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Title of Research: MULTIPURPOSE SMS ACTIVATED PROGRAMMABLE TIMER SWITCH

Author: Julius Moises S. Albalos
University of Northern Philippines

Abstract:

The study aimed to design and develop a Multi-Purpose SMS Activated Programmable Timer Switch. Specifically, it utilized the mobile phone short messaging service (SMS) to activate the timer switch to the desired time in minutes. The device replies to the user the time set, which is equivalent to the time requested or texted by the user and the status of the switch if it is ON or OFF. Likewise, the user can interrupt the time or switch OFF the device by just texting STOP. Further, the user can inquire of the status if it is ON or OFF at the moment or the remaining time of the device by means of texting STATUS.

This study used the developmental method of research accomplished by the following: 1. Designing or programming the microcontroller to the desired function of the device; and, 2. Construct and test the device's functionality and performance. The study also used the descriptive method wherein the device was evaluated in terms of its technical feasibility, economic and financial viability, political and social acceptability.

The result of the study revealed a fully functional device that is used to switch on and off different appliances with the texting service of a mobile phone. The device performed an accurate Switch-Off Timer with a feedback message on the time set, status, stop, and info service. Evaluators strongly agreed that it is technically feasible, economic, and financially viable, politically, and socially acceptable.

The device is very much recommended for use hence should deal with quality inspections and or any matters concerning product utilization or commercialization.

Keyword/s: *Mobile, SMS Activated, Programmable, Timer, Electronic, Switch*

INTRODUCTION:

The fourth industrial revolution or what is popularly known today as Industry 4.0, is another breakthrough in the field of electronics, communications, and automation industries all over the world. These include advance computing (cloud and cognitive), cyber-physical systems, and the Internet of things (IoT).

Inventions and innovations keep going for the satisfaction of the needs of an individual and the society as a whole. With technology, they keep on finding ways to ease our work and improve production. At present, with the scheme in the automation and the internet of things, people find gadgets that could help in daily living. That even if people are far from home or workplace, they can still communicate and do other things through wireless technology.

With wireless communication between devices, people can remotely and or automatically control systems and processes to improve productivity. The interaction between things is possible whether near or far. With these possibilities, people can also do two or more things at the same time in different places and or wherever they are.



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Wireless automation is a process of controlling devices remotely at a distance at home, office, school, or workplaces. Today it is not only in a short range but...an infinite range. Anyone can remotely switch on and off devices anywhere in the world except of course with a dead spot.

Home automation is a trend these days by the electronics and communication industries. Busy people at work, especially those who have a little time to be at home because most of their time is consumed at work and travel (especially traffic), needs this home automation.

“Home automation is anything that enables you to use your home's lighting, heating, and appliances more conveniently and efficiently. It can be as simple as remote or automatic control of a few lights, or it can be a complete system that controls all major parts of your home, custom set to your personal preference. Home automation is anything that gives you remote or automatic control of things around the home.” (Introduction to Wireless Home Automation Technologies. (2018 March 10). Retrieved from [https:// www.vesternet.com/ resources/ introduction-to-wireless-home-automation-technologies/](https://www.vesternet.com/resources/introduction-to-wireless-home-automation-technologies/))

But do people need to automate home? Or do they need wireless control? Maybe a few somehow are aware of these automation and wireless controls, and many are unaware of it. As they find ways to save energy or to increase capabilities or wish to do things at home when they are away, automation and wireless communication as of today's technology make it possible.

Some reasons why people need automation and wireless control is that it can make tasks which are repetitive to be accomplished automatically. It can save money for electric bills as it automatically turns on or off lights and other electrical appliances, that sometimes they forget to do so. It is for home safety, as people can prevent accidents such as overheating of electrical devices, tripping or running into things as we aim for the light switches. It also helps manage time as they can do two or more things at the same time or even make tasks even when they are not around.

For these reasons, this study will provide a solution to these needs. With wireless control through the short messaging service of mobile phones for a highest possible range of control and the control of time to switch on and off devices, people will tend to spend time wisely as for those who find their time mostly at work and on travel. It also provides users the safety and security.

Objective of the Study

This study aims to:

1. Design and develop a multi-purpose SMS activated programmable timer switch.
2. Construct and Test the performance of the device.
3. Validate the device's Technical Feasibility, Economic/Financial Viability, Political and Social Acceptability.



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Conceptual Framework

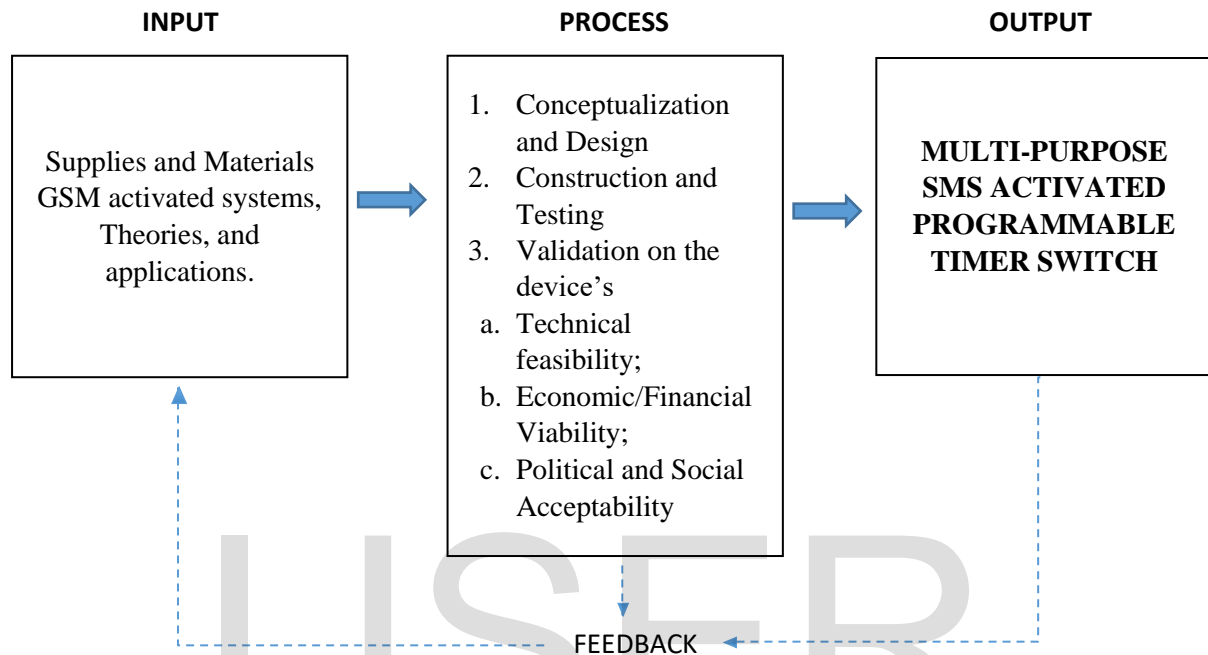


Fig.1. The Paradigm

The figure presents the guide of the researcher in the design and development of the Multipurpose SMS Activated Programmable Timer Switch. Conceptualization and design process was based on the different theories, current innovations and application systems, and the identification of the materials to be used. Construction of the device includes the design of the program that serves as the basis for its functionality and performance tests. A validation or evaluation will determine the level of its technical feasibility, economic/financial viability, and the political and social acceptability.

Theoretical Framework

Related works and literature were considered in the realization of the project. The theories and applications involved in the system which includes the Global System for Mobile (GSM), the Short Messaging Service, Microcontroller programming and control. Related studies and patented devices similar to the project served as prior arts.

Christensson, P. (2006), discussed and technically defined SMS that Stands for "Short Message Service" used for mobile phones in sending text messages. He said that these messages could be typically up to 160 characters in length but some services supports 224 characters. This service was originally used for GSM (Global System for Mobile) supported phones for communications, but now all cell phone systems support it.

Text messaging was most commonly used between friends, relatives, and co-workers. But now, it has several other uses as well, like, weather, news, sports updates, sales inquiries, and other business information.



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Devices like in this study display the power of SMS or the text messaging service through mobile phones definitely useful not only in the purpose above but as a trigger for a wireless switch.

As stated above, GSM stands for “Global Systems for Mobile” communications. It is a standard protocol for the second generation (2G) digital cellular networks used by capable mobile devices, developed by the European Telecommunications Standards Institute (ETSI). 2G capable mobile phones are used for SMS and full duplex voice telephony.

GSM modules are now being used together with a central processing unit (CPU) or a processor or microcontroller in developing wireless switching devices such as in this study. These modules allow you to customize and extend the applications of cellular communications into a useful or powerful remote controlling device.

Patented and other studies are also presented in this section that will serve as the basis later for the comparison or observations of the differences, variations or innovations made in the study.

Wahab et.al.(2010), developed a GSM-based control for a smart home system. They aimed to reduce electricity wastage by controlling the switching ON and OFF home appliances through the short messaging service from user’s mobile phone. They used a microcontroller and GSM network interface accomplished by an assembly language through an MPLAB software.

Another device developed for home automation, smart home control, and wireless control was made by Rao et.al.(2013), where smartphones with software application that is configured to control an electrical switch or outlet through WiFi. A unique identifier is set to access the control of an electrical switch. The mobile device and the electrical switch must be on the same wireless local area network.

Jiang et.al.(2008), made a utility model of an Intelligent Power Socket controlled by SMS. It consisted of a single-chip microcontroller, GSM transceiver, power supply, switch, relay, and plug/jacks. Same application was developed by Haldavnekar et.al.(2004), using mobile communications with mobile telephony capabilities. He called his work as Smart space appliance control.

Chinese inventors Fang Jing Fu et.al.(2014), developed a utility model of a fishpond aerator GSM control system that provides a solution to farmers in monitoring and controlling the environmental parameters in a fishpond in real time. This also utilizes different sensors like the oxygen sensor, ammonia nitrogen sensor, pH sensor, and water temperature sensor.

GSM Cellular phones are also being used in alarms and immobilizers. Bergen et.al.(1999), disclosed a security system called the CELL-EYE, designed to protect property, human life, vehicle theft or any intrusions that also provide automatic reporting via GSM mobile unit. The activation and deactivation of the alarm is through a call from the user’s mobile phone. It provides a sensing mechanism for security applications and also integrates an immobilizer when used in vehicles.

All of the cited studies and patented devices used GSM and or mobile phones but are of different features than the present study. The present study controls different appliances rated up to 2000 watts through text messaging. It switches ON or OFF a device or appliance



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by simply texting the time in minutes that we want the device to operate. Other features were discussed in the device description that makes it different from the rest.

Methodology

The study used the project method of research, where it involves the design and development, construction, and testing of a Multipurpose SMS Activated Programmable Timer Switch. The descriptive-evaluative process was also used in the validation of the device's Technical feasibility, Economic/Financial Viability, Political, and Social Acceptability. The instrument was adapted from the DOST TEEPS evaluation instrument and was modified to fit into the purpose of the study. Evaluators of the research output were experts in the field of electronics and end users. Inputs of the research were the materials used based on the different theories and applications of an SMS or GSM based applications and controllers.

Description of the Device:

With the infinite possibilities of wireless controls, this device is somewhat similar to other devices that control electrical switching through short messaging service(SMS) or the use of the Global Service for Mobile communication devices (GSM). The features and operation of the device make the difference from the other systems. Since the study used the Arduino development board and SMS modules, Arduino based SMS projects were the reference of the researcher in designing the personal preferences for an SMS controlled timer switch.

This Multipurpose SMS Controlled Programmable Timer Switch is a device that controls different appliances and related applications with just a text or SMS message corresponding to the time in minutes that the user wants to switch it ON. This feature makes it called programmable in the sense that you can set the time of operation (as a timer) wirelessly by texting, for example, the number "10" (without the quotation marks) if you want to switch ON the device for ten minutes. Other features include texting the word "STOP" to terminate the set time; texting "STATUS," to determine if the device is ON or OFF including the remaining time if it is ON; texting "INFO" will provide you the INPUT messages if you forgot. An automatic response will be texted back by the device such as the set time, current state (On or Off), terminated/stopped, and when the time is up.

The device can be controlled by anybody who knows the number. But you can set a master number by texting the word "SAVE" so that every time the device starts, it will send the master number a message "I am ready." The device should have a load for text messaging service from the service provider of the SIM card to reply via text. However, it still operates without a load, but you will not receive a confirmation or response from the device.

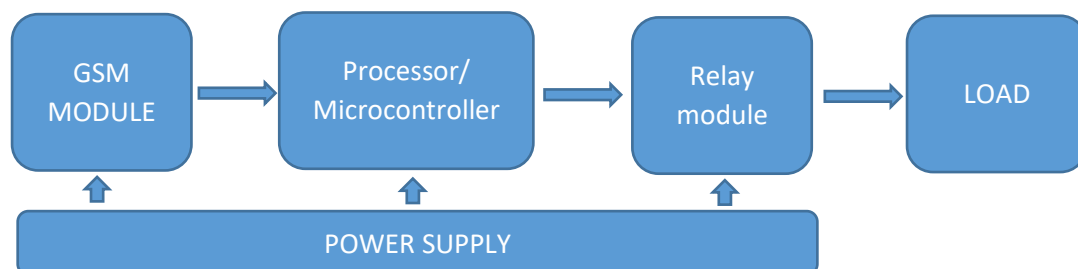



Fig.2. Block diagram of the Multipurpose SMS Controlled Programmable Timer Switch.



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Materials

Components	Figure	Description	Quantity
Microcontroller		A device the serves as the computer processing unit programmed to do input and output tasks. The study utilized the ARDUINO UNO R3.	1pc
GSM Module		SIM800L GSM module	1pc
Relay Module		5V relay module, HIGH/LOW activated, 240V/10A	1pc
Power Supply		9V 1A power supply	1pc
Receptacle and Plate Cover		Single receptacle wall mount	1pc
Enclosure		Wall mount switch box and Plate Cover	1pc
Connecting Wires		Assorted	2m



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AC CORD		AWG 14, 1m, with plug	1pc
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CONSTRUCTION PROCESS

1. Programming the microcontroller

The design and development of this SMS controlled programmable timer started with the concept of the features and operation. The features determine the code or program design. Features of which include the programmable timer via text input. Sending a text message corresponding to the time in minutes the user wants the device to operate. A confirmation text will be received by the user if successfully activated the device bearing the time set and the condition of the switch. The user can also stop or terminate the system by texting "STOP." Further, the user can inquire of the state of the device by means of texting "STATUS," and a confirmation message will be received bearing the time left and switch condition if it is ON.

These features were programmed to the microcontroller or processor.

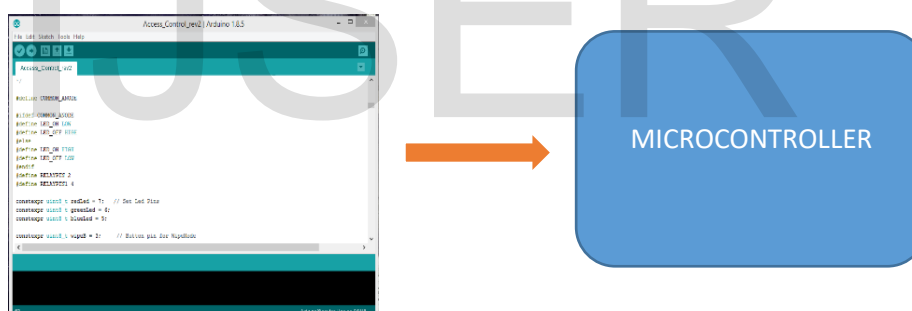


Fig.3. The Code programmed into the microcontroller.

2. THE CIRCUIT and CONNECTIONS

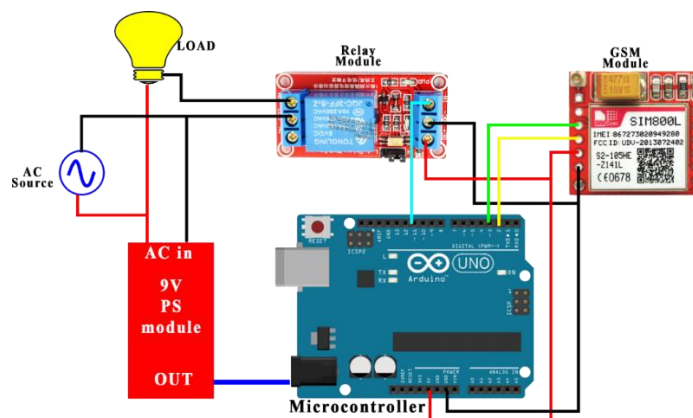


Fig. 4. The SMS controlled programmable timer circuit



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The figure presents the whole circuit of the device. It includes a microcontroller that is a program containing the tasks or operation and features of the device; a GSM module that serves as the SMS interface that sends and receives text messages; a relay module that switches ON and OFF the load from the low current to high current switching; and the power supply module that supplies all the parts of the circuit.

3. ENCLOSURE

The enclosure utilized in the study was a surface mount switch or receptacle box wherein a receptacle can be easily mounted. All the parts and components were placed strategically to fit in the box.



Fig. 5. The SMS controlled timer switch

TESTING AND EVALUATION PROCESS

The Multipurpose SMS Controlled Programmable Timer Switch was tested based on its designed features or operation.

Procedures in testing the device

1. The SMS controlled timer switch must be placed in an area where a GSM signal can be adequately obtained. Weak or no signal may cause the device not to operate properly like a delay in sending and receiving messages. Note: The device's reliability can be due to the Operator Network's system.
2. Insert SIM card to the Sim card slot of the device. Save the sim card number to your phone for sending requests or text command messages later.



Fig. 6. Sim Card Slot of the Device

3. Plug the device into a 220V line voltage. Wait around 25seconds to start and then text "Save" to the sim number to set your phone number as a Master number. Wait for a reply containing a text message "I am ready" then you can now send the text commands.



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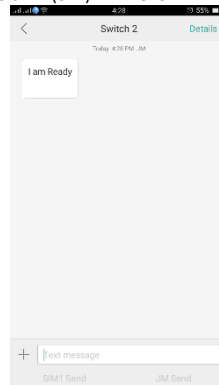


Fig. 7. Text Message from the Device on Startup

4. Text commands are the following:

- 1 up to 10080. Time in minutes to be sent from 1 minute up to approximately 168 hours (1week) to set the timer (i.e., text "10" without the quotation marks, will activate the device for 10 minutes). Note: Convert hours into minutes if it will operate in hours. The device confirms by texting back the time set in hours/minutes/seconds.

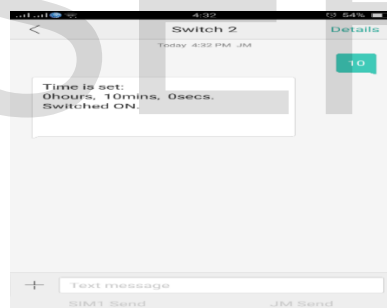


Fig.8. Command SMS and Reply for timer operation

When the time set is reached, the device sends a message "Time is up! Switched OFF".



Fig. 9. Time is up SMS message of the device



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- b. **STOP.** The device can be stopped immediately by texting "STOP". This will terminate the timer function and switch off the device. The device sends, "Terminated! Switched OFF" message to the sender's number.

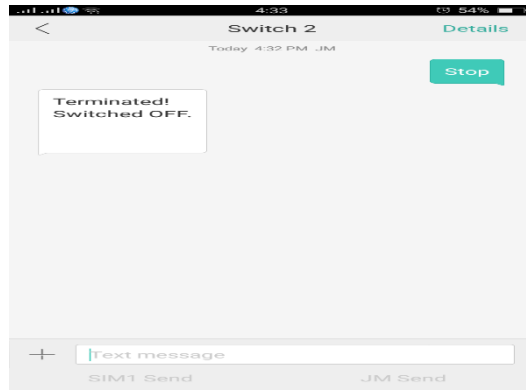
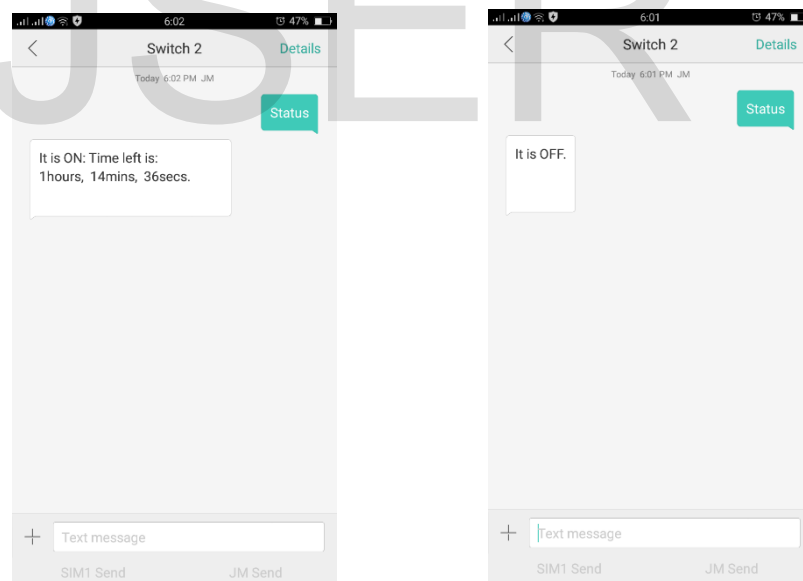


Fig. 10. SMS reply of the device when sent "stop."

- c. **STATUS.** The user can inquire of the state of the device by texting "STATUS". The device replies, "It is ON." plus the remaining time in hours/minutes/seconds if the device was activated; otherwise, it will send the



message "It is OFF."

Fig. 11. Device Status Messaging

- d. **INFO.** If the owner or user forgot the commands or inputs, he/she would just text "INFO", and the device replies the commands to be used as listed.



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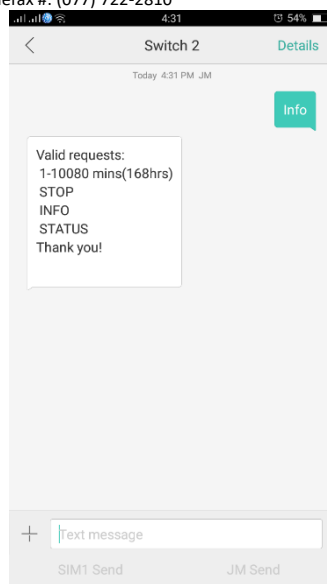


Fig. 12. Device info Service

Note: The device's SIM card must be subscribed in a text messaging service so that it can send a confirmation or reply messages.

EVALUATION

The SMS controlled timer switch was evaluated for its technical feasibility, economic and financial viability, and political and social acceptability. The table below shows the ratings of the device.

Table1. Level of the validity of the SMS controlled timer switch.

INDICATORS	Mean	Descriptive Rating
Technical Feasibility		
1. The device activates through the command messages.	5	Strongly Agree
2. The device sends confirmation messages or replies correspondingly based on the command.	5	Strongly Agree
3. Overall, the device is fully functional based on its features.	5	Strongly Agree
Sub Mean	5	Strongly Agree
Economic and Financial Viability		
1. The device's cost is in consonance with the price of materials based on the present SRP.	5	Strongly Agree
2. The device is not expensive or is affordable.	5	Strongly Agree
3. The device can be a way to minimize electric bills.	5	Strongly Agree
Sub Mean	5	Strongly Agree
Political and Social Acceptability		
1. The device does not violate any laws and regulations of the government.	5	Strongly Agree
2. The device is acceptable for use in homes and for any other related purpose.	5	Strongly Agree



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3. The device addresses problems in ensuring appliances to be turned off, especially when you are on-the-go.	5	Strongly Agree
4. The device promotes efficient utilization of energy or electricity.	5	Strongly Agree
Sub Mean	5	Strongly Agree
Grand Mean	5	Strongly Agree

Legend:

5 – Strongly Agree
4 – Agree

3 – Undecided
2 – Disagree

1 – Strongly Disagree

DATA ANALYSIS

The table shows the rating of the device in the different indicators along technical feasibility, the economic and financial viability, and the political and social acceptability. It clearly shows that all the items or criteria have passed the evaluators validation (Experts, End Users) with an overall mean of **5** or **Strongly Agree**. This means that the device is technically feasible that shows its full functionality as designed, economic and financially viable as the device is affordable, politically and socially acceptable, as it does not violate rules and regulations of the government and benefits users from its application.

SUMMARY

As automation and wireless applications with the present technology is providing, innovative, and useful devices that could be of great help to mankind are being developed. Short Messaging Service (SMS) of the Mobile Network providers is one of the best wireless communication systems. With its far range, anyone in the world can communicate with each other, and as used in this study, it triggers a programmable timer switch to toggle lights, electric fans, and other appliances from one state to another (Off to On and vice versa).

The Multipurpose SMS activated switch performed successfully in the switching of appliances with the different text messages set as a command. Time in minutes – sets the time or duration of the device to keep On. Stop – Terminates the set On time or switches OFF the device's relay. Status – able to reply about the state of the device if switched On or Off and the corresponding remaining time when On. Info – allowed the users to know the accepted commands.

FINDINGS

Findings showed the following:

1. This study designed and developed a Multipurpose SMS Activated Programmable Timer Switch with features based on the preference of the researcher.
2. The constructed device operates with the designed features that include setting the timer switch through texting time in minutes; terminating the set time by texting STOP; inquiring the state of the device if ON or OFF by texting STATUS, and inquiring text commands by texting INFO. The owner's cellphone number can also be saved to the device by texting SAVE. The device responds by texting back a message corresponding to the command.
3. The device was evaluated with an overall mean rating of 5 or all the evaluators Strongly Agreed in all the criteria in terms of its technical feasibility, economic and financial viability, and political and social acceptability.



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CONCLUSIONS

Based on the findings, the following conclusions were drawn:

1. The Multipurpose SMS activated programmable timer switch is a very functional device that enables the user in controlling lights, electric fans, and other appliances from far distances. With the personally preferred features, the device can be used easily or is user friendly.
2. The constructed device operates as designed.
3. The device is technically feasible, economic and financially viable, and politically and socially acceptable.

RECOMMENDATIONS

1. The device is very much recommended for use, especially for those people who are always On-the-Go hence should consider rigidity of the product.
2. The researcher should also consider all matters concerning product utilization and commercialization.

References:

Arduino. SMS controlled relays and LEDs. Retrieved from <https://create.arduino.cc/projecthub/FiDeNet/sms-controlled-relays-and-leds-2906ff>

Bergen, J.C.V. & Cilliers, P.J. (1998), WO2000017021A1 Alarm and immobilizer with gsm cellular phone. Retrieved from <https://patents.google.com/patent/WO2000017021A1/en?q=WO2000017021A1+>

Chinese Inventor. (2008). CN201307685Y CN Grant. Intelligent power socket based on short message service (SMS) control. Retrieved from <https://patents.google.com/patent/CN201307685Y/en?q=CN201307685Y>

Chinese Inventor. (2014). CN204102004U. Fishpond aerator GSM control system based on TC35. Retrieved from <https://patents.google.com/patent/CN204102004U/en?q=CN204102004U>

Christensson, P. (2006). *SMS Definition*. Retrieved 2018, Dec 1, from <https://techterms.com>

Haldavnekar, N. et al. (2005). US Patent No.20050071879A1. Smart space appliance control using a mobile communications device. Retrieved from <https://patents.google.com/patent/US20050071879A1/en?q=US20050071879A1>

Introduction to Wireless Home Automation Technologies. (2018 March 10). Retrieved from <https://www.vesternet.com/resources/introduction-to-wireless-home-automation-technologies/>



Republic of the Philippines
UNIVERSITY OF NORTHERN PHILIPPINES
Tamag, Vigan City
2700 Ilocos Sur

1987

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Telefax #: (077) 722-2810

Mohd Helmy Abd Wahab et.al. *GSM Based Electrical Control System for Smart Home Application* Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor Malaysia doi: 10.4156/jcit.vol5.issue1.4

Rao, S & Rao, R. (2014). *US Patent No.20140098247A1*. Home Automation and Smart Home Control Using Mobile Devices and a Wireless Enabled Electrical Switches.

Wahab, Abd et al. (2010). *GSM Based Electrical Control System for Smart Home Application* JCIT: Journal of Convergence Information Technology, 5 (1). pp. 33-39.

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