pySMOFI: ARDUINO-BASED FIRE AND SMOKE DETECTOR WITH SMS NOTIFIER

A Research Paper
Presented to the Faculty of the
Regional Science High School for Region 1
Bangar, La Union

In Partial Fulfillment
Of the Requirements for the Subject
Research IV

By

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June 2022

INDORSEMENT

This research entitled, **SMOFI: ARDUINO-BASED FIRE AND SMOKE DETECTOR WITH SMS NOTIFIER,** prepared and submitted by **Aaron Jay S. Garcia and Braedan Anthony Jorge H. Paguirigan,** in partial fulfillment of the requirements for the subject, **Research IV**, has been examined and is recommended for Oral Examination.

JAKE L. MANTILLA, LPT, MED-BIO
Research Adviser

This is to certify that the research entitled **SMOFI: ARDUINO-BASED FIRE AND SMOKE DETECTOR WITH SMS NOTIFIER,** prepared and submitted by **Aaron Jay S. Garcia and Braedan Anthony Jorge H. Paguirigan,** and in partial fulfillment of the requirements for the subject, **Research IV,** has been examined and is recommended for Oral Examination.

BERNARDO D. MAYRENA, JR.
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Approved by the Committee on Oral Examination on June 2022.

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Accepted and approved in partial fulfillment of the requirements for the subject **Research IV**.

AMERFINA D. NELMIDA, Ed. D.
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Over-all Chairman

This is to certify further that **Aaron Jay S. Garcia and Braedan Anthony Jorge H. Paguirigan** have completed all academic requirements for the subject **Research IV**.

AMERFINA D. NELMIDA, Ed. D.
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ACKNOWLEDGEMENT

First and foremost, the researchers would like to thank the **Lord Almighty God** for providing them with the wisdom and knowledge that enabled them to complete this study. Thank you for giving them the courage to confront all of the challenges that this study posed. Without Your assistance, this study would be impossible to complete.

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In addition, the researchers would like to thank their friends, classmates, mentors, and their classroom adviser for giving them technical assistance, help and support.

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Finally, the researchers would like to express their sincerest gratitude and deepest appreciation to all the people who contributed and unselfishly lent their hands, hearts and minds for the successful completion of this study.

To God be the Glory!

- **The Researchers**

DEDICATION

The researcher would like to offer this humble research paper to the Almighty Father for His unending love as He became their source of strength all throughout this study. Lord God, they present to you the fruit of their hard work to be blessed with your grace that it may become as one of their beautiful symbols of Your goodness.

Likewise, it is dedicated to their loving and supportive parents and friends who served as their inspiration and provider of endless piece of advice and never-ending words of encouragement. Also for the financial support, and sacrifices during the development of this work.

This piece of work is also dedicated to the members of the Bureau of Fire Protection, and particularly to the farmers as they've served as the motivation of the researchers to venture to this study.

And lastly, to their self for having the determination in accomplishing this work, and for never getting tired of this journey.

- The Researchers

ABSTRACT

This study aims to lessen the delay between the ignition of fire and the arrival of external help, especially the Bureau of Fire Protection, in order to lessen the damage caused by fire disasters. Using a smoke and fire detector and a GSM module, the device will inform the BFP of any fire upon detection through SMS text. This research will significantly benefit both the victims and rescuers of such incidents, allowing for a more immediate response to fires. In order to assess the device's acceptability, questionnaires were given to the respondents. The farmers of Bulbulala, Balaoan, La Union and the BFP members of the same municipality gave their unbiased scores, evaluating the device's functionality, usability, efficiency, maintainability, and portability. After careful analyzation of data, the device's level of acceptability was determined to be "Very Highly Acceptable."

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CHAPTER 1

INTRODUCTION

In many cases of disasters, fire disaster is one of the accidents that causes a lot of devastation. Casualties of this disaster often receive huge losses. Belongings are burned, buildings and real estate get damaged, and lives perish.

About 2.5 to 4.5 million fires occur every year, and 21 to 62 thousand deaths are recorded as fire casualties. Such number of fire accidents can be lessened if it is systematically planned to prevent casualties and losses (J. D. Urrutia et.al 2018).

Approximately 90 people die every year in a domestic fire in Sweden. The number has not changed significantly during the last two decades, in spite of information campaigns and an increased use of smoke detectors and fire extinguishers in homes. In recognition of this, the Swedish Civil Contingencies Agency initiated and funded a research program to investigate why the number has not decreased and what could be done in Sweden in order to reduce the fatalities in Sweden in residential fires. This work is a first step in that process where fire fatalities statistics are studied from other countries together with measures taken in these countries to lower the number of fatalities in residential fires (D. Windberg 2016).

Costs due to losses from fire are estimated at approximately 1 (one) percent of global GDP per year, with the death toll in Europe alone reaching several thousands. Fire safety cannot be taken for granted and therefore a national fire strategy must be part of any national risk management or disaster risk reduction strategy. (The Geneva Association Staff 2016).

Year 2017, the BFP recorded a total of 77,724 fire incidents, or an average of 15,545 fire incidents every year or 42 fire incidents a day. During the period, the total estimated damage to property reached P23.273 billion or an average of P4.65 billion every year. Also during the period, 1,257 people were killed or an average of 251 deaths every year. The top three causes of fires are electrical connection, lighted cigarette butt and open flame. Fire originating from electrical connections may either be triggered by electrical overload, electrical arc or electrical short circuit (The Bureau of Fire Protection 2017).

As stated to the Annual Accomplishment Report of Bureau of Fire Protection (2015), the effect of fire should not be taken lightly. It damages properties and even take lives. Several factors are contributory to the amount of the property damage. Some fire may not reach a critical level but could result to a very substantial damage to property if it occurred in a business or industrial area. However, a fire could reach the 3rd alarm call but the damage may not be sizable if people were able to salvage their properties before the critical alarm. In 2014, there was an estimated property damage of 3.30 billion while this 2015, there was 3.62 billion. A 9.70% increase was recorded from 2014. This is due to fire incidents in business and industrial areas.

Early detection of fire and the presence of Fire Alarm Systems is indeed a good practice for different establishments and is a requirement for an issuance of building permit on the Bureau of Fire Protection. The manual system is one of the many forms of fire alarm systems. So, if someone spots a fire, they may activate the call points on the wall and send off the alarms. Automatic fire detection is the next right alternative. So, if a fire breaks out in a room, a detector will recognize it and activate the fire alarm. Most suitable system is determined by the working environment. A manual system may be effective if people are usually working in a specific environment; but, if there are places where people aren't working and don't go into on a regular basis, an automatic fire detection system may be the better option.

This study is a significant endeavor in our society. In various places with high risk of fire particularly in North Luzon where the majority of farmers reside, with regards of fire management is highly needed, especially for the safety of the farmers and the residents as well as the safety of the crops and stored barns. The development of SMOFI will provide the necessary and preliminary actions for fire incidents in the different farmer’s houses and barns.

The study will be conducted at Purok 6, Bulbulala Balaoan, La Union on November 2021 – January 2022. A total number of Twenty (20) respondents from Purok 6, Bulbulala Balaoan, La Union and from the Bureau of Fire Protection in the Municipality of Balaoan are the main repondents of the study. Likewise, this study only focuses on sensing fire and smoke and signaling the Bureau of Fire Protection to take action. Furthermore, the device cannot put out the fire or smoke it is detecting.

The study aims to design and develop an Arduino-Based Fire and Smoke Detector with SMS Notifier

Specifically, it sought to:

1. What is the level of acceptability of the device in terms of:
    a. Functionality
    b. Usability;x`
    c. Efficiency;
    d. Maintainability; and
    e. Portability

Arduino - refers to the micro controller that act as a brain of the device.

Arduino Technology - refers to the device which is the main component to design and develop to the study.

***Battery* -** refers to a power supply that will help the device to function with the help of its available currents.

***Buzzer* -** refers to the device that acts to inform the users in case of fire.

***Fire detection* -** it refers to the device that will detect a fire.

***Fire Detection and Notification Using Arduino Technology* -** refers to the study where the researcher aims to achieve.

***GSM Module* -** a programmable module that is capable to input all the data that is needed to the study from the end-users.

***Level of Acceptability* -** refers to the goal of the study.

***functionality* -** refers to the purpose of the developed device.

***Usability* -** refers to the usefulness of the device.

***Efficiency* -** refers to the prompt of the device.

***Maintainability* -** refers to the cost-friendliness of the device.

***Portability* -** refers to the adaptation of the device on a specific location.

***Smoke sensor* -** a module that is capable of sensing smoke in the area.

***SMS notification* -** a module that is capable to send a message to notify the end-users.

CHAPTER II

METHODOLOGY

This chapter revolves around the methods and processes that will be used throughout the conduct of the study. Subsequently, it includes the research design, materials and equipment, data gathering process, data management, and ethical considerations.

Research Design

This study will utilize a questionnaire survey adapted from the study of Imperial (2016) entitled Improvised Ice Bag Tier due to the property of questionnaires which lets respondents provide information that can easily be turned into quantitative data (Macleod, 2018). This will also allow researchers to garner primary data, which is data gathered from main sources through surveys, interviews, and others (Salkind, 2010). Upon collecting, the researchers will analyze and process the given data for evaluating the effects of the treatment given to the experimental group and its differences with the control group and to determine which will yield the best results in terms of functionality, reliability, usability, efficiency, maintainability, and portability.

Data Gathering Process

A. Gathering of Materials and Equipments

The device will be made from a piece of wood with the shape of a square. The square box will act as the body of the device. Inside the box will have an installed software like Arduino IDE. The Arduino Module comes with the required sensors, such as a flame sensor and a smoke sensor. In addition, a GSM module is connected to the Arduino module to alert the end-user if the device detects fire or smoke in its area. According to their intended use, the flame sensor, smoke sensor, and GSM module each have their own code. That is, they are coded separately and then compiled together to complete the system for the Fire Detection and Notification Using Arduino Technology.

B. Design and Development of the Device

When manufacturing the device, careful and precise planning of the shape and design is ensured in order to avoid misjudgments and errors. Then the parts and components can be gathered mainly from a nearby store, junkshop, and online shops. After that, the tool can be built in line with the carefully thought out layout and can be examined for better improvisation and finalization of the device.

C. General Procedures

The researchers will deploy the tool in front of the panel, providing information to users about how the device actually works and to ensure the device is effective and safe. A series of tests are then carried out in front of the panels and respondents, a fire will be made out of flammable sources for the device to detect and will then send an SMS notification to the panels.

D. Data Gathering

The researchers will use a questionnaire as the main instrument or tool in gathering and evaluating the device. Then the questionnaires will be given to the respondents from the residents (mainly farmers) of Purok 6 Bulbulala, Balaoan, La Union and to the Bureau of Fire Protection of Balaoan, Municipality to evaluate the level of usability of the device.

Table 1. The Treatments

T0	Commercial Fire Alarm
T1	Arduino-based Fire Alarm System With SMS Notifier

The quality of outputs will be included to determine which of the treatments will yield the best performance in terms of Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability. The overall outlook of the device will be evaluated using the rating scale below.

Table 2. Descriptive Evaluative Scale Range

POINT VALUE	STATISTICAL RANGE (WEIGHTED MEAN)	DESCRIPTIVE EVALUATIVE RATING
5	**4.51-5.00**	Very Highly Functional/Reliable/Usable/Efficient/ Maintainable /Portable
4	**3.51-4.50**	Highly Functional/ Reliable/Usable/Efficient/ Maintainable /Portable
3	**2.51-3.50**	Functional/ Reliable/Usable/Efficient/ Maintainable /Portable
2	**1.51-2.50**	Less Functional/ Less Reliable/ Less Usable/ Less Efficient/ Less Maintainable / Less Portable
1	**1.00-1.50**	Not Functional/ Not Reliable/ Not Usable/Not Efficient/ Not Maintainable/ Not Portable

Note. From "Fire Detection and Notification using Arduino Technology" (p.17) by Damayo et.al, 2019

Data Management

The answers of the respondents will be interpreted by getting the mean of their scores. In which, the researchers will have got the average or its central value. Since this study will use only the average scores, usage of this technique was of a great help to determine the results.

On the assessment of the accuracy, the mean of the results gathered will identify which treatment will have the best results in terms of Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability

Ethical Consideration

The researchers will refrain from plagiarizing information without proper citation and will only discuss statements verified through proper experimentation. Therefore, promoting the pursuit of information and facts which is the main goal of research. It adheres to ethical standards in command for the public's support, illustrating that the researcher followed the appropriate guidelines. Also, the study observed ethical behavior and complete work because it inspires an environment of trust, accountability, and mutual respect among researchers. Maintaining neutrality and validity were applied by the researcher for deceiving information, as well as subjective depiction of data findings will slacken the reliability of the researcher together with his/her study. Lastly, objectives and precision will be maintained because misleading information as well as biased depiction of gathered data will lessen the credibility of the researchers.

Experimental Procedure

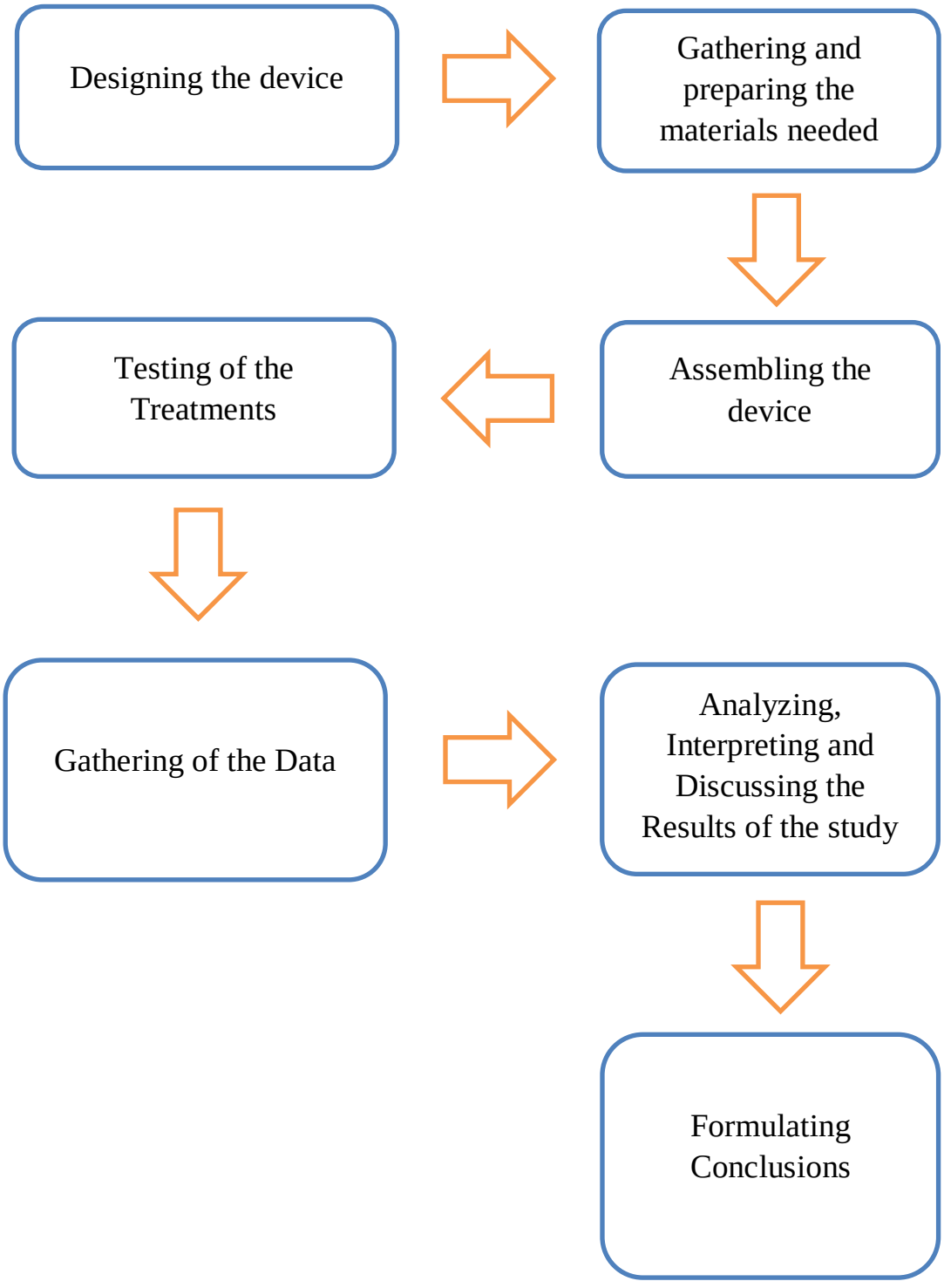

Figure 1. Flowchart of Data Gathering

CHAPTER III

RESULTS AND DISCUSSIONS

The SMOFI was tested through the evaluation of the respondents from the Bureau of Fire Protection in Balaoan as well as the farmers form Purok 6 Bulbulala, Balaoan La Union. This was tested in terms of functionality, usability, efficiency, maintainability, and portability.

Table 3. Functionality of the device

Item	Weighted Mean	Descriptive Equivalent Rating
1. The device is capable of performing the needed functions.	4.85	Very Highly Functional
2. The result as expected	4.45	Highly Functional
3.The device prevent unauthorized access	4.45	Highly Functional
Mean	**4.58**	**Very Highly Functional**

Table 3 shows the level of acceptability of the SMOFI as to functionality. The subitem “The device is capable of performing the needed functions” showed a significant result and has the highest mean of 4.85 and described as “Very Highly Functional.” The result indicates that the device was very useful to the users because of the device's immediate notification to the users when it detects fire or smoke, as well as the GSM module's ability to send SMS notifications to its end users. On the other hand, the subitem “The device prevent unauthorized access” has the lowest mean of 4.45 which was

described as “Highly Functional.” This means that other users who do not have permission to code the internal program will be denied access to the developed device.

The overall mean of the developed device in terms of functionality is 4.58, which is described as "Very Highly Functional." This means that SMOFI is functional to the user because it performs and fulfills the end-users' needs and expectations in terms of immediate response.

Table 4. Usability of the device

Item	Weighted Mean	Descriptive Equivalent Rating
1. The user comprehend how to use the device easily	4.75	Very Highly Usable
2. The user easily learns how to use the device	4.7	Very Highly Usable
3. The user can use the device without much effort	4.6	Very Highly Usable
Mean	**4.68**	**Very Highly Usable**

Table 4 shows the level of acceptability of the SMOFI in terms of usability. The sub item that has the highest mean in terms of usability is the first sub item, "The user comprehends how to use the device easily," with a mean of 4.75 evaluated as "Very Highly Functional" in the Descriptive Evaluative Rating. The second sub item, "The user easily learns how to use the device" got the second highest mean in terms of usability which is 4.7 that has a "Very Highly Functional" rating. The third and last sub item, "The user can use the device without much effort," got a mean of 4.6 which did not fall too far behind from the other two, thereby still getting a "Very Highly Functional" rating.

Taking into account the means of the different sub items, the overall mean in terms of usability is 4.68, garnering a "Very Highly Functional" rating in the Descriptive Evaluative Rating. This indicates that SMOFI can be easily used by anyone without having too much difficulty.

Table 5. Efficiency of the device

Item	Weighted Mean	Descriptive Equivalent Rating
1. The device has low delay	4.3	Highly Efficient
2. The device is efficient in detecting smoke or fire and sending sms messages	4.9	Very Highly Efficient
Mean	**4.6**	**Very Highly Efficient**

Table 5 shows the level of acceptability in terms of efficiency of the device. The sub item “The device has low delay” has gathered a score of 4.3 on which it is described as “Highly Functional.” This means that the device and the system provides necessary information in an instant to the users by sending SMS notifications automatically to the user/s and BFP stations if there’s and fire and smoke in the area. While the sub item, “The device is efficient in detecting smoke and sending SMS messages**”** got a score of 4.9 which means it falls into “Very Highly Efficient.” This proves that SMOFI is capable of detecting smoke or fire and sending SMS notification to the end user.

With this results, the overall mean in terms of efficiency of the device is 4.6 in which it falls under the “Very Highly Efficient” of the Descriptive Evaluative Rating. This means that the device is Efficient in performing the tasks needed.

Table 6. Maintainability of the device

Item	Weighted Mean	Descriptive Equivalent Rating
1.Faults can be easily diagnosed	4.35	Highly Maintainable
2.The device can be easily modified	4.45	Highly Maintainable
3. If adjustments are made, the device will continue to work.	4.45	Highly Maintainable
4.The device can be tested easily	4.7	Very Highly Maintainable
Mean	**4.48**	**Highly Maintainable**

Table 6 presents the level of acceptability in terms of maintainability. The highest mean was 4.7 by the sub item, "The device can be tested easily" and the lowest mean was 4.35 by the sub item, "Faults can be easily diagnosed," these two sub items brought out "Very Highly Maintainable" and "Highly Maintainable" ratings respectively.

The overall mean in terms of maintainability is 4.48, with a Highly Maintainable rating. This states that the device can be maintained without much effort and time.

Item	Weighted Mean	Descriptive Equivalent Rating
1. The device can be relocated to other suitable locations	4.75	Very Highly Portable
2. The device can be installed easily	4.45	Highly Portable
3. The device does not take up too much space	4.8	Very Highly Portable
Mean	**4.66**	**Very Highly Portable**

Table 7. Portability of the device

Table 6 shows the level of acceptability of the device in terms of portability. The sub item "The device can be relocated to other suitable locations "got the highest score of 4.75 and described as "Very Highly Portable." This means that the developed device can be used and moved to different locations, but keep in mind that it requires a signal connection to send an SMS notification to the end user. While the sub item "The device can be installed easily" has the lowest mean of 4.45 described as "Highly Usable." This proves that SMOFI and its components can be installed with ease.

Overall, the level of acceptability of the device in terms of portability got the mean of 4.66 described as "Very Highly Portable." This means that the developed device can be moved to any location where there is a slight dim light and the device does not take up too much space due to its small size. The device can be placed in any room of the house.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The researchers aimed to test the acceptability of the device through experimentation and surveys. The device SMOFI: Arduino-based fire and smoke detector with SMS Notifier was found to be an effective tool for detecting a fire using a flame and smoke sensor, according to the findings. The device's level of acceptability was determined to be "Very Highly Acceptable," which means that the developed device met all of the end user's acceptability criteria.

Recommendations

Based on the conclusions derived from the study, the following recommendations are suggested:

1. If at all possible, the device should be powered by clean and renewable energy sources, such as solar energy.
2. Adding a loud enough buzzer for the occupants to hear is highly appreciated.
3. To avoid hardware malfunctions, the device should be assembled thoroughly and with sufficient precision and accuracy.
4. The outer appearance of the device should be improved upon for a more pleasing image.

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APPENDICES

APPENDIX A

QUESTIONNAIRE ON THE ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name(Optional):_____

[ ] Farmers [ ] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

n

Scale	Descriptive Meaning
5	Very Highly Funtional/Usable/Efficient/Maintainable/Portable
4	Highly Functional/Usable/Efficient/Maintainable/Portable
3	Funtional/Usable/Efficient/Maintainable/Portable
2	Less Funtional/ Less Usable/ Less Efficient/ Less Maintainable/ Less Portable
1	Not Funtional/ Not Usable/ Not Efficient/ Not Maintainable/ Not Portable

ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.					
2. The result as expected					
3.The device prevent unauthorized access					
Usability	**5**	**4**	**3**	**2**	**1**
1. The user comprehend how to use the device easily					
2. The user easily learns how to use the device					
3. The user can use the device without much effort					

Efficiency	**5**	**4**	**3**	**2**	**1**
1. The device has low delay					
2. The device is efficient in detecting smoke and sending sms messages					
Maintainability	**5**	**4**	**3**	**2**	**1**
1. Faults can be easily diagnosed					
2. The device can be easily modified/reprogramed					
3. If adjustments are made, the device will continue to work.					
4. The device can be tested easily					
Portability	**5**	**4**	**3**	**2**	**1**
1. The device can be relocated to other suitable locations					
2. The device can be installed easily					
3. The device dos not take up too much space					

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

APPENDIX B

Republic of the Philippines
Department of Education
REGION I
LA UNION SCHOOLS DIVISION
REGIONAL SCIENCE HIGH SCHOOL FOR REGION I
MA. CRISTINA EAST, BANGAR, LA UNION

March 28, 2022

SINSP. AMANTE N. CASTILLO
Municipal Fire Marshall
Balaoan, La Union

Sir:

Warm greetings from the Regional Science High School for Region I!

We are pleased to inform you that the undersigned, Regional Science High School students are currently conducting experimentation in their research study in partial fulfillment of their requirements in Research 10. In this regard, may we respectfully request from your good office the conduct of **a Survey Questionnaire on the Arduino- Based Fire Alarm System with SMS Notifier** knowing fully that your institution is accredited in this endeavor. Rest assured that data to be gathered will be utilized according to its educational purposes only. We are looking forward for a positive response regarding this humble request in the name of noble cause of research.

Thank you.

Respectfully yours,

AARON JAY S. GARCIA

BRAEDAN JORGE H. PAGUIRIGAN
Researchers

Noted:

JAKE L. MANTILLA
Research Adviser

Recommending Approval
SINSP AMANTE CASTILLO
4-4-22

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PLATES

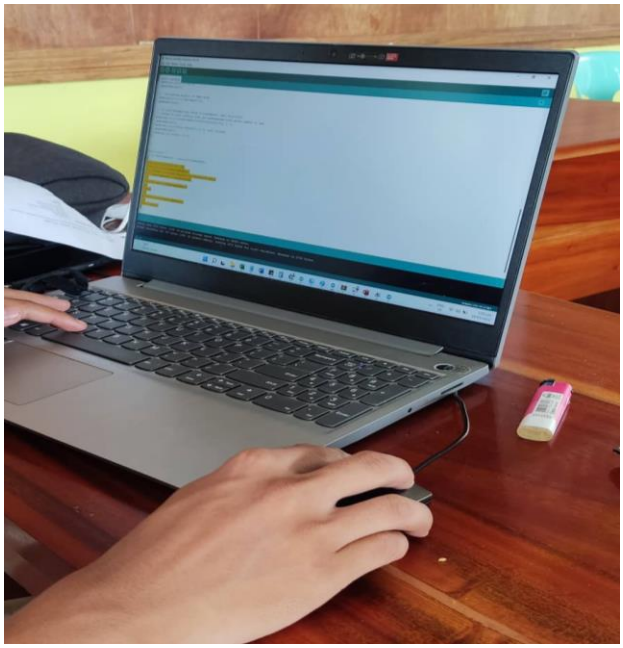

Plate 1. The researcher (Jorge) working on the program of the device

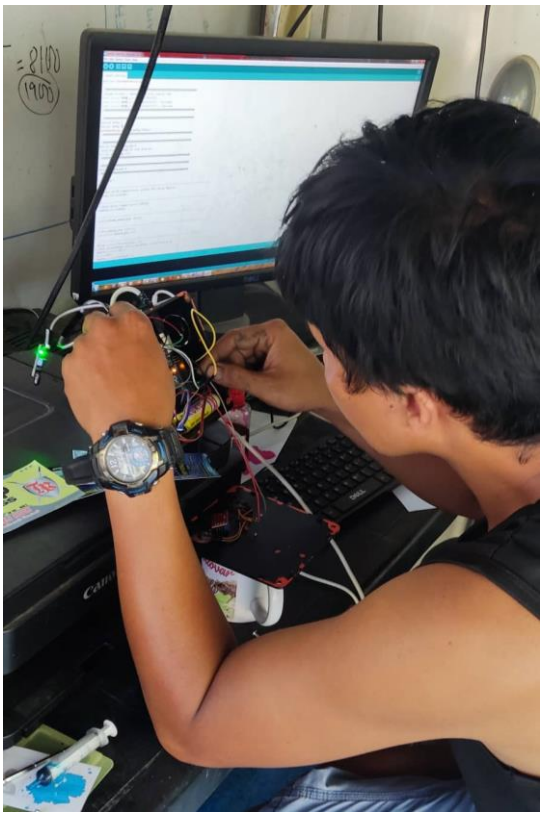

Plate 2. A Technician helping the researchers on their device

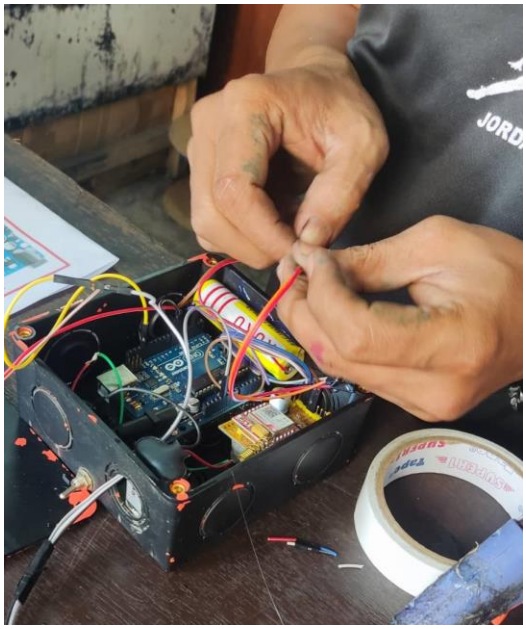

Plate 3. Double checking of the wirings

Plate 4. Examining the smoke detector

Plate 5. Final Assembly of the SMOFI

Plate 6. The Researcher (Aaron) Conducting experimentation on BFP employees

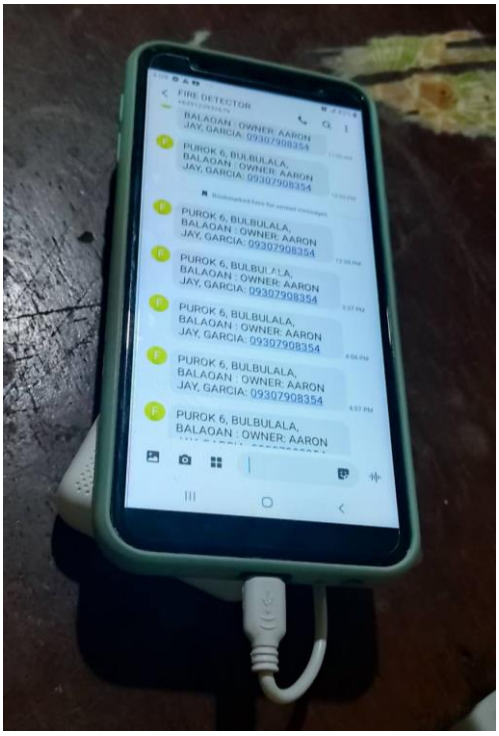

Plate 7. Receiving an SMS from SMOFI

Plate 8. Farmer A assessing the survey

Plate 9. Farmer B answering the survey

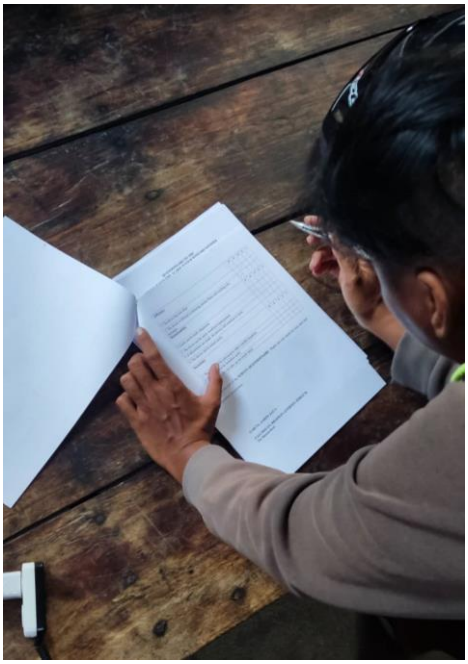

Plate 10. Farmer C answering the questionnaires

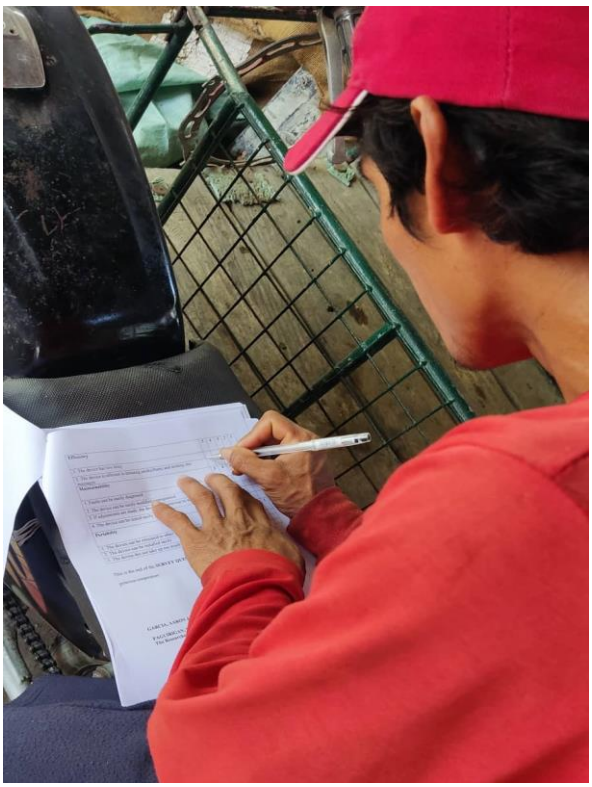

Plate 11. Farmer D answering the questionnaires

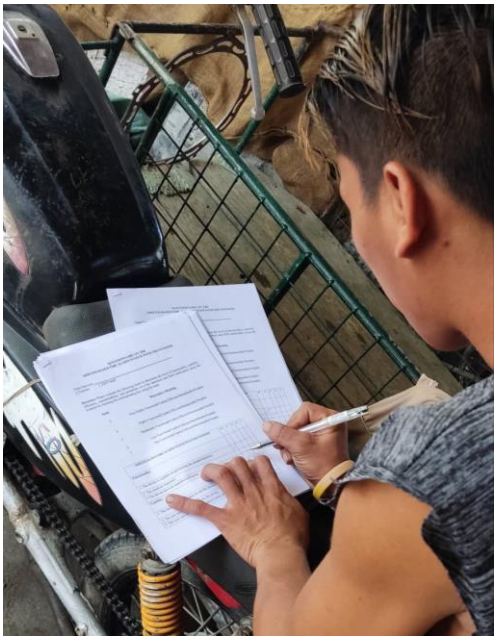

Plate 12.. Farmer E answering the questionnaires

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): FO3 Jhunar G Fauchoo
[ ] Farmers [✓] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

Scale	Descriptive Meaning
5	Very Highly Functional/Usable/Efficient/Maintainable/Portable
4	Highly Functional/Usable/Efficient/Maintainable/Portable
3	Moderately Functional/Usable/Efficient/Maintainable/Portable
2	Less Functional/Usable/Efficient/Maintainable/Portable
1	Not Functional/Usable/Efficient/Maintainable/Portable

ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected	✓				
3.The device prevent unauthorized access		✓			
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily	✓				
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort	✓				

Efficiency	5	4	3	2	1
1. The device has low delay		✓			
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed	✓				
3. If adjustments are made, the device will continue to work.		✓			
4. The device can be tested easily	✓				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations		✓			
2. The device can be installed easily		✓			
3. The device dos not take up too much space	✓				

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

The alarm should be made so that it can be easily recognize

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE II.
The Researchers

QUESTIONNAIRE ON THE
SMOFI - ARDUINO-BASED FIRE AND SMOKE DETECTOR WITH SMS NOTIFIER

Name (Optional): _____
[✓] Farmers [ ] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

Scale	Descriptive Meaning
5	Very Highly Functional/Usable/Efficient/Maintainable/Portable
4	Highly Functional/Usable/Efficient/Maintainable/Portable
3	Moderately Functional/Usable/Efficient/Maintainable/Portable
2	Less Functional/Usable/Efficient/Maintainable/Portable
1	Not Functional/Usable/Efficient/Maintainable/Portable

ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected			✓		
3.The device prevent unauthorized access			✓		
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily		✓			
2. The user easily learns how to use the device		✓			
3. The user can use the device without much effort	✓				

Efficiency	5	4	3	2	1
1. The device has low delay		✓			
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed	✓				
2. The device can be easily modified/reprogramed	✓				
3. If adjustments are made, the device will continue to work.		✓			
4. The device can be tested easily	✓				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations		✓			
2. The device can be installed easily			✓		
3. The device dos not take up too much space		✓			

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE II.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[✓] Farmers [ ] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

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1	Not Functional/Usable/Efficient/Maintainable/Portable

ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected		✓			
3. The device prevent unauthorized access		✓			
Usability	**5**	**4**	**3**	**2**	**1**
1. The user comprehend how to use the device easily	✓				
2. The user easily learns how to use the device		✓			
3. The user can use the device without much effort			✓		
Efficiency	**5**	**4**	**3**	**2**	**1**
1. The device has low delay	✓				
2. The device is efficient in detecting smoke/flame and sending sms messages		✓			
Maintainability	**5**	**4**	**3**	**2**	**1**
1. Faults can be easily diagnosed	✓				
2. The device can be easily modified/reprogramed	✓				
3. If adjustments are made, the device will continue to work.		✓			
4. The device can be tested easily	✓				
Portability	**5**	**4**	**3**	**2**	**1**
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily		✓			
3. The device dos not take up too much space	✓				

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[✓] Farmers [ ] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

Scale	Descriptive Meaning
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3	Moderately Functional/Usable/Efficient/Maintainable/Portable
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1	Not Functional/Usable/Efficient/Maintainable/Portable

ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected		✓			
3. The device prevent unauthorized access		✓			
Usability	**5**	**4**	**3**	**2**	**1**
1. The user comprehend how to use the device easily	✓	✓			
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort	✓				
Efficiency	**5**	**4**	**3**	**2**	**1**
1. The device has low delay		✓			
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	**5**	**4**	**3**	**2**	**1**
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed	✓				
3. If adjustments are made, the device will continue to work.	✓				
4. The device can be tested easily	✓				
Portability	**5**	**4**	**3**	**2**	**1**
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily		✓			
3. The device dos not take up too much space	✓				

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GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[✓] Farmers [ ] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected	✓				
3.The device prevent unauthorized access		✓			
Usability	**5**	**4**	**3**	**2**	**1**
1. The user comprehend how to use the device easily	✓				
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort	✓				
Efficiency	**5**	**4**	**3**	**2**	**1**
1. The device has low delay			✓		
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	**5**	**4**	**3**	**2**	**1**
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed		✓			
3. If adjustments are made, the device will continue to work.	✓				
4. The device can be tested easily	✓				
Portability	**5**	**4**	**3**	**2**	**1**
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily	✓				
3. The device dos not take up too much space	✓				

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QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[✓] Farmers [ ] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.		✓			
2. The result as expected	✓				
3.The device prevent unauthorized access	✓				
Usability	**5**	**4**	**3**	**2**	**1**
1. The user comprehend how to use the device easily	✓				
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort	✓				
Efficiency	**5**	**4**	**3**	**2**	**1**
1. The device has low delay		✓			
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	**5**	**4**	**3**	**2**	**1**
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed		✓			
3. If adjustments are made, the device will continue to work.		✓			
4. The device can be tested easily	✓				
Portability	**5**	**4**	**3**	**2**	**1**
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily		✓			
3. The device dos not take up too much space	✓				

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The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[/] Farmers [ ] BFP Staff

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	/				
2. The result as expected	/				
3. The device prevent unauthorized access	/				
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily	/				
2. The user easily learns how to use the device	/				
3. The user can use the device without much effort					
Efficiency	5	4	3	2	1
1. The device has low delay		/			
2. The device is efficient in detecting smoke/flame and sending sms messages	/				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed		/			
2. The device can be easily modified/reprogramed		/			
3. If adjustments are made, the device will continue to work.		/			
4. The device can be tested easily	/				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	/				
2. The device can be installed easily	/				
3. The device dos not take up too much space	/				

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

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The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	/	/			
2. The result as expected	/	/			
3. The device prevent unauthorized access	/	/			
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily		/			
2. The user easily learns how to use the device	/	/			
3. The user can use the device without much effort	/	/			
Efficiency	5	4	3	2	1
1. The device has low delay		/			
2. The device is efficient in detecting smoke/flame and sending sms messages	/	/			
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed	/	/			
2. The device can be easily modified/reprogramed	/	/			
3. If adjustments are made, the device will continue to work.	/	/			
4. The device can be tested easily		/			
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	/	/			
2. The device can be installed easily	/	/			
3. The device dos not take up too much space	/	/			

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
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QUESTIONNAIRE ON THE
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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected		✓			
3.The device prevent unauthorized access		✓			
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily	✓				
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort	✓				
Efficiency	5	4	3	2	1
1. The device has low delay		✓			
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed	✓				
3. If adjustments are made, the device will continue to work.		✓			
4. The device can be tested easily	✓				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily		✓			
3. The device dos not take up too much space		✓			

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GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

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[✓] Farmers [ ] BFP Staff

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected		✓			
3.The device prevent unauthorized access	✓				
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily		✓			
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort			✓		
Efficiency	5	4	3	2	1
1. The device has low delay		✓			
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed			✓		
3. If adjustments are made, the device will continue to work.	✓				
4. The device can be tested easily		✓			
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily		✓			
3. The device dos not take up too much space		✓			

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GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	/				
2. The result as expected		/			
3.The device prevent unauthorized access		/			
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily	/				
2. The user easily learns how to use the device	/				
3. The user can use the device without much effort	/				
Efficiency	5	4	3	2	1
1. The device has low delay	/				
2. The device is efficient in detecting smoke/flame and sending sms messages	/				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed	/				
2. The device can be easily modified/reprogramed	/				
3. If adjustments are made, the device will continue to work	/				
4. The device can be tested easily	/				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	/				
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PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	/				
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3.The device prevent unauthorized access		/			
Usability	5	4	3	2	1
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3. The user can use the device without much effort	/				
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1. The device has low delay		/			
2. The device is efficient in detecting smoke/flame and sending sms messages	/				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed		/			
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3. If adjustments are made, the device will continue to work		/			
4. The device can be tested easily	/				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	/				
2. The device can be installed easily	/				
3. The device dos not take up too much space	/				

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): SINSP. AMANTE HUYLAR CASTILLO
[ ] Farmers [✓] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

Scale	Descriptive Meaning
5	Very Highly Functional/Usable/Efficient/Maintainable/Portable
4	Highly Functional/Usable/Efficient/Maintainable/Portable
3	Moderately Functional/Usable/Efficient/Maintainable/Portable
2	Less Functional/Usable/Efficient/Maintainable/Portable
1	Not Functional/Usable/Efficient/Maintainable/Portable

ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.	✓				
2. The result as expected	✓				
3. The device prevent unauthorized access	✓				
Usability	5	4	3	2	1
1. The user comprehend how to use the device easily	✓				
2. The user easily learns how to use the device	✓				
3. The user can use the device without much effort	✓				
Efficiency	5	4	3	2	1
1. The device has low delay	✓				
2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	5	4	3	2	1
1. Faults can be easily diagnosed		✓			
2. The device can be easily modified/reprogramed	✓				
3. If adjustments are made, the device will continue to work.		✓			
4. The device can be tested easily	✓				
Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations	✓				
2. The device can be installed easily	✓				
3. The device dos not take up too much space	✓				

This is the end of the **SURVEY QUESTIONNAIRE**. Thank you very much for your time and generous cooperation.

- IT IS THE SIM CARD SEND THE MESSAGE WITHOUT LOAD.
- THE ALARM MUST BE LOUD ENOUGH TO BE HEARD BY THE OCCUPANTS.
- IT IS GOOD ENOUGH ALSO WHEN TO BE CONNECTED AT SOLAR CHARGER

GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): Sto. Numeriano C Master
[ ] Farmers [✓] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2	1
Functionality					
1. The device is capable of performing the needed functions.		✓			
2. The result as expected		✓			
3. The device prevent unauthorized access		✓			
Usability	5	4 ✓	3	2	1
1. The user comprehend how to use the device easily		✓			
2. The user easily learns how to use the device		✓			
3. The user can use the device without much effort		✓			
Efficiency	5	4 ✓	3	2	1
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2. The device is efficient in detecting smoke/flame and sending sms messages	✓				
Maintainability	5	4 ✓	3	2	1
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2. The device can be easily modified/reprogramed		✓			
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Portability	5	4	3	2	1
1. The device can be relocated to other suitable locations		✓			
2. The device can be installed easily	✓				
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GARCIA, AARON JAY S.

PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): [illegible]
[ ] Farmers [✓] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

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The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[ ] Farmers [✓] BFP Staff

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PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
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QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): _____
[ ] Farmers [✓] BFP Staff

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PAGUIRIGAN, BRAEDAN ANTHONY JORGE H.
The Researchers

QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

Name (Optional): Mr Rod Henry Glen N Gastar
[ ] Farmers [✓] BFP Staff

Direction: Please evaluate the following items to determine the level of functionality, usability, efficiency, maintainability, and portability of a fire detection and SMS notification using the Arduino by checking the corresponding box using the scale.

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QUESTIONNAIRE ON THE
ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER

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ARDUINO-BASED FIRE ALARM SYSTEM WITH SMS NOTIFIER	5	4	3	2
Functionality				
1. The device is capable of performing the needed functions.		✓		
2. The result as expected		✓		
3.The device prevent unauthorized access	✓			
Usability	5	4	3	2
1. The user comprehend how to use the device easily	✓			
2. The user easily learns how to use the device		✓		
3. The user can use the device without much effort	✓			

Curriculum Vitae

Name: AARON JAY S. GARCIA

Age: 16

Date of Birth: November 5, 2005

Gender: Male

Religion: Roman Catholic

Nationality: Filipino

EDUCATIONAL BACKROUND:
Secondary: Regional Science High School fo Region I ***Primary:*** Bulbulala Elementary School

Name: BRAEDAN ANTHONY JORGE H. PAGUIRIGAN

Age: 16

Date of Birth: Aril 6, 2006

Gender: Male

Religion: Roman Catholic

Nationality: Filipino

EDUCATIONAL BACKROUND:
Secondary: Regional Science High School fo Region I ***Primary:*** Saint Agustine's school