Journal of Namibian Studies, 31 (2022): 162-171 ISSN: 2197-5523 (online)

SMS – Operated Room Air-Conditioning Unit

Dr. Jonathan D. Tayabas

Abstract

The main purpose of the study was to design and innovate the SMS-Operated Room Air – Conditioning Unit. this was done by installing an arduino inside the control panel of the WAC unit which is operates based on the short messaging system (SMS). For this study, the turning ON and OFF function of the WAC unit was done with by sending the appropriate keywords with the use of a mobile phone. The special feature of this device was its auto-reply in which the unit is programmed to notify the sender of the current status of the unit. The advantage of device is to allow the owner to turn ON and OFF the unit even at considerable distance for as long as there is a network signal in the area. In addition, the user is informed of the current status of the WAC unit. The study was conducted at Bohol Island State University Bingag Extension Campus during the academic year 2016-2017. The researcher used the experimental research design during the assembly and testing of the device and descriptive research design to determine its acceptability. There were thirty (30) respondents from BSIT and DIT major in Refrigeration and Air-Conditioning Technology who evaluated the acceptability of the device. The data were collected using an observation guide to determine its functionality, and a questionnaire with five criteria such as functionality, convenience, safety, durability and cost, which consist of formulated questions with the corresponding rating for acceptability assessment. It was observed that the device was able to successfully switch ON and OFF from different locations and was able to successfully send a reply to the sender of the current status of the unit. Based on the tabulated data, the operation of SMS- Operated Room Air – conditioning unit is functional based on desired operation. The researcher collected the questionnaire and evaluated, analyzed and interpreted the data. The data of the acceptability showed that the device earned a general weighted mean of 3.33 which confirms that the device was highly accepted to the respondents. However, it was recommended to expand the scope of operation of the device to include the control of its temperature setting, timer, fan speed and air-swing.

Keywords: Short Messaging System (SMS), Arduino, Air-Conditioning Unit.

Introduction

Short Messaging System (SMS) is one of the main applications of mobile phones today. Any mobile phone sold today should have at least SMS messaging capabilities, and in fact, nearly all users of any age know how to send and receive messages through mobile phones. Mobile phone with a built-in SMS application enables to send and receive SMS messages (Wei – Meng Lee, 2012).

SMS is available in most digital mobile phones that send short message also known as text message between phones and/or other handheld devices. Messages were sent via store-on-forward mechanism to a short messaging service center, which attempts to send to the recipient and possibly retry if the user is not reachable at a given moment (Brown, Shipman & Vetter, 2007). It is considered in the Global System for Mobile (GSM) communication group as a possible service for the new digital cellular system.

The GSM standard is developed as a replacement for the first generation analog cellular network and originally described as a digital circuit-switch networked optimized for full duplex voice telephony. This was expanded over time to include data communications. GSM is one of the latest mobile technologies using Smart Modern, which can easily be interfaced to embed Microcontrollers. Nowadays, using this technology makes automation possible (Lammle, 2015).

In line with this, as a product of modern technology, in order to establish SMS operated Room Air-conditioning, the researcher used an Arduino uno as brain of the device. Arduino uno is single-board microcontroller making use of electronics in multidisciplinary projects more accessible. An Arduino uno board consists of an Atmel 8-bit Automatic Voltage Regulator (AVR) microcontroller with complementary components to facilitate programming and incorporate it in other circuits. An important aspect of the Arduino uno is the standard way that connectors were exposed, allowing the CPU board to be connected to a variety of interchangeable add-on modules known as shields. Some shields communicate with the Arduino uno board directly over various pins, but many shields were

individually addressable via a PC serial bus, allowing many shields to be stacked and used in parallel. Official Arduino uno used the mega AVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega2560. A handful of other processors have been used by Arduino uno compatibles. Most boards include 5-volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the Lily Pad run at 8 MHz and dispense with the board voltage regulator due specific form factor restrictions (McRobert, 2013).

In order to create the SMS - Operated Room Air – conditioning unit, the Arduino uno was attached to the air – conditioning unit with the help of step-down transformer and AC and DC converter to produce 9 volts specifically for Arduino uno. The Arduino uno is connected to control relay. Control relay can enable and disable the electric connection if the Arduino uno received the text code. In general, the Arduino uno was only attached in the control the air – conditioning system.

Arduino uno can sense the environment by receiving input from a variety of sensor and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino uno programming language (based on Wiring) and the Arduino uno development environment (based on Processing). Arduino uno projects can stand-alone or they can communicate with software running on a computer (J. Young-Sik, P Young-Ho,R.H. Ching-Hsien, 2013).

As cited by Hambley that charges with like sign repel one another and unlike charges attract one another. It applies when the system of air – conditioner starts when it is being texted via SMS. Through such dynamics it allows the said machine to function properly. Without the application of the law of charges the air - conditioner could not achieve its full function. The atom of a piece of magnetic material is a magnet in itself. These atoms arranged themselves in to group called magnetic domain. The magnetic properties of a material depend on how the domains were arranged. In an unmagnetized piece of magnetic material, the domain arranged hardly when all the domains were lined up, the material was said to be magnetized.

On the other hand, Hertz theory states that frequency systems exist in form of transmitters and receivers or combined transmitters and receivers also called transceivers. The SMS frequency receiver must have the ability to receive the intended signals only. Intended signals include data and messages may serve as an example. The Transmitter and receiver must both be able to tune to one another and secure the signal being communicated. There were various ways of accomplishing this ultimate goal of SMS communication. Among the latest advents and greatest accomplishments of wireless data communications is the spread SMS technology (Hertz, 1880).

Inclined with this, Network theory is a representation of symmetric relations between separate objects. Association between separate objects was attain through links within networks. Like dialing telephone numbers to associate with other telephones. Linking networks provides the crucial relationships and associations between many objects of different types that were not from isolated pieces of information. On the other hand, the network flow must not be restricted or else the link is not instituted. Linking the network between the cell phone that sends the SMS keyword to the separate object- the Arduino uno, which was programmed to be the command server of the air – conditioner. As such, the separation between the (2) two objects and linking them through network confirms the theory (Baez, 2012).

It stated that it is not possible for heat to flow from a colder body to a warmer body without any work having been done to accomplish this flow. Energy does not flow spontaneously from a low temperature object to a higher temperature object. This precludes a perfect refrigerator. The statements about refrigerators apply to air – conditioners and heat pumps, which embody the same principles (Carnot, 1824). It is applied in the study since the researcher was using air – conditioner as an accessory to create SMS Operated Room air – conditioning unit and air – conditioner was a machine that is the best example was the second law of thermodynamics was applied.

These basic principles and policies state the support, scientific and technological research, the outcome of this studies contributes to the national development and can support and promote the use of scientific and technological research. Through this theory, principles, law and articles, the researcher was motivated to conduct the

scientific and technological research and study about the SMS operated Room air – conditioning unit.

Methodology

The researcher utilized the experimental method in conducting this study to design, evaluate and asses the level of performance and acceptability of the SMS - Operated Room Air – conditioning unit. Self-made questionnaires and an observation guide were used as instruments to gather data from the participants.

The study was conducted at Bohol Island State University Bingag Extension Campus. The researcher chose the university as the place of the study because it has the equipment and tools needed in designing the product. Furthermore, the experts were in the schools so it is easy for the researcher to approach them and seek some advice. The participants of the study were thirty (30) Bachelor of Science in Industrial Technology Refrigeration and Air-conditioning students. They were the respondents who observed the performance of the gadget as it was tested. They were chosen because they were familiar with some of the concepts applied in the study. Data were collected with the use of research instruments for the evaluation of the product.

Self-made questionnaires were formulated as the data gathering tool of the study. The questionnaires were used to assess the acceptability level of SMS operated Room air-conditioning unit. The researcher validated the questionnaires through pilot testing. This was the pilot tested to the thirty (30) Bachelor of Science in Industrial Technology Refrigeration and Air-conditioning students. This helped the researcher improved the questionnaires. An observation guide was also be used to gather data on the performance level of SMS – Operated Room Air – conditioning unit in terms of accuracy in generating results.

Results and Discussion

The researcher did the following preparation in order to design and assemble the device. First, the researcher designed a circuit diagram of SMS -operated Room air – conditioning unit. Second, the researcher searched the materials used in assembling the SMS – Operated Room air – conditioning unit. Third, the researcher canvassed the availability and affordability of the materials in the market or online market. Fourth, the researcher bought the right and

durable materials to be used in making the SMS operated Room air – conditioning unit. Fifth, the researcher prepared the tools and equipment to be used in making the device. Sixth, the researcher uploaded the AT commands for the Arduino uno and GSM shield and connect the air – conditioner to the relay which is connected to the Arduino uno and GSM shield. Seventh, the researcher inserted the sim card to the interfaced modules. Eighth, the researcher put all the components on its casing. Ninth, the researcher attached the casing containing the microcontroller to unit. Last, the researcher distributed questionnaire to the respondents at at Bohol Island State University Bingag Extension Campus.

Functionality of the SMS-Operated Room Air-Conditioning Unit

Item	Input (Text SMS)	Town	Trials	Operation	Description	Auto-reply
1	ON	Dauis	1	ON	Functional	Functional
			2	ON	Functional	Functional
			3	ON	Functional	Functional
		Tagbilaran	1	ON	Functional	Functional
			2	ON	Functional	Functional
			3	ON	Functional	Functional
		Inabanga	1	ON	Functional	Functional
			2	ON	Functional	Functional
			3	ON	Functional	Functional
		Jagna	1	ON	Functional	Functional
			2	ON	Functional	Functional
			3	ON	Functional	Functional
		Ubay	1	ON	Functional	Functional
			2	ON	Functional	Functional
			3	ON	Functional	Functional
2	OFF	Dauis	1	OFF	Functional	Functional
			2	OFF	Functional	Functional
			3	OFF	Functional	Functional
		Tagbilaran	1	OFF	Functional	Functional
			2	OFF	Functional	Functional
			3	OFF	Functional	Functional
		Inabanga	1	OFF	Functional	Functional
			2	OFF	Functional	Functional
			3	OFF	Functional	Functional

		Jagna	1	OFF	Functional	Functional
			2	OFF	Functional	Functional
			3	OFF	Functional	Functional
		Ubay	1	OFF	Functional	Functional
			2	OFF	Functional	Functional
			3	OFF	Functional	Functional

Switching ON and OFF with Auto-Reply

Table above shows the result of the trials in testing the functionality of the SMS-operated Room air-conditioning unit to turn ON and OFF and auto-reply. The researcher chose five (5) different venue from which the sender sent the SMS. It was observed that the device was able to successfully switch ON and OFF from different locations and was able to successfully send a reply to the sender of the current status of the unit. Based on the tabulated data, the operation of SMS-Operated Room Air – conditioning unit is functional based on desired operation.

Acceptability Level of SMS-Operated Room Air-Conditioning Unit

Criteria	WM	Description	Rank
FUNCTIONALITY			
1. The unit is on when the message received is "ON".	3.63	Very High	
2. The unit is off when the message received is "OFF"	3.57	Very High	**2**
3. Can operate anytime without losing functional ability.	3.30	Very High	
Average	**3.50**	**Very High**	
CONVENIENCE			
1. Easy to use and operate.	3.60	Very High	
2. Operation can be done even at far distance.	3.37	Very High	
3. Can operate in manual and automatic.	3.60	Very High	**1**
Average	**3.52**	**Very High**	
SAFETY			
1. No contact of electrical voltage and provided only 9V supply	3.33	Very High	
2. Free from fraud SMS.	3.37	Very High	**3**
3. Parts were properly installed.	3.47	Very High	

Average	**3.39**	**Very High**	
STABILITY			
1. The entire system can withstand series of testing.	3.33	Very High	**4**
Average	**3.33**	**Very High**	
Overall Average	**3.33**	**Very High**	

Table above presents the data for the level of acceptability of SMS – Operated Room Air – conditioning unit. It shows that the SMS – operated Room air – conditioning unit has general average weighted mean of 3.33. This data confirmed that the device was highly accepted to the respondents.

The respondents' perception towards the system in terms of functionality was rated with an average weighted mean of 3.50 which can be interpreted as highly acceptable since the result indicated that unit was able to successfully function according to its desired operation to switch ON and OFF the unit and sending back a reply of the current status of the unit.

In terms of convenience, the respondents' perception towards the system was rated with an average weighted mean of 3.52 which was interpreted as highly acceptable due to its ease of operation which can be done even at far distance, and its flexibility to operate manually and automatic.

The respondents' perception towards the system in terms of safety was rated with an average weighted mean of 3.39 which was interpreted as highly acceptable which indicates that the system is safe.

The respondents' perception towards the system in terms of durability was rated with an average weighted mean of 3.33 which was interpreted as highly acceptable and indicates that the system is durable.

Findings

Based on the data collected, the researcher came with the following findings:

1. The researcher found out that SMS – Operated Room Air – Conditioning Unit result based on the collected data was accurate in switching ON and OFF.
2. The product has a general average weighted mean of 3.32. The data confirmed that the product was highly acceptable in terms of its functionality, convenience, safety, durability and cost of materials.

Conclusion

Based from the data gathered, the researcher concluded that the SMS – Operated Room Air – conditioning unit was acceptable because it was functional, convenient, safe, durable and affordable.

Recommendations

The researcher formulated the following recommendations for future researcher, students, studies and the same applications.

1. Control the low, medium and high temperature of the unit using one interfaced module.
2. Customize air – conditioner casing to fit the control.
3. Customize the case to be used when the two modules have been attached to the unit.
4. Provide a single switch for two modules in turning on and off the Arduino uno and GSM shield, and it must be located in front of the unit with LED indicator.
5. Provide back-up power for the interfaced module.
6. Use some alternative and standard material to lessen the cost.

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