Surigao City Campus

Bachelor of Science in Electrical Engineering

SURIGAO STATE COLLEGE OF TECHNOLOGY

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APPROVAL SHEET

This Project Study entitled **"THE IMPLEMENTATION OF THERMOELECTRIC SYSTEM"** prepared by **Delf Enriq Aloyon, Lord John Kevin Bangcoyo, Reiolvi Orcullo, Lowie Pejer, Hannie Bert Quinalagan** in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical Engineering** has been examined and is recommended for acceptance and approval for ORAL EXAMINATION.

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Renewable Energy: Thermoelectric Power Generating Device

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Abstract

Countless households and business establishments are longing to find an alternative source of energy due to the increasing of electricity rates. Nowadays, the most popular solution for this problem are power generating devices that relies only on renewable energy. Specifically, the researchers create a study of how the waste heat from the roast chicken machine turned to be an independent source of energy for the power supply of the machinery itself. Thus, the purpose of this study is to develop a device that can generate electricity using heat energy. Additionally, experimental research is used in this study to develop the device and its scientific design, and to collect data to support the hypothesis. Also, to fully understand the device, the researchers create a project development plan which consists planning, gathering, designing, creating the system, testing, and evaluation.

Index Terms

Electricity, Heat Energy, Power Generating Devices, Renewable Energy, Solar Panels

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I. INTRODUCTION

In the study of *Renewable Energy Resources* by Ellaban et al., renewable energies are sources of energy that are always being replenished by nature. They can come directly from the sun (like thermal, photo-chemical, and photo-electric energy), indirectly from the sun (like wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment, like wind, water, and plants.

Today's modern world is evolving and powered by technologies which lead into a massive production, those it requires enormous source of energy. According to P.K. Haldar et al. (2015), in 2013, global energy consumption was 12,730.4 million tons' oil equivalent (Mtoe), nearly double the 1980 level of 6629.8 Mtoe.

Non-renewable resources cannot be used indefinitely since they cannot be replicated or regenerated with the same capability once exhausted. Global energy demand is expected to climb to 5 times current levels by 2100, according to projections (Sadia Ali et al., 2017). Hence, the rate of electricity is also rising. Base on *Reducing Energy Poverty* (2020) by Son and Yoon, low-income countries undergo economic development like Philippines, electricity usage is continuously increasing in both the industrial and household sectors.

What's the good news? As the renewable energy sector increases and advances, a clean energy revolution is happening. The researchers chose thermoelectricity as the source of power. So how is thermoelectric power generated? According to WatElectrical (2021), it is based on the Seebeck effect, which is a type of thermoelectric effect. A temperature gradient or temperature difference is formed between two endpoints in the Seebeck effect. The electrons flow from one end to the other when a temperature gradient is produced. The electrons at the high-temperature end of the spectrum would have a lot of energy. As a result, they begin to move in the opposite direction.

The application of research output can span in different areas and industries. It puts an advantage especially for those industries that uses coals or any kind of combustion process that provides heat to generate the thermoelectric generator. They can look forward to a device that can generate renewable energy using thermoelectric because it will definitely aid the problem in power interruption for the industrial machinery like for roast chicken machine, this will allow you to make an independent source of energy for the said machinery. Furthermore, it'll also minimize the total estimated bill every month for the household or the industrial itself.

A. PROBLEM STATEMENT OBJECTIVES

The researchers will develop a thermoelectric device that can generate a renewable energy from waste heat energy. To finish this study, the researchers desired to answer the following problems after developing the said device:

1. What amount of wasted heat energy is required to make a device generate a renewable energy?

2. What is the effect of the device on the production in a certain business?

3. What is the reduction in terms on the electric bill of the user?

B. SPECIFIC OBJECTIVES

The general objective of this study is to develop a thermoelectric generating device; the specific objectives are the following:

1. To design a secure alternate source of energy for continuous and efficient production.
2. To identify the amount of waste heat energy and its corresponding output voltage.
3. To evaluate the owner's insight and the reduction in their electric bill.

C. Conceptual Framework

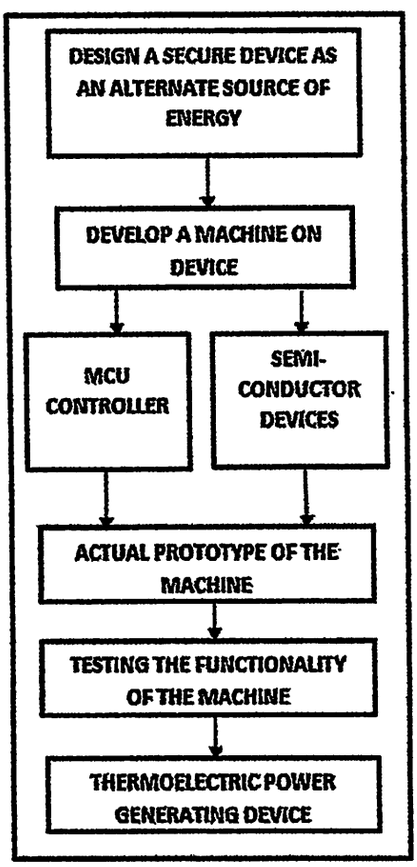


Fig. 1.1 Conceptual Framework of the Study

In designing a device, the researchers used an 11-plate battery as an alternative source of energy. They also used a 6000 Watts power inverter which takes on the role of inverting the power supply to provide sufficient power for the device. However, the researchers used a p-type

and n-type semiconductor which is connected in series and covered by a ceramic material which can hold a higher temperature because of its property of having a high melting point. For observing the heat index of the device, the researchers used a digital thermometer.

The current prototype of the machine uses a 0.3 HP motor and a speed controller to control the speed of the rotation of the roast chicken machine. The motor will be directly connected to the 6kW power inverter, which will provide the required power output for the 0.3 HP motor. Additionally, the researchers used p-type and n-type semiconductors for completing the design of the thermoelectric generating device, which further gives enough output power to make renewable energy that'll be stored in an 11-plate battery. Moreover, after the design of the said machinery, the researchers will directly test the functionality of the actual prototype and evaluate the level of success for the actual prototype of the Thermoelectric Generating Device.

D. Review of Related Literature

This section presents the REVIEW LITERATURE about Renewable Energy: Thermoelectric Power Generating Device.

1.1 Concept of Thermoelectric Device

Based on the reaction effect, thermoelectric device materials provide a technique to transform low-quality heating energy into electrical energy. The German scientist Thomas Johann Seebeck discovered this effect in 1821, and it can be employed in a wide range of energy conversion applications. When a thermal gradient is introduced to a material, the charge carriers spread from the hot side to the cold side. An electrostatic voltage is induced as a result. A mono-electrostatic stalk's potential is very low. As a result, thermal generators often consist of tens, if not hundreds, of thermal pairs to obtain

high voltage output and energy. Because their output power ranges from several watts to kilowatts, thermoelectric devices can be utilized in a wide range of energy conversion applications, from wristwatches to cars. Electrons leap from a low energy level to a higher energy level, absorbing heat from the environment and vice versa. Low to medium power and size applications benefit, whereas other conversion systems (including power plants) become less efficient when their size and power are reduced. As a result, they're interesting for low to medium power applications, particularly those that are utilized in huge numbers. The human body, for example, is a thermal source that loses heat by convection, conduction, and radiation. That's still plenty to power low-power personal devices, which typically require a power source in the W to mW range. (Fahd, Saud & Khalifa, 2016).

1.2 Thermoelectric Power Generator

According to (Delightus Peter et al, 2013), TEG stands for Thermoelectric Power Generator, and it is a solid-state device that converts heat energy into electrical energy. All intriguing traditional power generators transform Thermal Energy into Mechanical Energy, which is ultimately converted into Electrical Energy. As a result, there is no mechanical work here. When compared to traditional power generators, it produces less noise and no pollutants. Thermoelectric Effect (seebeck) is how TEG works. TEG produces a voltage when it is held between temperature gradients (Hot end, Cold end). This voltage is known as seebeck voltage. Modules, which are semiconductors, are available from TEG (p,n). Electrons are used as a thermoelectric power fluid here (working medium). A Module is made up of a pair of p-type and n-type semiconductors. To boost electric conductivity, these semiconductors are heavily doped with contaminants. TEG has a cover that protects modules from being damaged by high temperatures. TEG's efficiency and voltage generated are proportional to the semiconductor material and temperature gradients. As a result, semiconductors are chosen based on the material's electric conductivity, with the goal of increasing the temperature difference value. Copper electrodes connect this semiconductor. Increasing the number of modules, stages, and TEG couplings improves overall efficiency and voltage output. TEG has an exciting efficiency of 4.2 percent to 6%. When you use phases, you can enhance your efficiency by 7%.

The idea of a waste-heat thermoelectric generator has a lot of potential benefits in terms of simplicity, dependability, and safety. It appears that the successful development of new thermoelectric materials and power module designs is critical to their economic competitiveness. Reduced waste-heat thermoelectric generator costs and higher market penetration are also possibilities. In addition, the concept of a completely reversible heat engine has aided in the advancement of thermoelectric generator performance. The ideal thermoelectric generator efficiency has been considered as an upper bound for external irreversible thermoelectric generators by the engineering academic community. It is, however, a poor predictor of the efficiency of real waste-heat thermoelectric generators. Furthermore, the external reversible ideal waste-heat thermoelectric generator produces no specific power. To account for both internal and external irreversibility factors, this research proposes a true waste-heat thermoelectric generator model. This method produces a considerably more realistic forecast of generator specific power and efficiency than the ideal thermoelectric generator. (Wu, 1996).

1.3 The Seebeck and Peltier Effects

The thermoelectric phenomenon is the use of solid-state materials to convert heat energy into electrical energy and vice versa. A potential difference (dV) is formed between the free ends of the circuit when a temperature gradient (dT) exists between two different materials (a and b) that are in contact. The Seebeck effect is a term that describes this. The Seebeck coefficient (a) is calculated as follows:

$$(1) \qquad \alpha_{ab}=\frac{dV}{dT}$$

A current will flow if the generated dV is put across some external electrical resistance, and the Seebeck effect provides the basis for a power generation mode; the refrigeration mode is based on the reverse operation of sending a current through a thermoelectric to extract heat (Fig. 1).

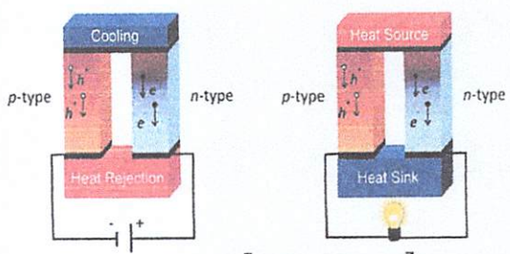
Figure 1: A illustration of the TE effect in a Peltier cooler (left) and a TE generator (right). Charge carriers flow from one end of the thermocouple to the other, carrying entropy and heat. A full device requires both n- and p-type materials.

The performance of the semiconducting materials from which a thermoelectric device is made is directly connected to its efficiency. The performance of the materials is represented by a dimensionless figure of merit, ZT, which includes the Seebeck coefficient (S), electrical conductivity (σ), and thermal conductivity (K) and can be written as:

$$(2) \qquad ZT = \frac{S^2\sigma T}{k}$$

Charge carriers (e) and lattice vibrations (L) both contribute to heat conductivity. A significant Seebeck coefficient and low thermal conductivity, which are typical of non-metallic systems, must be paired with a high electrical conductivity, which is more commonly seen in metallic phases, to achieve good performance. As a result, S, and cannot be adjusted separately, posing a problem in the development of high-performance materials. Semiconducting materials with charge carrier densities in the range of 1019–1020 cm3 provide the optimum compromise. Device efficiency () is traditionally computed as follows (using the materials figure of merit):

Fig. 1.3.1



$$(3) \qquad n = \frac{T_h - T_c}{T_h}\left[\frac{\sqrt{1+ZT}-1}{\sqrt{1+ZT}+\frac{T_c}{T_h}}\right]$$

Where Th/Tc is the hot/cold junction temperature and ZT is the device's average temperature from Tc to Th. Increases in average ZT over the device's temperature range has a greater influence on efficiency than increases in maximum figure of merit of the component semiconductors. However, ZT for material and ZT for device must be distinguished (indicated by bold italic text here). They showed that for a finite temperature differential (Th Tc), the thermoelectric device ZT is given by:

$$(4) \qquad ZT = \left(\frac{T_h - T_c(1-n)}{T_h(1-n)-T_c}\right)^2 - 1$$

The temperature dependent characteristics S(T), σ(T), and K (T) between the hot and cold sides

are used to compute maximum efficiency.(Freer & Powell, 2020)

1.4 Theory and Generic Model of a Thermoelectric Generating System.

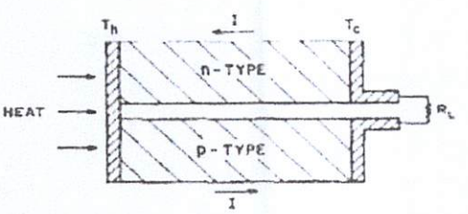


Fig. 1.4.1 Thermocouple as power generator.

According to (Rosi, 1968), Figure 1 graphically depicts the circuit for a basic power generating thermocouple. It involves the joining of two different materials, such as an n-type and p-type semiconductor, at their ends by a metallic conductor with higher thermal and electrical conductivities than the branch materials. The hot junction receives heat from an external source at temperature TH, while the other junction is kept at a constant lower temperature, TC. A current, I, runs through the branches as a result of the temperature differential, TH- TC, as represented by the arrows. The configuration in Fig. 1 shows a direct conversion of heat into electrical energy with conversion efficiency, Φ, by allowing current to flow through an external load resistor, RL, added into the circuit between the cold junctions, given by:

$$(5) \qquad \emptyset = \frac{power\ supplied\ to\ load}{heat\ absorbed\ at\ hot\ junction}$$

A TE (Thermoelectric) system, in general, is made up of numerous thermal masses that store and exchange heat via conduction and/or convection. Inside the TE device and/or additional elements, such as electrical heaters, heat is partially transferred to or from electricity. To ensure optimal performance, the thermal connectivity of the TE device with the rest of the system must be designed properly.

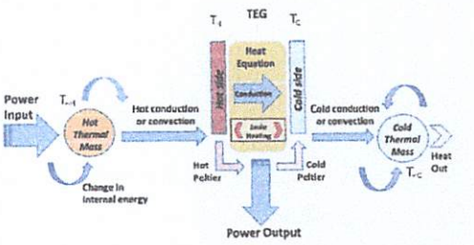


Fig. 1.4.2 Architecture of a thermoelectric power generating system.

The architecture of a generic TE power generating system is shown in Figure 2. On both the hot and cold sides, the TEG is usually in touch with a thermal mass. Electrical or heat power is applied to or removed from the thermal masses, resulting in changes in the thermal energy stored within the thermal masses.

A portion of this energy is transported to and from the TEG module via conduction or convection. The sides of the TEG are modelled separately from the inner half of the TEG. Inside the TEG, the heat equation (HE) deals with both heat conduction and generation (Joule heating). Additional heat is brought in from the sides where two dissimilar materials meet (Peltier effect). The process is closely related to the thermoelectric effects described by Equations 1 and 2. A portion of the energy flowing through the TEG is transformed into electrical power. (Montecucco & Knox, 2014)

$$(1) \qquad V_{OC} = \alpha \Delta T$$

$$(2) \quad P_P = \pi l = \alpha I T_J$$

II. RESEARCH METHODS

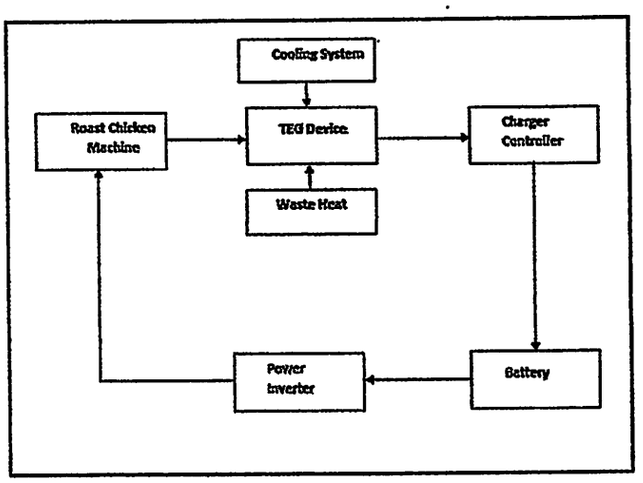
A. RESEARCH DESIGN

In this project, the researchers are going to use an experimental research study. Experimental research is a study that strictly adheres to a scientific research design. It includes a researcher and variables that can be measured, calculated and compared. The researcher collects data and results will either support or reject the prototype.

Firstly, the researchers are going to use a p-type and n-type semiconductor pellets which is connected electrically in series and thermally in parallel and we'll covered it with a ceramics plate material for the durability of the device while absorbing the heat from the combustion in the roast chicken machine. The researchers will also use a heat sink which is place behind of the hot side of the thermoelectric generator to redirect the heat which is provided by the roast chicken machine.

Furthermore, a 6000 Watts power inverter and 11 plates rechargeable battery is also needed for the purpose of an independent power source of the roast chicken machine. The role of the thermoelectric generator device is to provide a renewable energy for the rechargeable battery for the purpose of sustaining the power that is needed for the consumption of the roast chicken machine.

B. PROJECT DESIGN



Project Design of the Actual Prototype

Fig. 2.1

Figure 2.1 shows the diagram of how the Renewable Energy: Thermoelectric Generating Device works; while the Roast Chicken Machine is operating and while producing an efficient heat to generate the thermoelectric generating device, the diagram itself explains that heat produced will be directed into the heat sink and absorbed by the thermoelectric generator and triggers the semiconductors to create a Seebeck effect that produced an output voltage that will be stored in a rechargeable 11plates battery while at the same time, it also supplies the power needed for the roast chicken machine to operate and by using the 6kW Power Inverter, the stored power in the battery will be enough for the roast chicken machine to operate.

C. PROJECT DEVELOPMENT

Fig. 2.2 ADDIE MODEL:

ADDIE is a standard procedure and method used by instructional designers and training creators. The model's phases include analysis, design, development, implementation, and evaluation. In the present era, ADDIE is considered the most commonly implemented model for instructional design. The researchers first made a brainstorming analysis and makes an examining and articulating of the study's problem. The researchers then make a design of the proposal then further make a development, Implementation and evaluation of the actual finished prototype.

D. PROJECT EVALUATION

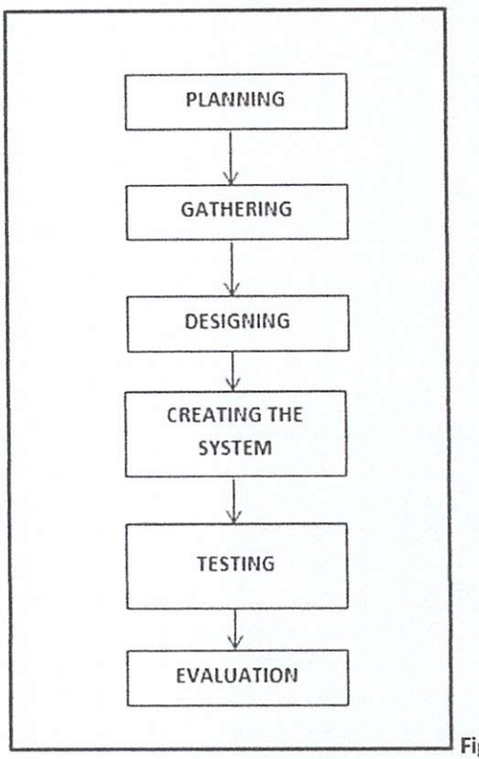


Fig. 2.3 Project Evaluation of the Proposal

Fig. 2.3

It shows the diagram flow of the general overview of the gathered data. Firstly, the researchers planned the study and gather all the needed information and designed the device that will be created by the researchers. Furthermore, when the prototype is done, the researchers will test and analyze its application. Thus, the researchers will able to evaluate the efficiency and the effectiveness of the project.

D. PARTICIPANTS OF THE STUDY

The researchers will present a video presentation during the testing of the mini

prototype to the ten selected roast chicken machinery owners. Furthermore, the researchers will collect their insights and opinion about the proposed concept and the prototype itself. The response of the respondents will be evaluated and will be considered for the development of the project.

E. INSTRUMENTS

1. *TEG Module* - Small and lightweight, convenient for use. Designed specifically for power generation when there is applied heat on it's hot side and cooling in it's cold side. It is a connection of p-type and n-type semiconductor connected alternately.
2. *Heat sink* - a component that increases the heat flow away from a hot device or surrounding.
3. *Cooling System* – a device that can produce cold temperature.
4. *11 Plates Battery* - Used as an alternative source for the roast chicken machine to operate. Serves as a storage device where the power generated from the TEG module is stored.
5. *Power inverter* - A device used to invert the power output of the battery to be able to run a 0.3 HP 220 V AC electric motor of the roast chicken machine.
6. *MCU Controller* – Used as a controller device to regulate the output voltage that the TEG module produced and a device used in charging the rechargeable battery.
7. *Analog Multi-tester* – A device used to monitor the output voltage that the TEG module produced.
8. *Thermometer* – A device used to monitor the temperature that the TEG module produced.

III. RESULTS AND DISCUSSION

This chapter provides the discussion of results for this study. The researchers will use table and diagram to present the results.

3.1 DESIGN OF THE ACTUAL DEVICE

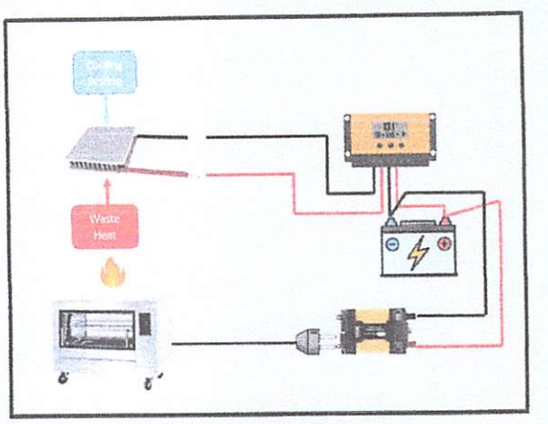


Fig. 3.1.1: Schematic Diagram

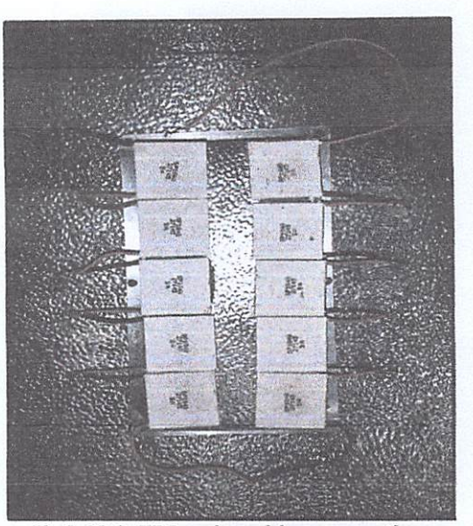


Fig 3.12.2: TEG series wiring connection

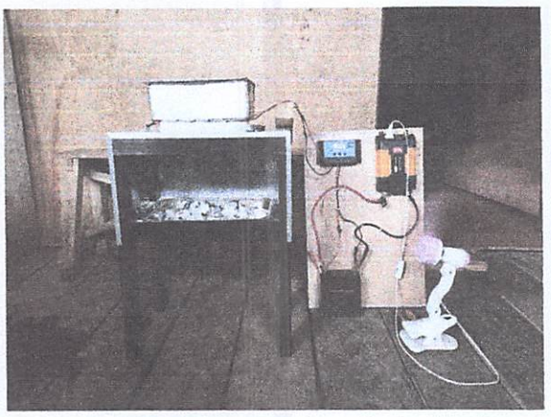


Fig. 3.1.3: Picture Diagram of the Finished Device

3.2 AMOUNT OF HEAT AND ITS OUPUT VOLTAGE

Heat Index

No. of Trial	Heat Index	Cooling Temp.	Voltage Produced
1	at 50C°	at 0C°	0.8 Volts
2	at 100C°	at 0C°	1.4 Volts
3	at 150C°	at 0C°	2.1 Volts

Table 1: Shows how much volts can be produced by a single TEG module at a specific heat index.

No. of Trial	Heat Index	Cooling Temp.	Voltage Produced
1	at 50C°	at 0C°	6.4 Volts
2	at 100C°	at 0C°	11.2 Volts
3	at 150C°	at 0C°	16.8 Volts

Table 2. Shows how much volts can be produced by 10 TEG module (in series) at a specific heat index.

Operation

Heat Index	Cooking duration (min.)	No. of TEG module needed to supply the battery	11 Plates Battery Capacity (32Ah), Duration of battery to supply a 1.5 A to the machine
at 50C°	24-28 min.	A parallel connection of a series of 8 TEG module (14V) producing 1 Ampere	21.333 hrs.
at 100C°	20-24 min.	A parallel connection of a series of 8 TEG module (14V) producing 1 Ampere	21.333 hrs.
at 150C°	16-20 min.	A parallel connection of a series of 8 TEG module (14V) producing 1 Ampere	21.333 hrs.

Table 3. Shows the duration of how long the battery can supply the roast chicken machine and also shows it's cooking duration as well.

11 plates battery charge capacity = 32Ah ; Current output for the roast chicken machine to run= 1.5A

$Q = TA$

$Q\ (charge\ capacity)\ in\ Ah$

$A\ in\ amperes$

$T\ in\ hours$

$$T = \frac{Q}{A}$$

$$T = \frac{32}{1.5}$$

$$= 21.333\ hrs.$$

There will be an evaluation of the TEG module to determine the maximum voltage that the TEG could provide. Specifically, a single TEG can produced a peak voltage of 1.9 V at 150° C as shown in Tab. 1. However, a battery is a 12V DC supply, so a series of 8 TEG module is much needed to meet up with the voltage needed for the battery to recharge. As shown in Tab. 3, a series of 8 TEG module can produced a voltage of 16.8 V which is sufficient enough for the battery to recharge. The 11 plates battery has the capacity of 32Ah and the electric motor has a power output of 0.3 HP 220V AC 60Hz, as shown in Tab. 3. At a current supplied by the battery through inverter to run the roast chicken machine is approximately 1.5 A, so the battery can definitely supply the roast chicken machine for up to 21.333 hrs.

3.3 EVALUATION OF THE OWNER'S INSIGHT AND THE ELECTRIC'S BILL REDUCTION

Owner's Rating

Ratings	No. of Participants (n = 10)	% of Involvement
Satisfied	8	80%
Dissatisfied	2	20%

Table 4. Shows the rating of the ten selected roast chicken machinery owners.

Owner's Bill Reduction

HP	Watt	Monthly Total kWh (12 hrs. of usage)	kWh rate in PHP	Total Cost per Month
0.3	223.71 W	80.5356 kWh	11 PHP	885.89 PHP

Table 5. Shows the total cost of potential reduction of the owner's bill if the device will be use.

$$\text{kWh} = \frac{watts \times time\ (hrs)}{1000}$$

$$= \frac{223.71 \times 12 \times 30}{1000}$$

$$= 80.5356\ \text{kWh}$$

$$\text{Total Cost Reduction} = 80.5356 \times 11$$

$$= 885.89\ PHP$$

Based on the provided data. It shows in table 4 that 8 out of 10 participants are satisfied and have optimistic perception that this device can give advantages in operating their business. While 2 out of 10 participants are doubted due to some concerns including high-cost, maintenance and the design may not suitable to their roast chicken machine. But overall, the satisfaction percentage of participants is above average. Meanwhile, in table 5, the researchers will able to calculate the total cost of potential reduction of the owner's bill with the used of Kwh formula.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Heat energy is a type of energy that can be transferred from one particle to another in a substance by utilizing the kinetic energy of the particles in question. In other words, according to the kinetic theory heat is transferred when particles collide with each other and bounce off. Heat is everywhere and can be transferred through three processes known as conduction, convection, and radiation. For the past decades, heat is already discovered as a source of energy or known as one of a renewable energy source. Even so, heat from the other heat sources are being neglected which will turn it into a waste heat. Specifically, heat from the roast chicken machine are one of the heat source that are being neglected so the researchers make a conclusion on how to take an action for the waste heat to be an independent source of energy for the device itself. The researchers then make a design of the actual prototype of the roast chicken machinery with a series connection of TEG module on top of it and a number of trials on it had followed after the device was finally finished. Furthermore, the researchers make simple a presentation for the roast chicken machine owners and rate their satisfaction and their perspective about the actual device. In conclusion, the thermoelectric power generating device were perceived by the participants as acceptable as more than half of the participants are satisfied with 80% of rating. To some it up, the researchers had finally make the study successfully and the device were actually functioning that corresponds with the theory that is stated in the research proposal.

RECOMMENDATION

Based on the research's findings acquired, the following recommendations are given:

1. To use a cooling system with a monitoring system for its temperature being monitored from freezing point down to the negative degree Celsius Temperature.
2. To use more number of TEG for an efficient charging output that will be sufficient to supply the rechargeable battery and the roast chicken machine.
3. For a fast charging duration in recharging the battery, make a parallel connection of TEG modules that are connected in series and measure it using ammeter to monitor the output current that the TEG module produced.

V. ACKNOWLEDGEMENT

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APPROVAL SHEET

This Project Study entitled **"Automated Solar Powered Chamber With Image Processing Detection Using AI In Cacao Beans"** prepared by **Catherine A. Balaez, Johanni O. Dotarot, Noel P. Galol , Norman II G.Limosnero, Arvien M. Vidal** in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical Engineering** has been examined and is recommended for acceptance and approval for ORAL EXAMINATION.

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Date: June 10, 2022

AUTOMATED SOLAR POWERED CHAMBER WITH IMAGE PROCESSING DETECTION USING AI IN CACAO BEANS

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Abstract: This paper presents the design and development of an automatic solar powered chamber with image processing using AI in cocoa beans. The drying mechanism was based on the combination of direct radiation and convective heating with the incorporation of electric backup heaters to address the intermittent effect of drying. Arduino Uno and the raspberry pi 3b+ along with the appropriate sensors are used to monitor and control the moisture content, speed of the motor and temperature of the heating chamber. Direct radiation maximized the solar reception during daytime by providing sufficient heat inside the chamber. The electric heaters also provide reliable heat sources during night time, preventing the occurrence of moisture re-absorption by the beans. The developed system maintained a drying temperature 40-50°C by automatically switching the drying modes depending on the weather conditions. The prototype of the system is developed and powered using solar photovoltaic energy generated from 70- and 100-watts solar panels in conjunction with converter and charge controller. This study demonstrated a methodology for textural feature analysis on digital images of cocoa beans. Our results showed that using GLCM with RGB segmentation for image processing can contribute more reliable results. Our method was implemented through on –site preprocessing within a low- performance computational device. It is also helped to foster the use of modern Internet of Things (IoT) technologies among farmers and to increase the security of the food supply chain as a whole.

Keywords Image Processing, Mobile Application, Artificial Intelligence, Drying chamber, Raspberry Pi,

1. Introduction

Fermentation process is an important indicator of cocoa beans quality. Human workers currently employ the traditional drying method, which requires a significant amount of time and efforts. Advanced agricultural development and procedural operations differ significantly from those of several decades earlier, principally because of technological developments, including sensors, devices, appliances, and information technology.

Cacao seeds are the seed of Theobroma cacao (Sterculiacaea family), a tropical tree which is grown mostly in the wet tropical forest climate countries. It is a Philippines cash crop that has economic potentials for rural farmers but is otherwise beset with drying problems (Burguillos, Elauria, & De Vera, 2017) [1].Traditionally, drying is usually carried out using natural sun drying. The various drawbacks to this method include unpredictable weather patterns, labor intensive and prolonged rate and product spoilage(Hii, Law, & Suzannah, 2012) [2].

Drying is the most important process to preserve grains, crops and foods of all varieties. The removal of moisture prevents the growth and reproduction of microorganisms causing decay and minimizes many of the moisture-mediated deterioration reactions. It brings about substantial reduction in weight and volume, minimizing packing, storage and transportation costs and enables storability of the product under ambient temperatures.

Thermodynamic relations should be considered in designing a solar dryer system for a specific product such as cocoa beans. Previous works includes Burguillos et al. (2017) which adopts a structural arrangement for the direct type, and the heating mode for the indirect type of drying fermented cacao beans. The dryer consists of an integrated drying chamber and convective heating with the incorporation of electric backup heaters to address the intermittent effect of drying, DC fans in parallel to enhance moisture removal and used antenna for mobility. Fermentation and drying are two main steps in the postharvest processing of cocoa beans. These steps play an important role in the formation of flavor and taste. These steps should be treated properly in order to improve the status of cocoa beans [3].

Information technology has indeed shifted very significantly in human life. It is undeniable that technology currently represents an essential role in the development process from time to time. We are entering the Industrial Revolution Era 4.0, where Internet of Things (IoT) technologies are very influential in everyday life. Even in the area of agriculture, such technologies [4,5] have many important roles. Feature extraction is an artificial intelligence (AI) method that selects or consolidates

numerous variables as a feature, which can effectively decrease the substance of data processed while still representing the fundamental dataset.

The objective of the study is to design and develop an automated solar dryer system capable of monitoring and detecting moisture during fermentation using AI camera; programmed in raspberry pi 3b+. To reduce the moisture content of cocoa beans in less than 10% using Arduino Uno and its components relayed. Lastly to give secondary back-up power using solar power system and aims to implement a prototype for testing and evaluation. However, drying method can improve the quality of dried beans. Many researchers have reported study on the effects of drying method to the cocoa beans quality (Jinap, Thien, & Yap, 1994) [6].

Agriculture allowed people to create civilizations, fight hunger and work to combat challenges in population growth and climate change. This is why researchers are interested in developing and revising this technology to give more advantages to the community Galiche et al. (2011) [7], conducted a study on this system with analog-digital combination control method and the feasibility of its usage in solar dryers.

Related Literature

Solar radiation is an integral part of different renewable_energy_resources. It is the main and continuous input variable from practically inexhaustible sun. Solar energy is expected to play a very significant role in the future especially in developing countries, but it has also potential prospects for developed countries. The material presented in this paper is chosen to provide a comprehensive account of solar energy sources and conversion methods. For this purpose, explanatory background material has been introduced with the intention that engineers and scientists can have introductory preliminaries on the subject both from application and research points of view. Applications of solar energy in terms of low and high temperature collectors are given with future research directions. Furthermore, photovoltaic devices are discussed for future electric energy generations based on solar power site-exploitation and transmission by different means over long distances such as fiber-optic cables[8].

The sun has produced energy for billions of years, and it is the most important source of energy for all life forms. It is a completely renewable source of energy unlike non-renewable sources such as fossil fuels. The sun provides a consistent and steady source of solar irradiance. Solar power technologies use the sun's energy to light homes, produce hot water, heat homes, and produce electricity.

In the Philippines, the potential is even greater than the inspirational target of 1,528MW attributed to solar in the National Renewable Energy Plan until 2023. According to the DOE's 2009-2030 Power Development Plan (PDP), the country's energy consumption is seen reaching 124,067 gigawatts-hours (GWh) by 2023, from an estimated demand of 86,809 GWh by 2018 and actual demand of 55, 417 GWh in 2008. The yearly monthly daily average irradiance yield received in the horizontal plane of Surigao city is about 7.5 kW h/m2 / day with the Latitude: +9.8 (9°48'00" N) and Longitude: +125.4(125°28'12" E).

Many innovative systems have been developed that replace the traditional gravel-filled bed. When evaluating the type of system to install, consideration should be given to such factors as the type of cacao beans, space requirements, drying time, support system, and economics. These systems can be set up in either a direct and indirect place. As cacao beans production is often limited by environmental factors, interest in alternative drying practices is increasing. In this regard, automated solar powered chamber serves as a promising dryer practice that offers a solution for some serious challenges of cacao beans production such as lack of space to dry on, climate change, deforestation, rising fossil fuel prices and ecosystem degradation.

The utilization of technology is necessary to increase agricultural production [9] especially in terms of quality and competitiveness. The availability of technological innovations such as machine learning and deep learning. [10,11] is also one of the keys to improving farmer welfare and attracting the younger generation's interest in creating various derivative business opportunities.

Therefore, this work aims to use computer vision as a fast and accurate method to classify cocoa beans of fermentation, using features extracted from cocoa bean images as predictors. The proposed approach could substitute the cut-test, [illegible] to evaluate [illegible]

The uniqueness of this project is that it has a switched mode that can be used manually or automatically depending on the decision of the user. It also has a password that only authorized personnel can operate or access the system. The purpose of the AI camera is to monitor the cacao beans even if the host is not around. Using this method, it helps the farmers to improve the quality of life and less hassle. The database that is contained in computer which is then accessed by the website via the web server to display the data to determine the quality of dried cacao beans as well as the temperature, and humidity inside the chamber.

1.2 Theoretical Framework

Cocoa bean fermentation is still a spontaneous curing process to facilitate drying of nongerminating cocoa beans by pulp removal as well as to stimulate color and flavor development of fermented dry cocoa beans. As it is carried out on farm, cocoa bean fermentation is subjected to various agricultural and operational practices and hence fermented dry cocoa beans of variable quality are obtained. An automated solar powered chamber system will help the cacao beans to dry both indoors and outdoors. As a result, famers don't need to waste large amount of time to manually operate the traditional gravel-filled bed method. Instead, the farmers could monitor the fermenting process through the application being provided.

The Internet of things (IoT) describes the network of physical objects that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the Internet.[13]

Sensors are used in everyday objects such as touch-sensitive elevator buttons and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micromachinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure, or flow measurement.[14]

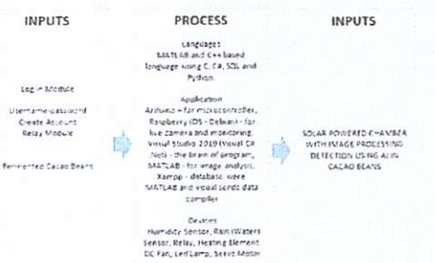
There are numerous IoT applications in farming such as collecting data on temperature, rainfall, humidity, and wind speed.[15] This data can be used to automate drying techniques, make informed decisions to improve quality and quantity, minimize risk and waste, and reduce the effort required to manage drying.[13] For example, farmers can now monitor moisture from afar and even apply IoT-acquired data to precision ferment programs.

The Raspberry Pi is a low-cost, credit-card-sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing and to learn how to program in languages. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

1.3 Conceptual Framework

The following figure shows the input-process-output diagram of the project.

Figure 1. Input- Process- Output diagram of the project



The block diagram illustrates the general concept and explains the flow of the system. The input block is the materials needed to implement a power supply project. Monitoring systems are designed using sensors such Humidity Sensor, Rain (Water) Sensor, Relay, Heating Element, DC Fan, Led Lamp, Servo Motor. The process block contains various stages: online research, analysis, system design, implementation, construction, testing, and system evaluation. Online research methods (ORMs) are ways in which researchers can collect data via the internet. An analysis is a detailed examination of the elements or structure of something. System Design System design is the process of defining the components, modules, interfaces, and data for a system to satisfy specified requirements. Implementation is the carrying out, execution, or practice of a plan, a method, or any design, idea, model, specification, standard, or policy for doing something. Construction and Testing is the testing of materials used to build new projects, add to existing projects, or amend existing construction projects. Evaluation Assesses the quality and success of a project in reaching stated goals. Presents the information collected for project activities and outcomes.

The input and process will produce an output of the project, the innovative Solar Powered Chamber with Image Processing Detection Using AI in Cacao Beans.

1.4 Objectives

This project aims to design and implement an automated solar powered chamber with Image processing detection using AI in cacao beans using raspberry pi, Arduino uno and sensors to keep human intervention at a minimum and help local farmers eliminate the inconvenience and time-consuming traditional method of farming.

1. To foster the use of modern Internet of Things (IoT) technologies among farmers and to increase the security of the food supply chain as a whole.

2. To design and develop a solar dryer system capable of detecting moisture during fermentation using AI image processing.

3. To increase agricultural production especially in terms of quality and competitiveness. To increase agricultural

production especially in terms of quality and competitiveness.

4. To improve farmer's welfare and attracting the younger generation's interest in creating various derivative business opportunities.

5. To implement a prototype for testing and evaluation.

2. Methods

2.1 Research Design

A lot of research on farming and hydroponics was required to complete this investigation. The first goal was to determine what a hydroponic system is. Hydroponics, by definition, is a method of growing plants in a water-based, nutrient-rich solution. Hydroponics does not use soil, instead, the root system is supported using water. The next goal was to determine what type of water would be compared and estimate the amount needed.

2.2 Project Design

The figure below shows the block diagram of the project

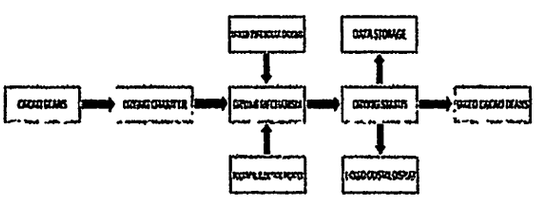


Figure 2. Block Diagram of the project

The diagram of the project shows three boxes, the first box represents the hydroponic system together with the sensors attached on raspberry pi which is the brain of the system. Sensors are connected to Raspberry Pi, temperature and humidity sensor together with the ultrasonic sensor connected to ADC (Analog to Digital). Then the sensor data will be inputted into the Database and display the output data on the webpage and then monitored through the webpage back to the database and to the hydroponic system in which the sensors are placed. The data on the webpage will be the final output, where the sensor data are displayed and can be controlled even if the user is far away.

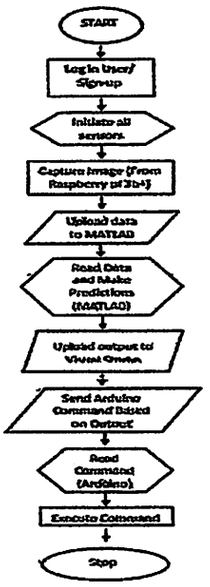


Figure 3. Flowchart of the system

The flowchart of the project is shown in Figure 3, which the researchers used as the basis on how the data collecting procedure is done. As shown in the figure, the project starts with log in users or signing up and then all the sensors initializing and then capture image from raspberry pi 3b+ by uploading the data to MATLAB, it will now read the data and make predictions after making predictions the output will proceed to visual studio and then the Arduino will send a command based on the output. The output will be read by the Arduino's command and finally will execute the command which ends the process.

2.3 Project Development

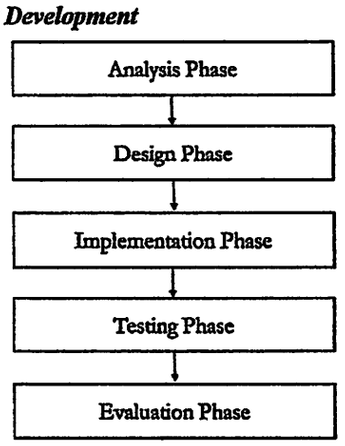


Figure 4. Project Management Diagram

The first stage in doing a project study is online research on the internet. In this generation, almost everything that a person wants or needs to is already on the internet. In this stage, the researcher will be able to gain some knowledge and ideas which could help them implement a good project.

The next step in developing this project study is system designing. Designing a system is a hard task because everything should be considered, the materials, finances, sizes, mechanism of the project, packaging, etc. Everything should be well planned so that there will be fewer problems on the next level of the implementation. Additional to that is programming, it creates instructions that tell a computer how to perform a task and how the project works.

The third step is the purchase of materials. All materials should be ordered or be ready as soon as possible for the construction of the project.

The fourth step is construction and testing. After completing the needed materials, the researcher can now start the implementation of the project. The first to be realized will be the internal parts, which are the frame of the chamber, to be followed by the construction of lower and upper part of the chamber that has 1x2 and 1x1, then Plain zin that encloses the outside of the chamber. We also added a tray where the cacao beans are placed. We used plastic as a cover so that the sunlight passes through the chamber in order to dry the cocoa beans. Trial and error are also needed to test if the project is working correctly or not.

Then finally, the packaging of the project should be neat and presentable. The last stage in this research project is system evaluation. The project will be evaluated according to its performance, serviceability, aesthetics, and features. The researcher will conduct a survey to be undertaken using paper-based techniques through questionnaires and personal interviews to hear the opinions of the participants.

2.4 Project Implementation

The project will be implemented at a place where it can be tested and performed. Researchers conduct a test and survey together with the participants, the farmers, and professionals. The researchers and the participants will manage and monitored the project if it can meet the process expectation and the said output to the project. Professionals and farmers will test the project if it is applicable to use solar drying systems with the Internet of Things (IoT). If the project will be failed to deliver the resulting output, the researchers will fix the problem and re-tested it again. Until it meets the expectations output.

2.5 Project Settings

Figure 5. Location of the place

The Automated solar drying system can be placed anywhere, either indoor or outdoor. The said project will be placed and tested in Brgy. Roxas, Mainit Surigao del Norte Professionals/farmers are invited to participate, observe and give feedback to the project about automated solar powered chamber with image processing detection using AI in cocoa beans. Researchers chose this location because it's easier to conduct a survey.

2.6 Participants of the Study

The participants of this project study are mainly the project beneficiaries, who include the farmers and professionals. The proficient evaluators are chosen to concur to their mastery that would offer assistance to confirm whether the framework's execution is palatable sufficient for the proper implementation. In contrast, the user/evaluators/ ranchers are chosen to assess whether the framework is worthy enough to utilize the said venture.

Table 1. Participants of the Study

PARTICIPANTS	f(n=10)	%
Professionals	4	40%
Farmer	5	50%
Agricultural Engineer	1	10%
TOTAL	10	100%

2.7 Instruments

In this study, the following instrument for the fulfillment of the study:

Proteus Simulator - The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. Electronic design engineers and technicians use the software to create schematics and electronic prints for manufacturing printed circuits.

DHT11 Temperature and Humidity Sensor

It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and outputs a digital signal on the data pin.

Raspberry Pi 3 Model B Plus

The latest product in Raspberry Pi 3 range, boasting a 64-bit quad-core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE (Bluetooth Low Energy), faster Ethernet, and PoE capability via a separate PoE (Power over Ethernet) HAT (Hardware Attached on Top).

Water Sensor

It detects the presence of water and when placed in locations where water should not be present, a leak.

Led Lamp

Led Lamp or Led light bulb is an electric light that produces light using light-emitting diodes (LEDs).

Stepper Motor

A stepper motor is an electromechanical device it converts electrical power into mechanical power.

5V Single Relay

This is a single channel Relay Module; relays are used to control or switch devices that use higher power than what most micro-controllers such as an Arduino or Raspberry Pi can handle. This particular relay module can control typical household appliances up to 15A.

DC Fan/ Heating Element

The direct current fans, or DC fans, are powered with a potential of fixed value such as the voltage of a battery we used 12V in DC fan.

LCD

Used to display data in devices such as calculators, microwave ovens, and many other electronic devices.

Breadboard

A construction base for prototyping electronics.

Jumper Wire

Are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering.

Power Inverter

A power inverter, or invertor is a power electronic device or circuitry that changes direct current (DC) to Alternating Current (AC).

Charge Controller

The charge controller regulates the amperage and voltages that is delivered to the loads and any access power is delivered to the battery system so the batteries maintain their state of charge without getting overcharged.

Software specification

- Visual Studio Code
- SQLite
- Putty
- Raspbian
- C++
- C
- C#

In-depth Interviewing.

It is a qualitative interviewing technique that involves conducting individual interviews with

a small number of respondents to explore their perspective on a particular idea, program, or situation

2.8 Research Ethics

In this study, the researcher makes sure not to violate any legal and environmental issues. The participants of this study will be voluntary, so they will have the right to withdraw from it at any point and for any reason. Next to this, participants were fully informed regarding the objectives of the study. Participant's safety was also secured; they were not harmed or abused, both physically and psychologically, during the conduction of the study. In contrast, the researcher attempted to create and maintain an atmosphere of comfort.

2.9 Data Collection Procedure

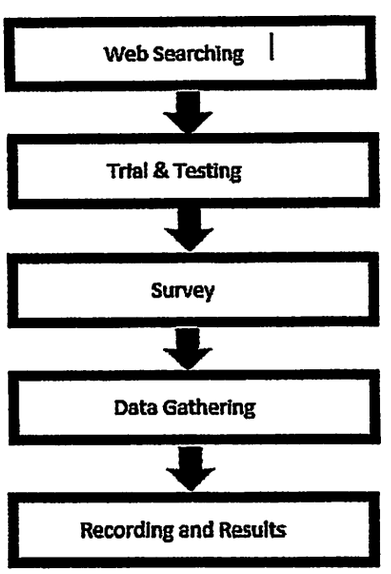


Figure 6. Data Collection Procedure Diagram

The diagram above shows the data collection procedure in doing this research project. These include web searching, trial & error testing, surveys/interviews, data gathering, and recording and results.

The first stage is web searching wherein the researcher collects some information that could help them understand further about the project and how to make it work.

Researchers focused on the issues and problems that are related to the study of interest in order to avoid errors in the implementation of the project. Conclusions and recommendations were also being noted.

Through a survey, researchers can collect information from a sample of individuals through their responses to questions.

Researchers gathered observations or measurements through survey and online searching

Series of trials and tests were conducted. The researchers gather data about the effectiveness of the project by conducting a survey, personal interviews, and providing some questionnaires to the participants. All of the data collected from survey questions and personal interviews were also recorded.

2.10 Statistical Tool

The project studies use means statistical tool. Frequency statistics simply count the number of times that each variable occurs, such as the number of males and females within the sample. Measures of central tendency give one number that represents the entire set of scores, such as the mean.

On the other hand, "Mean" Mean implies average and it is the sum of a set of data divided by the amount of data. Mean can prove to be an effective tool when comparing different sets of data.

2.11 Financial Analysis

Table 2. Materials Cost Analysis

PARTICULARS	QTY.	UNIT COST	AMOUNT
Electrical Heating System	1 set	₱1,348	₱1,348
Electronic components	1 set.	₱8,419.50	₱8,419.50
Solar power system	1 set	₱ 14,000	₱14,000
Construction Materials	1 set	₱3,225	₱3,225
TOTAL			**₱26,992.5**

Table 2 shows the Material cost analysis, which indicates the cost of each component that is used in the project. The packaging of the system is not included because it is free of charge.

Table 3. Fixed Cost Analysis

PARTICULAR	QTY.	UNIT COST	AMOUNT
MATLAB	1	₱10,000	₱10,000
TOTAL		**₱10,000**	**₱10,000**

Table 3 shows the Fixed Cost Analysis of the project, and these are acquired to Automated solar powered chamber System with AI image processing.

Table 4. Total Fixed Cost Analysis

DESCRIPTION	QTY.	AMOUNT
Material Cost	All	₱ 26,992.5
Fixed Cost	All	₱10,000
OVERALL TOTAL		**₱36,992.5**

Table 4 shows the overall total of the materials and the services of the project.

Selling Price:

Price = Variable Cost + Mark- up (35%)
Price= 26,992.5+ 26,992.5 (35%)
Price= ₱ 36,439.89≈ **₱36, 500.00**

The "Automated Solar Powered Chamber with Image Processing Detection Using AI in Cocoa Bans" selling price is based on the total price of the materials being used plus the product of markup and 35% of the materials used. The fixed cost of the project is not included on the price basis.

Return of Investment:

Total fixed cost= **₱10, 000**
Tax (12%) = ₱1,200.00

$$\textbf{ROI} = \frac{\text{Net Profit}}{\text{Total Investment}} * 100$$
$$= (₱1{,}200 / ₱36{,}992.5) * 100$$
$$= \mathbf{3.3\% \approx 3\%}$$

Break-Even Analysis:

Researchers used break-even analysis to determine the number of units or dollars of revenue needed to cover total costs.

Total fixed cost= ₱36,992.5
Variable Cost= ₱26,992.5
Selling price= ₱36,500

$$\textbf{BEA} = \frac{\text{Total Fixed Cost}}{\text{Selling Price} - \text{Variable cost}}$$
$$\textbf{BEA} = \frac{₱36{,}992.5}{₱36{,}500 - ₱26{,}992.5}$$

BEA= 3.89 % ≈ 4 units per month

Monthly Sales = No. Units sold pre month x selling price

4 units x ₱36, 500.00 = ₱146,000.00

Annual Sales = ₱146,000 x 12 months
= ₱1,752,000.00

The breakeven analysis of the device is the basis on how much Automated Solar Powered Chamber be sold in sales in a particular month, time, or period to realize the profit being spent. In this project, the researchers must sell at least four chamber per month to profit.

3. RESULTS AND DISCUSSIONS

3.1 Technical Materials of the System

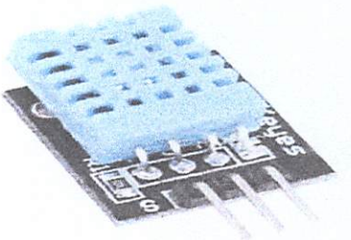


Figure 7. DHT11 Temperature and Humidity Sensor

It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin.

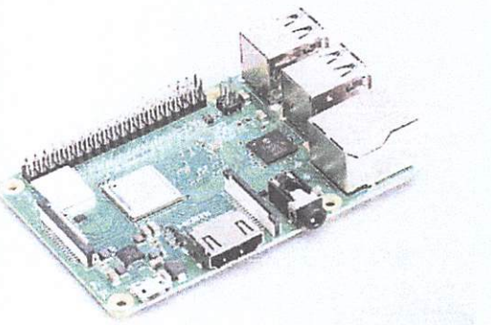


Figure 8. Raspberry Pi 3 B+

The Raspberry Pi is a series of single-board computers. They are low-cost, high-performance, and the size of a credit card.

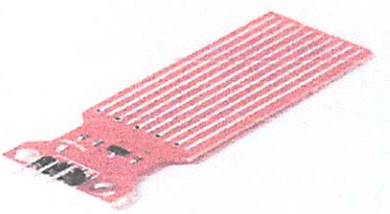


Figure 9. Water Sensor

It detects the presence of water and when placed in locations where water should not be present, a leak.

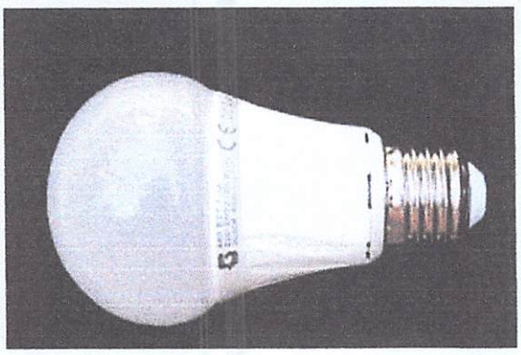


Figure 10. LED Lamp

Led Lamp or Led light bulb is an electric light that produces light using light-emitting diodes (LEDs).

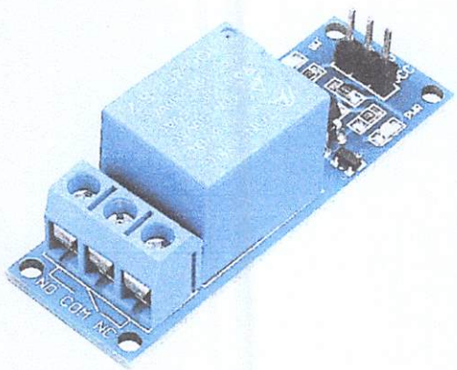


Figure 12. 5V Single Relay

It comprises components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not.

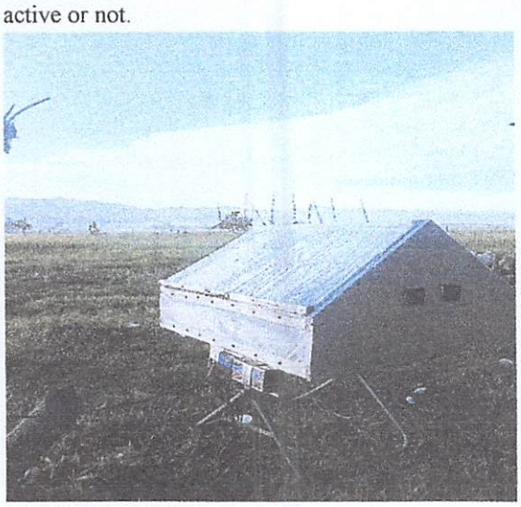


Figure 13. Automated solar powered chamber

The chamber where the cocoa beans being fermented.

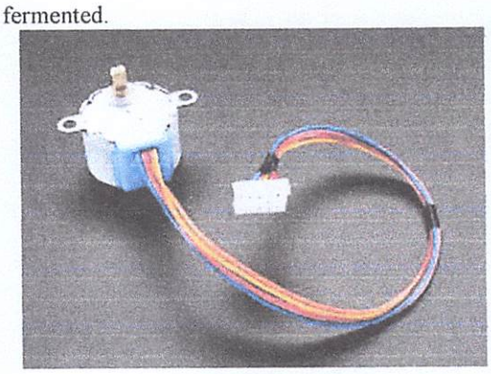


Figure 14. Stepper Motor

A stepper motor is an electromechanical device it converts electrical power into mechanical power.

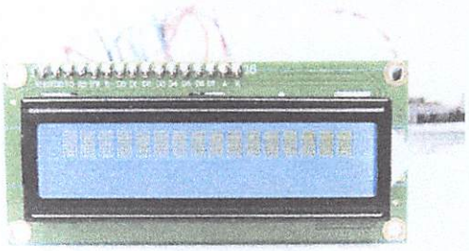


Figure 15. LCD

Used to display data in many other electronic devices.

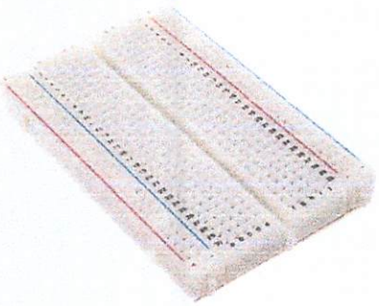


Figure 16. Breadboard

A construction base for prototyping electronics.

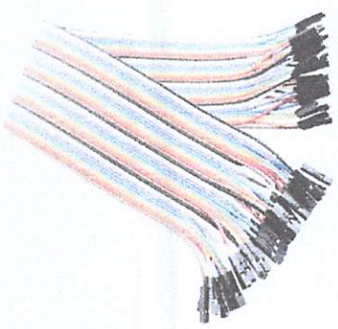


Figure 17. Jumper Wire

A smaller and more bendable corrugated cable is used to connect antennas and other components to network cabling.

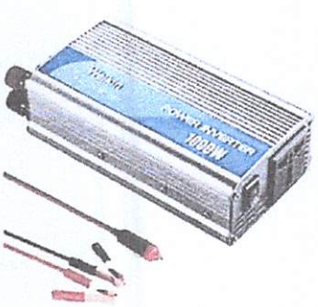


Figure 18. Power Inverter

A power inverter, or invertor is a power electronic device or circuitry that changes direct current (DC) to Alternating Current (AC).

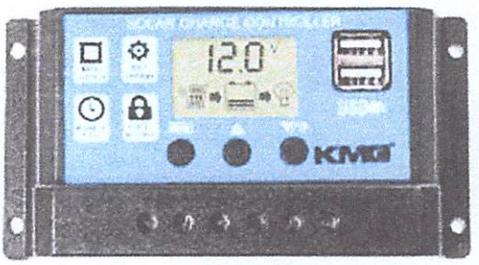


Figure 19. Charge Controller

The charge controller regulates the amperage and voltages that is delivered to the loads and any access power is delivered to the battery system so the batteries maintain their state of charge without getting overcharged.

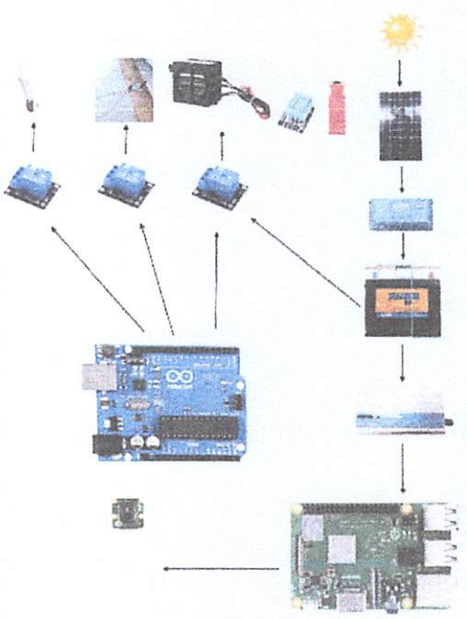


Figure 20. Architectural Design of the System

Figure shows the architectural design of the system. The arrows pointing to/from the components indicate whether they are inputs or outputs. The solar panel collects solar energy from the sun and converts it into an electrical power source stored in the battery. The solar charger controller charges the battery simultaneously stores energy and supply power to the system (inverter).

The Inverter USB (Universal Serial Bus) in 5Vdc 1 ampere, supplies the Arduino Uno, then all of its data signals of in specific relay module for e.g., LED lamp (pin 7), Servo motor (pin 8, pin 9, pin 10, pin 11), Main Source (pin 5), Heater Fan (pin 6) are connected to the Arduino Uno. Also,

the passive sensors; Water Sensor (pin 3) and Humidity Sensor/Temperature (pin 2) sensor. The temperature sensor measures the temperature inside the chamber while the water sensor detects the water droplets from the rain. Arduino Uno microcontroller to command the Arduino to execute all of its commands.

The 5Vdc was supplied to the raspberry power port, and the camera was connected in camera slot module. Raspberry pi 3b+ camera both process and provide data to the raspberry pi 3b+ microcontroller. Burguillos et al. (2017) conducted a series of drying test using moisture reduction of cacao beans.

While operating in the drying mode, the data from the raspberry pi 3b+ camera and temperature sensor are encoded in the SD card every hour interval. It is also displayed in the LCD. Heating stops when too much heat output came out from the heater fan and when the temperature is below 35 degrees C the heater fan will automatically start.

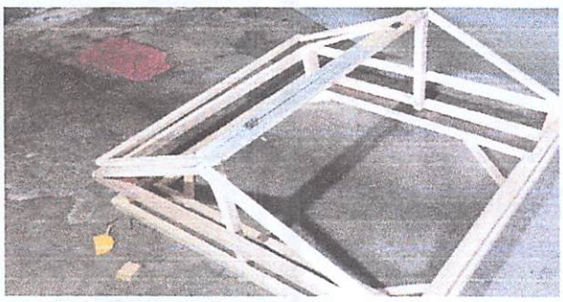
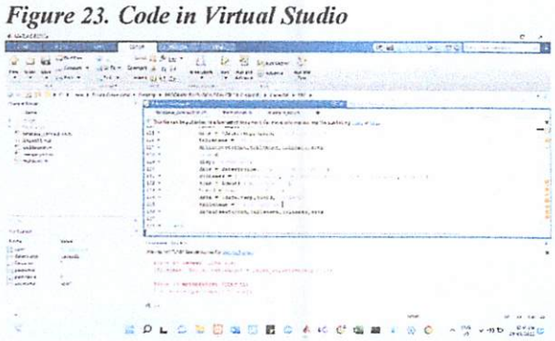


Figure 21. Frame Design

Shows the shows the frame design of the chamber.

Figure 23. Code in Virtual Studio



3.2 Evaluation Results

Table 5. Temperature and Humidity of the system Day 1

NO	Week 1		Week 2	
	T	H	T	H
1	29.6.C	74.3%	29.6.C	75.1%
2	28.8.C	80.3%	29.9.C	77.6%
3	29.5.C	76.1%	28.1.C	77.2%
4	29.2.C	78.9%	30.2.C	81.3%
5	29.7.C	77.8%	29.2.C	80.4%
6	28.9.C	79.7%	31.5.C	76.2%
7	29.8.C	80.3%	31.3.C	75.2%
R	**29.3.C**	**78.3%**	**29.9.C**	**77.6%**

Table 6. Temperature and Humidity of the system Day 2

NO	Week 3		Week 4	
	T	H	T	H
1	29.9.C	80.5%	31.2.C	90.1%
2	31.5.C	80.9%	30.4.C	92.3%
3	31.1.C	78.2%	28.8.C	95.6%
4	30.4.C	77.6%	29.7.C	90.8%
5	29.3.C	79.4%	30.1.C	92.1%
6	31.4.C	76.7%	31.2.C	91.8%
7	29.2.C	81.1%	31.3.C	93.6%
R	**30.4.C**	**79.2%**	**30.4.C**	**92.32%**

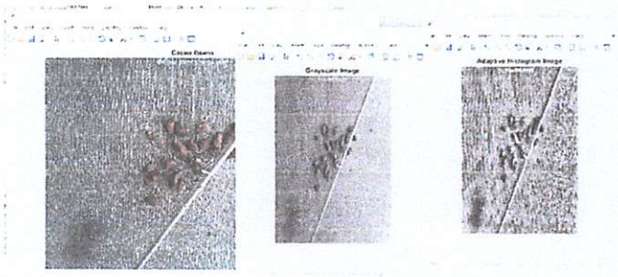
Table 7. Temperature and Humidity of the s system Day 3

NO	Week 5		Week 6	
	T	H	T	H
1	30.3.C	93.7%	29.5.C	91.6%
2	30.1.C	90.3%	30.1.C	92.3%
3	31.8.C	94.1%	31.1.C	94.7%
4	29.1.C	92.3%	31.8.C	90.1%
5	29.3.C	90.3%	30.4.C	91.5%
6	31.1.C	90.9%	29.4.C	95.5%
7	30.9.C	92.9%	29.2.C	94.7%
R	**30.2.C**	**92%**	**30.07.C**	**91.9%**

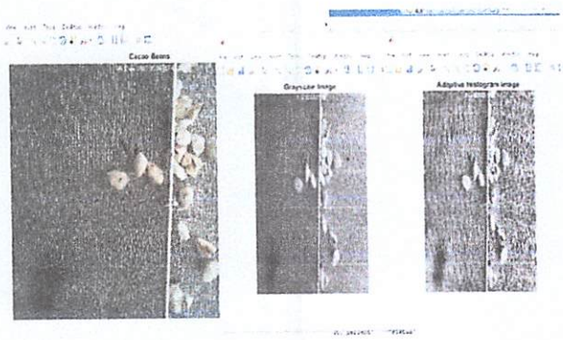
T – Temperature
H – Humidity
R – Average

Data Analysis of Cocoa Beans

MOLDS IMAGE PROCESSING



NOT FERMENTED IMAGE PROCESSING



3.3 Performance level of the design project

Table 10. Evaluation of Performance Level of the project.

TYPE								
	ACTUAL			SCANNING				RESULTS
	TEMP.	HUMID.	STATE		TEMP.	HUMID.	STATE	
TEST 1	26.50	89%	WET	TEST 1	26	89%	WET	GOOD
TEST 2	26.40	78%	WET	TEST 2	28	84%	DRY	BAD
TEST 3	37	68%	DRY	TEST 3	35	63%	DRY	GOOD
TEST 4	27.4	88%	DRY	TEST 4	27	84%	DRY	GOOD
TEST 5	34	80%	FERMENTED	TEST 5	30	75%	FERMENTED	GOOD
TEST 6	36	75%	FERMENTED	TEST 6	30	76%	FERMENTED	GOOD
TEST 7	72	40%	NOT FERMENTED	TEST 7	74	32%	NOT FERMENTED	GOOD
TEST 8	36	81%	NOT FERMENTED	TEST 8	30	74	NOT FERMENTED	GOOD
TEST 9	39	42%	GOOD	TEST 9	40	38%	DRY	GOOD
TEST 10	35	46%	WET	TEST 10	32	69%	DRY	BAD

The range for the remarks of the device is Wet, Fermented, Not Fermented, and Dry.

4. CONCLUSIONS AND RECOMMENDATIONS

Conclusion

After making this thesis, the researchers discovered that in order to accomplish the project, each of them should participate. Because of the unavailability of materials available in local areas, the sharing of ideas is must for improvising such parts and materials that is essential for completion of the said project. This will not only provide a wide vision of innovations, but also to test the capability of a researcher on how will her/his ideas will make an impact in securing the full operation.

Aside from the researchers' contribution to one another, there are also other things the researcher had encountered; most of them are in the electrical work.

The electric backup heaters effectively maintained drying temperature from 40 degrees Celsius to 50 degrees Celsius, eliminating the occurrence of moisture re-absorption during night time. The continuous drying process effectively shorted the drying time and addressed the intermittent effect of drying cacao beans.

The Raspberry Pi is a low-cost, credit-card-sized computer that plugs into a computer monitor or TV. It is a capable little device that enables people of all ages to explore computing and to learn how to program in languages like Scratch and Python.

Recommendation

Furthermore, the researchers formulated the following recommendations:

1.
2. Add Circuits Breaker to protect the system.
3. Recommended Battery of the System must exceed 50% from the actual load of the system.
4. I recommend use only solar battery for deep cycle or slow discharge purpose.
5. Execute the proper packaging to protect the system from wet weather conditions.

5. ACKNOWLEDGEMENTS

The researchers would like to extend their heartfelt gratitude to the people who are behind in this study.

First, to Almighty Father, who empowered the researchers to be the best versions of themselves and to keep them safe all the time. To the research adviser for sharing knowledge and for keeping the door always open whenever the researchers ran into a trouble spot or had questions about this study.

The researchers would like to thank also to the participants of the project study who freely give their precious time. To the parents and friends of the researchers, for providing them with unfailing support and continuous encouragement throughout the whole research.

This accomplishment will not be possible without the people mentioned above. Thank you.

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[6]	(Jinap, Thien, & Yap, 1994). "Effect of drying on acidity and volatile fatty acids content of cocoa beans"
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HYDRAULIC ANALYSIS OF MACOPA IRRIGATION FOR HYDROPOWER SYSTEM

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Abstract: This study aims to analyze the potential of the water flow in Macopa, San Francisco, Surigao del Norte irrigation and to utilize the energy with the construction of a pico-hydro power plant. The study was carried out by measuring the speed and velocity of the water flow and calculating the hydraulic power that may be generated by the irrigation flow. If it is feasible, a hydropower plant can be constructed. Construction begins with actual discharge analysis, turbine selection, type of generator used, and impact of generator output toward loading were tested in the field to be able to produce electrical energy that can be used for streetlights in Macopa communities concerning secure generator system, environmentally friendly, easy to operate and affordable. The results show that irrigation flow can be achieved as a water resource for the construction of a hydroelectric power plant.

Keywords: Irrigation, Hydropower, Turbine, Generator, Renewable

1. INTRODUCTION

Water power has been an energy source for hundreds of years. Initial developments used water wheels to drive millstones and water pumps and later plant machinery. In the past century, a new system was invented to use the energy of water, the water turbine, to generate electricity. It started on a small scale, with power plants producing small quantities of electricity for their needs; and turned into a large infrastructure producing large quantities of electricity to sell it. [1].

In line with the social, economic, and economic development of the economy as well as information, electricity has become one of the main needs for the community, including the remote communities. In the middle of 2016, the level of household electrification in the Philippines stood at 89.6 percent, leaving 2.36 million households without electricity and many other areas with a limited service of only four to six hours per day [2]. This is due to several factors such as the limited ability of the State Electricity Company to provide and distribute electrical energy to all communities in the country, especially in remote rural areas.

The power shortage situation in Surigao del Norte was caused by generation insufficiency brought about by shutdown/non-availability of generating units [3]. Power distributor's management implores for public understanding since this power crisis is beyond its control and is experienced in Surigao del Norte and the Philippines as a whole.

The Province of Surigao del Norte has many rivers and some of the rivers can store lots of water in the dam. However, there is irrigation in the existing dam here in Surigao del Norte that is suitable for the hydropower plant. This project study can be used as an alternative source of energy in some of the barangays and municipalities in Surigao del Norte.

It is important to pursue this study because electricity is one of the most important needs in Surigao del Norte and even in the world in this generation and also in the future. If this study will be successful, it can minimize the power shortage because of this alternative source of energy. In addition, the study will help the researcher understand how the hydroelectric plant operates.

Related Literature

Hydropower technology is fairly mature, but new challenges continue to emerge. First, given current trends in decarbonization in the electricity sector [6], the amount of electricity produced by variable renewable energy sources (RES) has steadily increased [5]. Effective and efficient treatment of VRE production intermittent is a growing field of research [4].

Under the name, Dammed Hydroelectric power plants derive electricity from the potential energy of dam water through the use of a turbine and generator. The height at which this water is discharged from the dam supplies the energy needed to run the hydraulic turbine. That creates electricity. To keep a steady stream of electricity some of the

water from the head of the dam is stored in a reservoir which can be used to elevate the water level whenever necessary [9].

Hydropower is the most advanced clean, renewable energy technology available. It helps to curb climate change as hydroelectric plants produce very small amounts of greenhouse gases [8]. Although it is widely used throughout the world, only one-third of the economic hydroelectric potential has been used so far [7].

To meet the electricity needs of villages that have not been powered with electricity, building a pico-hydro power plant can be a solution. Based on potential and feasibility surveys, pico-hydro power generation is highly feasible to develop [5]. Pico-hydro power plants require the flow of water as a source of energy, which can be sourced from river flows, municipal wastewater streams, and irrigation flows [9].

The turbine system is central to the plant and transforms water into mechanical energy. The selection of which turbine(s) to use depends in large part on the characteristics of the installation site, for example, the available net head and anticipated dynamics of the river discharge, and is therefore arguably one of the most difficult decisions in the design of a hydropower plant [12].

Before the implementation of these pico-hydro power plants in the field, ongoing research was first done to improve the performance of a pico-hydro power plant, such as by developing flow steering in the turbine, and by increasing the shaft fatigue life of the cross-flow turbine. Before the construction of this pico-hydro power plant, several things should be done, namely the potential surveys and development feasibility, and analysis of the operation, performance, and economy of the power plant to be built.

1.1 Theoretical Framework

In this study, the speed of the water pounding the blade (V) is calculated with this formula:

$$V = \sqrt{2.g.h} \qquad (1)$$

Where g is the gravitational flow of water and *h* is the head of the irrigation. The amount of hydraulic power (Ph) Pico-hydro power plant using a waterwheel on irrigated irrigation can be known based on the following equation:

$$Ph = 9.81.Q.h+1/2.Q.V^2 \qquad (2)$$

where Q is the actual discharge of the water.

This Pico-hydro power plant uses a waterwheel to utilize water in irrigation, using an under-shot water mill type that has a maximum efficiency of 80-85% and no longer requires a rapid pipe. The speed of the circumference of the mill can be calculated through the equation:

$$U1 = \frac{V1\ cos\ \alpha 1}{2} \qquad (3)$$

Where V is the speed of the water founding by the blade.

Reaction hydraulic turbines absorb a portion of the kinetic and potential water energy as mechanical energy. This power transfer occurs in the turbine blades and is given by the well-known Euler's equation for a steady flow of an ideal fluid along a streamline. It is the relation between velocity, pressure, and density of a moving fluid. This equation is achieved by applying the law of conservation of the angular pulse to the liquid inside the turbine [12].

This study aims to design a pico-hydro power plant using a simple waterwheel by utilizing a water source from Macopa irrigation, which tends to be used only for agriculture. The waterwheel used in this study is based on the water flow system, which is the under-shot water wheel. The flowing water height is 2.7034 m and the water capacity is 1.40 m3/s up to 1.68 m3/s. The potential water source from the existing irrigation in the area is very possible to be converted into a source of electrical energy by using the Pico-hydro Power Plant.

1.3 Conceptual Framework

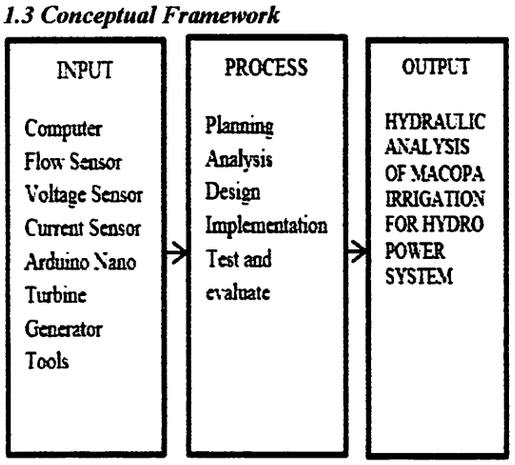

Figure 1. ***Flowchart of the study (IPO Diagram)***

As shown in Figure 1, the conceptual framework of the study starts from the input which is the first block. Using a computer, the voltage and

current were programmed through the Arduino Nano to generate the data logging. The turbine and the generator were installed using tools.

Second is the process which has done first with planning to achieve an efficient and effective output. Analyzing all parameters that involve in this study. The design process deals with appropriate design for the location and other factors to consider. This was followed by further tests and evaluations to have a reliable, operational, and efficient output for the project study.

The output of this project study is the Hydraulic analysis of Macopa irrigation for hydropower systems which is done after the process is completed. Where the produced output would become the alternative source of energy.

1.4 Objectives

The General objective of this project study is to find out if the Macopa irrigation is feasible for the pico-hydropower system, considering seasonal variation in power generation to meet the area's demand during all seasons. The specific objectives are the following:

1.) To test the flow of water, to determine the capacity, and to produce power
2.) To implement the design of Pico-hydropower system
3.) To test the output using lighting load

2. METHODS

2.1 Research Design

The research design applied to this project study is Observational design. Which can conclude with the results of collected data of a particular system's behavior. In cases where the researchers have no control over the experiment in collecting the data to determine the feasibility of water flow for hydropower systems.

2.2 Project Design

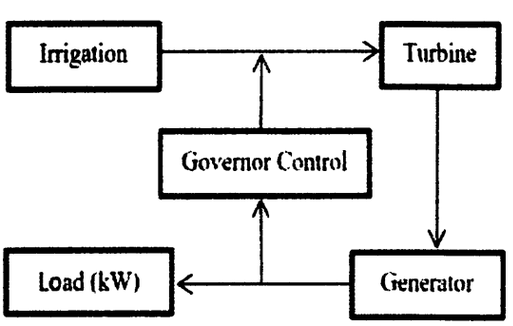

Figure 2. ***Block Diagram of the Pico- hydropower plant***

As shown in Figure 2, the water starts at the water storage that flows in the irrigation and spins the turbine which drives the generator. When the generator produces more than the desired output, the governor's control will control the flow of water in the irrigation.

2.3 Project Development

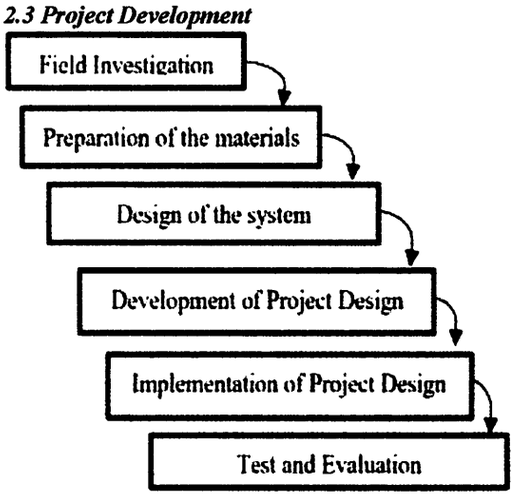

Figure 3. ***Workflow of Detailed Project Design***

Figure 3 shows the flow of work of detailed project design. To develop this project study, it is necessary to gather data relevant to the project design and location through field investigation. With the data collected, the researchers must prepare the materials to be used and the detailed layout design of the project with accurate and precise calculations is ready to implement in the particular location. Then, the development of the prototype hydropower plant design will be implemented as well as the evaluation of the performance and acceptability of the project.

2.4 Project Implementation

To implement this project is to study first the area by measuring the existing irrigation and the discharge of the water flow. The second is installing the production solution. This is the piece everyone remembers. The solution needs to be moved from development to test. The third is converting the data. Changing data from one format to another needs to take place once the solution is implemented. Fourth is Performing the final verification in production. The researchers should have prepared to test the production solution to ensure everything is working as expected. The desired output of this pico-hydropower plant is 0.5kW to 3kW. And the last is monitoring the solution. Usually, the project team will spend some period monitoring the implemented solution. If there are problems that come up immediately after implementation, the project team should address and fix them.

2.5 Project Setting

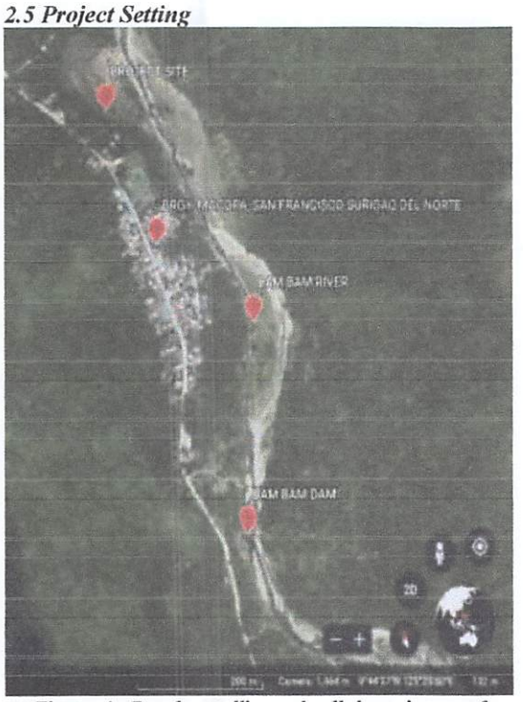

Figure 4. ***Google satellite and cellphone image of the location of the proposed study***

Figure 4 shows the configuration of the area analyzed and implemented, the pico-hydropower plant located at Macopa, San Francisco, Surigao del Norte.

2.6 Participants of the Study

Table 1. ***List of the participants***

Participants	f(n=7)	% involvement
Electrical Engineer	2	28.57%
SURNECO	2	28.57%
EVALUATORS	3	42.86%
TOTAL	7	100%

Table 1 shows a voluntary sample is made up of people who self-select into the survey. Often, these folks have a strong interest in the main topic of the survey. A convenience sample is made up of people who are easy to reach. With multistage sampling, selecting a sample by using combinations of different sampling methods.

2.7 Instruments

List of instruments that obtain to this project study:

1. Flow Sensor
2. Voltage/Current Sensor
3. Arduino Nano
4. Computer

These lists of instruments ar used to perform research and disseminate the information needed for project development.

2.8 Research Ethics

Know and obey relevant laws and institutional and governmental policies. Do not fabricate, falsify, or misrepresent data. Don't deceive colleagues, research sponsors, or the public. Strive honesty in all scientific communications. Honestly report data, results, methods and procedures, and publication status. Avoid careless errors and negligence; carefully and critically examine your work and the work of your peers. Strive to avoid bias in experimental design, data analysis, data interpretation, peer review, personnel decisions, grant writing, expert testimony, and other aspects of research where objectivity is expected or required. Share data, results, ideas, tools, resources. Be open to criticism and new ideas.

2.8 Data Collection Procedure

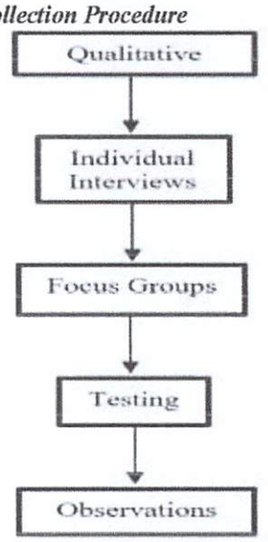

Figure 5. ***Gathering Qualitative Data Block Diagram***

To gather Qualitative data, Interview some individuals with the use of an evaluation tool. Have more time to discuss with the team and observe every opinion and Ideas of the group. Then doing some execution and trials.

2.10 Statistical Tools

The statistical tools that are used in this project study are the mean and coefficient of variation. Mean refers to the mean or average that is used to derive the central tendency of the data in question. These are very useful tools in this study for more opinions and ideas that we gather.

2.11 Financial Analysis

Table 2. *Direct Materials and Service Cost*

Description of Materials	QTY	COST(PHP)
Synchronous Generator	1	6,000
Angular bar	11	4,015
Pillow Block	4	1,280
1x2x16 Pully	1	1,440
1x2x18 Pully	1	1,450
1x2x3 Pully	1	222
1x8x8 Wood Planks	4	1,634
1 kl. Welding rod	4	360
Flow Sensor	1	1,300
Voltage/Current Sensor, Arduino Nano		1,700
2 pcs F - Belt	2	726
Bolt and Nut w/ washer	80	720
10 m wire AWG #14	1	700
SERVICES		
Transportation		3,000
Fabrication		4,000
TOTAL		**28,547**

3. RESULTS AND DISCUSSIONS

This research investigated hydraulic analysis in Macopa irrigation for hydropower plant development. The results of this study are explained further.

3.1 Potential of Water Flow Energy in Irrigation

Head (h) = **2.7034 m**
Debit Air (Q) = **0.168 m3/s**
The speed of the water pounding the blade (V):

$$V = \sqrt{2.g.h} = \sqrt{2(9.81)(2.7034)}$$
$$= \mathbf{7.283\ m/s}$$

Figure 7. *Measurement of water potential in irrigation flow*

Based on data head(h) and discharge(Q) that has been obtained then the ydraulic power, as follows:

$$Ph = (9.81).Q. + 1/2.Q.V^2\ (kW)$$
$$= (9.81)(0.168(2.7034)$$
$$+(1/2)(0.168)(7.283)^2$$
$$= \mathbf{8.91\ kW}$$

Table 3. *Energy Potential*

TIME (Per Hour)	WATER SPEED AND VELOCITY (m^3/hour)
15:00:03	1488
16:00:10	1472
17:00:16	1464
18:00:23	1552
19:00:29	1560
20:00:36	1552
21:00:42	1512
22:00:56	1440
23:00:02	1432
24:00:08	1512
1:00:15	1536
2:00:21	1528
3:00:27	1552
4:00:34	1528
5:00:40	1520
6:00:47	1488
7:00:53	1488
8:00:00	1552
9:00:06	1560
10:00:13	1520
11:00:19	1456
12:00:26	1472
13:00:32	1552
14:00:39	1560
15:00:03	1504

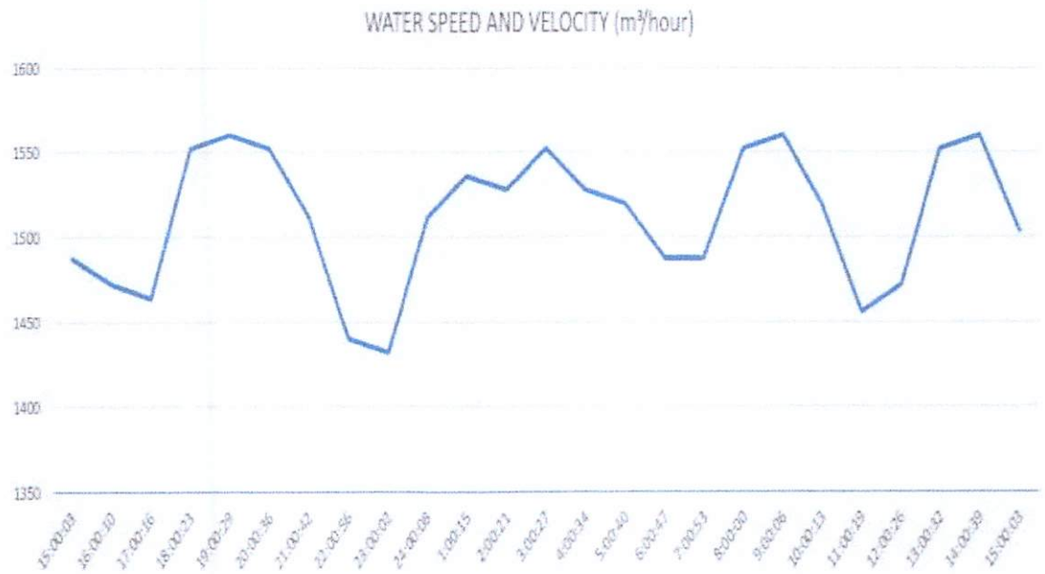

Figure 8. ***Duration of water speed in the irrigation flow***

Based on the graph of the data gathered, the speed of the water was consistent and has a potential for the Pico-hydropower system. The pick ranges from 1560 to 1432 m³/h as shown in figure 8 and it shows that the speed of the water was not constant. An Arduino Nano programming had been used to gather the data within 24 hours. The x-axis and y-axis represent the time and the speed of water respectively.

3.2 Implementation of the Pico-hydro Power Plant

The speed of the circumference of the mill can be calculated through the equation:

$$U1 = \frac{V1\ cos\ \alpha 1}{2} = \frac{7.283\ \cos(8)}{2} = \mathbf{3.606\ m/s}$$

Turn of the mill:

$$N = \frac{60.U1}{\pi.D1} = \frac{60(3.606)}{\pi(0.9144)} = 75 \text{ x } 85\%(ME)$$

$$= \mathbf{64\ rpm \sim 62\ rpm}$$

The blades used for this waterwheel form as shown in FIG. 9. Many blades are used as many as 16 pieces. With a radius of 3 ft and 2.1 ft wide using an angular iron plate with 3/16 mm thick and ½ x 8 x 25 inches wood planks 16 pieces.

Figure 9. ***Waterwheel pico-hydropower plant***

Mechanical transmission system using multiple pulley model to increase the rotation to be distributed to a generator (see figure 10).

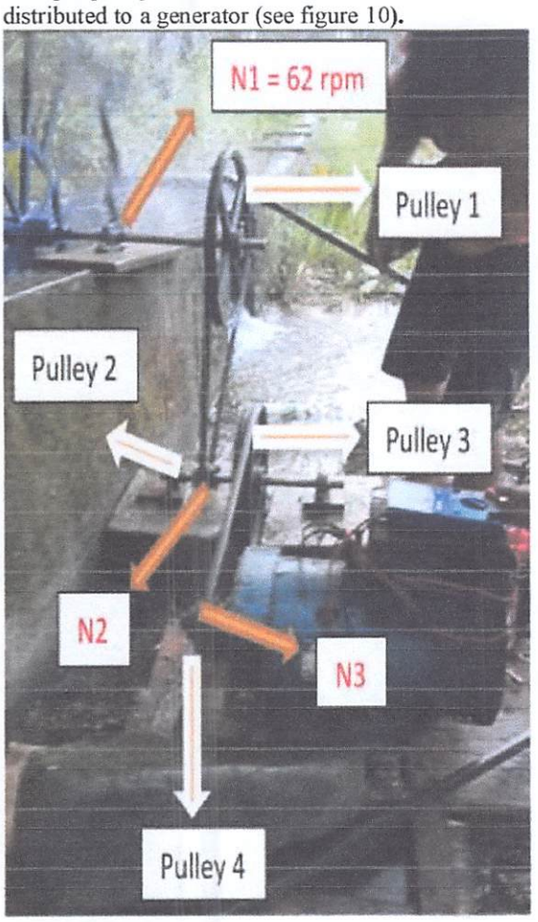

Figure 10. *Mechanical Transmission System*

r Pulley 1 = 9 inches = 0.2286 m
r Pulley 2 = 1 inches = 0.0254 m
r Pulley 3 = 8 inches = 0.2032 m
r Pulley 4 = 2 inches = 0.0508 m

The rotation at n1 is equal to the rotation of the mill which is 62 rpm.

$$N2 = \frac{r\ pulley\ 1.n1}{r\ pully\ 2} = \frac{0.2286(62)}{0.0254}$$

$$= \mathbf{558\ rpm}$$

Next rotation n2 is transmitted by pulley to generator ratio (n3), Increasing the round can count through the following equation:

Mechanical efficiency of 83.33%

$$= N2(83.33\%) = (558)\ (83.33\%)$$
$$= 465\ \text{rpm}$$

$$N3 = \frac{r\ pulley\ 3\ .n2}{r\ pully\ 4} = \frac{0.2032(465)}{0.0508}$$

$$= 1860\ \text{rpm}$$

From the results of mechanical transmission system using multiple pulley model, then got the spin on the generator of 1860 rpm. Mechanical efficiency 85 %, then obtained:

$N3 = 1860 \times 85\% = \mathbf{1581\ rpm}$

Table 4. ***Potential Energy as Output of Generator***

TIME (Per Hour)	VOLTAGE (Volts)	AMPERE (Amps)	POWER (Watts)
14:33:00	165.95	0.03	5.66
15:33:03	158.26	0.03	5.16
16:33:10	164.53	0.03	5.57
17:33:16	164.21	0.03	5.55
18:33:23	165.79	0.03	5.65
19:33:29	162.35	0.03	5.42
20:33:36	158.43	0.03	5.17
21:33:42	159.56	0.03	5.24
22:33:56	162.69	0.03	5.44
23:33:02	162.29	0.02	5.42
24:33:08	159.43	0.03	5.23
1:33:15	132.93	0.03	3.65
2:33:21	159.4	0.03	5.23
3:33:27	137.36	0.03	3.9
4:33:34	164.05	0.03	5.53
5:33:40	168.38	0.03	5.83
6:33:47	168.66	0.03	5.85
7:33:53	164.99	0.03	5.6
8:33:00	166.06	0.03	5.67
9:33:06	159.5	0.03	5.23
10:33:13	159.39	0.03	5.23
11:33:19	166.69	0.03	5.71
12:33:26	167.65	0.03	5.78
13:33:32	169.16	0.03	5.88
14:33:39	171.55	0.04	6.05

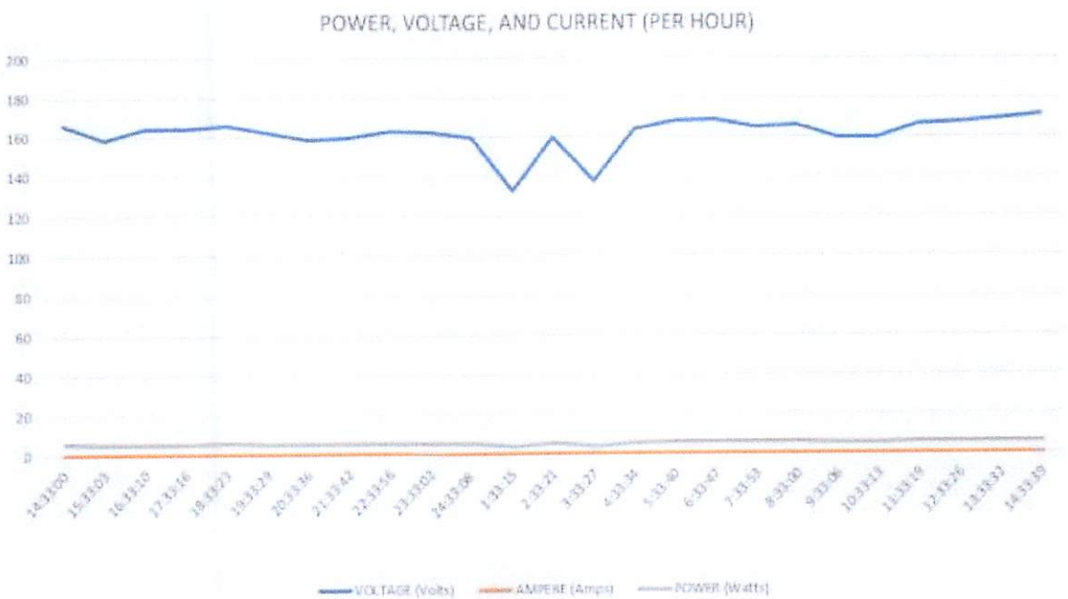

Figure 11. ***Duration of Energy as an output of Generator***

Figure 11 shows the graph of the voltage, current, and power output. The data was gathered 24 hours using Arduino Nano Programming. Based on the graph of the data gathered, the voltage and current were consistent. The voltage pick ranges from 132.93 to 171.55 V and the current pick ranges from 0.03 to 0.04 amperes based on the load that was used for monitoring. The graph was observed that there was a very low peak voltage and current due to connecting of high-powered load like a laptop, water heater, electric fan, etc.

3.3 Test Result with Load

This project was designed to provide energy for the streetlights in the Macopa community and the results prove that the system can carry the desired load.

Number of lights = 40
Type of load = 18 W CFL
Lighting hours = 12
Total load = 40 x 18 W = 720 W

Energy Consumption per day:
720 x 12 = 8.64 kW

Figure 12. ***Development of pico-hydropower system***

The development of this project was done as the image shown in figure 12. The preparation of materials, implementation of the project design, and testing were evaluated to achieve the desired output of the Hydraulic Analysis of Macopa Irrigation for Hydropower system.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Based on survey data and pico-hydro power plant design using under-shot type waterwheel. From the survey that has been done got the data in the form of water debit 0.168 m3 / s and head 2.7034 m, so known big hydraulic power (Ph) with the efficiency of 85% equal to 8.91 kW.

In the calculation of the water velocity relationship design fell with the diameter of the mill, it is obtained the speed of the mill around 62 rpm. To increase the rotation to be distributed to the generator, the feeding system used a multiple pulley transmission model, with 85% mechanical efficiency obtained by rotation distributed to the generator of 1581 rpm. From the results of the increase of rotation by using the transmission system multi-pulley model, then get the generator specification that will be used, that is Rated Power (w) = 3000 Watts, rated voltage (v) = 115V/230V, rated rotating speed (rpm) = 1800 rpm.

Based on data of potential water from irrigation of Brgy. Macopa, San Francisco, Surigao del Norte the suitable type of power plant used is pico-hydro power plant using under-shot type waterwheel. From the observation, all loads could sustain by the pico-hydro power plant with the load specification has been used.

4.2 Recommendations

The researchers would like to recommend the following for hydraulic analysis of Macopa irrigation for hydropower system:

1. Install more waterwheels and generators in the irrigation to produce more energy.
2. Improvement of revolution per minute through the best design of pulleys.
3. Maintenance and control in Macopa irrigation for pico-hydropower system.

5. ACKNOWLEDGEMENTS

The researchers would like to acknowledge the accomplishment of this project study was the work and sacrifice of several people to whom the researchers owe gratitude: First of all, praises and thanks to the God Almighty for the wisdom, guidance, and blessings, He had showered upon the researchers to achieve the goals/concept of this paper. To parents, for their unconditional love, understanding, and support, both moral and financial all along with the writing of this document.

To Engr. Robert R. Bacarro, MECE, MBA, for giving a chance to the researchers to experience making this project study, this is of great help to the student not just in this subject but also the knowledge as an Electrical Engineering student. This document opens a further door for improvement that will be meaningful in line with future work.

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SURIGAO STATE COLLEGE OF TECHNOLOGY

SURIGAO CITY, MAIN CAMPUS

A Narrative Report in

On-The-Job Training undertaken at

Surigao State College of Technology

Located at Narciso St., 8400, Surigao City

Presented to the Placement Office

Surigao State College of Technology

Narciso St., 8400, Surigao City, Surigao del Norte, Philippines

In Fulfillment of the Requirements of the degree of

Bachelor of Science in Electrical Engineering (BSEE)

Submitted by:

Don Russel Amado

BSEE

Submitted to:

Rhoda May B. Macalam, DBA

Placement Coordinator

Summer OJT

A.Y. 2020-2021

CONTENTS OF THE NARRATIVE REPORT

INTRODUCTION

"Whatever your goal in life, the beginning is knowledge and experience". It means that the knowledge that a student used in an experience is the beginning of reaching his/her goal. That is why an internship or the so-called OJT (On-the-Job Training) is created. On the job training or OJT is one method by which students is given a chance to apply the theories and computations that they have learned from the school. It also helps the students to acquire relevant knowledge and skills by performing in actual work setting.

An OJT or internship program allows students to experience the actual techniques of a certain work while using genuine tools, equipment, and papers. In effect, a student trainee's employment becomes a growth arena where he can learn more about his chosen subject and put what he's learned in school into reality.

Where realism is necessary, on-the-job training is beneficial.Typically, the supervisor observes the trainees while they perform their duties. After observation, the observer provides the trainees with feedback on their performance.

For a company or an organization who willingly accept a student trainee, OJT program provides them additional manpower without expecting salary to pay back. Student trainees can bring fresh ideas, and if even given such opportunity to speak their minds freely, they may be able to contribute significantly in brainstorming sessions that will possibly help for the productivity of the company.

In the Civil Engineering OJT program, students would be trained in their selected field of interest. This gives students the chance to practice realistic job procedures with real tools, equipment, and papers. This, in turn, will undoubtedly contribute to their professional growth and development.

Supervisors are generally educating while training interns. The process of coaching trainees stretches their patience, enhances engineering skills, and makes them more sensitive to the demands and mindset of the younger generation. The supervision program also teaches them how to communicate their knowledge and respond to questions.

THE INDUSTRY PARTNER:

Company Picture

"For Nation's Greater Heights"

Company History

Company Orgizational Chart

SURIGAO STATE COLLEGE OF TECHNOLOGY

SURIGAO CITY, MAIN CAMPUS

OJT DAILY ACCOMPLISHMENT REPORT

Name of Industry: Surigao State College of Technology

Address of Industry: Narciso St., 8400, Surigao City, Surigao del Norte, Philippines

Date	Activities Done	Remarks
06-23-21	OJT Orientation being discussed by Ma'am Rhoda May B. Macalam and Engr. Federico Aves	Accomplished
06-24-21	Reinstallation of AutoCAD, Reviewing Past Plans	Accomplished
	Designing Ground Floor Plan	Accomplished
	Designing Second Floor Plan	Accomplished
06-25-21	Roof Plan	Accomplished
	Elevations and Sections	Accomplished
	Doors and Windows Details	Accomplished
06-26-21	Foundation Plan, Framing Plan, Roof Beam, Roof Framing Plan	Accomplished
06-27-21	Section of Column, Walls and Two-Way Slab Detail	Accomplished
06-28-21	Stair Detail, RCB Details, and Beam Schedule	Accomplished
06-29-21	Lighting Plans, Lay-out Plans, and Rise Diagram	Accomplished
	Schedule of Loads, Circuit Breaker, Electrical Notes, and Legend of Electrical	Accomplished
06-30-21	Plumbing Plans and Septic Plans	Accomplished
	Isometric Plan of Plumbing, Specification and Legend of Plumbing	Accomplished
07-01-21	Perspective of Two-Storey of Residential House	Accomplished
07-02-21	Estimates	Accomplished
	Estimates and Bill of Quantities	Accomplished
07-03-21	Design and analysis of Slabs using ETABS and excel	Accomplished

07-04-21	Design and analysis of Columns using ETABS and CSi detailing	Accomplished
07-05-21	Design and analysis of Beams using ETABS and excel Design and analysis of Tie Beams using ETABS and excel	Accomplished Accomplished
07-06-21	Design and analysis of Footings using ETABS and excel	Accomplished
07-07-21	Design and analysis of Wall Footings using excel	Accomplished
07-08-21	Design and analysis of Stairs using excel	Accomplished
07-09-21	Design and analysis of Trusses using ETABS and CSi detailing	Accomplished
07-10-21	Rebar Cutting List using excel	Accomplished

DAY 1: June 23, 2021 (afternoon)

We had an OJT orientation via zoom. Ma'am Rhoda May Macalam discussed the requirements we must comply before and after the OJT. While Engr. Federico Aves discussed the things we must finished within the allotted time for this training. We were assigned to make a complete two-storey plan of either commercial building or residential building, its structural designs of footings, columns, beams, slabs, wall footings, tie beams, stairs, and trusses, its complete estimations, and rebar cutting list.

DAY 2: June 24, 2021 (8 a.m. – 5 p.m.)

I started reinstalling my AutoCAD application. I scanned my past plans last semester to get more ideas. Then, I started making my ground floor plan using AutoCAD application. After making my ground floor plan, then proceed making my second floor plan.

DAY 3: June 25, 2021 (8 a.m. – 5 p.m.)

At 8 a.m. I started creating my roof plan. I designed it with its detailed truss. Then, I designed the elevations of my proposed two-storey residential building. I did the front, rear, left, and right elevations. After I finished doing my elevations, I continued on working on longitudinal and traverse section which are essential part of architectural plan. Next, I started creating the windows and doors details which are also essential information for the overall of the design.

DAY 4: JUNE 26, 2021 (8 a.m. – 5 p.m.)

For my structural plan, I started designing the foundation plan first from the ground floor. Then, I proceeded on making the roof beam and roof framing plan and put the details of all the structural design.

DAY 5: JUNE 27, 2021 (8 a.m. – 5 p.m.)

Still working on structural plan, I started designing the column. Then I continued working on designing the walls and two-way slab details.

Company Profile

Objectives: We strive to help CEIT of SSCT attain its goals as learning institution through;

CEIT College Dean's Office Duties:

- Supervising various campus programs
- Serving as a liaison between college administrators and student organizations
- Oversee Academic Programs
- Budgets
- Handle Student Complaints
- Working with Professors
- College Representative

VISION

To be a center of excellence in engineering and information technology education.

MISSION

To provide relevant, quality and sustainable instruction, research and extension programs and services to produce responsible and globally competitive individuals in the fields of engineering and information technology.

GOALS

1. An outcomes-based learning experience for students that fosters the application of engineering and information technology disciplines.
2. Research, innovation and creative works that promote a sustainable, just, and prosperous world.
3. Establish linkages with industry, government and other sectors in the realization of common goals.

OBE Framework

In compliance with the Commission of Higher Education (CHED) Memorandum Order Nos. 37 and 46 series of 2012, the College of Engineering and Information Technology adopts the Outcomes-Based Education (OBE) system in the implementation of its academic programs.

The center of the SSCT College of Engineering and Information Technology OBE framework is CMO 37 and 46 which specifies the standards of Outcomes-Based Education in the Philippines where the learning outcomes, learning environment, teaching-learning activities, and assessment & evaluation were all anchored on. All these activities were also based on the Program Educational Objectives (PEO) which is also based on the Vision, Mission, and Goals of the college. The PEO shall undergo accreditation process so that it can be certified in complying the Outcome-Based Education.

approving the appointment of Dr. Medina as the College President to serve the unexpired term of Dr. Lañada effective May 15, 2007. On March 4, 2009, Dr. Anastacio P. Martinez succeeded Dr. Medina and was designated as Officer-in-Charge to the Office of the President per BOT Resolution No. 661 s. 2009 who served the College until August 14, 2009. On August 15, 2009, Dr. Virginia D. Akiate who was the Regional Director of the Commission on Higher Education in CARAGA Region was designated as Officer-in-Charge of the College and was confirmed by the Board per Resolution No. 716 s. 2009 during its Special Meeting on October 30, 2009 at Almont Hotel and Inland Resort in Butuan City. Her designation as OIC ended on November 30, 2010.

The Surigao del Norte College of Agriculture and Technology (SNCAT) which was formerly the Mainit National Agricultural School (MNAS) by virtue of R.A. 5256 1983 Batas Pambansa Blg. 358 on May 26, 1969 was integrated to SSCT through a Memorandum of Agreement (MOA) entered into by and between CHED and TESDA on October 10, 2008 duly represented by TESDA Director General Emmanuel Joel J. Villanueva and Dir. Virginia D. Akiate who was then the CHED Regional Director in Caraga at the same time the Officerin-Charge of SSCT with the presence of the two representatives of Surigao del Norte, Cong Francisco T. Matugas of District I and Cong. Guillermo A. Romarate Jr. of District II.

Under the Memorandum of Agreement, the Higher Education Programs of Surigao del Norte College of Agriculture and Technology (SNCAT) will be placed under the direct supervision of SSCT. The same was confirmed by the Board through Resolution No. 735 s. 2009 on December 28, 2009 during its 44th BOT Meeting. Dr. Georgito G. Posesano, Professor II of SSCT-Main Campus was designated on November 25, 2010 as its Campus Director.

The year 2010 marked another milestone in the history of SSCT as the new lady president, Dr. Gloria C. Gemparo, after undergoing the year-long selection process, assumed into office as the 5th College President of the Surigao State College of Technology on December 1, 2010 pursuant to BOT Resolution No. 25 s. 2010. With Dr. Gemparo at its helm, everybody hopes for a bright future as it faces 21st Century challenges in pursuit of quality and relevant education for all its constituents.

The Surigao State College of Technology is a public college in the Philippines. It is mandated to provide higher vocational, professional and technological instruction and training in the fields of agriculture, fisheries, engineering and sciences, as well as short-term technical courses. It is also mandated to provide primary consideration to the integration of research/studies for the development of the Province of Surigao del Norte. Its main campus is located in Surigao City. Surigao State College of Technology (SSCT) was formerly Surigao del Norte School of Arts and Trades, established as a trade school with the help of then Governor Jose C. Sering on August 8, 1969 by virtue of Republic Act 6057 under the supervision of Supt. Marcelo S. Bonilla of Cebu School of Arts and Trades, Cebu City.

The school formally started its operation on September 15, 1969 with borrowed technology teachers from three different schools of the province. There were 103 pioneering students in the first secondary trade and the trade technical curricula. Two 2-storey buildings were constructed upon donation of 1.2 hectares of land through the Provincial Government. Along with this, several machineries were acquired from Japan Overseas Cooperation Volunteers; Technical Vocational Education Program; Asian Development Bank; and Philippine Australian Technical Vocational Education Program which became instruments of becoming a fullfledged higher institution offering Bachelor of Science in Industrial Technology and the Bachelor of Science in Industrial Education.

From 1969 to 1988, Dr. Tomas P. Solana, the principal of Numancia National Vocational School (NNVS) served as its 1st Principal and later became the College Vocational School Superintendent II and steered SNSAT for almost two decades. Upon Dr. Tomas P. Solana's retirement in February 1988, Dr. Ernesto N. Gonzales assumed into office as the Vocational College Superintendent.

Through the efforts of the late Senator Robert Z. Barbers, R.A. 8650 merged SNSAT with the Malimono School of Fisheries, a secondary school that offered the Revised Fisheries Curriculum of 1972 under P.D. 223 in 1975, thereby creating the Surigao State College of Technology (SSCT) which was signed into law on June 5, 1998 by then President Fidel V. Ramos. With the conversion of SNSAT and Malimono School of Fisheries to a State College, there was a major review of its organization, curriculum, and programs and standards under Dr. Teresita T. Tumapon who took the seat as the 1st College President on September 25, 1998.

The chartered State College integrated a satellite campus on October 30, 2000 which is the Siargao National College of Science and Technology or SNCST situated in Del Carmen, Surigao del Norte. The integration was made pursuant to Section 8 of RA 7722 and Section 4.1 of RA 8292.Dr. Gloria C. Gemparo, VIS-III of SSCT assumed as its 1st College Administrator until May 14, 1998. The retirement of Dr. Tumapon on October 2, 2003 paved the way for Dr. Reynaldo T. Peña as the 2nd College President on October 3, 2003 and after more than four (4) months of presidency, Dr. Peña opted to end his term on February 29, 2004 to assume as Regional Director of CHED –Region XI, Davao City where the then CHED Regional Director, Dr. Joanna B. Cuenca was designated as the Officer-in-Charge of the College on March 1, 2004 until March 3, 2005. Engr. Henry L. Lañada, Ph.D. assumed into office on March 4, 2005, as the 3rd College President of the Surigao State College of Technology and unexpectedly resigned on January 4, 2007 which eventually led to the designation of Dr. Jocelyn T. Medina as Acting President effective January 5, 2007 per BOT Resolution No. 490 s. 2007. On May 11, 2007, the Board passed Resolution No. 521 s. 2007

ASSESSMENT OF WORK EXPERIENCE

It was an excellent opportunity for me to further expand and broaden my knowledge and competency as a civil engineering student and for future career ambitions after graduation as one of the 3rd year students who took the Civil Engineering on-the-job training course. Throughout my journey, I've been able to use the tools and abilities that my extensive academic training in SSCT provided me with to be competent enough to pursue various chances available in the outside world.

Regardless of the pandemic, my personal objective was to work in an on-the-job training role where I could use my critical and analytical skills from my academic studies. I understand why we were not permitted to participate in typical on-the-job training, and it is to ensure the safety of all trainees in the middle of the covid-19 pandemic that is currently affecting the country. Despite the fact that we were receiving on-the-job training at home and using our school as a practice site, I was still interested in strengthening my foundation in structural planning and design. With this in mind, I applied for a student trainee position at Surigao State College of Technology. (Main Campus). Fortunately, my application was accepted.

The whole practicum requires 240 hours of training which totals to 30 days for a schedule of 8 hours per day. I started my training on June 24, 2021 after the OJT orientation. Prior to that day, Ma'am Rhoda May B. Macalam gave us a brief orientation regarding the practicum and Engr. Federico Aves stood as the supervisor for the whole training. Of course, he briefed us of our duties and responsibilities we have been tasked as a student trainee. We were assigned to make a complete two-storey plan of either commercial building or residential building using CAD, its structural designs of footings, columns, beams, slabs, wall footings, tie beams, stairs, and trusses, its complete estimations, and rebar cutting list using excel, but I also used ETABS which is an engineering software product that caters to multi-story building analysis and design for my further learning.

My schedule starts at 8:00 in the morning and ends at 5:00 in the afternoon from Monday to Sunday. My experience was personally motivating and enhancing. I was able to make documentations of the accomplishments of my work. And I was able to broaden my knowledge regarding structural planning and designing. And later on analyze it, ensuring that the building is safe enough to withstand some load factors such as deadloads, liveloads, and environmental loads. These elements were designed base on the standards set by the code. I was able to manipulate my time also in computing bill of quantities and cost estimate of the building. Of course, my academic training experience was a great help in doing such task. Additionally, I had the very opportunity to interact with my co-trainee via zoom and Google meet as we shared our own ideas on structural plans and designs.

Overall, I found the experience to be really rewarding. In addition, I was able to contribute my knowledge to the completion of the tasks. The on-the-job training I received at the Surigao State College of Technology (Main Campus) inspired me to develop and become a better civil engineering student and aspiring professional engineer in the Philippines in the near future. As a Civil Engineering student who will soon be a part of society as a working professional, the experience inspired my compassion, competence, and devotion.

DAY 6: JUNE 28, 2021 (8 a.m. – 5 p.m.)

I started working on detailing the stairs. Followed by RCB and beams in detailed. This helps to identify to what kind materials and the quantity of materials to be used.

DAY 7: JUNE 29, 2021 (8 a.m. – 5 p.m.)

For my electrical plan, I designed on lighting first, since it would be essential for a finished two-storey plan. Next is the lay-out plans then the rise diagram to where the source of the electricity. I did a quick review on electrical loads computation and then I started computing the loads of electrical plan. After computing, began on the distribution of circuit breaker. Lastly, I inputted the Electrical Legends which serves as the guide of the plan.

DAY 8: JUNE 30, 2021 (8 a.m. – 5 p.m.)

I did a quick review on the guidelines for plumbing. Then, I started making my plumbing plans and the design of the septic tank. I created the isometric plan for plumbing which will serve as a guide for the flow of waste and non-waste. Next, I browsed my other plans for specifications and Legends of Plumbing.

DAY 9: JULY 1, 2021 (8 a.m. – 5 p.m.)

I made a perspective of my house design using AutoCAD because I do not know how to use other application to make my perspective.

DAY 10: JULY 2, 2021 (8 a.m. – 5 p.m.)

This day I made the BOQ for my building.

DAY 11: JULY 3, 2021 (8 a.m. – 5 p.m.)

I opened first the ETABS to analyze if the slab design is suitable or safe. After that the data collected is then exported to excel to produce the final design.

DAY 12: JULY 4, 2021 (8 a.m. – 5 p.m.)

I opened first the ETABS to analyze if the column design is suitable or safe. After that the data collected is then exported to excel to produce the final design.

DAY 13: JULY 5, 2021 (8 a.m. – 5 p.m.)

I opened first the ETABS to analyze if the beams design is suitable or safe. After that the data collected is then exported to excel to produce the final design. Since beams and tie beams are typically the same the methods used by designing is also the same.

DAY 14: JULY 6, 2021 (8 a.m. – 5 p.m.)

I opened first the ETABS to analyze if the footing design is suitable or safe. After that the data collected is then exported to excel to produce the final design.

DAY 15: JULY 7, 2021 (8 a.m. – 5 p.m.)

I opened first the ETABS to analyze if the wall footing design is suitable or safe. After that the data collected is then exported to excel to produce the final design.

DAY 16: JULY 8, 2021 (8 a.m. – 5 p.m.)

In designing stairs, I only used Excel to perform designing and analysis of the structure. After designing I also computed the rebar required for the structure.

DAY 17: JULY 9, 2021 (8 a.m. – 5 p.m.)

I opened first the ETABS to analyze if the truss design is suitable or safe. After that the data collected is then exported to excel to produce the final design.

DAY 18: JULY 10, 2021 (8 a.m. – 5 p.m.)

After finishing all my design and analysis I made the rebar cutting list for all the structures. I minimized the total wastage of rebar so that the contractors can save money and we can easily keep track of the materials needed and used during the process.

SURIGAO STATE COLLEGE OF TECHNOLOGY
NARCISO ST., SURIGAO CITY
MAIN CAMPUS

A Narrative Report in
On-The-Job Training Undertake at
SSCT College of Engineering and Information Technology
Located at Narciso St., Surigao City

Presented to the Placement Office
Surigao State College of Technology
Narciso St., Surigao City

In the Fulfillment of the Requirements of the Degree of
Bachelor of Science in Electrical Engineering(BSEE)

Submitted by:
Darriel C. Benedicto
BSEE

Submitted to:
Mr. Romel C. De La Cruz, PhEdD
Placement Coordinator

Summer 2018-2019

CONTENTS OF THE NARRATIVE REPORTS

Republic of the Philippines
SURIGAO STATE COLLEGE OF TECHNOLOGY
Narciso Street, Surigao City

"For Nation's Greater Heights"

CERTIFICATE NUMBER: AJA19-0225

COLLEGE OF ENGINEERING & INFORMATION TECHNOLOGY

ENDORSEMENT

This is to endorse Mr/Ms BENEDICTO, Darriel, a bonafide student of Surigao State College of Technology under the Bachelor of Science in Electrical Engineering program to undergo **ON THE – JOB – TRAINING (OJT)** after having been evaluated by the Program Chair to be compliant of the mandatory academic requirements set by the college.

ENGR ROBERT R. BACARRO, MECE, MBA
Dean, College of Engineering & Information Technology

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that Mr/Ms BENEDICTO, Darriel, a Fifth Year BSEE Student to undergo the 240 hours **ON THE – JOB – TRAINING (OJT),** this Summer 2019 in partial fulfilment for the degree Bachelor of Science in Electrical Engineering.

This certificate is given on June 13, 2019 for whatever legitimate purposes this may serve him/her.

ROMEL C. DE LA CRUZ, PhEdD
Placement Coordinator - Designated

Noted by:

CARLOS H. DONOSO, EdD
Campus Director

Introduction

On-The-Job-Training are part of a college curriculum that not only aims to train and orient students about the work and their future career but to show the students the reality of the actual world. The trainee learns in the real work environment and gain experience dealing with task and challenges that will meet during a normal working day.

For the students, an internship program provides oppurtunities to go through the actual methodologies of a specific job using the real tools, equipments and documents. In effect, the workplace becomes a development venue for a student trainee to learn more about her chosen field and practice what she has learned from the institutuion.

On the other hand, an effective internship program also benefits the host company who accept trainees. Interns provide additional manpower for a lesser labor cost than a regular employee. Most of them are all eager to learn the ropes so chances are high that they will cooperate.

Moreover, internships focuses on the acquisition of skills within the working environment generally under normal condition. The aquired general skills of the trainees from training can be performed from one task to another while the specific skills can be shown uniquely to a particular job.

Presently, SUC's includes OJT in the curriculum to meet the standard of growing IT industry. It is done by deploying interns into host companies to complete a training within a certain period of time. OJT can become a powerful tools and possibly even be a source of experience when students take the big lift from being a student to career professionals.

SURIGAO STATE COLLEGE OF TECHNOLOGY

Document Code No.:	FM-SSCT-RFG-007
Revision No.:	000
Effective Date:	01 January 2019
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Certificate of Registration

Summer, AY 2018 - 2019

ID No.:	Last Name	First Name	Middle Name	Sex
2012 - 1040	BENEDICTO	DARRIEL	C.	Male

PROGRAM: **Bachelor of Science in Electrical Engineering**
MAJOR:

YEAR LEVEL: **Fourth Year**
STATUS: OLD

Section	Course	Day	Time	Room	Code	Lec Hrs.	Lab Hrs.	Units
BSEE - A	EE 108 AC Apparatus and Devices	[M,T,W,Th,F,S]	[01:00PM-02:00PM]	[EB 304]	00141	2	3	3
BSEE - 5R	EE 200 EE PRACTICUM (Company Exposure and Reporting) 240hrs.				00134	0	0	3

Total Units: 5.0

Certified by: _____

Assessment

Description	Amount
Other Service Income - OJT Fee	800.00
School Fees - Tuition College	1,800.00
Registration Fees	150.00
Other Service Income - Guidance Fee	150.00
Other Service Income - Media Resource Fee	50.00
School Fees - Library Fee	150.00
School Fees - Laboratory Fee	130.00
Total:	3,030.00

Darriel C. Benedicto

Panikian, Carrascal, Surigao Del Sur
09505606281
Darriel.benedicto7@gmail.com

OBJECTIVE

I am perseveringly looking for an intern job that will beneficially help my experiences and learning as an Electrical Engineering student. A job that will help me to gain knowledge, creates more ideas about my field, camaraderie and learn/train how to become a professional worker.

PERSONAL BACKGROUND

Age	: 23 years old
Sex	: Male
Date of Birth	: December 4, 1995
Religion	: Roman Catholic
Civil Status	: Single
Height	: 5'9"
Weight	: 74 kg.
Father's name	: Exuperancio I. Benedicto
Occupation	: Ice Cream Vendor
Mother's name	: Ellen C. Benedicto
Occupation	: Housewife

Person to contact in case of emergency: Ellen C. Benedicto
Contact Number : 09077726961

EDUCATIONAL BACKGROUND

Tertiary : Surigao State College of Technology
Narciso St., Surigao City
Bachelor of Science in Electrical Engineering
Present
2012-2019

Secondary : Panikian National High School
Panikian, Carrascal, Surigao Del Sur
2008-2012

Elementary : Panikian Elementary School
Panikian, Carrascal, Surigao Del Sur
2002-2008

LANGUAGE

Filipino, English, Bisaya

SKILLS AND CAPABILITIES

- **Basic knowledge in Electrical Engineering related applications**
  - Soldering Components
  - Electrical wiring
  - MATLAB
- **Proficient in Microsoft Office application such as:**
  - Microsoft Office Word
  - Microsoft Office Powepoint
  - Microsoft Office Excel
- **Leadership Skills**
- **Technology literate**
- **Responsible and Flexible**
- **Willing to be trained, to learn and committed to work.**

SEMINAR AND TRAINING

1st IIEE SURIGAO DEL NORTE CHAPTER COVENTION AND EXECOM CHAPTER VISIT
Gateway Hotel, Surigao City
October 26-27, 2018

Workshop on Hardware Description Languages and Field Programmable Gate Arrays
Surigao State College of Technology
April 25, 2019

Seminar on Electrical Power System, SURNECO Rate Components and Electrical Safety
Surigao Education Center
August 24, 2018

CHARACTER REFERENCE

ENGR. JOSELITO BALDAPAN
Professional Electrical Engineer (PEE)
College of Engineering & Information Technology Program Chair, BSEE
09998531847
Surigao State College of Technology
Narciso Street, Surigao City

ENGR. CONRADO B. DELOSA JR.
Licensed Electrical Engineer
IIEES-SSCT, Adviser
09985694470
Surigao State College of Technology
Narciso Street, Surigao City

ENGR. AUREA M. MADELO
Licensed Electronics Engineer
Surigao State College of Technology
Narciso Street, Surigao City

I hereby certify that the above records and information are true and correct to the best of my knowledge, belief and ability.

Daniel C. Benedicto
Student Trainee Applicant

Republic of the Philippines
SURIGAO STATE COLLEGE OF TECHNOLOGY
Narciso Street, Surigao City
"For Nation's Greater Heights"

CERTIFICATE NUMBER: AJA19-0225

Republic of the Philippines)
Province of Surigao del Norte) S.S.
City of Surigao)

AFFIDAVIT OF WAIVER

That I, Darriel C. Benedicto, of legal age, Filipino, and a resident of Pavilion, Carmen, SDS, after being sworn to in accordance with law do hereby depose and say:

That I am a 5th year BSEE student from the SURIGAO STATE COLLEGE OF TECHNOLOGY Surigao City Campus;

That I am applying as On-the-Job trainee at SSCT - main Campus.

That being privileged to work in your establishment, I promise to render the necessary work to the best of my ability in order that my practicum shall be brought to successful end;

That while performing the OJT, and for the duration thereof, I shall abide by the rules and policies of the company / industry relative to work, and further, that I shall follow and obey other orders and instructions incidental thereto;

That I do hereby waive and renounce any right to damages for any injury sustained by me in the course or connection with my job as a student-trainee;

IN WITNESS WHEREOF, I have hereunto set my hands this 14 day of June, 2019 in the City of Surigao.

Conforme:

Signature of Parent / Guardian

Affiant

Noted:

ROMEL C. DE LA CRUZ, PhEdD
Placement Coordinator – Designate

ENGR. ROBERT R. BACARRO, MECE, MBA
Dean, College of Engineering and Information Tech.

SUBSCRIBED AND SWORN to before me this 15th day of June, 2019 at Surigao city Philippines, affiant exhibited mto me his / her Residence Certificate No. _____ issued on _____ at _____.

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PAGE NO. 10
BOOK No. VII
SERIES OF 2019

JOSE E. VILLACES
NOTARY PUBLIC
UNTIL DECEMBER 31, 2019
PTR No. 0573322, 01-7-19-S.C.
IBP No. 068424, 01-08-19, S.C.
TIN 131-443-873 - SURIGAO CITY

Tel. Nos.: (086) 826-0135;
(086) 231-7798
Email: surigaostatecollege@yahoo.com
URL: ssct.edu.ph

Republic of the Philippines
SURIGAO STATE COLLEGE OF TECHNOLOGY
Narciso Street, Surigao City

"For Nation's Greater Heights"

CERTIFICATE NUMBER: AJA19-0225

PARENT'S CONSENT

I, Ellen C. Benedicto and Expercancio T. Benedicto Jr. parent/guardian of Daniel C. Benedicto, a prospective student trainee of the Surigao State College of Technology, Main Campus, Surigao City, have hereunto grant permission for him/her to undergo 3 months or 240 hours On-the-Job Training (OJT) at SSCT - Main Campus which is a requirement for graduation.

That we made it known our continued financial, moral support and assistance to him/her during the duration of the training. That we shall adhere to any disciplinary action of the school, such as dropping him/her from the rolls of trainees should it be found that he/she is frequent absentee and / or notoriously undesirable trainee.

It is fully known that we have read and understand all the contents of the parent's consent and we have signed the same with our voluntary act and deed.

Signed this 14 day of June, 2019 in the City of Surigao, Philippines.

Signature of father / Guardian

Signature of mother / Guardian

Conforme:

Signature of Student Trainee

Noted by:

ROMEL C. DE LA CRUZ, PhEdD
Placement Coordinator – Designate

ENGR. ROBERT R. BACARRO, MECE, MBA
Dean, College of Engineering and Information Tech.

SUBSCRIBED AND SWORN TO ME BEFORE THIS 15th day of June, 2019 at Surigao City Philippines, affiant exhibited to me his / her Residence Certificate No. _____ issued on _____ at _____.

DOC. NO. 319
PAGE NO. 10
BOOK NO. XII
SERIES OF 2019

JOSE E. VILLACES
NOTARY PUBLIC
UNTIL DECEMBER 31, 2019
PTR No. 0573322, 01-7-19 S.C.
IBP No. 066424, 01-08-19, S.C.
TIN. 131-443-873 - SURIGAO CITY

Tel. Nos.: (086) 826-0135;
(086) 231-7788

Email: surigaostatecollege@yahoo.com
URL: ssct.edu.ph

INDUSTRY PARTNER

SSCT MAIN CAMPUS

COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY

HISTORY OF THE SCHOOL

The Surigao State College of Technology is a public college in the Philippines. It is mandated to provide higher vocational, professional and technological instruction and training in the fields of agriculture, fisheries, engineering and sciences, as well as short-term technical courses. It is also mandated to provide primary consideration to the integration of research/studies for the development of the Province of Surigao del Norte. Its main campus is located in Surigao City. Established on June 15, 1998.

History Surigao State College of Technology (SSCT) was formerly Surigao del Norte School of Arts and Trades, established as a trade school with the help of then Governor Jose C. Sering on August 8, 1969 by virtue of Republic Act 6057 under the supervision of Supt. Marcelo S. Bonilla of Cebu School of Arts and Trades, Cebu City. The school formally started its operation on September 15, 1969 with borrowed technology teachers from three different schools of the province. There were 103 pioneering students in the first secondary trade and the trade technical curricula. Two 2-storey buildings were constructed upon donation of 1.2 hectares of land through the Provincial Government.

Along with this, several machineries were acquired from Japan Overseas CooperationVolunteers; Technical Vocational Education Program; Asian Development Bank; and Philippine Australian Technical Vocational Education Program which became instruments of becoming a fullfledged higher institution offering Bachelor of Science in Industrial Technology and the Bachelor of Science in Industrial Education. From 1969 to 1988, Dr. Tomas P. Solana, the principal of Numancia National Vocational School (NNVS) served as its 1st Principal and later became the College Vocational School Superintendent II and steered SNSAT for almost two decades. Upon Dr. Tomas P. Solana's retirement in February 1988, Dr. Ernesto N. Gonzales assumed into office as the Vocational College Superintendent. Through the efforts of the late Senator Robert Z. Barbers, R.A. 8650 merged SNSAT with the Malimono School of Fisheries, a secondary school that offered the Revised Fisheries Curriculum of 1972 under P.D. 223 in 1975, thereby creating the Surigao State College of Technology (SSCT) which was signed into law on June 5, 1998 by then President Fidel V. Ramos. With the conversion of SNSAT and Malimono School of Fisheries to a State College, there was a major review of its organization, curriculum, and programs and standards under Dr. Teresita T. Tumapon who took the seat as the 1st College President on September 25, 1998. The chartered State College integrated a satellite campus on October 30, 2000 which is the Siargao National College of Science and Technology or SNCST situated in Del Carmen, Surigao del Norte.

The integration was made pursuant to Section 8 of RA 7722 and Section 4.1 of RA 8292.Dr. Gloria C. Gemparo, VIS-III of SSCT assumed as its 1st College Administrator until May 14, 1998. The retirement of Dr. Tumapon on October 2, 2003 paved the way for Dr. Reynaldo T. Peña as the 2nd College President on October 3, 2003 and after more than four (4) months of presidency, Dr. Peña opted to end his term on February 29, 2004 to assume as Regional Director of CHED –Region XI, Davao City where the

then CHED Regional Director, Dr. Joanna B. Cuenca was designated as the Officer-in-Charge of the College on March 1, 2004 until March 3, 2005. Engr. Henry L. Lañada, Ph.D. assumed into office on March 4, 2005, as the 3rd College President of the Surigao State College of Technology and unexpectedly resigned on January 4, 2007 which eventually led to the designation of Dr. Jocelyn T. Medina as Acting President effective January 5, 2007 per BOT Resolution No. 490 s.2007. On May 11, 2007, the Board passed Resolution No. 521 s. 2007 approving the appointment of Dr. Medina as the College President to serve the unexpired term of Dr. Lañada effective May 15, 2007. On March 4, 2009, Dr. Anastacio P. Martinez succeeded Dr. Medina and was designated as Officer-in-Charge to the Office of the President per BOT Resolution No. 661 s. 2009 who served the College until August 14, 2009. On August 15, 2009, Dr. Virginia D. Akiate who was the Regional Director of the Commission on Higher Education in CARAGA Region was designated as Officer-in-Charge of the College and was confirmed by the Board per Resolution No. 716 s. 2009 during its Special Meeting on October 30, 2009 at Almont Hotel and Inland Resort in Butuan City.

Her designation as OIC ended on November 30, 2010. The Surigao del Norte College of Agriculture and Technology (SNCAT) which was formerly the Mainit National Agricultural School (MNAS) by virtue of R.A. 5256 1983 Batas Pambansa Blg. 358 on May 26, 1969 was integrated to SSCT through a Memorandum of Agreement (MOA) entered into by and between CHED and TESDA on October 10, 2008 duly represented by TESDA Director General Emmanuel Joel J. Villanueva and Dir. Virginia D. Akiate who was then the CHED Regional Director in Caraga at the same time the Officerin-Charge of SSCT with the presence of the two representatives of Surigao del Norte, Cong Francisco T. Matugas of District I and Cong. Guillermo A. Romarate Jr. of District II. Under the Memorandum of Agreement, the Higher Education Programs of Surigao del Norte College of Agriculture and Technology (SNCAT) will be placed under the direct supervision of SSCT. The same was confirmed by the Board through Resolution No. 735 s. 2009 on December 28, 2009 during its 44th BOT Meeting. Dr. Georgito G. Posesano, Professor II of SSCT-Main Campus was designated on November 25, 2010 as its Campus Director.

The year 2010 marked another milestone in the history of SSCT as the new lady president, Dr. Gloria C. Gemparo, after undergoing the year-long selection process, assumed into office as the 5th College President of the Surigao State College of Technology on December 1, 2010 pursuant to BOT Resolution No. 25 s. 2010. With Dr. Gemparo at its helm, everybody hopes for a bright future as it faces 21st Century challenges in pursuit of quality and relevant education for all its constituents.

Dr. Gloria C. Gemparo ended her four-year term of office seat and Dr. Ecclesiastes T. Dumanig was designated as Office-in-Charge in 2015 until January 18, 2016 in which Dr. Gregorio Z. Gamboa Jr., the 6th President of Surigao State College of Technology assumed into office after a yearlong process of selection.

COMPANY PROFILE

Objectives:

We strive to help CEIT of SSCT attain its goals as learning institution through;

VISION

To be a center of excellence in engineering and information technology education.

MISSION

To provide relevant, quality and sustainable instruction, research and extension programs and services to produce responsible and globally competitive individuals in the fields of engineering and information technology.

GOALS

1. An outcomes-based learning experience for students that fosters the application of engineering and information technology disciplines.
2. Research, innovation and creative works that promote a sustainable, just, and prosperous world.
3. Establish linkages with industry, government and other sectors in the realization of common goals.

OBE Framework

In compliance with the Commission of Higher Education (CHED) Memorandum Order Nos. 37 and 46 series of 2012, the College of Engineering and Information Technology adopts the Outcomes-Based Education (OBE) system in the implementation of its academic programs.

The center of the SSCT College of Engineering and Information Technology OBE framework is CMO 37 and 46 which specifies the standards of Outcomes-Based Education in the Philippines where the learning outcomes, learning environment, teaching-learning activities, and assessment & evaluation were all anchored on. All these activities were also based on the Program Educational Objectives (PEO) which is also based on the Vision, Mission, and Goals of the college. The PEO shall undergo accreditation process so that it can be certified in complying the Outcome-Based Education.

"For Nation's Greater Heights"

SURIGAO STATE COLLEGE OF TECHNOLOGY

Document Code No.	FM-SSCT-PLM-004
Revision No.	00
Effective Date	20 September 2018
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OJT DAILY ACCOMPLISHMENT REPORT

Name of Industry SSCT
Address of Industry Narciso St. Surigao City

Date	Activities Done	Remarks
July 17, 18, 19	Installing TV outlet 3rd floor Engineering Building	
22, 23, 24, 25	Inspection Maintenance of wirings SSCT Building.	
29, 30, 31	Computing loads of Engineering Building	

Prepared by: Daniel C. Benedicto
Name of Student

Noted by: JOSELITO S. BALDAN
Supervisor

Date: July 17/19

Date: August 30, 2019

"For Nation's Greater Heights"

SURIGAO STATE COLLEGE OF TECHNOLOGY

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OJT DAILY ACCOMPLISHMENT REPORT

Name of Industry SSCT
Address of Industry Narciso cor, Surigao City

Date	Activities Done	Remarks
August		
1	- Preparing Manuscript / Paper for BSEE Accreditation Lvl II	
2	- Preparing Manuscript / Paper for BSEE Accreditation lvl II	
5, 6, 7, 8, 9	→ Inspectioning Emergency light of Engineering bldg	
13, 14, 15, 16, 19	→ Observing Wiring Installation in newly renovated rooms	
20, 22, 23, 27, 28	→ Installing of Tv and socket/outlet 2nd floor Engineering Building	
29, 30	→ Installing of Tv and outlet of 2nd floor Engineering Building	

Prepared by: Daniel C. Benedicto
Name of Student
Date: July 17, 2019

Noted by: JOSELITO S. BALDARA
Supervisor
Date: August 30, 2019

No. _____ Pay Ending July 2019

Name Benedicto, Daniel C. Position OJT

Dept. CBIT Age 24

	Hours	Rate	Amount
Reg.			
Over			
Total Earnings			
Less Deductions			
NET PAY			

DEDUCTIONS

ABSENCES	
Late	
Withholding Tax	
SSS	
TOTAL	

Days	MORNING IN	MORNING OUT	AFTERNOON IN	AFTERNOON OUT	OVERTIME IN	OVERTIME OUT
16						
17	8:00	12:00	1:00	5:00		
18	ABSENT					
19	8:00	12:00	1:00	5:00		
20						
21	REST DAY					
22	7:40	12:03	12:50	5:03		
23	8:00	12:00	1:00	5:00		
24	7:51	12:01	1:00	5:00		
25	8:00	12:00	1:00	5:00		
26	8:00	12:00	1:00	5:00		
27	REST DAY					
28						
29	8:00	12:03	12:50	5:03		
30	8:00	12:03	1:00	5:00		
31	8:00	12:07	1:00	5:00		

I hereby certify that the above records are true and correct.

DATA

EMPLOYER'S SIGNATURE

No. _____ Pay Ending August 2019

Name Benedicto, Daniel C. Position OJT

Dept. CBIT Age 24

	Hours	Rate	Amount
Reg.			
Over			
Total Earnings			
Less Deductions			
NET PAY			

DEDUCTIONS

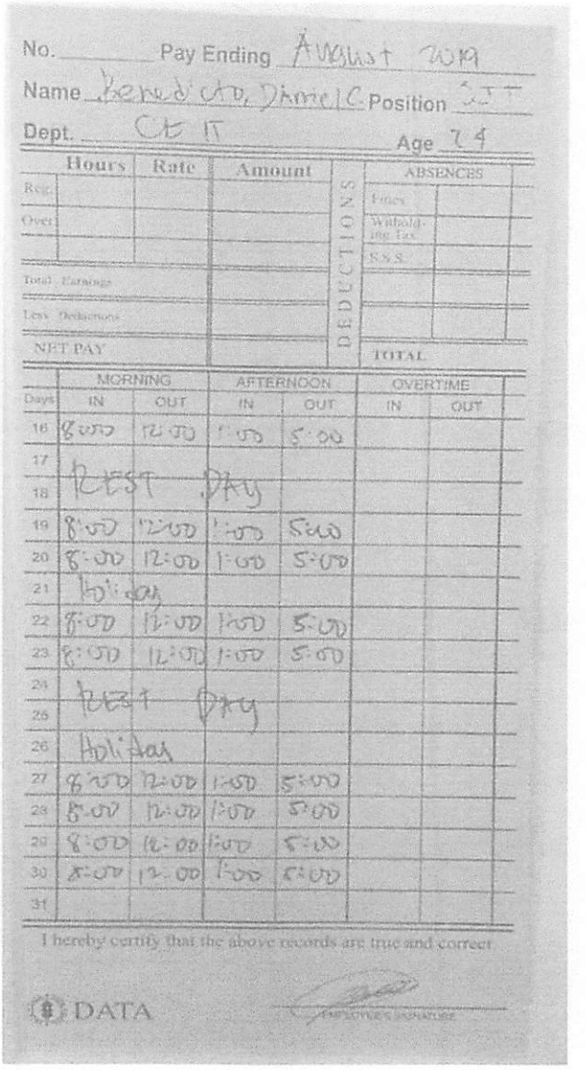
ABSENCES	
Late	
Withholding Tax	
SSS	
TOTAL	

Days	MORNING IN	MORNING OUT	AFTERNOON IN	AFTERNOON OUT	OVERTIME IN	OVERTIME OUT
1	8:00	12:00	1:00	5:00		
2	8:00	12:00	1:00	5:00		
3	REST		DAY			
4	REST		DAY			
5	8:00	12:00	1:00	5:00		
6	8:00	12:00	1:00	5:00		
7	8:00	12:00	1:00	5:00		
8	8:00	12:00	1:00	5:00		
9	8:00	12:03	1:00	5:00		
10						
11	REST	DAY				
12	HOLIDAY					
13	8:00	12:00	1:00	5:00		
14	8:00	12:00	1:00	5:00		
15	8:00	12:00	1:00	5:00		

I hereby certify that the above records are true and correct.

DATA

EMPLOYER'S SIGNATURE



No. _____ Pay Ending August 2019

Name Bernardo, Diane C. Position SIT

Dept. CS IT Age 24

	Hours	Rate	Amount
Reg.			
Over			
Total Earnings			
Less: Deductions			
NET PAY			

DEDUCTIONS

ABSENCES

Taxes	
Withholding Tax	
S.S.S.	
TOTAL	

Days	MORNING IN	MORNING OUT	AFTERNOON IN	AFTERNOON OUT	OVERTIME IN	OVERTIME OUT
16	8:00	12:00	1:00	5:00		
17						
18	REST DAY					
19	8:00	12:00	1:00	5:00		
20	8:00	12:00	1:00	5:00		
21	Holiday					
22	8:00	12:00	1:00	5:00		
23	8:00	12:00	1:00	5:00		
24						
25	REST DAY					
26	Holiday					
27	8:00	12:00	1:00	5:00		
28	8:00	12:00	1:00	5:00		
29	8:00	12:00	1:00	5:00		
30	8:00	12:00	1:00	5:00		
31						

I hereby certify that the above records are true and correct

DATA

EMPLOYEE'S SIGNATURE

Summary

Month	Hours
July	80
August	160
Total	**240 hours**

SURIGAO STATE COLLEGE OF TECHNOLOGY
SURIGAO CITY

CERTIFICATION OF COMPLETION

This certify that

DARRIEL C. BENEDICTO

Has exihibited a good performance,willingness and patience to learn/enable here to finish the job on time. He deligently handle whatever task assigned and deliver more than what expected of him during his practicum at BUILDING AND STATE SSCT.

Issued this **13th day of September**, 2019 at Surigao State College of Technology, Surigao City Phiippines.

Joselito S. Baldapan
Program Chair, Bachelor in Science in Electrical Engineering

"For Nation's Greater Heights"

SURIGAO STATE COLLEGE OF TECHNOLOGY

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Revision No.	00
Effective Date	20 September 2018
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OJT PERFORMANCE RATING SHEET

Darrel C. Bernardo	BSEE-5	Electrical Engineering
Name of Student	Course/Year	Major
SSCT		Narciso St. Surigao City
Name of Industry		Address of Industry
July 17, 2019		August 30, 2019
Start of Training		End of Training

DIRECTION:
The evaluation checklist below shall be used for rating the performance of students taking On-the-Job Training (OJT). Please check (/) the column that best described the performance of the trainee. The rating is as follows: 5 means Excellent/Outstanding; 4 means Very Satisfactory; 3 means Satisfactory; 2 means Unsatisfactory; and 1 means Poor.

OJT – Supervised Industrial Training

CRITERIA	1	2	3	4	5
Attendance & Punctuality					/
Work Habits & Attitudes					/
Quality of Works				/	
Judgment				/	
Cooperation					/
Honesty & Dependability					/
Comprehension					/
Safety					/
Relationship with Superiors				/	
Relationship with Co-trainees				/	
Emotional Stability & Maturity				/	
Leadership				/	

Sum 24 + 30

Total 54

Equivalent Rating 1.25

COMMENTS/OBSERVATIONS:

Equivalent Rating

60	-	1.00	35	- 30	2.25
59	- 54	1.25	29	- 24	2.50
53	- 48	1.50	23	- 18	2.75
47	- 42	1.75	17	- 12	3.00
41	- 36	2.00	11	- 6	4.00

Rated by:

JOSELITO S. BALDAPAN
Foreman/Supervisor

Approved: JOSELITO S. BALDAPAN
Dept. Head/Area Supt.

Documentation

Fig.01- Checking Wiring

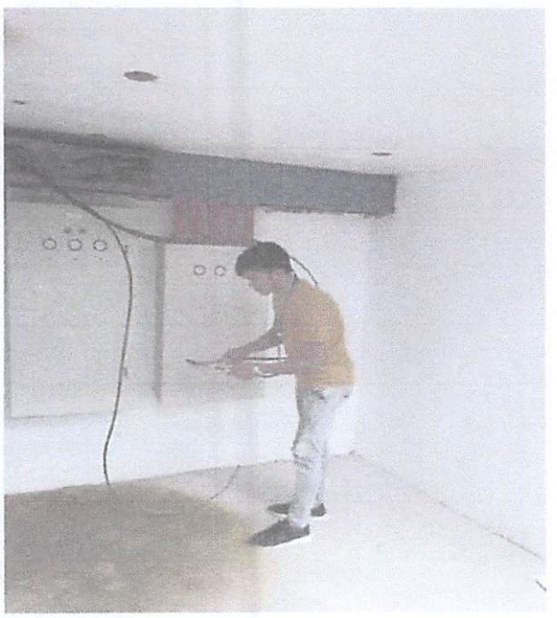

Fig. 02- Checking control panel

Fig. 03- Computing Official Documents

ASSESSMENT OF WORK EXPERIENCE

I, Darriel C. Benedicto, a Electrical engineering sssss student of SSCT, had completed a total of two-hundred forty (240) hours of office practicum with SSCT College of Engineering and Information Technology (CEIT), Surigao City from July 17, 2019 to August 28, 2019.

My intership in the SSCT came as a sudden decision since the Placement Office offered me along with a co-trainee, vacancies on the CEIT so we accepted the offer. We started on the afternoon right after.

I've been on an OJT course for about 30 days now, and one of the hardest issues to face is how to PROVE YOURSELF-that you are really doing your job and that you desrve a good grade, not only to your supervisor but also to my work mates.

I've learned a lot of things in just 240 hrs of on the job training but I've noticed that there are still other things that i have to improve one of it is my verval communication.

Nervousness and shyness are always when it's you're first time. For many reason, and lot of stuff playing on my mind. Such, I do not know the people in the office; and I do naot have any acual experience. That made me quite at first. Trying to observe on how to get along with the employee. There are times that i'm having a hard time on expressing my self, my thought with others because i dont exactly know how i am going to say it in and get my point.

Every day is a challenge for me to stand out. But i always have winning attitude through the guidedance of the lord, and always tell my self, "I'm gonna win this."

I've learned a lot of things during my OJT. I was not only exposed to actual office environment but i also realized wha i really want even before the time i graduated. What carrer i would want to have, etc. There are important things I've learned. First is you need to please everyone and try as much as you can to be polite and nice to everyone, and do it with sincerity. Beacause when we are kind to people same kindness return to us. And always smile.