all of these different concepts, Information Technology specialists came up with a whole new concept, which is called online automatic switching. The term involves embedded systems with a twist of online networking in making a switch that can control appliances remotely. Through the online interface, users can monitor the power status of every appliance that is connected in the system in real time.

An online automatic switch will have a great impact not just in manual appliances but also on the Information Technology community. Because it will be a new discovery on the aspect of networking and programming and it will give more popularity to the people involved in the modern technology world. Therefore, a new phase of technology is enhanced to a newer level in just a period of time. From just a simple timer switch now it will be integrated into a more functional module that involves user and machine involvement.

The researchers proposed the Online Automatic Switch of Appliances to improve the technology to save electrical energy because users can control it automatically when you are in or outside of their home or school. The purpose of this is to secure user information, save electricity and prevent unforced accidents, especially fire, to occur in or outside the home or school. The proposed study is easy to manipulate appliances in your home or school, especially when the user forgot to turn the appliance on or off.

1.1 Statement of the Problem

The proposed study aimed to develop an Online Automatic Switch of Appliances.

Specifically, this study sought to the answer of the following:

1. Schematic representation of the Online Automatic Switch of Appliances.
2. Identify the materials to be used.
3. Evaluate the level of acceptability of the proposed project in terms of:
 - 3.1. Effectiveness;
 - 3.2. Efficiency;
 - 3.3. Maintainability
 - 3.4. Security;
 - 3.5. Simplicity; and
 - 3.4. User-Friendliness

1.2 Scope and Limitations of the Study

The Online Automatic Switch of Appliances is a technology that enables the people of Batangas State University ARASOF Nasugbu especially the College of Engineering and Computing Sciences faculty and staff to automatically turn off and turn on their appliances through the internet. This study focuses only in

the automation of turning the appliances off or on through the use of internet. It is also helpful for reducing the consumption of electricity because of the appliances that has been forgotten to turn off. This switch is managed by accessing an online site that involves the list of the sockets, status displays, on and off buttons and date and time notifications. Then, the user will click the on or off button of to turn on or off the flow of electricity on the said socket based on the user's decision. After that, the switch will send a network signal with the help of a router or modem regarding the instruction to the server PC or laptop to trigger the microcontroller. Then, the microcontroller will trigger the relay of the preferred socket and either cut or allow the flow of electricity on it to turn on or off the appliance that is connected to it. Users can register to the web page to gain access to the switch

However, the project has its limitations. In case of power failure and power loss in the area where the appliance is, the Automatic Switch of Appliances can no longer be used. Another case is if the person cannot access the internet or does not have an access to the internet the user cannot see the status of the appliances and the user is unable to turn off the appliance if it is on, because it is dependent to the internet. Although other mobile devices have access to the internet, the automatic switch does not support this feature and it cannot be used to view the status and control the switch. The appliances that are connected to the switch must have an electric current of five (5) amperes or less such as lamps, radios and chargers because the current relay cannot handle the electric flow if the appliance has a current of more than five amperes. The respondents of this study are faculty instructors and students of College of Engineering and Computing Sciences only.

2. Literature Review

Goodwin (1) states that home automation starts with controlling its appliances remotely through its power supply. By this method, appliances can be switched on or off automatically. The researchers developed a concept about making a simple product regarding automatic switching. The difference of the two concepts is that the product will not be installed in a house directly. It is because the funds regarding the study are sufficient for a simple set of appliances only.

Gitonga pointed out that automatic switching can be done through the use of SMS texting. SMS automatic switches are convenient because through SMS texting, appliances can be switched on or off remotely through the use of a code written in the message. The researchers developed a concept that will use a method to switch on or off appliances automatically. The difference is that the proponents will use networking via internet because with the internet, more security features can be applied to the software. Some examples are user information and login parameters. Therefore, the proposed study will be online-based only.

Kamal (4) described an embedded system as a simple device such as an appliance with a software program embedded in its circuitry. Through microcontrollers, these devices are controlled and manipulated remotely depending on the program inserted in the controller. The researchers developed a concept about using embedded systems for automatic switching. The difference is that the devices will be connected in a device that will accept Ethernet signals. Therefore the proposed study will be Ethernet-based only.

Banzi (17) explained that an Arduino Board is a simple microcontroller that is usually installed in small devices like cell phones. With the use of nanotechnology, large motherboards are converted into microcontrollers and arduino boards and it makes technology more simple and convenient. The researchers developed a concept about embedding Arduino boards to the appliances as a triggering device for automatic switching. The difference is that the program of the board will be connected in a server that will serve as a

receiver and transmitter. Therefore, the proposed study will be server-based only.

Ahmed, Wong and Kapila described Ethernet as a network protocol that helps send signal through the web. Every person that has internet access is using Ethernet as one of the network protocols in accessing the web. The researchers developed a concept about using internet as a primary transmitter in controlling the appliances remotely. Because people usually use internet in their daily lives, the users of the product can have a convenient way to access their appliances automatically.

Fourie and Rousseau (120) stated that a relay switch is a safety apparatus that uses an electromagnet to convert low voltages to higher voltages. The researchers used these switches to convert a 5V trigger from the arduino board to 220V required by the socket.

The American Heritage (343) said that a web page is a web-based document that presents text, images and links through the internet. The users communicate the web through the web pages within a website and through this process a web access begins. The researchers developed a concept that a webpage will be used as the primary interface on the proposed project because the study focuses on the internet access to manage the automatic switch.

Cohen (888) stated that Home Automated Control System is an automatic switch that enable appliances in a home to be switched on or off remotely. This system uses SMS texting as a triggering method. The difference between this research and the proposed study is that instead of SMS texts, the researchers used an online based interface that will trigger the module directly. Through this method, the system will have security and user-friendliness.

The Power Executive is a cheap automatic switch that controls and monitors the power status of an appliance remotely. This system also uses SMS texting as a triggering device just like the Home Automated Control System. It means that the user will have to install it first because it focuses on home automation. The difference of this research and the proposed study is that the product will have a stable interface because of the online parameters and users do not need to install it.

The Model TM810-10A switch used a timer that triggers the appliance to switch on or off depending on the user's needs. It helps a lot when the user is in the area to activate or set the device, but when there is no one around the device is just like a simple alarm clock. The difference of this research to the proposed study is that even though the user is away to the device, he/she can access it through internet access.

The Bye Bye Standby Switch is a module that used internet in triggering the appliances remotely. It has an interface that will trigger the module and it also shows the power status of the appliance. The only problem in this system is that it has no security features like usernames and passwords. The researchers developed a concept that they will develop a web site that can access the proposed project. The difference of the proposed study to the said research is that the security will be emphasized in make the online interface to make the system more secure.

Cañizares (2) described the GSM Based Lighting Control System Using Microcontroller is a program that enables the user to access the lights connected to the system through a microcontroller using SMS messaging. With the help of the system, the user can manage their lights remotely. Just like the Home Automated Control System, It uses SMS text and problems regarding it will also occur to this system. The researchers developed a concept that will apply the connection of the microcontroller to a module. The difference is that the module will be a server instead of a GSM module.

3. Methodology

In the development of the proposed project, the researchers completed different processes in

developing the physical and mechanical design of the project. It includes all the basic components that will be used to operate the proposed Online Automatic Switch. The researchers developed the project according to the following processes in the prototyping software development life cycle.

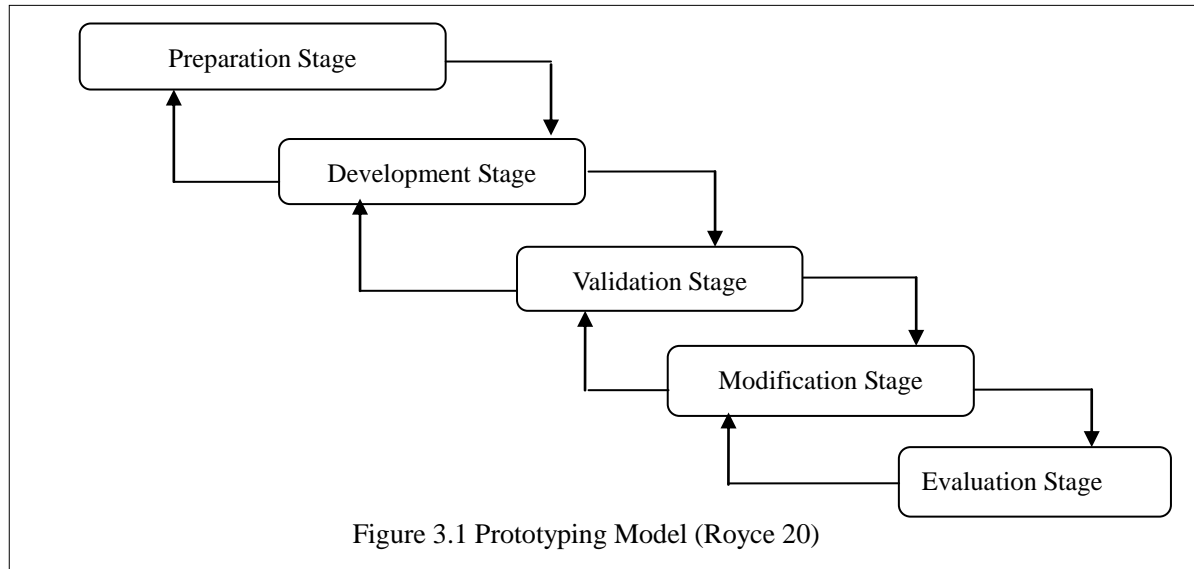


Figure 3.1 Prototyping Model (Royce 20)

Figure 3.1 demonstrated the processes regarding the prototyping model. In the process of prototyping, every stage of the process will have an output, or prototype, that can be modified again and again until the final product is finished. Preparation is an important stage in the development of the project. It involves the planning process where the objectives, alternatives, and constraints of the proposed project will be determined and analyzed in order to come up with approaches or strategies that are essential during the project life cycle. Development is the stage where the project will be developed based on the requirements and concepts built in the preparation stage. Validation is the stage where the prototype will be tested to ensure its reliability. If there are problems concerned, then modification is needed. Modification is the stage where the prototype of the project will be improved, changed or enhanced. Evaluation is the stage where the project will be tested by the users to have their comments and suggestions. Through this model, the project can be evaluated and improved without making changes to the requirements or design of the project.

PROGRAMMING PROCEDURE

The researchers will use the following programming languages:

1. ASP.Net with HTML and CSS;
2. MsSQL; and
3. Arduino Programming Language.

The researchers used HTML because it is the basic language for making a web page. With the help of CSS, the researchers can design the web page without typing too many source codes just for designing purposes only. Also, with the help of ASP.Net, the web page can send and retrieve information and access the database. The researchers will use Microsoft Visual Studio 2008 as a software package in making ASP.Net web pages. The researchers used MsSQL because it is the primary database in ASP.Net web pages. They used SQL Server Management Studio Express 2005 as a software package for making a local host database then afterwards they exported the SQL file to upload it in an web site with the ASP file. The researchers used Arduino Language because it is the programming language used to manipulate the arduino.

They used the Arduino IDE as a software package in using Arduino Language.

Schematic Diagram

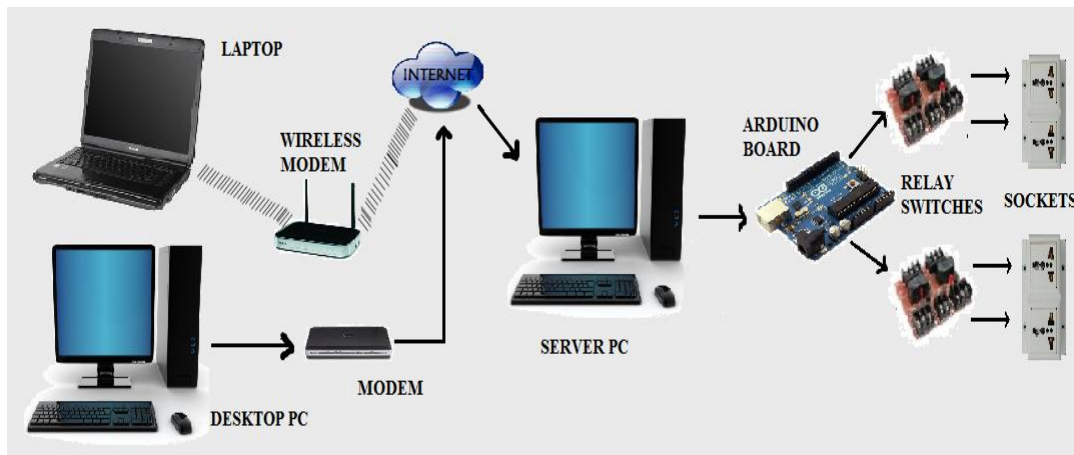


Figure 3.4 Schematic Diagram of the Project

Figure 3.4 shows the schematic diagram regarding the flow of the project. First, the users will access the website on the web with the use of a web browser of a desktop or laptop computer through a wired or wireless router or a modem. Then, the user will choose which socket/s will be managed. After the user makes a decision regarding the socket to be managed, the interface will send a signal to the arduino board connected to the computer or laptop through the serial to usb port. Then the arduino board will trigger the relay switch to trigger the socket either to cut the electricity flow or allow it.

3.1 Instrumentation

The researchers gathered the information from two hundred sixty-four (264) respondents. First, the researchers made a questionnaire and consulted it to their adviser and tribunal panel to gain correctness in regards to the questions. The questionnaire was consisted of a name, designation and date and six questions regarding the criteria in the statement of the problem. After that, the proponents reproduced the questionnaires. Afterwards, the researchers prepared for the evaluation of the proposed product.

3.2 Preparation and Evaluation

The researchers developed the proposed project based from the supplies and materials and proper hardware and software requirements. After developing the system, the researchers prepared the finished product with the questionnaire and distributed it to the respondents. After distributing it, the researchers discussed the proposed project and differences of it to the existing one. Then, the researchers collected the questionnaires for tallying.

Table 3.6 Guideline Interval for Questionnaire

SCALE	MEAN RANGE	DESCRIPTIVE EQUIVALENT
5	4.21 – 5.00	Excellent
4	3.41 – 4.20	Very Satisfactory
3	2.61 – 3.40	Satisfactory
2	1.81 – 2.60	Fair
1	1.00 – 1.80	Poor

Table 3.6 shows the ranges of each scale and their corresponding equivalents. The mean range is

based on the class interval between the lowest score which is one (1) and the highest score which is five (5). The formula for getting the class interval are as follows:

$$\text{Class interval} = (H - L)/C$$

By subtracting the H or highest score to the L or lowest score, the researchers will have 4 as its difference. Then, by dividing the difference to the C or number of classes needed which is five, we will have 0.80 as the quotient or the class interval itself. The lowest range is found by adding the lowest score to the class interval. Then, the other intervals follow.

Sampling Procedure

The researchers used random sampling procedure because it is the easiest way to gather respondents. The respondents were composed of seven (7) faculty instructors and two hundred fifty-seven (257) students of the College of Engineering and Computing Sciences because they are in the same department as the proponents and they are easy to convince.

In getting the samples for the student respondents we use the Slovin's formula to achieve it. By using this formula the proponents got the samples required for evaluation:

$$n = N / (1 + Ne^2)$$

$$n = 722 / [1 + 722(0.05)^2]$$

$$n = 722 / (1 + 1.805)$$

$$n = 722 / 2.805$$

$$n = 257.39 = 257 \text{ respondents}$$

Where n stands for the sample respondents required for the evaluation, N for the population that the proponents got the samples and e for the error tolerance. The error tolerance is achieved by getting the confidence level percentage and subtract it by 100 percent. For example, the proponents' confidence level is 95 percent and when it is subtracted to 100 percent, the difference of 5 percent or 0.05 will be its error tolerance.

Formula

The researchers used some formulas in order to determine some findings from the results of the evaluation. They are the weighted mean and the *t-test* formula.

In getting the weighted mean, the proponents used this formula:

$$WM = \frac{\sum f(v) = f_1v_1 + f_2v_2 + f_3v_3 \dots + f_nv_n}{S_s}$$

Where:

WM = weighted mean

f = frequency

v = value of the scale

S_s = sample size of the population.

In getting the significant difference between the proposed and existing system, the proponents used the *t-test* formula:

$$t = \frac{\Sigma D}{\sqrt{\frac{N \Sigma D^2 - (\Sigma D)^2}{N - 1}}}$$

Where:

ΣD – summation of the difference between the weighted mean of the proposed and existing system

ΣD^2 – summation of the squared difference between the weighted mean of the proposed and existing system.

N – number of criteria

4. Findings and Discussions

After tallying and analyzing the results of the respondents’ feedback about the existing and proposed system based on the questionnaires, the researchers developed different tabular presentations showing different criteria.

Table 4.3 Frequency Distribution of the Existing “Traditional Way of Plugging and Unplugging Appliances”

Criteria	Ratings					Weighted Mean	Remarks
	5	4	3	2	1		
Effectiveness	20	84	145	15	0	3.41	Very Satisfactory
Efficiency	23	72	163	6	0	3.42	Very Satisfactory
Maintainability	27	58	164	13	2	3.36	Satisfactory
Security	20	24	146	71	3	2.95	Satisfactory
Simplicity	40	63	153	8	0	3.51	Very Satisfactory
User-Friendliness	40	55	143	26	0	3.41	Very Satisfactory
Average Weighted Mean						3.34	Satisfactory

Table 4.3 presents the frequency of different criteria of the existing system based on the respondents’ feedback and their corresponding equivalents. The weighted mean is computed based on the formula discussed in chapter three. In the example, the weighted mean for the effectiveness of the existing system was computed. Almost all the criteria were rated Very Satisfactory except Maintainability and Simplicity which were rated Satisfactory. Also, the average weighted mean was rated Satisfactory.

Table 4.4 Frequency distribution of the proposed “Online Automatic Switch of Appliances”

Criteria	Ratings					Weighted Mean	Remarks
	5	4	3	2	1		
Effectiveness	120	92	48	4	0	4.24	Excellent
Efficiency	120	78	62	4	0	4.19	Very Satisfactory
Maintainability	121	89	47	7	0	4.23	Excellent
Security	120	75	65	4	0	4.18	Very Satisfactory
Simplicity	120	79	61	4	0	4.19	Very Satisfactory
User-Friendliness	122	71	69	2	0	4.19	Very Satisfactory
Average Weighted Mean						4.20	Very Satisfactory

Table 4.4 presents the frequency of different criteria of the proposed system based on the respondents’ feedback and their corresponding equivalents. The weighted mean is computed based on the formula discussed in chapter three. In the example, the weighted mean for the effectiveness of the proposed system was computed. Almost all of the criteria were rated Very Satisfactory except Effectiveness and Maintainability which were rated Excellent. Also, the average weighted mean was rated Very Satisfactory.

Table 4.5 Significant Difference between the Proposed and Existing System

Criteria	Weighted Mean of the Proposed System	Weighted Mean of the Existing System	D	D ²
Effectiveness	4.24	3.41	0.83	0.69
Efficiency	4.19	3.42	0.77	0.59
Maintainability	4.23	3.36	0.87	0.76
Security	4.18	2.95	1.23	1.51
Simplicity	4.19	3.51	0.68	0.46
User-Friendliness	4.19	3.41	0.78	0.61
			$\Sigma D = 5.16$	$\Sigma D^2 = 4.62$

Tabular value of t at 5 df, 5% = 2.02

Observed Value of t = 10.98

Table 4.5 presents the weighted mean of the existing and proposed system, the differences of the weighted mean of the proposed and existing system and their doubled products. Also, the *t-test* computation was being displayed. Since the observed value of t is greater than the tabular value at 5% level of significance, the mean of the proposed system is significantly different from the existing system’s mean. It further means that the proposed system has more features than the existing system.

After developing and completing the “Online Automatic Switch of Appliances”, the study yielded the following findings:

1. The level of acceptability of the existing system was 3.34 as evaluated by the respondents.
2. The level of acceptability of the proposed project was 4.20 as evaluated by the respondents.
3. The significant difference between the level of acceptability between the existing system and the proposed project was 10.98.

5. Conclusion

The researchers have several conclusions and observations during the development of the “Online Automatic Switch of Appliances”. From the findings of the study, the following conclusions are drawn:

1. The improvement of the traditional way of turning on/off of appliances was possible.
2. The overall impression of the respondents as evaluated was very satisfactory in terms of acceptability.
3. The Online Automatic Switch of Appliances could be used and implemented.

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