**Recyclean Vending Machine**

**For Barangay San Agustin**

A Work Immersion Proposal

Presented to the

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**Chapter 1: Introduction**

Waste is already part of every one's daily life, and it is one of the major problem that the world is facing right now. There are different types of waste but most people failed to manage their waste. The waste that are being produced is one of the reason why there is a massive floods, flash floods, and pollutions.

As the time goes by, the usage of waste specifically the plastic bottles are increasing. It is very alarming because plastic bottles can harm the environment. Each plastic bottles leaks harmful chemicals that can cause a variety of health issues including reproductive problems and cancer. Plastic bottles takes time to decompose, it takes approximately 1000 years to break down.

Around the world, almost 1 million plastic bottles are purchased every minute. As the environmental impact of that tide of plastic becomes a growing political issue, major packaged goods sellers and retailers are under pressure to cut the flow of the single-use bottles and containers that are clogging the world’s waterways. Plastic production has surged in the last 50 years, leading to widespread use of inexpensive disposable products that are having a devastating effect on the environment. Images of plastic debris-strewn beaches and dead animals with stomachs full of plastic have sparked outrage. (Scarr and Hernandez, 2019)

Beside of the plastic bottle waste problem, the COVID-19 pandemic is also one of the problem that the world is facing right now. According to Centers for Disease Control and Prevention, the coronavirus disease or also known as COVID-19 is a new disease, caused by a novel (or new) coronavirus that has not previously been seen in humans. Because it is a new virus, scientists are learning more each day. Although most people who have COVID-19 have mild symptoms, COVID-19 can also cause severe illness and even death. You can be infected by the virus if you touched a contaminated surface and then your eyes, nose or mouth. That is why sanitizing your hands is a must.

Since plastic bottles is one of the problem in the society and the world is in the midst of pandemic, the researchers came up with an idea of making a machine that can help to lessen the plastic bottles on the surrounding at the same time provide protection to the people of community. The purpose of the idea is to minimize the plastic bottles that are just being thrown away and help to keep people sanitized their self specially in this time of pandemic

Barangay San Agustin already had advocacies that can help the environment to be better, clean, and safe for the citizens. San Agustin has six zones and this barangay has a lot of population it produces large amount of plastic bottle wastes. Even though there are already implemented policies and actions on the host community still it is difficult for them to minimize the plastic bottle waste. The wastes in each house should be segregated for it to be collected; the collecting of wastes was scheduled once a week.

In today’s generation it is a good thing that there are technologies and machineries that can help the society to be better. This study can help the community to minimize the plastic bottle waste on the surrounding and to keep the people sanitized not only in this time of pandemic but also in all times. With this study, it can create a machine that can help the community to have a better environment and to save the world from the plastic waste.

* 1. **Background Of The Study**

Waste pollution plays a significant role on calamities in the Philippines. Mismanaged waste disposal and plastic disposal contributes to the global share of mismanage waste in the ocean. According to Ritchie. H & Roser, M. (2018), The Philippines shares 6% on mismanaged plastic waste. This data alone makes the Philippines vulnerable to flash floods and severe flooding in low lying areas. Improper waste disposal leads to a major problem that must be solved in order to attain a less threatening mother nature's wrath.

According to K. Paler et. al., Plastic waste occurs as well on beaches or coastlines which micro plastics were measured and was calculated that 13.14 which is classified under dirt comprises 85% of the beach litter. The data studied in marine ecosystems greatly affects the cleanliness of our marine wildlife and water reservoirs. The entire world got into a pandemic of COVID-19 which led to more usage of plastic, this will surely increase the plastic mismanagement disposal. People are buying disposable plastic items for usage in consumption of food and drinks. Sanitation is a must to put an end in this concurrent pandemic, however despite how sanitize people are, improper waste management still soars and so RTA Vending Company adapted an already existing machine and tweaked and change its features to a new innovation, a vending machine that uses plastic bottles as a form of currency to dispense alcohol for sanitation.

In this way, the RTA Vending Company can help to minimize the plastic bottles waste in the surroundings which can help to prevent the flash floods and other effect of it to the communities.

* + 1. **Major Problem**

Factories nowadays boosts their production capacity on producing plastic bottles in order to supply and have a durable container that can hold a certain amount of volume. However, plastic bottles can also cause a new problem to the environment, plastic pollution. This problem affects every living things and our living planet. Plastic waste is one of the problem that every country is facing. Here in the Philippines, especially in the Barangay of San Agustin, in the Municipality of Sta. Ana, Pampanga. Although despite the barangay having policies that warns about the tendencies of improper waste disposal, people still don't follow and sometimes violates the statute. The proponents wants to solve on how to develop a machine that even a single plastic bottle will not affect the people but instead will be useful on both protecting the environment and proper hygiene.

* + 1. **Minor Problem**

What are the problems that are cause by improper plastic waste disposal of the people?

*Improper plastic waste disposal cause a problem and it affect the community.*

How to lessen plastic waste in the community?

*Lessening the plastic waste will help the community in their problem.*

How to have a useful product out of the plastic bottles that are being dispose?

*Having useful products in exchange of plastic bottles will encourage the people to properly dispose their plastic bottles.*

* 1. **Current State Technology**

Barangay San Agustin already make an action about the problem that they are facing, by implementing some policies to prevent the increasing of plastic bottle wastes in the community. There is “No Segregation, No Collection Policy” and “No Throwing of Garbage in the Pond Policy” but there are still some people who don’t follow these policies due to lack of discipline. Every Monday, there are people who are assigned to collect the garbage in every house of the barangay and the people in the barangay are paying twenty (20) pesos for the collectors. The wastes of every house should be segregated because it will not be collected if the garbage are not segregated. This policy helps the people in the community in a way that the wastes will not stink and some place of the house will not be occupied with the garbage. The trucks that are carrying the segregated garbage will go straight in the dumpsite in San Nicholas, Sta. Ana Pampanga.

There are house in Barangay San Agustin that are built near the pond, so to keep it clean the barangay officials make the ordinance “No Throwing of Garbage in the Pond”. The rule of this policy is, the people are not allowed to throw any garbage including plastic bottles to the pond. The violators of this policy will have to pay one thousand pesos (1,000) pesos for first offense. The barangay captain roam every week to check if the pond is clean and there is no trace of any garbage. The purpose of this policy is to make the pond clean and when the rainy season came the wastes will not stock in just one place.

**Review of Related Literature**

**RRL #1:** "The consumption and recycling collection system of PET bottles:

A case study of Beijing, China" In the statement of Zhang (2014), "the recycling collection system of polyethylene terephthalate (PET) bottles worldwide, the authors conducted an intercept survey in Beijing. Two separate questionnaires were issued, one questionnaire to PET bottle consumers and one to PET bottle recyclers. In this study, consumers are defined as people that consume PET-bottled beverages in their daily life. Recyclers were defined as those involved in the collection and recycling of PET bottles. These include scavengers, itinerant waste buyers, small community waste-buying depots, medium/large redemption depots, and recycling companies.

**RRL #2:** "Use of recycled plastic as fine aggregate in cementitious composites"

According to almeshal (2020), "the consumption of plastic products is observed all over the world in recent years; this has contributed to increasing the production of plastic waste. Reuse of plastic waste in the production of concrete or mortar appears as an environmentally friendly solution for getting rid of plastic waste, due to its ecological and economic advantages. Furthermore, it leads to a decrease in plastic waste incineration or the proportion of plastic waste in landfills. Several studies presented the properties of cementitious composites (mortar and concrete) containing different types of plastic waste as aggregate (PWA).

**RRL #3:** "Waste, recycling, and “Design for Environment”:

Roles for markets and policy instruments" As mentioned by Calcott (2005), "sometimes have two recycling options. Curbside recycling collections are convenient, but do not provide payment. Alternatively, payment might be available from ‘reverse vending machines’ or drop-off centers, but some transaction costs would be incurred. We examine policies to encourage efficient product design and recycling in a setting with these two recycling options plus the option of putting recyclables in the trash. We find value in having two parallel recycling options.

**RRL #4:** Monitoring and improving the effectiveness of surface cleaning and disinfection

According to Rutala (2016), "disinfection of noncritical environmental surfaces and equipment is an essential component of an infection prevention program. Noncritical environmental surfaces and noncritical medical equipment surfaces may become contaminated with infectious agents and may contribute to cross-transmission by acquisition of transient hand carriage by health care personnel.

**RRL #5:** DESIGNE AND CONSTRUCT AN AUTOMATIC HAND SANITIZER DISPENSER MACHINE

According to Jadhav (2021), "Sanitizing hands is a simple act that pays in dividends when it comes to keeping ourselves healthy and safe. Hand sanitizing is also one of the key cornerstones of COVID-19 prevention. Using a squeezing type sanitizer container spout in public places (hospitals, schools, shopping centers, industry plants and workplaces) is unsafe as it was touched by many hands. Therefore there is a need of automate the squeezing operation which guarantee a legitimate cleanliness and safe to use as touch less operation. Proposed unit is based on pre-programmed electronics and an inbuilt ultrasonic sensor. It detects hands when it comes in its programmed range and machine start pouring set amount of liquid into hand. Additionally there is preset delay is provided to serviceable and efficient use.

* 1. **Objectives**
     1. **GENERAL OBJECTIVES**

To improve the plastic waste disposal in San Agustin, Sta.Ana, Pampanga and provide quality sanitation for the people in the community. To sum up everything that has been stated so far, this study aims to contribute to the community people and to the community itself. RECYCLEAN vending machine is a type of machine that accepts all types of sizes of plastic bottles which will be segregated into bins where it will be weighed. The shredder will break the plastic bottles to small parts which probably look like small strips of plastic which will eventually be used for recycling and in exchange for those plastic bottles combined, people will receive alcohol.

**1.3.2.** **SPECIFIC OBJECTIVES**

* To lessen and provide correct plastic waste disposal for the community people.

*Due to community’s excessive plastic waste, appearance and lack of ways on correct plastic waste disposal, it is not very pleasing to see a community full of plastic bottles scattered around the community. The researchers would like to create a machine where it will control and utilize plastic waste disposal.*

* To create new product out of the plastic bottles combined.

*When the machine fills up the bins with shredded plastic bottles, of course the community people that bought our machine will be inspired to create new products out of those shredded plastic bottles. Which potentially also provide source of income for them.*

* To provide convenience for the community people and to the community itself.

*Sometimes lack of convenience will provide laziness for people. They will not be inspired to create new things for themselves and for their community. So, the RECYCLEAN vending machine is made wherein it provides convenience for them.*

**1.3.3. Scopes and Limitations**

**1.3.3.1. Scope**

**1.3.3.1.1. Power Supply**

* This module will convert electric current from the source to a correct voltage that is needed to supply the different parts of the machine.

**1.3.3.1.2. Bottles Chute**

* This module will be responsible in receiving the plastic bottles.

**1.3.3.1.3. Sensor**

**Capacitive sensor**

* + This is responsible for detecting the thickness and density of the bottles to know if it is a plastic bottle.

**1.3.3.1.3.2 Sensor for the Weighing Scale**

* This module will be responsible for determining if the plastic bottles are enough to be shred.

**1.3.3.1.3.3. Infrared Sensor**

* This module will be responsible for detecting the hands of the user so that the alcohol dispenser will function and for triggering the shredder to start and stop it from shredding.

**1.3.3.1.3.4. Point Level Sensor**

* This will be responsible in tracking the level of alcohol and shredded plastic using infrared light.

**1.3.3.1.3.5. Photoelectric Sensor**

* This will be responsible for detecting it is a plastic bottle or not.

**1.3.3.1.4. Door Chute**

* This module will serve as a barrier between the weighing scale and the bottle sensor. It will also be responsible in protecting the machine from foreign object.

**1.3.3.1.5. Alcohol dispenser**

* This module will serve as the container of the alcohol and it will give the alcohol to the user.

**1.3.3.1.6. Weighing scale**

* This module will be responsible in determining if the weight of the bottles is in limit.

**1.3.3.1.7. Plastic Shredder**

* This module will be responsible for shredding the plastic bottles to help the container of plastic waste to not quickly fill up.

**1.3.3.1.8. Bin**

* This module will serve as a storage where the plastic bottles will placed when it is already shredded.

**1.3.3.1.9. Automated Messaging**

* This module will be responsible for notifying the machine’s owner when the alcohol runs out and the shredded plastic bin is full.

**1.3.3.1.10. Servo motor**

* This module will be responsible for accepting and rejecting the plastic bottles.

**1.3.3.1.9. Ejection Tray**

* This module will be responsible as bin for the ejected bottles.

**1.3.3.2. Limitations**

**The machine is only limited to the following functions:**

* The machine will only accept plastic bottles.
* The sensor for bottles can only detect if it is a plastic or not.
* The chute can only accept 200mL to 2 L plastic bottles.
* The alcohol dispenser will not be activated if it didn’t detect the hand of the user.
* The alcohol will not spray if there is no plastic bottle that is inserted.
* The machine will only dispense one ml of alcohol for one bottle.
* The machine will not accept any bottles and start dispensing alcohol if it detects that there are no bottles had been inserted after 10 seconds.

**Chapter2: Theoretical Framework**

**2.1. Introduction**

In theoretical framework, it defines the key concepts in your research, differences between the relations between them. Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study (Abend, Gabriel, 2008).

**2.2.1. Physical modules**

The physical modules are the different component parts of the machine which will be describe with their definition and purposes for the project.

**2.2.2. Capacitive Sensor**

Capacitive sensor is designed in which the output of the capacitive sensor can be used to infer the lift-off. An algorithm is proposed to combine the inferred lift-off and the inductance measurement for predicting thickness. The effect of lift-off variations is significantly reduced using this combined sensor approach. (Salas, 2020).

*Capacitive sensor is responsible for detecting a plastics bottles.*

**2.2.3. Photoelectric**

A design of autonomous tracing system in intelligent vehicle is introduced, the software and hardware design method which realizes the autonomous tracing using the infrared reflective photoelectric sensors as the path recognition module is researched. (Yue-hua, 2009)

*Photoelectric sensor is used to detect the light beam reflected from the target. A thrubeam type sensor is used to measure the change in light quantity caused by the target crossing the optical axis.*

**2.2.4. Electrical Power Plug**

AC power plugs and sockets allow electric equipment to be connected to the primary alternating current (AC) power supply in buildings and at other sites. Electrical plugs and sockets differ from one another in voltage and current rating, shape, size, and connector type. Different systems of plugs and sockets have been standardized, and different standards are used in different parts of the world (CableFree, 2018)

*The electrical power plug will serve as the primary power source of the machine with a supply voltage of 220V.*

**2.2.5. Automatic Hand Sanitizer**

In an automatic hand sanitizer, when a person hands are placed under the nozzle and before the sensor then the activated sensor will further activate a pump that dispenses a specific amount of sanitizer (or soap) from the nozzle. The sensor employs an emitter and a collector. The emitter emits pulses of infrared light while the collector, which is positioned to face in the same direction as the emitter, "sits" dormant waiting to sense the emitted pulses. When no hands are present in front of the device, no reflection of light takes place, and therefore, no pulse is sensed. When hands are present in the path of the emitted light, a portions of the emitted infrared light is bounced back in the direction of the collector which then becomes excited by the light (in the event a photodiode is used) and generates voltage to switch the pump on. If a photo transistor is utilized, then the photo transistor, upon sensing the infrared pulse, will simply switch the pump on and dispense the sanitizer or liquid soap. Yakubu, 2020)

*The purpose of the automatic hand sanitizer is to provide sanitation to people without having to touch surfaces or the machine itself. It is a Touch less automatic alcohol dispenser with a capacity of 1000ml.* *Infrared sensors detect infrared energy that is emitted by one's body heat. When hands are placed in the proximity of the sensor, the infrared energy quickly fluctuates. This fluctuation triggers the pump to activate and dispense the designated amount of alcohol*

**2.2.6. Shredder**

A plastic shredder is a machine that shreds the plastic into smaller pieces. Plastic will be fed into plastic shredder moving at slower speed then the blades will do the work which will shed the plastic into tiny pieces. After the shredding of the plastic, it will directly go in to the container. (Busch Systems International Inc., 2020)

*In this sample, the shredder will act to break the plastic into tiny fragments, which will then be collected in a container. The shredder has a capacity of one bottle per shred.* *It comes with a Geared Motor, metal plates for the frame, and tool steel blades.*

**2.2.7. Automated Messaging**

Simply put, text message automation is the sending or activation of text messages to persons or groups of people without the need for human interaction. Marketers are also using marketing automation to save time by pre-scheduling text messages to be delivered later.

*The aim of the automated messaging program is to automatically notify the machine's owner when the alcohol supply runs out and when the shredded plastic container is already full.*

**2.2.8. Power Supply (DC)**

Direct current (DC) energy is generated by electrons moving along a straight line. This current's name comes from its linear motion, as opposed to AC's wave motion. Batteries, solar panels, fuel cells, alternators with commutators that generate direct electricity, and rectifiers that transform AC to DC power all provide this kind of current. Since the voltage provided by DC power is so constant, most devices need it. That's why most devices use DC power sources like batteries or use a rectifier to transform AC power from outlets to DC power. Rectifiers and transformers are often installed into power supplies to increase or lower the voltage to the required degree.

*Power supply is a device that converts electric current from the source to a correct voltage that is needed or right amount to supply the different parts of the machine like sensors.*

**2.2.9. Weighing scale**

Weighing scales is a measuring instrument to determine the weight or mass of an object. Weighing scales usually used in other industrial and commercial applications. In the process, you will put the object into the weighing scale to determine the weight of the object. (cite.me,2021)

*In this study, the weighing scale is very essential in this machine because it will determine how much plastic bottles are in the bin to start the shredding process.*

**2.2.10 Processor**

The processor is a chip or logical circuit that reacts to and processes the simple instructions used to drive a computer. The processor's primary roles include fetching, encoding, running, and writing back the operations of an instruction.

*It serves as a brain of the product. It controls the sensors, hand sanitizer, and the overall basic functions of the machine like opening the doors.*

**2.2.11 Servo motor**

Servo Motors play vital role in Industries. In the field of robotics servo motor act as actuators in robotic control arm, conveyor belts which carry products, Robotic vehicle, Solar tracking system, Metal cutting and Metal forming machines, etc. Usually PID control Strategy is used to control the motor. (Pillai, 2017)

*Servo motors as they are known, are electronic devices and rotary or linear actuators that rotate and push parts of a machine with precision. Servos are mainly used on angular or linear position and for specific velocity, and acceleration.*

**2.3. Processes and Techniques**

**2.3.1. Prototype**

Prototypes are essential in product development. They can help to create, explore, describe, test and analyses the item being designed. The role and the importance of prototyping has been rapidly changing and progressing as emerging business models - such as crowd funding and new digital fabrication technologies - directly influence engineering design and product development practices. Prototypes in different industries and research traditions serve different purposes: Industrial designers produce prototypes of conceptual ideas to explore form and geometry, engineers prototype designs to validate a functional principle or to benchmark performance and software developers write prototype programs to test user experience or requirement specifications (Jensen, et al., 2016)

*In starting a business, prototypes are significant to subject the product into testing the potential customers, and to attain the general objective and the purpose of the machine. Creating the prototype of the Recyclean Vending Machine is important in order to test possibilities, expand on the machine's functionality, analyze, and, finally, create the best version that is ready for mass production.*

**2.4. Summary**

The summary is a condensed version of the text. It is a condensed translation of the whole text designed to make reading easy for the reader. The primary goal of the summary is to provide readers with the key points so that they can interpret the whole context more easily.

Upon thorough observation during this pandemic, there are only few machines that can help our community and environment to sanitize. So, the researchers were able to propose an idea that turned into a machine to help us during this pandemic.

The machine will help the environment clean and your hands sanitized. It composes of a shredder that will shred the plastics into tiny pieces and when the plastic has been shred, it will produce an alcohol, the machine will sanitize your hand.

The researchers picked and gathered the right materials to make the machine work more efficient. Lastly, the product itself is affordable and efficient specially in this midst of pandemic.

**2.5. Framework**

The process and incorporation of the modules for the machine can be represented using the following block chart.

POWER SUPPLY

TURN ON

PROCESSOR

POINT LEVEL SENSOR

AUTOMATED MESSAGING

AUTOMATIC HAND SANITIZER

PHOTOELECTRIC SENSOR

CAPACITIVE SENSOR

EJECTION TRAY

SERVO MOTOR

INFRARED SENSOR

PLASTIC SHREDDER

CONTAINER

**Figure 2.1 Block Diagram**

**Flow Chart 2**

A representation on how the machine will work from “start” to “end”.

Capacitive Sensor will check

Is the signal interrupted?

Entry of Bottles

Bo

No

Photoelectric Sensor

Servo motor rotates counter clockwise

Doesn’t meet the requirements

Yes

Checks thickness and density

Capacitive sensor

Eject

Meet

The

Requirements

Plastic Bottles

(IR Sensor Top hopper)Is the signal interrupted?

Wait 3 seconds

Plus one to LED tally counter

Servo motor rotates clockwise

Is the signal interrupted?

IR Sensor (Top hopper)

Power up hand sanitize

Hand sanitizer

No

Motor on Stand by

Yes

Pour

Yes

It detects?

No

Wait 3 seconds

No

Yes

Power up motor

**Chapter 3: System Design and Application**

**3.1 Hardware Specification**

**3.1.1. Infrared sensor/IR Sensor**

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion (Chilton, A. 2015).

*There are four infrared sensors attached in the machine. The first one is attached in the alcohol dispenser, it will triggers the pump to activate and dispense an alcohol when it detect an infrared energy that is emitted by one's body heat. The second one is attached in the alcohol container, and it will triggered the hand sanitizer to stop dispensing alcohol if it detects that there is only one liter of alcohol left in the container. The IR Sensor that will be used in the container is point level sensor. The last two are attached in the shredder, one at the top hopper to trigger the shredder to start shredding and one at the low hopper to stop it from shredding.*

**3.1.2. Capacitive Sensor**

Capacitive proximity sensor are non-contact devices that can detect the presence or absence of virtually any object regardless of material. They utilize the electrical property of capacitance and the change of capacitance based on a change in the electrical field around the active face of the sensor. (Moemond, J. 2017)

*The machine will have the capacitive sensor near the door chute to detect if the thickness and density of the inserted bottle has reach the requirements of the plastic bottle for it to be accepted. The capacitive sensor that will be use is a capacitive proximity sensor.*

**3.1.3. Photoelectric Sensor**

A photoelectric sensor detects visible or infrared light emitted from a transmitter. It senses how much light is received but also how much has been blocked or reflected; it can determine the presence or absence of an object. (Bulgin, 2019)

*The will have a photoelectric which will detect the presence or absence of the plastic bottle. The photoelectric will be use is Reflective Photoelectric Sensor.*

**3.1.4. Automatic Hand Sanitizer**

An automatic hand sanitizer dispenser is a device dispensing a controlled amount of sanitizer. They are often used in conjunction with automatic faucets in public restrooms. They help conserve the amount of sanitizer used and stem infectious disease transmission (Joy, 2021).   
*The machine will have an automatic hand sanitizer to dispense alcohol. This has infrared sensors to detect infrared energy that is released by one's body heat. Its main purpose is to avoid touch to prevent contamination and spreading of diseases.*

**3.1.5. Shredder**

A tool or machine that is used for cutting things into very small pieces (Cambrigde Org., 2021).  
*The machine will have a shredder to shred the plastic bottles. The device will use 2hp shredder to be strong enough to shred the different types of plastic bottles.*

**3.1.6. Automated Messaging**

Automated Messaging refers to a system that delivers a recorded voice message or text message to multiple phones automatically. This type of system eliminates the need to waste time manually calling or texting multiple phone numbers one at a time (CallMultiplier, 2021).   
*The machine will have automated messaging which use to know if the machine still has enough alcohol to dispense. This purpose is to text the person in charge in refilling the alcohol, it will alert the person if there is only 1 liter of alcohol left.*

**3.1.7. Power Supply**

The power supply works to convert the power from the source into the correct format and voltage. Because a variety of options exist, the specific power supply function depends on whether it needs to regulate energy or convert power (ACT Inc. 2001).

*The machine has power supply that is use to convert electric current to the accurate amount of voltage, current and frequency. This is also use to maintain the supply of the voltage and current needed for the machine. The power supply is direct current,*

**3.1.8. Raspberry processor**

Raspberry Pi is a small, powerful, cheap, hackable and education-oriented computer board introduced in 2012. It operates in the same way as a standard PC, requiring a keyboard for command entry, a display unit and a power supply. (Maksimović, M. 2014)

*It is the main processor for our machine, and it serves as the brain and the main product that gives knowledge for our machine in order for it to work properly. For installation of Raspberry Pi OS with desktop and recommended software (Full) via NOOBS the minimum card size is 16GB. Raspberry Pi’s Dimension Height 2.22 in (56.5 mm) Width 3.37 in (85.6 mm) Depth 0.66929 (17 mm).*

**3.1.9. Computer box**

The primary function of a computer case is to protect the computer's components from harm. A secondary function is to easily transport the computer from place to place. Computer components, such as the motherboard, hard drive and power supply, are vulnerable to damage from dust and spills. (Staff writer, 2021)

*The computer box will serve as a protection for the main parts of the machine including our processor which needs delicate protection. The standard minimum height for a full tower is 22 inches. The width and depth vary greatly from brand to brand, but they are usually somewhere around 8 inches by 20 inches.*

**3.1.10. Servo motor**

Servo motors systems are typically used for motion control and have a wide range of applications, including robotic manipulators and electromechanical systems such as milling machines, cranes and lathes. In these applications, a servo motor system performing a point to point positioning task prompts several problems: path planning and trajectory generation (IEEE, 2014)

*It controls the reject and accepted bottles on our machine where it will rotate counterclockwise if the bottle is rejected and clockwise if the bottle is pure plastic. It will also serve as a protection to those other parts so that every bottle that are placed in our machine will not damage any parts of the machine and the machine itself. The servo motor’s Dimensions: 1.6 x 0.8 x 1.4 in (1-9/16 x 13/16 x 1-7/16 in) (40 x 20 x 36 mm) Weight: 1.3 oz. (37 g)*

**Chapter 4: Computation**

**4.1. Introduction**

This chapter presents a comprehensive discussion of the experiments and testing of the device to get the pertinent data regarding its performance, effectiveness, and durability. Furthermore, this chapter will also go through the particular measurements of the materials needed in the machine, the computed wattage, and the time it will take to complete the entire process of the machine's operation.

**4.2. Computation**

**4.2.1. Bottle Chute**

The chute door is 130mm in diameter, big bottles like 1.5liter coke can easily fit with the diameter of 99.06mm. The allowances of 30.4 mm so other bottles that are bigger up to 2 liter will still fit.

**4.2.2. Ejection Tray**

The ejection tray is 300mm in height and 560mm in length. While the height of 2liter round glass bottle is 300mm there is allowance of 260mm from the 560mm length of the eject tray, so it would be easier to take out. The height of eject tray is 300mm and the diameter of 2 Liter round glass bottle is 120mm, there is allowance of 180mm so there be a room for a hand to grab the bottle.

**4.2.3. Wattage**

The wattage of the sensors, light led bulbs and the shredder are multiplied to 24(hours)\* and is divided to 1000 to get the kWh (kilowatt-hours) thus combining all to get the total kWh.

\*Subject to change on how many hours the machine is used/turned on.

Presumably, 24/7 and machine so 24hrs

**4.2.3.1. LED Bulb (2.5W)**

24 x 2.5 = 60watt-hours

= 0.06kWh

**4.2.3.2. Shredder (4000W/4kW)**

24 x 4000 = 96,000wh

= 96kWh

**4.2.3.3. Sensors (3W)**

24x3 = 72wh

= 0.072kWh

= 96.132kWh

**Chapter 5: Conclusion**

The inventors of this project proposed Recyclean Vending Machine for the Capstone. The machine aims to help the community go green and let the public practice hygiene starting with sanitation by alcohol on your hands. With this invention, the community can contribute and reducing plastic waste and reduce carbon emissions to help fight climate change and plastic waste pollution. This machine is equipped with high quality sensors and a powerful shredder. On top of it, the machine is made of high quality materials to ensure that the machine is durable and convenient. This project also helps motivate the community on segregation and recycling as people will segregate plastic bottles to convert it into sanitary alcohol and recycling by helping the community recycle plastic bottles for other possible uses.

**APPENDIX A**

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APPENDIX D

(List of Figures)

**Block Diagram**

POWER SUPPLY

TURN ON

PROCESSOR

POINT LEVEL SENSOR

AUTOMATED MESSAGING

AUTOMATIC HAND SANITIZER

PHOTOELECTRIC SENSOR

CAPACITIVE SENSOR

EJECTION TRAY

SERVO MOTOR

INFRARED SENSOR

PLASTIC SHREDDER

CONTAINER









