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DESIGN AND FABRICATION OF HUMIDIFIER SYSTEM FOR OYSTER MUSHROOM HOUSE

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Form 2.1

PALAWAN STATE UNIVERSITY
COLLEGE OF ENGINEERING, ARCHITECTURE & TECHNOLOGY
PUERTO PRINCESA CITY

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As a member of the Oral Examination Committee, we certify that we have examined this paper and hereby recommend that it be acceptable as partial fulfillment of the undergraduate requirement for the Degree Bachelor of Science in **Mechanical Engineering.**

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This research paper is hereby approved and accepted by the College of Engineering, Architecture and Technology as partial fulfillment of the undergraduate requirement for the Degree **Bachelor of Science in Mechanical Engineering.**

ABSTRACT

Oyster mushroom farming in Palawan was a growing business. The culturing of this kind of mushroom required certain atmospheric conditions namely air humidity and temperature. The oyster mushrooms in Palawan were still being farmed in a traditional way—the farmers sprayed water inside the mushroom house when they felt that the air was warm (Fuertes 2019). In connection, this research undertaking focused on the design and fabrication of an automatic humidifier system for the oyster mushroom house which maintained the relative humidity and temperature of air inside the mushroom house to the optimum range of values. In order to achieve the objective of this research work, the researchers created an Arduino Uno R3 program with GSM Module and Humidity sensor as main components. Furthermore a design of the mushroom house was made in order to conduct several testing for the functionality of the whole system. Based from the tests conducted, if the relative humidity inside the mushroom house decreased below 75%, the ultrasonic humidifier would automatically turn on. In contrast, if the humidity level increased above 75%, the ultrasonic humidifier would automatically turn off. As conclusion, the ultrasonic humidifier effectively functioned in a certain period of time depending on the present climatic conditions. The device also operated quickly and performed low time delays on powering on/off the ultrasonic humidifier and sending notifications through SMS by GSM Module. Lastly, the researchers recommended that another study should be conducted regarding the system and suggested some parts to be installed as further improvement.

Keywords: Humidifier System, Humidity, Oyster Mushroom, Arduino Uno R3, GSM Module

CERTIFICATION OF PROOFREADING

This is to certify that the undersigned has reviewed and went through all the pages of the thesis / research paper entitled "**Design and Fabrication of Humidifier System For Oyster Mushroom House**" by **Joy Ezra S. Bacuel, Alfred Stephen G. Bayhon, Virinis A. Calingao and Owen A. Entia**, aligned with the set of structural rules that govern the composition of sentences, phrases, and words in the English language.

Signed this 25th day of March in the year of our Lord, 2019 at the College of Engineering, Architecture and Technology, Palawan State University, Puerto Princesa City, Palawan, Philippines.

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TITLE:

DESIGN AND FABRICATION OF HUMIDIFIER SYSTEM FOR OYSTER MUSHROOM HOUSE

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LIST OF RECOMMENDATIONS:

TESTING
DATA FROM PAGASA (CLIMATE CONDITIONS IN PALAWAN)
INCLUSION OF PROGRAM CODES
CAPTIONS IN EVERY FIGURE AND TABLES
CLASSIFICATION OF OBJECTIVES
SCHEMATIC DIAGRAM
BLOCK DIAGRAM
CONCEPTUAL / THEORETICAL FRAMEWORK
METHODS
LIST OF TABLES
LIST OF FIGURES

(Use additional sheet/s if necessary)

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JESB
ASGB
VAC
OAE

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CHAPTER 1
INTRODUCTION

Background of the Study

Oyster mushroom is type of edible fungi which grows with a strict requirement of environment and atmosphere. Despite the difficulty of growing and cultivating this kind of mushroom, its yummy oyster taste became an impetus for the mushroom growers to farm this kind of fungi (Zadrazil and Kurtzman, 1981).

Oyster mushroom farming was present in all parts of the globe. In the Philippines, this kind of farming also exists (Al Amin, 2004).

In Palawan, the oyster mushroom farmers uses the manual method of humidifying and cooling the atmospheric air. Such difficulty and cumbersome method of manual spray will be aided by an automatic humidifying and temperature control system. An automatic humidifier system humidifies the atmosphere inside the mushroom house (Ybarra, 2018).

The successful cultivation of oyster mushroom heavily relies on the strict farming conditions which is being controlled by the farmer. The farmer manually sprays water on the mushroom house when he feels that the atmosphere inside the house is hot and/or warm. This manual spray is a cumbersome and inconvenient method which requires the farmer to monitor the atmosphere inside the house from time to time (Fuertes, 2019).

The farming of oyster mushrooms has certain atmospheric as well as climactic requirements for them to grow. Such critical farming conditions are the air humidity and temperature. The temperature of oyster mushroom should be below 30 degrees Celsius.

This is satisfactory for the growth and development of the fungi. Since the Philippines is a tropical country, the temperature at noon may reach high undesirable temperatures of which the oyster mushroom plant may suffer to dying and abnormality in growth. The peak ambient air temperature in Puerto Princesa City reaches 33 degrees Celsius about the month of April every year (Fuertes, 2019).

The strict atmospheric condition of this mushroom makes the farmers think about the alternative technique of automating the process. With the help of the different automation devices, the humidity and temperature can be automatically controlled and monitored without the focus of the farmer about the changes in humidity and temperature from time to time.

Since Palawan is a tropical place, the temperature is expected not to drop down to 20 degrees Celsius since it doesn't occurred even in history of Palawan and the peak temperature occurs during the month of April of about 33 degrees Celsius and 60 percent RH. The evaporative cooling effect of automatic humidification is the only cooling technique that we will use and is expected to cool the mushroom house down to 25 degrees Celsius through evaporative cooling alone (PAGASA, 2018).

With this in mind, the researcher were able to come up with this study in order to address the humidification problem encountered by farmers by lessening human power and providing accurate data about the conditions of mushroom house.

Objectives of the study

The objectives of this research are: to study and to determine the temperature and relative humidity requirement for oyster mushroom farming; to design and fabricate

an automatic humidifier system which would maintain the optimum relative humidity for the oyster mushroom; and to create a program using the Arduino UNO R3 with GSM module and humidity sensor.

As details of the second objective, the target of the researchers were the maintenance of the relative humidity of air in mushroom house as high as 75% to 90% range while the temperature of air would be maintained below 30 degrees Celsius during the operation.

Significance of the Study

Generally, this research study would have a great significance in the field of Mechanical Engineering and in Agriculture because it would provide a system that could be used automatically in maintaining the optimum level of humidity inside the oyster mushroom house.

Also, this study would benefit the following institutions and individuals:

For the Faculty of College of Engineering, Architecture and Technology, the results of this study would provide them knowledge about the humidifier system and it could be used as an example in teaching some concepts in selected electrical and mechanical subjects.

For the students of College of Engineering, Architecture and Technology, the study would encourage and give opportunity for the students to develop new technologies in promoting electro mechanic development and enhancing creativity for societal benefits.

For the Future Researchers, the study could be serve as reference or guide for future research endeavors.

For farmers, the researcher-made system will help in the optimization of mushroom production.

Scope and Delimitation

The Humidifier System was designed and created outside the vicinity of the school for the reason of accessibility and convenience of the resources and it was tested outside the school. The research study started on August 2018 and it was completed on the second week of March 2019.

The research is focused in the design and fabrication of automated sprinkler sprayer system inside the mushroom house only. The mushrooms must be kept below 30 (20-30) degrees Celsius and relative humidity of approximately 75% to 90%. The design consisted of temperature sensor and humidity sensor as well as automated humidifier system.

The nutrients and biological changes associated with the fabrication of automatic humidifier system will not be discussed in detail but it was considered the design and fabrication of the hardware materials.

CHAPTER 2

REVIEW OF RELATED LITERATURE

As this study dwelled on the design and fabrication of an automatic humidifier for oyster mushroom house, the researchers gathered and compiled the various literatures that were related to the study at hand wherein the researchers were able to draw their concepts and ideas. In addition through this literatures, the researchers were able to distinguish the different kinds of researcher's perspective to serve as bases to expand their knowledge to make this study possible.

2.1 Biological Analysis of Oyster Mushroom

According to Stevenson (2008), oyster mushroom is a type of edible fungi which tastes like oyster when cooked. Wild oyster mushroom grows in clusters on decaying tree trunks yet the cultured oyster mushroom is being grown on a substrate of straw and cotton. It is almost stemless. The fleshy, tender cap is 8 to 13 cm (3 to 5 in) across, tawny olive-colored when young, but fades with age. The wild oyster mushroom is abundant from June to November. This mushroom is also being farmed in the Philippines and in Palawan to be exact but the mycelium comes from the Department of Agriculture.

According to Crossby and Fungi Ally LLC (2016), oyster mushroom comes with different types, videlicet: Blue Oyster Amycel 3015, Blue Oyster Lambert 123, Blue Oyster Pearl, Yellow Oyster AM1, White Oyster Elm A, Pink Oyster VDE-1 etc. Furthermore, other classifications of oyster mushroom breeds are not yet discovered or perhaps still under the process of breeding research. The type of oyster mushroom that the Department of Agriculture distributes to the oyster mushroom farmers in Palawan is the White Elm A. This White Elm A is a white oyster with aggressive colonization and ability to combat contaminants. Its Caps are

large and it can fruit singularly or in clusters with large individual mushrooms. It has higher temperature resistance than other types of oyster mushrooms.

According to P. Sihombing et al. (2015), in the cultivation, Oyster Mushrooms need special treatment because oyster mushrooms are susceptible to disease. Mushroom growth will be inhibited if the temperature and humidity are not well controlled because temperature and inertia can affect mold growth. Oyster mushroom growth usually will be optimal at temperatures around 22-28ºC and relative humidity around 70-90%. This problem is often encountered in the cultivation of oyster mushrooms. Therefore it is very important to control the temperature and humidity of the room of oyster mushroom cultivation.

According to Foley, M. and Yakushenko V. (2014), the successful culturing of oyster mushroom undergoes series of procedures, namely: preparation of substrate, inoculation and incubation, oyster mushroom fruiting and harvesting. The common raw materials are straw (which could be any from wheat, rice, barley etc.), husk or hull (sunflower seed hulls, Cotton seeds, oats, buckwheat…). These materials are mixed in a certain proportion suggested by the farmers. In Palawan, the Department of Agriculture suggests taking a proportion of 60% rice straw and 40% cotton seed hulls substrate composition of which it is grounded and mixed with water. Furthermore, the density compactness, moisture content, pasteurization and sterilization of substrate are essential to successful culturing of oyster mushrooms. After those strenuous processes, the oyster mushroom mycelium is then planted using a system called inoculation. Oyster mushrooms are then monitored and kept to a certain range of relative humidity and temperature of ambient air. Humidifying is essential to the development and growth of oyster mushrooms.

2.2 Automatic Humidification System

According to GeneralAire University, humidity is simply the moisture in the air. Relative Humidity is the amount of water contained in the air at any given temperature as compared to the maximum amount of moisture the air can hold at that temperature when saturated. The amount of water that a mass of air can hold varies with its temperature, increasing as the temperature of the air increases. This is due to the fact that air expands as it warms and contracts as it cools.

According to Jose R. Francisco (2006), humidification is the process of transferring water vapor to the atmospheric air. While, latent heat transfer is a heat transfer associated with mass transfer manifested by an increase in the concentration of water in the air-water vapor mixture. The process of mass and energy transfer is accomplished by spraying fine droplets of water into the air. As the water mist is sprayed into the air, the air at higher temperature is lowered during the saturation process as the air gives off latent heat to accommodate the phase change of water mist into vapor. This process is called adiabatic saturation where air is being sprayed with water mist while latent heat from air is transferred to the water mist to convert it to vapor through evaporative cooling. The evaporative cooling process is indicated by a line in the psychrometric chart parallel to the wet bulb temperature line.

According to Isidoro Martinez (2018), there are several different techniques to humidify. One way to add vapor to air is by using an evaporative pad. A fan pushes air to pass through the moistened cloth. Air is humidified after passing through a moistened cloth and air is being cooled due to evaporative cooling process as the air exerts latent heat energy to accommodate mist into air as vapor. Other methods includes the utilization of piezoelectric transducer (ultrasonic), high pressure water nozzle, compressed air nozzle and centrifugal atomizer.

According to Nate Seidle Fried (2015), another hardware that we could use for automatic humidification is the Arduino Microcontroller. Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on computer and laptops, used to write and upload computer code to the physical board. There are different types of Arduino microcontroller, the most common and popular to both laymen and professional programmers is the Arduino Uno R3. Arduino uno R3 can perform a variety of tasks from downloading data from a sensor to controlling an intricate automated system of processes. Considering the automation system of our project, we will use Arduino Uno R3 as the heart of our Automatic Humidifier System with SMS Notification.

According to P. Sihombing et al. (2015), in this study, they have developed an automatic temperature monitoring tool in the cultivation of mushroom based Arduino Uno microcontroller. They have designed a tool that will control the temperature and humidity automatically by Android Smartphone. If the temperature increased more than 28ºC in the room of mushrooms, then this tool will turn on the pump automatically to run water in order to lower the room temperature. And if the room temperature of mushrooms fall below of 22ºC, then the light will be turned on in order to heat the room. Thus, the temperature in the room of mushrooms will remain stable so that the growth of mushrooms can grow with good quality.

CHAPTER 3

CONCEPTUAL FRAMEWORK

In this chapter, the researchers showed the concepts and theories that gave support and further substantiated the central theme of this endeavor.

In the study conducted by Sihombing et al. (2015), they used DHT 22 sensor as a sensor for humidity and temperature of air. DHT 22 sensor has a margin of error of about $\pm$ 2% RH. This sensor is connected to the Arduino Uno module board which gives power to the sensor and receives data signals from it.

From the project created by Sihombing et al. (2015), the Arduino Uno served as the heart of the sprinkler system. It was incorporated with relay switch and temperature and humidity sensor, electric fan and water pump. As the temperature exceeds 28 degrees Celsius, the fan and water sprinkler is being turned on to cool the vicinity of the mushroom house by evaporative cooling.

In line with this, the researchers have adapted their technique for cooling the mushroom house as well as humidify the air inside the mushroom house simultaneously. The researchers used the same arrangement of devices but instead of pump, ultrasonic humidifier was used.

From the study conducted by Caabay et al. (2017), they have used a similar system for monitoring the soil humidity and upgraded their system by incorporating a GSM module to inform the farmer about the humidity status of his farm. In connection with this, we also used a GSM module to inform the farmer about the air humidity and temperature status of his or her mushroom house.

The setup of the devices used in this study can be seen in figure 3.3 where the 220 AC volt outlet is externally connected from the Arduino system. The Arduino Uno processes the data fed to it from DHT22 and sends signal to the relay switch about when to turn on the ultrasonic humidifier. The GSM module is responsible for the sending a notification to the farmer about the humidity and temperature readings fed to it by the Arduino Uno.

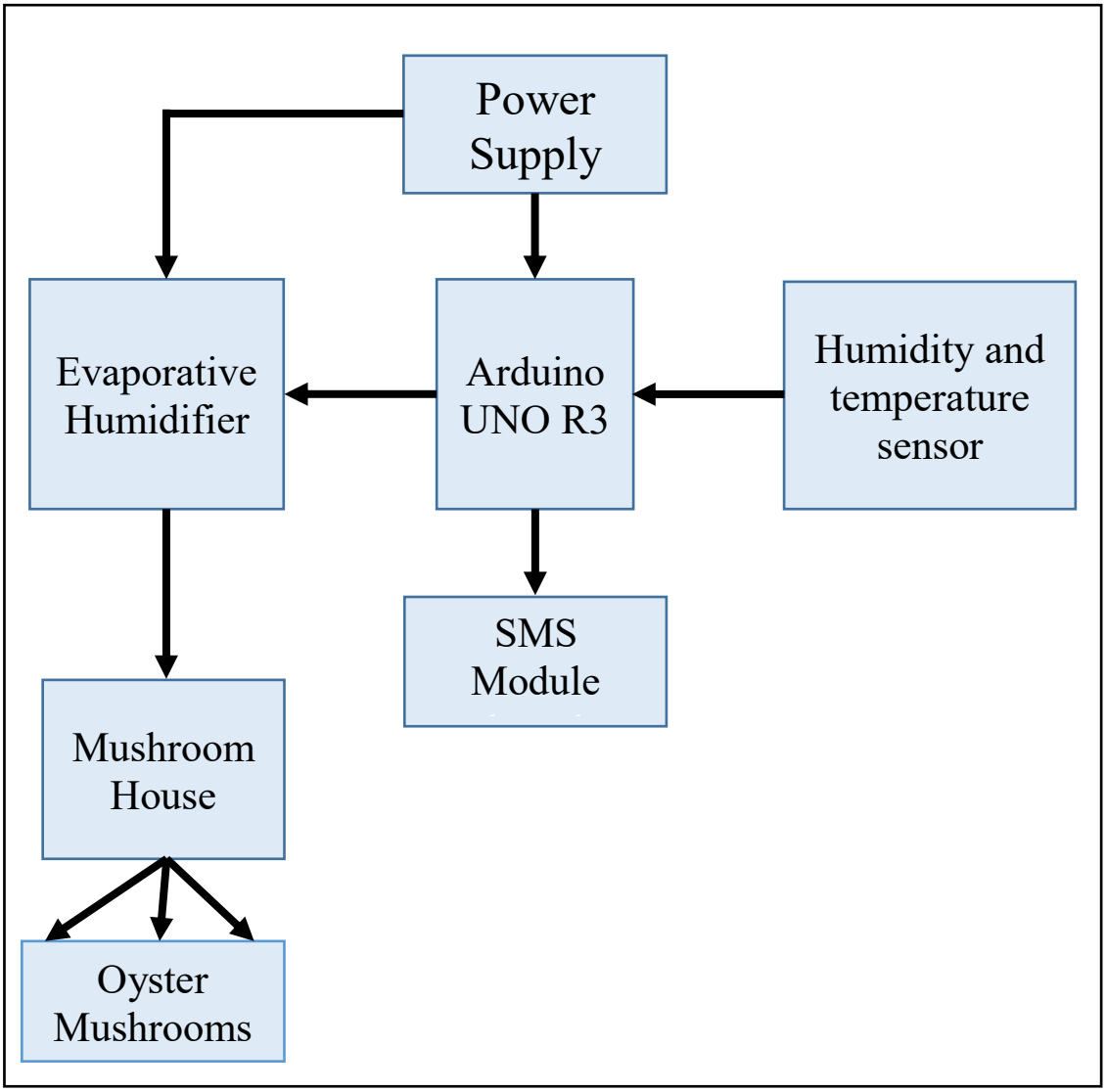

Figure 1 Block Diagram

The figure in the previous page showed the flow of the Humification System for Oyster mushroom House using from detecting the temperature and humidity to sending SMS using GSM Module as well as turn on and off the ultrasonic humidifier using the relay. (Caabay, 2017)

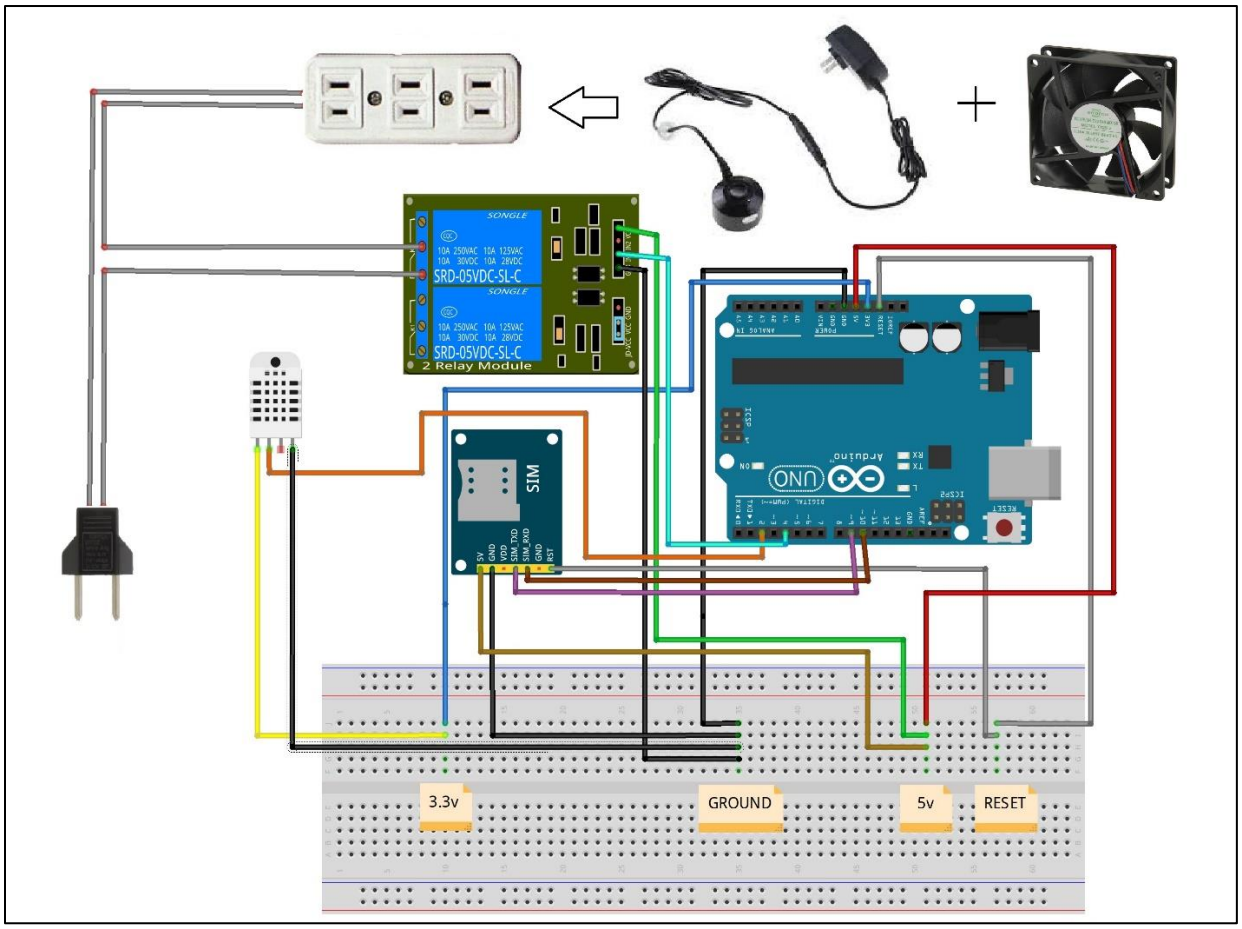

Figure 2 Circuit Diagram

The above figure presented the circuit diagram of the humidification system and the interconnection of Arduino Uno R3 with the breadboard and other electronic devices used in the system. (Caabay, 2017)

CHAPTER 4

METHODOLOGY AND MATERIALS

This chapter aimed to present the methods, major materials and instruments that were used by the researchers for the development and creation of the system. The researchers set a sequence of steps to show the system's overall content by following the methods and materials used.

4.1 Methods in Determining the temperature and Relative Humidity Condition Requirements for Oyster Mushroom Farming

To determine the temperature and Relative Humidity Condition Requirements for Oyster Mushroom Farming, the researchers conducted an interview with the Research and Development head of the Department of Agriculture in Palawan, Ms. Librada Fuertes.

4.2 Materials and Instruments Used for Humidification System

These are the major components of the system and materials used to fabricate this research: Arduino UNO R3, GSM Module SIM800L, Relay, Humidity Sensor, Breadboard, Jumper Wires, Ultrasonic Humidifier, 24V/1A DC Adapter and Fan.

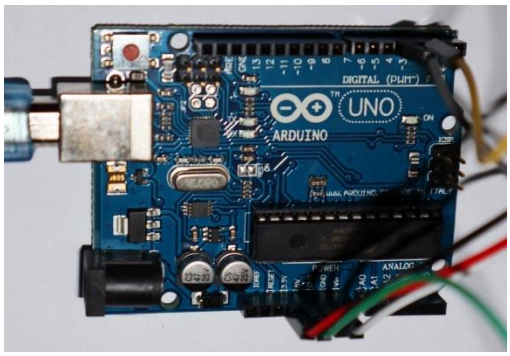

Figure 3 Arduino UNO R3 Board ATMEGA328

Arduino UNO R3 Board ATMEGA328 With USB Cable served as the heart of the circuit. Arduino UNO was a microcontroller board based on the ATmega328P. It has 14 digital input and output pins (of which is 6 analog inputs and 6 can be used as Pulse Width Modulation or PWM outputs), a 16 MHz crystal oscillator, a USB connection, Power Jack, an ICSP Header and a reset button. It has everything needed to support the microcontroller. Using a USB cable, an AC to DC adapter or a battery, just simply connect it to the computer to operate.

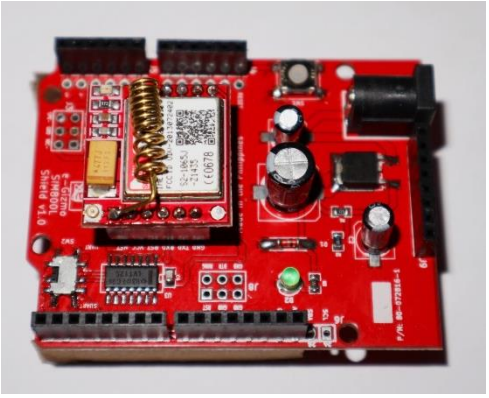

Figure 4 GSM Module, SIM800L

GSM/GPRS module was used to create communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) was an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) was an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with

power supply circuit and communication interfaces like USB for computer. GSM/GPRS MODEM was a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It required a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also, it had IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification.

Also, SIM800L was a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls. Low cost and small footprint and quad band frequency support make this module perfect solution for any project that require long range connectivity. After connecting power module boots up, searches for cellular network and login automatically.

At the heart of the module was a SIM800L GSM cellular chip. The operating voltage of the chip is from 3.4V to 4.4V. In this module, any activated 2G micro SIM card would work perfectly. Some of the features of this 1 square inch module are listed below:

- Connect onto any global GSM network with any 2G SIM
- Send and receive SMS messages
- Send and receive GPRS data (TCP/IP, HTTP, etc.)
- Accepts Micro SIM Card

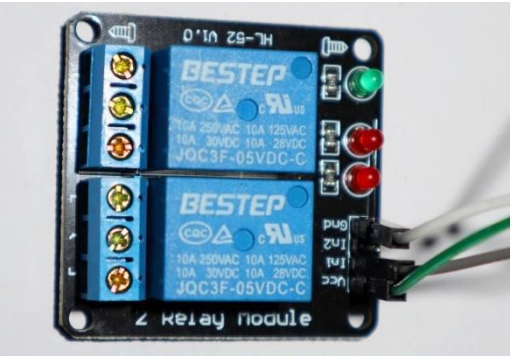

Figure 5 5V Relay Switch Board Module

Relays are switch that opened and closed circuits electromechanically or electronically. By opening and closing contacts in another circuit, relays controlled one electrical circuit. It could be generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amperes. In addition, relays are also widely used to switch starting coils, heating elements, pilot lights and audible alarms.

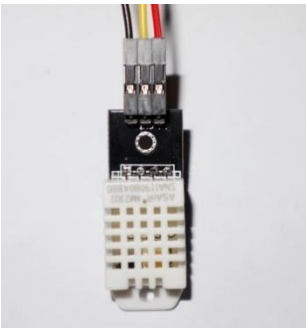

Figure 6 DHT22 Digital Temperature and Humidity Sensor

The DHT22 Temperature and Humidity Sensor was a basic, low-cost digital temperature and humidity sensor. Using a capacitive humidity sensor and a thermistor, it measured the surrounding air, and outputs a digital signal on the data pin. Simply connect the first pin on the left to 3-5V power, the second pin to your data input pin and the right

most pin to ground. It used a single-wire to send data and if you want multiple sensors, each one must have its own data pin.

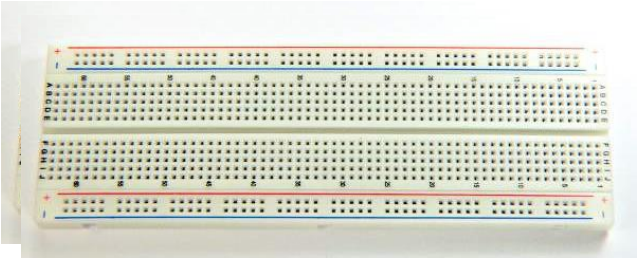

Figure 7 Breadboard

Breadboard or Solderless Breadboard was a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits could be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connect the holes on the top of the board. The top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.

Figure 8
Male to Male Jumper Wires

Figure 9
Male to Female Jumper Wires

Figure 10
Female to Female Jumper Wires

Jumper wires are used for making connections between items on the breadboard and header pins of Arduino. It could also be used to wire up all the circuits. In this study, the researchers used male to male, male to female, and female to female jumper wires depending on what is needed.

Figure 11 Ultrasonic Humidifier

Ultrasonic mist maker adopted high-frequency electronic concussion principle. Placed it into water, powered on the device, it produced natural flowing water mist under the condition that the atomized pieces vibrate in high frequency. There are

large number of air anions in the mist which could increase air humidity and fresh the air. An ultrasonic mist maker used in this study has advanced atomized pieces, producing a 400mL of mist per hour with an operating voltage of 24V DC and 1A.

Figure 12 24V/1A Adapter

An adapter was a physical device that allows one hardware or electronic interface to be adapted to another hardware or electronic interface. To operate the Mist Maker, we used 24V/1A Adapter.

Figure 13 12V DC Fan

An electric device with blades turned quickly by a motor, used to move the air around.

Figure 14 Screws

A screw was a type of fastener, in some ways similar to a bolt typically made of metal used to fastened materials by digging in and wedging into a material when turned.

Figure 15 Sealants and Adhesives

Sealant could be defined adhesive or glue as a non-metallic material which joined two materials using adhesion mechanisms and cohesive mechanisms.

The following are the major materials and equipment used in constructing the mushroom house: Angle Bar, Flat Bar, Plywood, Tarpaulin, Plastic Fine Screen, Rivets, Hinge, Welding Rod, Welding Machine, Steel Tape, Hand Drill, Sander, Screw Driver.

Figure 16 Angle Bar

Angle bars are used to offer a strengthened support to structures that otherwise would not be able to endure the pressure placed on them. They are also used to reinforce edges on surfaces to prevent damage or erosion due to weathering. Also, angle bars are used to protect any edges and corners that are required to hold their shape.

Figure 17 Flat Bar

Flat bars are a flat, rectangular section with square edges varying in sizes. This cost-effective steel product was suitable for a wide variety of applications and was distributed into the construction, engineering, manufacturing, mining, grating, fabrication and many other industries. The flat bar's versatility was the main reason it is usable throughout various industries, along with the excellent strength and formability combination of steel.

Figure 18 Plywood

Plywood is a laminated product made up of numerous thin strips of wood laid in alternating directions and bonded with glue into strong, stable sheets.

Figure 19 Tarpaulin Sheet

A tarpaulin was a large sheet of strong, flexible, water-resistant or waterproof material, often cloth such as canvas or polyester coated with polyurethane, or made of plastics such as polyethylene.

Figure 20 Rivets

A rivet was a permanent mechanical fastener. Before being installed, it consists of a smooth cylindrical shaft with a head on one end. The end opposite to the head is called the tail. On installation, the rivet was placed in a punched or drilled hole, and the tail is upset, or deformed so that it expands to about 1.5 times the original shaft diameter, holding the rivet in place. In other words, pounding creates a new head on the other end by smashing the tail material flatter, resulting in a rivet that is roughly a dumbbell shape.

Figure 21 Hinge

A hinge was a mechanical bearing, commonly used in doors that connects two solid objects, typically allowed only a limited angle of rotation between them. Two objects connected by an ideal hinge rotate relative to each other about a fixed axis of rotation.

Figure 22 Welding Rod

A Welding Rod could be defined as a rod or heavy wire that melts and thus supplies metal in fusion welding.

Figure 23 Welding Machine

A machine used for joining metal or metal sheets using a welding rod.

Figure 24 Steel Tape

A flexible rule of thin steel retracted into a protective case. It is used for measuring both regular and irregular shapes.

Figure 25 Hand Drill

A hand drill was a fastening tool used to secure screws or bolts. It could be used with a drill bit to tighten fasteners, and could also be used with stirring attachments to mix paint and joint and other liquid materials, such as glazing materials for ceramics.

Figure 26 Sander or Disk Grinder

An angle grinder, also known as a side grinder or disc grinder, was a handheld power tool used for grinding (abrasive cutting) and polishing.

Figure 27 Screw Driver

A screwdriver was a tool, manual or powered, for screwing and unscrewing or inserting and removing screws.

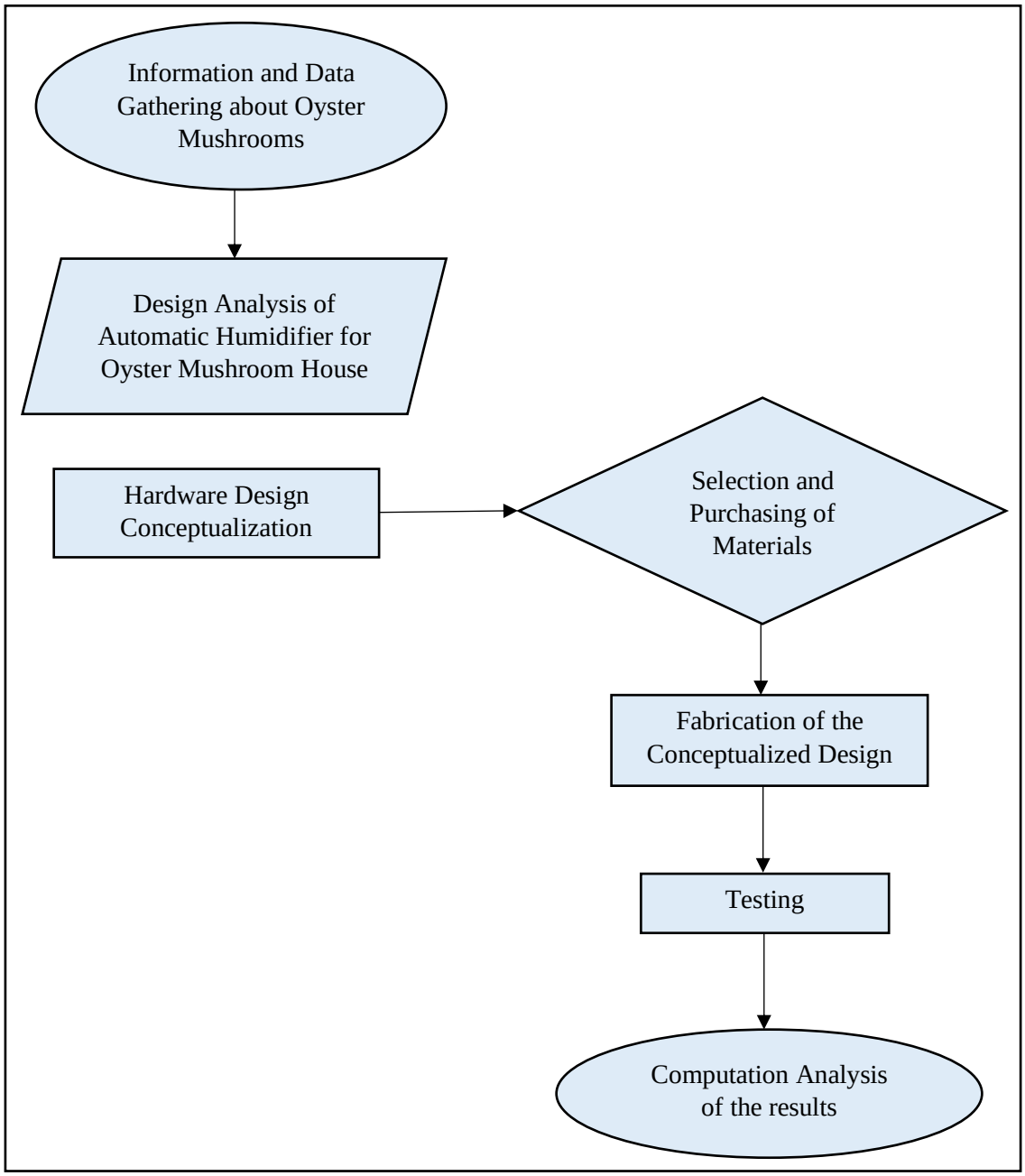

Figure 28 Flowchart of the Humidification System Design and Fabrication

The above figure showed the procedures and processes followed by the researchers in Designing and Fabricating the Humidifier System for Oyster Mushroom House.

4.3 Methods in Creating a Program using Arduino UNO R3 with GSM Module and Humidity Sensor

The researchers were able to come up with the program for Humidification System through video tutorials on the internet, and reviewing codes from Arduino website. The list of the codes was cited in Appendix E.

Furthermore, the sample computations and formulas in the next pages were used by the researchers to prove the accuracy of the data from humidification system which would be sent to the farmers via SMS.

State 1: INITIAL CONDITIONS OF AIR BEFORE HUMIDIFICATION

Dry Bulb Temp.	DB_1	30.8 °C
Wet Bulb Temp.	WB_1	26.2 °C
Relative Humidity	RH_1	69.40%
Enthalpy	h_1	$81.0\ \frac{KJ}{kgd.a}$
Specific Volume	V_1	$0.888\ \frac{m^3}{kgd.a}$
Moisture Content	W_1	$0.01953\frac{kg}{kgd.a}$

State 2: STATE CONDITIONS OF HUMIDIFIED AIR

Dry Bulb Temp.	DB_2	27.5 °C
Wet Bulb Temp.	$WB_2 = WB_1$	= 26.2 °C
Relative Humidity	RH_2	90%
Enthalpy	h_2	81.6 $\frac{KJ}{kgd.a}$
Specific Volume	V_2	0.881 $\frac{m^3}{kgd.a}$
Moisture Content	W_2	0.0212$\frac{kg}{kgd.a}$

Moisture Added

$$W_{added} = W_2 - W_1 , \frac{kg}{kgd.a}$$

$$= 0.0212 – 0.01953 = \mathbf{0.00167} \frac{\boldsymbol{kg}}{\boldsymbol{kgd.a}}$$

Total Moisture Added

$$W_{TA} = \frac{V_{house}}{V_1} \times W_{added} \text{ , kg moisture}$$

$$= [\frac{(1\text{m} \times 1\text{m} \times 1.15\text{m})}{0.888 \frac{m^3}{kgd.a}}] \times (0.00167 \frac{kg}{kgd.a}) = \mathbf{0.002163\ kg}$$

Total Heat removed by Humidification

$$h_R = h_2 - h_1 , \frac{KJ}{kg} = 81.6 – 81.0 \frac{KJ}{kgd.a} = \mathbf{0.6} \frac{\boldsymbol{KJ}}{\boldsymbol{kgd.a}}$$

$$h_{TR} = \frac{V_{house}}{V_1} \times h_R , KJ = [\frac{(1\text{m} \times 1\text{m} \times 1.15\text{m})}{0.888 \frac{m^3}{kgd.a}}] \times (0.6 \frac{KJ}{kgd.a}) = \mathbf{0.777}\ \boldsymbol{KJ}$$

CHAPTER 5

RESULTS AND FINDINGS

In this chapter, the researchers showed the results and findings they gathered after conducting multiple tests and findings from their created humidifying system through GSM module, where all the data were sent through SMS or text messages based on the condition of the oyster mushroom house. Each data was tabulated and each table answered each objective set by the researchers according to its order in Chapter 2.

To attain the first objective which was to determine the temperature and relative humidity requirement for oyster mushroom farming, the researchers conducted an interview with the Research and Development head of the Department of Agriculture in Palawan, Ms. Librada Fuertes.

According to Ms. Fuertes, the temperature requirement to grow the oyster mushroom was between the range of 22 to 28 Degrees Celsius and the Relative Humidity ranges between 75 to 90 percent.

For the second objective which was to to design and fabricate an automatic humidifier system which would maintain the optimum relative humidity for the oyster mushroom, the researchers used materials such as Arduino UNO R3, GSM Module SIM800L, Relay, Humidity Sensor, Ultrasonic Humidifier, etc.

Lastly, the third objective which was to create a program using the Arduino UNO R3 with GSM module and humidity sensor, the researchers were able to make the code for the system through video tutorials on the internet, and reviewing codes from Arduino website. Moreover, the tables in the next pages presented the results and records about the conditions of temperature and relative humidity through SMS.

The series of tables below would convey the sets of result of humidity and Ultrasonic humidifier condition sent through SMS by GSM Module starting from March 13, 2019 to March 21, 2019.

MARCH 13, 2019 – WEDNESDAY

TIME	PERCENTAGE OF HUMIDITY	TEMPERATURE DEGREES CELCIUS	HUMIDIFIER CONDITION
3:14 PM	69.40%	30.80	ON
3:37PM	78.90%	30.20	OFF
4:25 PM	99.9%	29.60	OFF
6:43PM	99.9%	28.00	OFF

Table 1 Results Gathered on March 13, 2019

Table 5.1 presented the gathered results in the afternoon of March 13, 2019 on humidification test inside the mushroom house. All the data were sent through SMS or text messages by GSM Module. The first column showed the time which the GSM Module sent notification about the status of the temperature, humidity and ultrasonic humidifier inside the mushroom house. This table shows that in the first hour of testing, around 3:14 pm, the percentage of relative humidity fell to 69.40% which means that the ultrasonic was in the ON state condition. Then, the OFF state was achieved when the percentage of humidity reached 75% and above of the relative humidity.

MARCH 15, 2019 – FRIDAY

TIME	PERCENTAGE OF HUMIDITY	TEMPERATURE DEGREES CELCIUS	HUMIDIFIER CONDITION
12:13 PM	97.20%	30.20	OFF
12:20 PM	93.60%	30.20	OFF
12:29 PM	91.60%	30.10	OFF
12:30 PM	91.60%	30.70	OFF

Table 2 Results Gathered on March 15, 2019

Table 5.2 presented the gathered results on humidification test inside the mushroom house on March 13, 2019 around 12:13 until 12:30 in the afternoon. All the data were sent through SMS or text messages by GSM Module. The first column showed the time which the GSM Module sent notification about the status of the temperature, humidity and ultrasonic humidifier inside the mushroom house. This table showed that in the first hour of testing, around 12:13 PM, the percentage of relative humidity was 97.20% which means that the ultrasonic humidifier was in the OFF state condition and maintained its OFF state until 12:30 PM which means that the percentage of humidity reached 75% and above of the relative humidity.

MARCH 19, 2019 – TUESDAY

TIME	PERCENTAGE OF HUMIDITY	TEMPERATURE DEGREES CELCIUS	HUMIDIFIER CONDITION
8:22 AM	71.40%	28.60	ON
9:30 AM	72.30%	30.60	ON
11:59 AM	71.30%	29.30	ON
12:55 PM	74.80%	28.40	ON

Table 3 Results Gathered on March 19, 2019

Table 5.3 presented the gathered results on humidification test inside the mushroom house on March 19, 2019 from 8:22 AM to 12:55 PM. In this testing, the farmer would only get notified when the ultrasonic humidifier is ON. All the data were sent through SMS or text messages by GSM Module. The first column showed the time which the GSM Module sent notification about the status of the temperature, humidity and ultrasonic humidifier inside the mushroom house. This table showed that the ultrasonic humidifier was in the ON state condition on 8:22 AM, 9:30 AM, 11:59 AM and 12:55 which means that the percentage of humidity was below 75%.

MARCH 20, 2019 – WEDNESDAY

SMS – 10 MINS. INTERVAL (24 HRS. OPERATION)

TIME	PERCENTAGE OF HUMIDITY	TEMPERATURE DEGREES CELCIUS	HUMIDIFIER CONDITION
10:06 AM	76.8%	30.20	OFF
10:17 AM	70.20%	30.10	ON
10:27 AM	74.5%	30.40	ON
10:37 AM	75.8%	30.40	OFF
10:47 AM	77.4%	30.60	OFF
10: 57 AM	77.80%	30.80	OFF
11: 17 AM	80.40%	30.80	OFF
11:27 AM	88.40%	30.70	OFF
11:37 AM	90.60%	30.50	OFF
11:47 AM	95%%	31	OFF
11: 58 AM	71.3%	29.3	ON
12:08 PM	94.60%	30.90	OFF
12:18 PM	94.20%	31.40	OFF
12:28 PM	93.10%	31.40	OFF
12:38 PM	92.90%	31.70	OFF
12:48 PM	92.70%	31.90	OFF
12:59 PM	92.20%	31.90	OFF
1:09 PM	91.40%	32.50	OFF
1:19 PM	91.60%	32.40	OFF
1:29 PM	90.80%	32.80	OFF
1:39 PM	90.10%	32.40	OFF
1:49 PM	88.30%	32.10	OFF

2:00 PM	86.20%	31.70	OFF
2:10 PM	85.50%	31.30	OFF
2:20 PM	83.30%	31.10	OFF
2:30 PM	82.40%	31.30	OFF
2:40 PM	81.20%	31.10	OFF
2:50 PM	79.20%	31.20	OFF
3:00 PM	78.30%	31.10	OFF
3:10 PM	77.50%	31.10	OFF
3:20 PM	76.30%	31	OFF
3:30 PM	74.80%	30.10	ON
3:40 PM	74.70%	30.20	ON
3:50 PM	79.50%	31.7	OFF
4:00 PM	81.5%	30.10	OFF
4:10 PM	79.30%	30.10	OFF
4:20 PM	85.50%	30.20	OFF
4:30 PM	91.90%	30.30	OFF
4:41 PM	92.60%	30.20	OFF
4:51 PM	93%	29.90	OFF
5:01 PM	93.90%	29.70	OFF
5:11 PM	93.70%	29.50	OFF
5:21 PM	94.10%	29.50	OFF
5:32 PM	94.50%	29.40	OFF
5:42 PM	95.60%	29.10	OFF
5:52 PM	96.50%	29	OFF
6:02 PM	96.40%	29	OFF
6:12 PM	96.70%	28.90	OFF
6:23 PM	96.50%	28.80	OFF

6:33 PM	97.60%	28.60	OFF
6:43 PM	97.50%	28.60	OFF
6:53 PM	98%	28.60	OFF
7:03 PM	98.70%	28.60	OFF
7:13 PM	98.70%	28.40	OFF
7:24 PM	99.20%	28.50	OFF
7:34 PM	99.80%	28.40	OFF
7:44 PM	99.9%	28.30	OFF
7:54 PM	99.9%	28.30	OFF
8:04 PM	99.9%	28.30	OFF
8:15 PM	99.9%	28.20	OFF
8:25 PM	99.9%	28.20	OFF
8:35 PM	99.9%	28.20	OFF
8:45 PM	99.9%	28.10	OFF
8:55 PM	99.9%	28	OFF
9:05 PM	99.9%	28.10	OFF
9:16 PM	99.9%	28	OFF
9:26 PM	99.9%	28	OFF
9:36 PM	99.9%	27.90	OFF
9:46 PM	99.9%	27.80	OFF
9:57 PM	99.9%	27.70	OFF
10:06 PM	99.9%	27.60	OFF
10:17 PM	99.9%	27.60	OFF
10:27 PM	99.9%	27.60	OFF
10:37 PM	99.9%	27.50	OFF
10:47 PM	99.9%	27.50	OFF
10:57 PM	99.9%	27.50	OFF

11:08 PM	99.9%	27.50	OFF
11:18 PM	99.9%	27.50	OFF
11:28 PM	99.9%	27.40	OFF
11:38 PM	99.9%	27.20	OFF
11:48 PM	99.9%	27	OFF
11:59 PM	99.9%	26.70	OFF
MARCH 21,2019	**THURSDAY**		
12:09 AM	99.9%	26.60	OFF
12:19 AM	99.9%	26.50	OFF
12:29 AM	99.9%	26.40	OFF
12:39 AM	99.9%	26.20	OFF
12:49 AM	99.9%	26.20	OFF
1:00 AM	99.9%	26.10	OFF
1:10 AM	99.9%	26	OFF
1:20 AM	99.9%	26.10	OFF
1:30 AM	99.9%	26.10	OFF
1: 40 AM	99.9%	26.10	OFF
1:51 AM	99.9%	26	OFF
2:01 AM	99.9%	26.10	OFF
2:11 AM	99.9%	26.10	OFF
2:21 AM	99.9%	26.30	OFF
2:31 AM	99.9%	26.30	OFF
2:41 AM	99.9%	26.30	OFF
2:52 AM	99.9%	26.30	OFF
3:02 AM	99.9%	26.30	OFF
3:12 AM	99.9%	26.20	OFF
3:22 AM	99.9%	26.20	OFF

3:32 AM	99.9%	26.10	OFF
3:43 AM	99.9%	26.10	OFF
3:53 AM	99.9%	25.80	OFF
4:03 AM	99.9%	25.50	OFF
4:13 AM	99.9%	25.40	OFF
4:23 AM	99.9%	25.40	OFF
4:34 AM	99.9%	25.30	OFF
4:44 AM	99.9%	25.20	OFF
4:54 AM	99.9%	25.10	OFF
5:04 AM	99.9%	25.10	OFF
5:14 AM	99.9%	24.90	OFF
5:24 AM	99.9%	24.90	OFF
5:34 AM	99.9%	24.90	OFF
5:45 AM	99.9%	25.20	OFF
5:55 AM	99.9%	25.40	OFF
6:05 AM	99.9%	25.50	OFF
6:15 AM	99.9%	25.60	OFF
6:26 AM	99.9%	25.70	OFF
6:36 AM	99.9%	25.70	OFF
6:46 AM	99.9%	26.20	OFF
6:56 AM	99.9%	26.80	OFF
7:06 AM	99.9%	27.10	OFF
7:17 AM	99.9%	27.30	OFF
7:27 AM	99.9%	27.40	OFF
7:37 AM	99.9%	27.50	OFF
7:47 AM	99.9%	27.70	OFF
7:57 AM	99.9%	27.90	OFF

8:07 AM	99.9%	28.10	OFF
8:17 AM	99.9%	28.10	OFF
8:27 AM	99.9%	28.40	OFF
8:37 AM	99.9%	28.60	OFF
8:47 AM	99.9%	28.70	OFF
8:57 AM	99.9%	28.80	OFF
9:09 AM	99.9%	29	OFF
9:19 AM	99.9%	29.40	OFF
9:30 AM	99.9%	29.20	OFF
9:40 AM	98.60%	29.20	OFF
9:50 AM	97.10%	29.90	OFF
10:00 AM	96.20%	30.20	OFF
10:10 AM	96%	30.20	OFF

Table 4 Results Gathered from March 20, 1019 to March 21, 2019

Table 5.5 presented the gathered results on humidification test inside the mushroom house from 10:06 AM of March 20, 2019 to 10:10 AM of March 21, 2019. All the data were sent through SMS or text messages by GSM Module. The first column showed the time which the GSM Module sent notification about the status of the temperature, humidity and ultrasonic humidifier inside the mushroom house. This table showed that in the first hour of testing, around 10:17 to 10:27 in the morning, the percentage of relative humidity fell to 70.2 and 74.5 percent which means that the ultrasonic humidifier was in the ON state condition. Then, the OFF state was achieved from 10:37 AM to 11:47 AM when the percentage of humidity reached 75% to 90% and above of the relative humidity. Around 11:58 AM, humidifier system was in the ON state condition when the relative humidity drops to 71.35. Around 12:08 PM to 3:20 PM, the ultrasonic humidifier was in the OFF

state which means that the percentage of relative humidity reached 75% and above of the relative humidity. Around 3:30 PM to 3:40 PM, ultrasonic humidifier was in the ON state condition on which means that the percentage of humidity below 75%. Around 3:50 PM of March 20, 2019 to 10:10 AM of March 21, 2019, ultrasonic humidifier was in the OFF state which means that the percentage of relative humidity reached 75% and above of the relative humidity.

MARCH 21, 2019 – THURSDAY

TIME	PERCENTAGE OF HUMIDITY	TEMPERATURE DEGREES CELCIUS	HUMIDIFIER CONDITION
2:24 PM	93.20%	31.10	OFF
2:34 PM	93.60%	31.10	OFF
4:25 PM	99.9%	29.60	OFF
6:43 PM	99.9%	28.00	OFF

Table 5 Results Gathered on March 21, 2019

Table 5.5 presented the gathered results in the afternoon of March 21, 2019 on humidification test inside the mushroom house. All the data were sent through SMS or text messages by GSM Module. The first column showed the time which the GSM Module sent notification about the status of the temperature, humidity and ultrasonic humidifier inside the mushroom house. This table showed that in the first hour of testing, around 2:24 PM to 6:43 PM, the ultrasonic humidifier was on the OFF state which means that the percentage of relative humidity reached 90% and above of the relative humidity.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

In this chapter, the researchers were able to arrive at the following conclusions and recommendations after using the methods and following procedures in attaining the objectives they formulated.

6.1 Conclusion

After using the concept of Sihombing et al. (2015), Caabay et al. (2017), and Arduino, the researchers were able to design and fabricate the humidifier system to be used for oyster mushroom house.

Specifically, the researchers were able to come up to the study with the following objectives for this research undertaking:

1. To determine the Temperature and Relative Humidity requirement for Oyster Mushroom Farming

The researchers were able to gather the data about the Temperature and Relative Humidity requirement for Oyster Mushroom Farming by conducting an interview with the Research and Development Head of the Department of Agriculture in Palawan, Ms. Librada Fuertes.

2. To design and fabricate an automatic humidifier system which would maintain the optimum relative humidity for the oyster mushroom.

The researchers gathered the following materials needed which are Arduino UNO R3, GSM Module SIM800L, Relay, Humidity Sensor, Breadboard, Jumper Wires, Ultrasonic Humidifier, 24V/1A DC Adapter and Fan. The other materials used were

listed on Chapter 3. Also, the researchers constructed a Flowchart of the Humidification System Design and Fabrication found in Figure 4.2.24.

3. To create a program using the Arduino UNO R3 with GSM module and humidity sensor.

The researchers arrived with the program for Humidification System through video tutorials on the internet, and reviewing codes from Arduino website. The codes were presented in Appendix E.

The device accurately humidified the system through ultrasonic humidifier depending on the relative humidity conditions inside the mushroom house. The ultrasonic humidifier was in the OFF state which means that the percentage of relative humidity reached 90% and above of the relative humidity and was in the ON state condition on which means that the percentage of humidity ranged below 75%.

The device also operated quickly and performed low time delays on powering on/off the ultrasonic humidifier and sending notifications through SMS by GSM Module.

6.2 Recommendation

In the light of the findings of the study, the following were recommended for consideration:

A. For the Faculty of College of Engineering, Architecture and Technology

1. This study could serve as an example in teaching electrical and mechanical subjects.

2. This study could be recommended to students for further studies.

B. For the students of College of Engineering, Architecture and Technology

1. This study could impart fresh ideas and future innovations in the field of Engineering.

2. This study could serve as an inspiration for future students to appreciate research.

C. For the Future Researchers

1. Conduct the similar study to provide a deeper understanding of the Relative Humidity Sensor and GSM Module device in relation with other factors.

2. Design/fabricate another Humidification System with further improvements such as:

   a. Install a sprinkler system that produces fine mist for better humidification.

   b. Incorporate the Proportional Integral Derivatives Controller.

   c. Use solar power in order to make it available in remote areas where absence of electricity become a barrier to system operation.

   d. Build and add water tank with automatic water level

controller to improve the efficiency of water usage.

e. Consider the water tank design upon the discretion of the farmer in using cold water as aid for cooling process of mushroom.

f. Expand the system in large scale for larger volume of oyster mushroom farming.

D. For Farmers

1. Avail the Humidifier System for convenient monitoring of the humidity regarding small scale mushroom house.

2. Provide further data about Humidification System for further improvement.

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GLOSSARY OF TECHNICAL TERMS

Arduino- is a microcontroller board based on the ATmega328P.

Humidity- is among the indoor environmental factors that could be affect the thermal comfort at higher humidity levels were mostly carried out in the climate chamber or air-conditioned spaces.

Humidification- humidification is the process of transferring water vapor to the atmospheric air.

Relative humidity- the amount of water vapor present in air expressed as a percentage of the amount needed for saturation at the same temperature.

APPENDIX A
Bill of Materials

QTY	SIZE (in inches)	MATERIALS/PRODUCT	TOTAL PRICE
1	-	Humidity Sensor	289.00
1	-	Ultrasonic Humidifier	338.00
1	-	24V/1A DC Adapter	289.00
1	-	Arduino Uno R3	347.00
1	-	GSM Module	982.00
20	3.937	Female to Female Jumper Wire	142.00
40	7.874	Male to Female Jumper Wire	150.00
40	7.874	Male to Male Jumper Wire	141.00
1	-	Relay	177.00
1	-	Breadboard	500.00
1	-	12V DC Fan	100.00
-	118.11 x 72	Plastic Fine Screen	35.00
3	1/8 x 1	Angle Bars	780.00
5	3/16 x 5/8	Flat Bars	340.00
2	3/16 x 1	Flat Bars	400.00
-	157.48 x 72	Tarpaulin	640.00
200	5/32 x ½	Rivets	350.00
3	½ x 2	Hinge	75.00
2	4	45° PVC Elbow	128.00
-	-	Adhesives	200.00
-	39.37 x 39.37	Plywood	300.00
-	-	Screws	50.00
3	-	Mushroom Fruiting Bag	150.00
20	-	Welding Rod	100.00
-	-	Labor	300.00
		TOTAL	**7303.00**

APPENDIX B.1
December 2018 Climatic Conditions from PAGASA

PAGASA
Philippine Atmospheric, Geophysical and Astronomical Services Administration
Field Operations Center

STATION: PUERTO PRINCESA LATITUDE: 09° 45" N LONGITUIDE: 118° 44" E For the Month of: DECEMBER 2018

Day of the Month	PRESSURE (hPa)		TEMPERATURE (°C)								WIND					SUNSHINE			MISCELLANEOUS METEORS					
	Station Pressure	Mean Sea Level Pressure	Dry Bulb	Wet Bulb	Maximum	Minimum	Mean	Mean Dew Point	Mean Relative Humidity	Rainfall (mm)	Average Speed (mps)	Prevailing Direction (degrees)	Maximum Speed (mps)	Direction of Maximum Speed	Time of Maximum Wind (UTC)	Minutes	Percentage of Maximum Possible	Mean Cloudiness (Oktas)	Smoke/Haze/ Smaze	Fog	Rain/Drizzle	Hail	Thunderstorm	Lightning
(1)	(2a)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	1008.8	1010.5	29.4	25.4	32.3	27.9	30.1	24.0	72	0.0	008	90	15	70	0240z	515	74.0%	3						
2	1008.7	1010.4	29.3	25.9	32.0	27.8	29.9	24.9	76	0.0	005	90	12	70	0115z	580	83.3%	4						X
3	1009.1	1010.8	29.2	25.5	32.2	26.2	29.2	24.3	75	0.0	005	90	11	90	0000z	563	81.0%	4						
4	1009.0	1010.7	28.7	25.8	32.4	25.8	29.1	24.9	80	0.0	003	90	8	90	0645z	548	78.8%	2						
5	1007.5	1009.2	29.5	26.2	32.6	27.9	30.3	25.2	77	0.0	005	90	11	90	2324z	594	85.5%	2						
6	1007.0	1008.7	29.4	26.2	32.7	25.3	29.0	25.1	78	0.0	006	90	12	90	0110z	489	70.4%	2						
7	1008.0	1009.7	28.7	25.2	33.3	25.3	29.3	24.0	76	0.0	006	90	12	90	0910z	602	86.6%	2						
8	1009.0	1010.7	29.0	25.6	32.4	24.6	28.5	24.5	77	0.0	005	70	13	70	0215z	597	85.9%	2						
9	1008.9	1010.6	28.0	25.5	31.8	24.4	28.1	24.6	82	T	004	70	10	70	0905z	314	45.2%	3			X			
10	1008.8	1010.5	28.3	25.3	32.1	25.4	28.8	24.3	79	0.0	004	90	13	90	0410z	610	87.9%	2						
11	1009.2	1010.9	28.5	25.4	32.4	24.8	28.6	24.4	78	0.0	005	70	11	70	0420z	600	86.5%	2						
12	1010.1	1011.8	28.5	24.4	32.1	25.5	28.8	23.0	72	0.0	005	70	12	70	1600z	607	87.5%	1						
13	1009.8	1011.5	29.0	25.3	32.9	27.2	30.1	24.0	74	0.0	006	70	12	70	0230z	538	77.5%	3						
14	1010.0	1011.7	29.2	25.4	32.7	25.2	29.0	24.1	74	0.0	005	70	11	90	0530z	554	79.9%	2						
15	1009.7	1011.4	29.3	25.8	32.6	26.9	29.8	24.7	76	0.0	007	70	16	70	0440z	448	64.6%	3						
16	1010.2	1011.9	29.0	25.5	32.2	25.8	29.0	24.4	76	0.0	003	VRB	9	70	0346z	570	82.3%	3						
17	1010.7	1012.4	28.6	25.3	32.1	26.6	29.4	24.2	77	0.0	005	90	10	90	0735z	557	80.3%	5						
18	1010.8	1012.5	29.3	24.8	32.5	27.5	30.0	23.3	70	0.0	007	70	13	70	0720z	332	47.9%	6						
19	1010.5	1012.2	29.0	24.8	31.9	25.4	28.7	23.4	72	0.0	006	90	13	70	1320z	548	79.0%	4						
20	1009.4	1011.1	28.1	24.5	31.7	25.2	28.5	23.1	74	0.0	003	270	10	90'	0153z	372	53.7%	7						
21	1008.2	1009.9	27.4	24.8	32.6	24.7	28.7	23.9	81	9.2	003	270	12	360	0315z	274	39.5%	6			X			
22	1008.0	1009.7	27.1	25.0	30.8	25.3	28.1	24.3	85	0.5	002	270				42	6.1%	7			X			
23	1006.7	1008.4	27.4	25.2	31.7	24.8	28.3	24.5	84	24.6	003	270				293	42.2%	5			X		X	X
24	1006.5	1008.2	26.5	24.8	30.3	24.9	27.6	24.3	88	17.3	002	VRB				107	15.4%	6			X		X	X
25	1007.3	1009.0	27.1	25.0	30.1	24.4	27.3	24.4	85	0.0	002	270				376	54.2%	4						
26	1007.0	1008.7	27.8	25.2	31.9	24.8	28.4	24.3	82	2.4	003	VRB				510	73.6%	6			X			
27	1006.3	1008.0	27.0	24.3	30.7	24.1	27.4	23.4	81	0.0	002	270				71	10.2%	6						
28	1006.4	1008.1	26.6	24.6	32.3	24.9	28.6	23.9	86	18.3	002	VRB				321	46.3%	7			X			
29	1007.0	1008.7	26.5	24.9	30.0	25.6	27.8	24.3	87	3.0	004	90	11	90	2050z	106	15.3%	7			X			
30	1008.3	1010.0	26.8	25.5	28.2	25.8	27.0	25.1	90	58.8	005	90	12	90	2245z	7	1.0%	6			X		X	X
31	1009.7	1011.4	28.3	25.8	30.7	26.8	28.8	24.9	82	0.0	005	90	11	90	0125z	463	66.7%	4						
Total	31266.6	31319.3	876.5	782.9	986.2	796.8				134.1						13108		126	0	0	9	0	3	4
Mean/ Extreme	1008.6	1010.3	28.3	25.3	31.8	25.7	28.8	24.2	79		004	90	16	70	15/0440z	422.8	61%	4						

EXTREMES

Seal Level Pressure		Temperature	
Highest	1013.9 hPa	Highest	33.3° C
Date2	19	Date	07
Lowest	1005.7 hPa	Lowest	24.1° C
Date	28	Date	27
Mean	1008.6 hPa	Abs. Range	9.2

TOTAL 24-H RAINFALL IN MILLIMETERS (8 AM TO 8 AM)

Trace	0.1 or more	1.0 or more	10 or more	25 or more	50 or more	100 or more
01	08	07	04	01	01	00

MONTHLY PSYCHROMETRIC VALUES

Dew Point Temperature (°C)	24.2 °C
Relative Humidity (%)	79 %
Vapor Pressure (mmHg)	2982

MEAN CLOUDINESS IN OKTAS
Number of days with:

0 – 1 Okta	2 – 6 Oktas	7 – 8 Oktas
01	26	04

Revised October 2004/FOMS/egs

Prepared by:

(Signature over Printed Name)

Verified by:

SONNY R. PAJARILLA, M.Sc.
(Signature over printed name of CMO/OIC)

APPENDIX B.1
January 2019 Climatic Conditions from PAGASA

PAGASA
Philippine Atmospheric, Geophysical and Astronomical Services Administration
Field Operations Center

STATION: PUERTO PRINCESA LATITUDE: 09° 45" N LONGITUIDE: 118° 44" E For the Month of: JANUARY 2019

Day of the Month	PRESSURE (hPa)		TEMPERATURE (°C)								WIND					SUNSHINE			MISCELLANEOUS METEORS					
	Station Pressure	Mean Sea Level Pressure	Dry Bulb	Wet Bulb	Maximum	Minimum	Mean	Mean Dew Point	Mean Relative Humidity	Rainfall (mm)	Average Speed (mps)	Prevailing Direction (degrees)	Maximum Speed (mps)	Direction of Maximum Speed	Time of Maximum Wind (UTC)	Minutes	Percentage of Maximum Possible	Mean Cloudiness (Oktas)	Smoke/Haze/ Smaze	Fog	Rain/Drizzle	Hail	Thunderstorm	Lightning
(1)	(2a)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1	1010.6	1012.3	28.0	25.6	30.8	25.9	28.4	24.8	82	0.4	005	70	9	70	1040z	262	37.7%	3			X		X	X
2	1011.7	1013.4	28.2	25.2	30.7	24.3	27.5	24.2	79	0.0	004	90				445	64.0%	5						
3	1013.0	1014.7	27.6	24.8	30.6	24.5	27.6	23.9	80	0.0	004	90	12	90	1132z	559	80.4%	2						
4	1013.5	1015.2	28.0	24.7	30.8	25.7	28.3	23.6	77	0.0	006	90	14	90	0855z	383	55.1%	6						
5	1012.6	1014.3	27.9	24.9	30.8	23.3	27.1	23.9	79	0.0	004	90	11	90	0315z	547	78.7%	2						
6	1012.1	1013.8	27.0	24.1	31.3	23.2	27.3	23.1	79	0.0	004	90	12	90	1115z	585	84.2%	2						
7	1011.4	1013.1	27.1	23.2	30.2	24.7	27.5	21.8	73	0.0	006	90	14	90	0205z	593	85.3%	1						
8	1011.4	1013.1	27.4	24.0	30.4	23.4	26.9	222.8	76	0.0	004	90	11	90	0454z	606	87.2%	1						
9	1011.7	1013.4	27.2	24.2	30.9	24.0	27.5	23.2	79	0.0	004	90	11	90	1130z	602	86.5%	1						
10	1010.8	1012.5	27.9	24.3	30.6	25.4	28.0	23.0	75	1.8	007	90	15	90	0950z	462	66.4%	4			X			
11	1010.7	1012.4	27.5	24.0	30.5	23.7	27.1	22.7	75	0.0	006	90	14	90	0536z	385	55.3%	3						
12	1010.2	1011.9	26.9	23.9	30.5	24.2	27.4	22.9	79	0.0	005	70	12	70	0440z	537	77.2%	2						
13	1008.9	1010.6	27.7	24.7	30.4	25.8	28.1	23.7	78	0.0	004	90	11	90	2320z	468	67.1%	5						
14	1008.3	1010.0	27.8	24.4	30.4	26.0	28.2	23.3	76	0.0	006	90	12	90	0250z	449	64.4%	3						
15	1009.6	1011.3	27.3	23.2	30.6	23.0	26.8	22.1	73	0.0	005	90	11	90	1101z	558	80.1%	2						
16	1009.9	1011.6	26.6	22.7	30.6	21.9	26.3	21.2	72	0.0	005	90	13	90	0734z	488	70.0%	2						
17	1010.1	1011.8	26.6	22.9	30.5	24.4	27.5	21.6	74	0.0	005	70	12	90	2050z	385	55.2%	4						
18	1010.0	1011.7	27.5	23.2	30.3	23.1	26.7	21.5	70	0.0	008	90	14	90	0234z	594	85.1%	1						
19	1009.4	1011.1	26.9	23.5	32.1	23.8	28.0	22.3	75	0.0	005	90	13	90	0756z	594	85.1%	2						
20	1008.6	1010.3	27.3	23.5	31.2	25.0	28.1	22.0	73	0.0	003	90				404	57.9%	6						
21	1008.0	1009.7	28.2	24.1	33.0	25.3	29.2	22.6	72	0.0	004	340	11	340	0630z	532	76.1%	4						
22	1008.5	1010.2	28.2	24.1	32.9	26.0	29.5	22.6	72	0.0	003	360	10	360	0100z	542	77.5%	5						
23	1008.7	1010.4	28.5	24.2	32.5	26.0	29.3	22.7	70	0.3	005	340	12	360	0545z	537	76.7%	4			X			
24	1009.5	1011.2	27.8	25.1	32.0	25.7	28.9	24.1	81	1.2	003	VRB				238	34.0%	7			X			
25	1010.3	1012.0	27.6	24.8	30.3	26.3	28.3	23.9	80	0.0	006	70	12	90	0520z	115	16.4%	7						
26	1010.8	1012.5	27.8	23.4	30.2	26.5	28.4	21.8	69	0.0	007	70	15	90	2120z	116	16.5%	7						
27	1011.9	1013.6	27.4	22.5	30.5	25.2	27.9	20.5	66	0.0	009	70	17	70	0610z	292	41.7%	5						
28	1011.8	1013.5	26.8	22.6	30.4	23.0	26.7	20.9	70	0.0	007	90	15	90	0308z	579	82.5%	2						
29	1012.0	1013.7	26.6	22.1	29.8	24.2	27.0	20.2	68	0.0	007	70	13	90	0236z	480	68.4%	4						
30	1012.3	1014.0	27.0	23.0	30.0	23.6	26.8	21.5	70	0.0	003	90	10	90	1135z	503	71.7%	3						
31	1012.4	1014.1	26.7	23.3	30.2	23.4	26.8	22.1	76	0.0	002	90				365	51.9%	4						
Total	31330.7	31383.4	851	740.2	956	760.5				3.7						14205		109	0	0	4	0	1	1
Mean/ Extreme	1010.7	1012.4	27.5	23.9	30.8	24.5	27.7	22.6	75		005	90	17	70	27/0610z	458.2	65.7%	4						

EXTREMES			
Seal Level Pressure		*Temperature*	
Highest	1017.0 hPa	Highest	33.0° C
Date	04	Date	21
Lowest	1008.2 hPa	Lowest	21.9°C
Date	14	Date	16
Mean	1012.4 hPa	Abs. Range	11.1

TOTAL 24-H RAINFALL IN MILLIMETERS (8 AM TO 8 AM)						
Trace	0.1 or more	1.0 or more	10 or more	25 or more	50 or more	100 or more
0	04	02	0	0	0	0

MONTHLY PSYCHROMETRIC VALUES	
Dew Point Temperature (°C)	22.6 °C
Relative Humidity (%)	75 %
Vapor Pressure (mmHg)	2807

MEAN CLOUDINESS IN OKTAS Number of days with:		
0 – 1 Okta	2 – 6 Oktas	7 – 8 Oktas
04	24	03

Revised October 2004/FOMS/egs

Prepared by:

(Signature over Printed Name)

Verified by:

SONNY N. PAJARILLA, M.Sc.
(Signature over printed name of CMO/OIC)

APPENDIX B.3
February 2018 Climatic Conditions from PAGASA

FOC_F_02

PAGASA
Philippine Atmospheric, Geophysical and Astronomical Services Administration
Field Operations Center

STATION: PUERTO PRINCESA LATITUDE: 09° 45" N LONGITUIDE: 118° 44" E For the Month of: FEBRUARY 20[redacted]

Day of the Month (1)	PRESSURE (hPa) Station Pressure (2a)	Mean Sea Level Pressure (2)	TEMPERATURE (°C) Dry Bulb (3)	Wet Bulb (4)	Maximum (5)	Minimum (6)	Mean (7)	Mean Dew Point (8)	Mean Relative Humidity (9)	Rainfall (mm) (10)	WIND Average Speed (mps) (11)	Prevailing Direction (degrees) (12)	Maximum Speed (mps) (13)	Direction of Maximum Speed (14)	Time of Maximum Wind (UTC) (15)	SUNSHINE Minutes (16)	Percentage of Maximum Possible (17)	Mean Cloudiness (Oktas) (18)	MISCELLANEOUS METEORS Smoke/Haze/Smaze (19)	Fog (20)	Rain/Drizzle (21)	Hail (22)	Thunderstorm (23)	Lightning (24)
1	1012.2	1013.9	27.1	23.1	31.0	24.6	27.8	21.6	72	0.0	006	90	14	90	0840z	456	64.9%	3						
2	1012.0	1013.7	27.0	23.5	30.5	26.0	28.3	22.2	75	0.0	005	90	9	70	0005z	562	79.9%	4						
3	1012.4	1014.1	27.6	23.2	30.6	22.6	26.6	21.5	69	0.0	004	90				507	72.0%	4						
4	1011.7	1013.4	27.0	23.5	30.5	24.3	27.4	22.3	75	0.0	003	90				553	78.6%	3						
5	1011.7	1013.4	26.8	24.1	30.7	23.2	27.0	23.1	80	0.0	004	90				290	41.2%	3						
6	1010.8	1012.5	26.6	23.4	31.3	22.4	26.9	22.3	78	0.0	003	270				573	81.3%	2						
7	1011.8	1013.5	25.8	22.6	30.5	21.5	26.0	21.4	77	0.0	003	270	9	90	0255z	484	68.6%	2						
8	1011.4	1013.1	25.9	22.9	30.2	22.6	26.4	21.8	78	0.0	003	VRB				594	84.1%	2						
9	1012.0	1013.7	26.8	23.7	31.0	24.4	27.7	22.6	78	0.0	003	VRB				596	84.4%	3						
10	1013.4	1015.1	28.1	24.8	31.5	24.8	28.2	23.7	77	0.0	005	90	12	90	2215z	483	68.3%	4						
11	1014.4	1016.1	27.3	23.7	30.9	23.0	27.0	22.3	74	0.0	005	90	12	70	2320z	558	78.9%	2						
12	1014.6	1016.3	26.7	22.9	30.8	22.2	26.5	21.5	73	0.0	004	70	12	70	0000z	599	84.6%	2						
13	1014.8	1016.5	25.7	22.0	30.7	20.6	25.7	20.5	72	0.0	003	90				600	84.7%	1						
14	1013.3	1015.0	26.9	23.2	31.0	23.4	27.2	21.8	74	0.0	007	70	16	70	1244z	589	83.1%	4						
15	1013.6	1015.3	27.1	23.2	30.6	26.0	28.3	21.8	72	0.4	006	90	12	90	0436z	203	28.6%	6			X			
16	1012.6	1014.3	27.2	24.1	30.5	23.8	27.2	23.1	78	0.0	004	90	11	70	0405z	576	81.1%	4						
17	1012.0	1013.7	26.8	23.3	30.8	23.0	26.9	21.9	75	0.0	003	90				599	84.4%	1						
18	1013.3	1015.0	26.0	22.8	30.7	22.3	26.5	21.5	76	0.0	003	90				497	70.0%	2						
19	1014.2	1015.9	26.5	23.1	31.0	23.8	27.4	21.9	76	0.0	002	90				565	79.5%	3						
20	1014.1	1015.8	26.7	23.5	31.2	22.2	26.7	22.2	76	0.0	004	270	9	90	0535z	594	83.4%	2						
21	1013.3	1015.0	26.0	21.8	30.9	21.2	26.1	20.1	70	0.0	004	90	11	90	0405z	589	82.7%	1						
22	1011.6	1013.3	26.0	21.9	30.9	22.0	26.5	20.2	70	0.0	003	270	9	90	0138z	604	84.7%	3						
23	1010.4	1012.1	26.0	22.9	30.5	21.6	26.1	21.7	77	0.0	002	270				584	81.9%	2						
24	1010.3	1012.0	26.7	23.2	30.8	22.9	26.9	21.9	75	0.0	003	90				609	85.4%	2						
25	1011.4	1013.1	26.5	22.7	30.6	21.9	26.3	21.1	73	0.0	003	270				606	84.9%	1						
26	1010.6	1012.3	26.2	21.8	31.0	23.4	27.2	20.1	69	0.0	005	90	11	90	1040z	618	86.6%	1						
27	1009.2	1010.9	26.6	21.1	30.6	22.2	26.4	18.6	62	0.0	004	90	10	90	0255z	599	83.8%	2						
28	1010.1	1011.8	26.3	21.8	31.0	21.2	26.1	19.9	69	0.0	003					593	82.8%	1						
Total	28343.2	28390.8	745.9	643.8	862.3	643.1				0.4						15,280		70	0	0	1	0	0	0
Mean/ Extreme	1012.3	1014.0	26.6	23.0	30.8	23.0	26.9	21.6	74		004	90	16	70	14/1244z	545.7	76.9%	3						

EXTREMES			
Seal Level Pressure		*Temperature*	
Highest	1018.1 hPa	Highest	31.5°C
Date	12	Date	10
Lowest	1009.5 hPa	Lowest	20.6°C
Date	27	Date	13
Mean	1014.0	Abs. Range	10.9

TOTAL 24-H RAINFALL IN MILLIMETERS (8 AM TO 8 AM)						
Trace	0.1 or more	1.0 or more	10 or more	25 or more	50 or more	100 or more
0	01	0	0	0	0	0

MONTHLY PSYCHROMETRIC VALUES	
Dew Point Temperate (°C)	21.6
Relative Humidity (%)	74
Vapor Pressure (mmHg)	2642

MEAN CLOUDINESS IN OKTAS Number of days with:		
0 – 1 Okta	2 – 6 Oktas	7 – 8 Okta
06	22	00

Revised October 2004/FOMS/egs

Prepared by:

(Signature over Printed Name)

Verified by:

SONNY N. PAJARILLA, M.Sc.

(Signature over printed name of CMO/OIC)

Appendix C
Program for the Humidifier System by using Arduino Uno R3

```
#include <DHT.h>
#include <SoftwareSerial.h>
SoftwareSerial sim(9, 10);
int _timeout;
String _buffer;
String number;
#define DHTPIN 2
#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);
boolean state, lastState;
void setup()
{
  // put your setup code here, to run once:
  delay(3000); //delay for 3 seconds to make sure the modules get the signal
  Serial.begin(9600);
   _buffer.reserve(50);
  delay(1000);
  Serial.println("System Started...");
  delay(1000);
  sim.begin(9600);
  pinMode(4,OUTPUT);
  dht.begin();
  digitalWrite(4,HIGH);
  delay(2000);
}
void loop()
{
  float h = dht.readHumidity();
  Serial.print("Relative Humidity = ");
  Serial.print(h);
  Serial.println(" % ");
  float t = dht.readTemperature();
  Serial.print("Ambient Temperature = ");
  Serial.print(t);
  Serial.println(" C ");
  delay(1000);
    if (h<75)
    {
      h = dht.readHumidity();
      digitalWrite(4,LOW);
      delay(5000);
    }
  else if (h>90)
  {
    digitalWrite(4,HIGH);
    delay(5000);
   }
 SendMessage ();
```

```
 delay(10*60000);
}
void SendMessage()
{
  //Serial.println ("Sending Message");
  sim.print("AT+CMGF=1");
  sim.println();     //Sets the GSM Module in Text Mode
  delay(1000);
  //Serial.println ("Set SMS Number");
  sim.print("AT+CMGS=\"+639991728430\"\r");
//Mobile phone number to send message
  sim.println();
  delay(1000);
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  delay(1000);
  String SMS = "Temperature = "+String(t)+" C
  and Humidity = "+String(h)+" %";
  sim.print(SMS);
  sim.println();
  delay(100);
  sim.println((char)26);// ASCII code of CTRL+Z
  delay(1000);
  _buffer = _readSerial();
  delay(1000);
}
String _readSerial() {
  _timeout = 0;
  while  (!sim.available() && _timeout < 12000  )
  {
    delay(13);
    _timeout++;
  }
  if (sim.available()) {
    return sim.readString();
  }
```

Appendix D
Designing and Fabricating Documentation

The following are the actual pictures taken during the designing and fabrication of the mushroom house, the humidifier system and other activities done throughout this research.

Department of Agriculture Regional Center for Mushroom – Puerto Princesa

Mushroom Fruiting Bags Sample on the Department of Agriculture Regional Center for Mushroom – Puerto Princesa

Fabrication of the Mushroom House

Fabricated Mushroom House

Installation of 12V DC Fan inside the Pipe

Installation of Piping for Air Distribution

Installation of Wirings and System for Humidification

Arduino Programming

Installed Wirings and System for Humidification

Mushroom Fruiting Bag for Testing

Mushroom Fruiting Bags starting to Produce Mushrooms

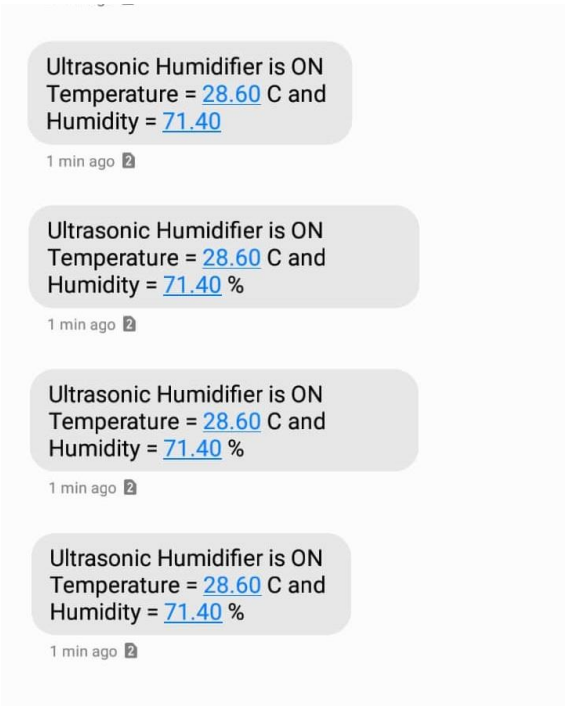
Ultrasonic Humidifier is on, starting to produce mist throughout the mushroom house

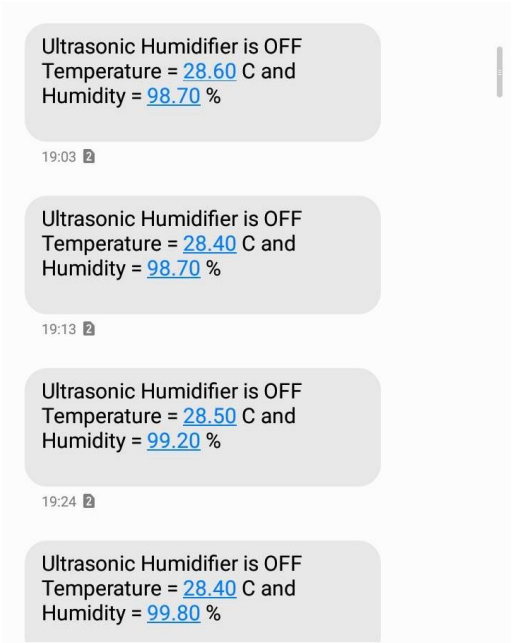
Mushrooms Ready for Harvesting

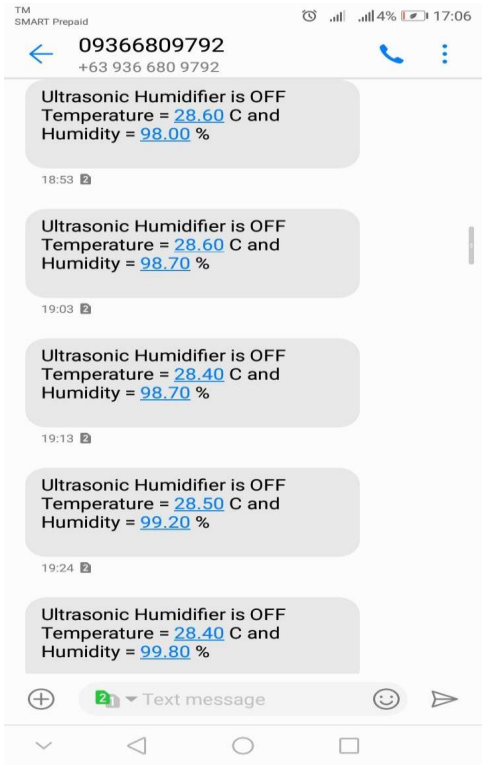
Mushrooms Ready for Harvesting

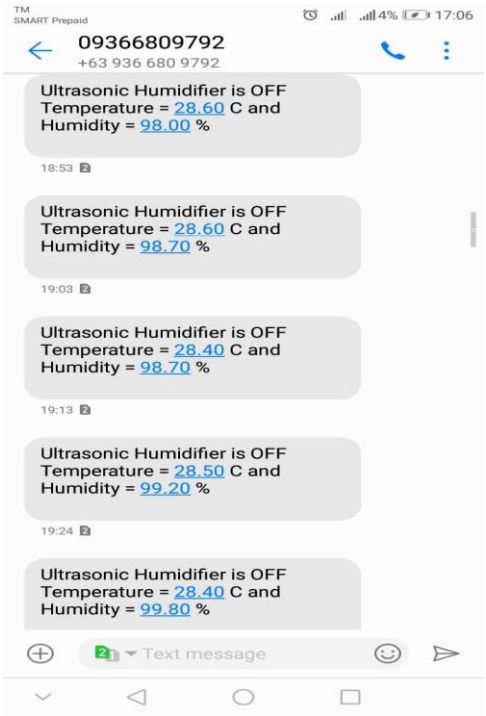
Appendix E
Sample SMS from GSM Module

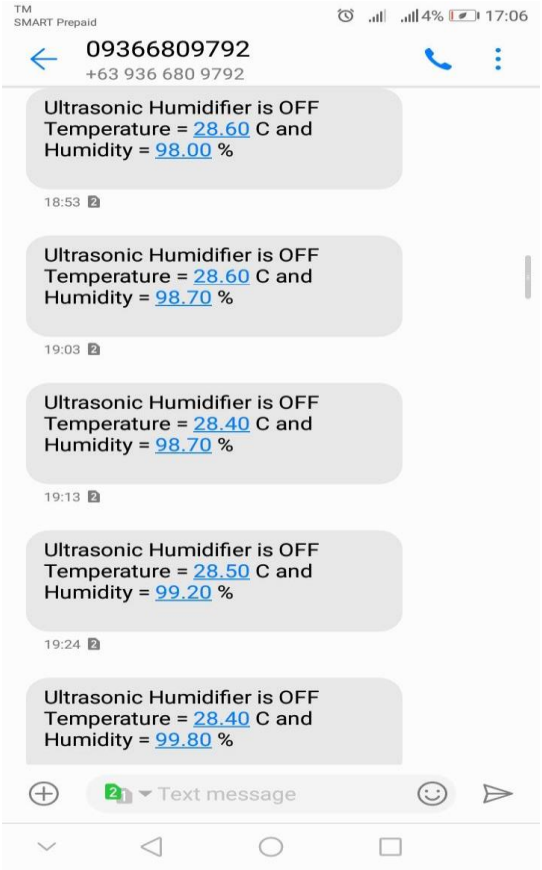
The following figures show the actual SMS sent by the system using the GSM Module:

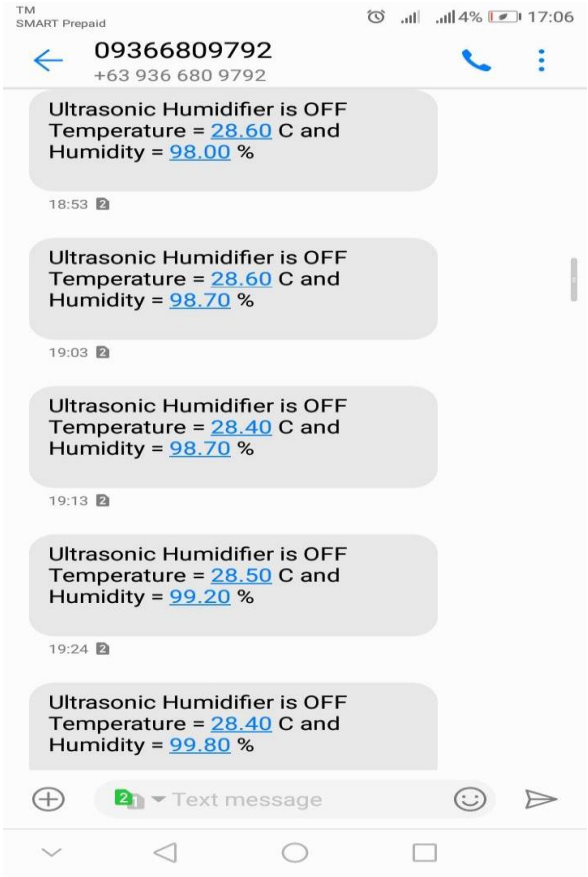


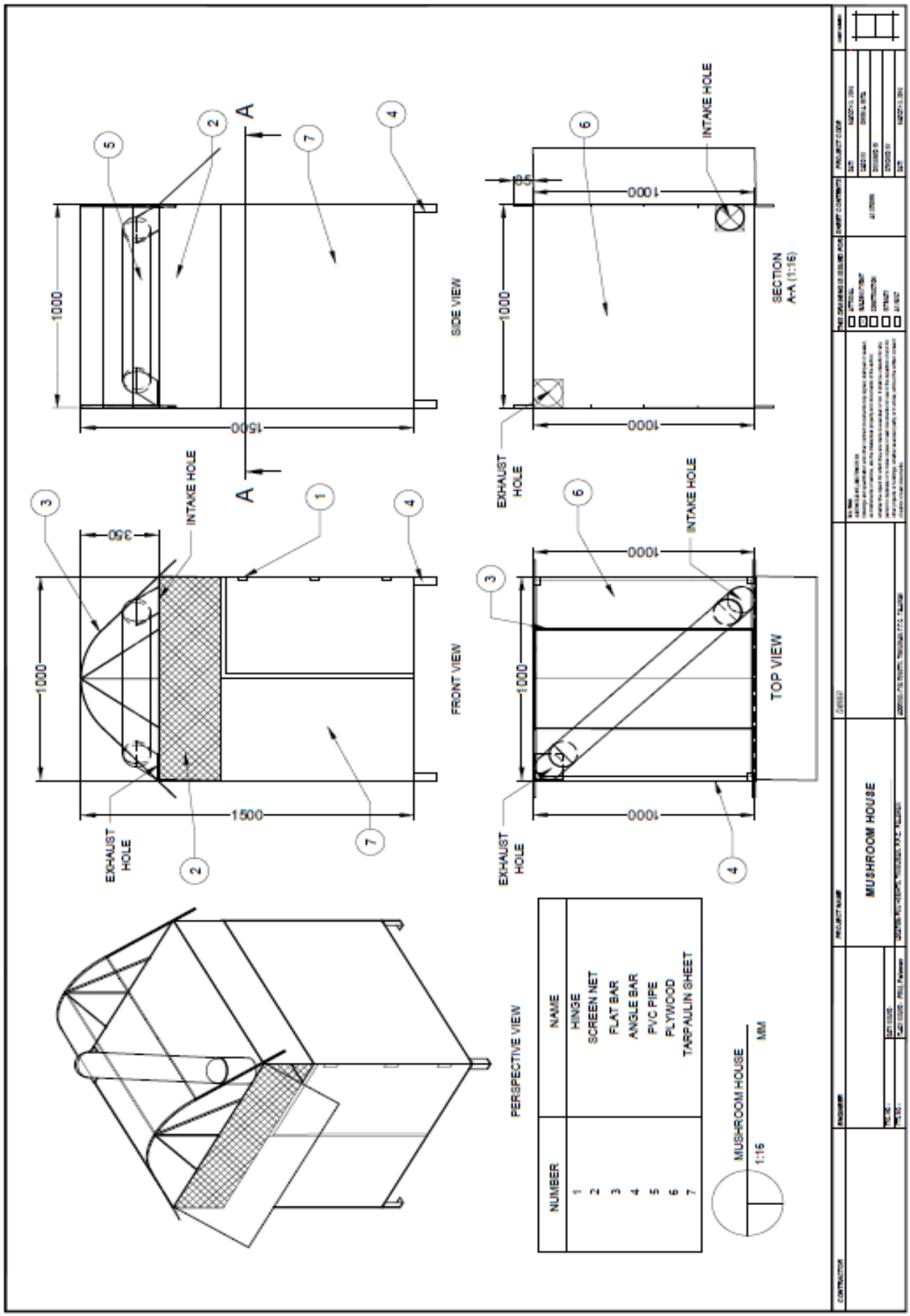







TM
SMART Prepaid
4% 17:06
09366809792
+63 936 680 9792
Ultrasonic Humidifier is OFF
Temperature = 28.60 C and
Humidity = 98.00 %
18:53
Ultrasonic Humidifier is OFF
Temperature = 28.60 C and
Humidity = 98.70 %
19:03
Ultrasonic Humidifier is OFF
Temperature = 28.40 C and
Humidity = 98.70 %
19:13
Ultrasonic Humidifier is OFF
Temperature = 28.50 C and
Humidity = 99.20 %
19:24
Ultrasonic Humidifier is OFF
Temperature = 28.40 C and
Humidity = 99.80 %
Text message


TM
SMART Prepaid
4% 17:06
09366809792
+63 936 680 9792
Ultrasonic Humidifier is OFF
Temperature = 28.60 C and
Humidity = 98.00 %
18:53
Ultrasonic Humidifier is OFF
Temperature = 28.60 C and
Humidity = 98.70 %
19:03
Ultrasonic Humidifier is OFF
Temperature = 28.40 C and
Humidity = 98.70 %
19:13
Ultrasonic Humidifier is OFF
Temperature = 28.50 C and
Humidity = 99.20 %
19:24
Ultrasonic Humidifier is OFF
Temperature = 28.40 C and
Humidity = 99.80 %
Text message


SIDE VIEW
FRONT VIEW
TOP VIEW
SECTION A-A (1:16)
PERSPECTIVE VIEW
INTAKE HOLE
EXHAUST HOLE
1000
1500
350
NUMBER
NAME
1 HINGE
2 SCREEN NET
3 FLAT BAR
4 ANGLE BAR
5 PVC PIPE
6 PLYWOOD
7 TARPAULIN SHEET
MUSHROOM HOUSE
1:16
MM
MUSHROOM HOUSE

CURRICULUM VITAE

PERSONAL DATA

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Email Address	:	calingaovirinis@gmail.com
Address	:	Block 9 Lot 1, Sitio Apan Bgy. Sicsican, Puerto Princesa City
Birth Date	:	August 19,1997
Birth Place	:	Puerto Princesa City
Age	:	21 years old
Citizenship	:	Filipino
Civil Status	:	Single
Height	:	5’3”
Weight	:	56 kls.

SKILLS

- ✓ Computer Literate
- ✓ AutoCAD 2015 Literate
- ✓ Oriented in Microsoft Office Applications

ORGANIZATIONAL INVOLVEMENT

Junior Philippine Society of Mechanical Engineering
Member
2014- Present

SEMINARS/TRAININGS ATTENDED

Robotics Today and Tomorrow	RSA Automation & Robotics Services Palawan State University-Main Campus March 30, 2015

A look into the Future Technology	RSA Automation & Robotics Services Palawan State University-Main Campus March 31, 2015
Programmable Logic Controller Training - Workshop	RSA Automation &Robotics Services Palawan State University-Main Campus April 1, 2015
RFID Technology	RSA Automation & Robotics Services Palawan State University-Main Campus March 31, 2015
4th Luzon Student Conference	Junior Philippine Society of Mechanical Engineers Western Philippine University-PPC Campus June 2, 2017
Arduino Programming Training Workshop	RSA Automation & Robotics Services Palawan State University-Main Campus January 30, 2018
Industrial Automation	RSA Automation & Robotics Services Palawan State University-Main Campus January 31, 2018
Petrosphere	Basic Engineering Safety December 14, 2017 Basic Life Support & First Aid Training December 15,2017

EDUCATIONAL BACKGROUND

TERTIARY:	Bachelor of Science in Mechanical Engineering Palawan State University-Main Campus Tiniguiban Heights,Bgry.Tiniguiban Puerto Princesa City, Palawan 2014-Present
SECONDARY:	Palawan National School H.mendoza St. Brgy. Model Puerto Princesa City 2010-2014
ELEMENTARY:	Puerto Princesa Pilot Elementary School Roxas St. Brgy. De Manga Puerto Princesa City 2004-2010

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Birth Place	:	Puerto Princesa City
Age	:	21 years old
Citizenship	:	Filipino
Civil Status	:	Single
Height	:	4’3”
Weight	:	46 kls.

SKILLS

- ✓ Computer Literate
- ✓ AutoCAD 2016 Literate
- ✓ Computer Literate (MS Excel, MS Word, MS PowerPoint)
- ✓ Windows 10

ORGANIZATIONAL INVOLVEMENT

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Member
2014- Present

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RFID Technology	RSA Automation & Robotics Services Palawan State University-Main Campus March 31, 2015
4th Luzon Student Conference	Junior Philippine Society of Mechanical Engineers Western Philippine University-PPC Campus June 2, 2017
Arduino Programming Training Workshop	RSA Automation & Robotics Services Palawan State University-Main Campus January 30, 2018
Industrial Automation	RSA Automation & Robotics Services Palawan State University-Main Campus January 31, 2018
Petrosphere	Basic Engineering Safety December 14, 2017 Basic Life Support & First Aid Training December 15,2017

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TERTIARY:	Bachelor of Science in Mechanical Engineering Palawan State University-Main Campus Tiniguiban Heights, Bgry. Tiniguiban Puerto Princesa City, Palawan 2014-Present
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Birth Date	:	March 8, 1998
Birth Place	:	Puerto Princesa City
Age	:	21 years old
Citizenship	:	Filipino
Civil Status	:	Single
Height	:	5’10”
Weight	:	75 kls.

SKILLS

- ✓ Computer Literate
- ✓ AutoCAD 2016 Literate
- ✓ Computer Literate (MS Excel, MS Word, MS PowerPoint)
- ✓ Windows 10

ORGANIZATIONAL INVOLVEMENT

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Member
2014- Present

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Petrosphere	Basic Engineering Safety December 14, 2017 Basic Life Support & First Aid Training December 15,2017

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TERTIARY:	Palawan State University Bachelor of Science in Mechanical Engineering Tiniguiban Heights, Puerto Princesa City, Palawan, Philippines (2014 up to present)
SECONDARY:	Palawan Polytechnic College Inc. Manalo Ext., Puerto Princesa City Palawan, Philippines (2012-2014) Central Palawan Adventist Academy Fernandez Street, Puerto Princesa City Palawan, Philippines (2010-2012)

ELEMENTARY: Puerto Princesa Adventist Elementary School
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(2008-2010)

Wescom Elementary School
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(2004-2008)

PERSONAL DATA

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Birth Date	:	October 27,1997
Birth Place	:	East Ave. Medical Center, Quezon City, Philippines
Age	:	21 years old
Citizenship	:	Filipino
Civil Status	:	Single
Height	:	5’3”
Weight	:	44 kls.

SKILLS

- ✓ Computer Literate
- ✓ AutoCAD 2016 Literate
- ✓ Computer Literate (MS Excel, MS Word, MS PowerPoint)
- ✓ Windows 10

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2014- Present

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