ECO-GREENHOUSE DESIGNING

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PROJECT REPORT

Section 1 – Criterion A- Investigating

The project is designing an eco-friendly greenhouse. This topic is chosen because creating, researching and designing are all involved in this project. The things should be used to create a greenhouse, such as soil types, energy types, plant types and their qualities and traits are researched to decide which one to use in it and then to design a model of it. The main goal of the project is, to give knowledge and awareness about global warming and climate change by showing how much our choices affecting to the amount of damage on earth. With few changes - using solar energy, rainwater and organic materials- the structure became beneficial for the environment because landfill of organic material (food waste, fruits, vegetables...) continuesly rot and release methane (strong greenhouse gas) landfill, a strong greenhouse gas (Horton) (Central) and greenhouse will contribute to the environment by composting these materials to make soil. Also, prefering a renewable energy source is contributing to the environment because renewable energy sources such as geothermal,wind and sun does not have any harmful effects on environment due to, they do not release any sera gas. (United States Environmental Protection Agency) In short, project aims to release sera gas as less as it can while planting healthy plants by using sustainable energy (solar power) and trying to be less depletory, such as making soil from organic waste products and collecting water instead of using tap water. This could be project just about designing a standard greenhouse but these days it is important to make our lives greener to stop global warming and its harmful effects. "Globalization and Sustainability" is the most interconnected global context with this project because of external factors such as light and internal factors such as pH, moisture and soil types are directly connected with the plant's growth and health because companies use commercial greenhouses which significantly large and high-technologically designed in order to have high quality of lighting,

cooling, heating in order to have high quality product to sell. (What Is Greenhouse?) If the pH level of the plants is more or less, it can affect the nourishment of the soil or If plants are over-watered roots won't have enough air pockets and will be died because roots won't be able to breathe(Mayer). All the internal and external factors must have been provided to grow a healthy plant. The main goal is to understand how plants are planted more healthily with an eco-friendly greenhouse and show that how easy to change something to make it more eco-friendly to protect our world and our lives from the awful effects of climate change. To complete the product project required to do research about what are greenhouses used for, what are the requirements to grow a plant and what are the specific requirements for each plant. It is a known fact our world will be ecologically destroyed in the future so global warming is the top topic problem talking all around the world. To prevent that disaster people who have awareness started to make their voices heard by using the internet and in the real world. There are numerous websites can give information about how to be more eco-friendly. Because "being more ecological" is the biggest need of the world, the project is aimed to be designed based on the already ecologically designed greenhouses. As an outcome, any information/plan about eco-friendly greenhouse could not find. As a solution, the greenhouse is designed based on "What can make this greenhouse more ecologic?". First using solar power decided. Then using the most natural soil (compost) decided because a landfill of organic materials release methane gas. Also, organic soils are very nutritious and rich by amino acids (an organism converts into protein by plants). Last of all instead of using refined water using a natural source of water decided: rainwater. Rainwater is free from harmful additives and richer by oxygen than refined water.(Meyer) In the beginning of the prosses of the project, not much information about greenhouses is known. As research continued because of the project's main goal is to be as ecological as it can be, all decisions are done while planning. Ecological materials are decided with a reason in the greenhouse. It is considered to have no harmful to the environment and to be economic. "National Geographic" was a very useful source to find information about renewable sources provide energy to the greenhouse. Two websites called "gardening know-how" and "home guides.sfgate" were very helpful to find information about plant requirements :soil pH level, moisture, sun and heat requirements. As planning and researching continued product is decided to make a model of the greenhouse instead of its digitally drawn version. A model of the greenhouse can catch more attention and can help to show the design in a more detailed way. Thus, more people can be get informed about the change happening in our world and how it is easy to contribute to the prevention of this change.

Section 2 – Criterion B – Planning

A successful outcome is a product which reflecting and summarizing the all process and message of the project. The first thing which has determined was the product. The idea of the product guided the direction of the research. Firstly, designing a greenhouse is decided. It is learned why are greenhouses used for. Then it founded out that greenhouses can be used either by companies to produce food in a big amount and to produce plants which are requires require strict growth conditions such as amount of light, controlled temperature and amount of moisture plants receive to growing plants that or by normal people who want to grow a plant.(Waterworth) To control the heat and the humidity of the habitat, videos about how to make heat and humid sensors by using Ardunio are watched and learned. Then the project is turned into designing an eco-friendly greenhouse to make a meaningful project which can help to spread awareness and catch attention about global warming. In the beginning, plants are chosen based on their habitats and sun requirements. As the second step, plants' living requirements such as soil pH, moisture and heat needs, amount of water need are researched. As the third step, the question of "what can make this greenhouse more ecological?" asked and researched to find some ideas. After the research, compost-soil decided to use. In any case, to provide plants' pH amount, making soil more acidic or alkaline is researched. To provide the heat sensor's and moisture sensor's energy, solar power is decided to use to make it more ecological and more economic. To provide the water, collecting rainwater is decided to make the greenhouse more economic and less depletory. As the fourth step, the model of the greenhouse is done by using proportional measurements of the real measurements of the greenhouse.

CRITERIAS FOR A SUCCESFUL PROJECT	HOW ARE THEY DONE?
1. Making detailed research about plants' requirements: moist, heat, pH level, light requirements. Being able to know how to plant them in a healthy habitat.	All plants' requirements are researched in a detailed way and written in the research report. All plant types have the information of their needs in every head title.
2. Having the knowledge and control of what to do in any case of defect in the pH, moisture level.	In any case of reduction or increment at the pH level of the soil. how to make soil more alkaline or acidic is researched. In any case cannot making well-drained soil some techniques to make a soil more well-drained researched.
3.Turning the greenhouse in to an eco-greenhouse by decreasing its sera gas emission and water and energy consumption. Finding solutions with their reason of beneficial effects.	To reduce the rate of consumption of energy types of energy sources researched and decided to use solar power because it is a renewable source and does not release greenhouse gas. To reduce the water consumption rainwater is decided to collect. And to release less greenhouse gas organic wastes decided to be uses as soil(composting), after making a research about it and find out what are their beneficial effects on earth.

4. Making a model of a greenhouse with proportional measurements.	Model is done by proportioning the real measurements of the greenhouse by using a document which have all mathematical information of the structure in it.

Section 3- Criterion C- Taking Action

In this long-term project, time management and plan were very important to produce a successful product. The process of the project aimed to produce an eco-friendly greenhouse plan with its model to explain why it is important to use eco-friendly materials and give a message and show my work visually. On 04.11.2019 project topic is decided to be based on my interest (making an eco-greenhouse is chosen). It is an eco-greenhouse because creating, thinking and planning skills are all united in this project. Also, being more ecological is one of the most important requirements to prevent global warming. In 05.11.2019 global context of the project is decided to be "Globalization and Sustainability" because the way plants grow up is all about the cycle in the ecosystem. Also, global warming is a global crisis every single person have to work to prevent it, by making this project more ecological; its soil type, type of energy it is using and its other materials are turned into more sustainable sources to make its harm as less as is can be. In 25.11.2019 research on making humidity and heat sensors are completed. Arduino will be used to make these sensors because it is easier to learn and make from the internet. Which plants I was going to use are decided based on their adaptation capacity at warm and sunny habitats (capacity of being able to live in my school's garden). In 08.12.2019 requirements of the plants are researched such as water, soil pH, heat and humidity requirements to make them grow healthy. In 5.01.2020 all the collected information is written as a report to use in the presentation and to make the process of creating the model easier. The model will be done based on the collected information. In 28.01.2020 types of sustainable energies, how to make compost and water resources are researched to turn this into an eco-greenhouse. In 14.02.2020 production of the model is started and finished in 20.02.2020. While doing the model playdough and toothpick are used to make the outside look. Flowerpots are made which are made of paper and photos of chosen plants are stuck inside them to a realistic look. In final photograph of a solar panel added as it is planned. This model will be used in the exhibition the project to make the presentation more effective. This was the best way to do the project because separating the work in time make the process easier and helped to create a better work due to giving full of concentration in the scheduled time of the project. Instead of doing an eco-greenhouse this can be done such as creating a greenhouse with high technology with technologically improved materials or this project could be about comparing the plant types and their growth throughout time in the greenhouse. But these ideas did not choose as the

project topic because these projects would not take much attention and would not teach me an important thing. The topic is more interesting because it is not done many times and it is related to the agenda of the world. During the process, lots of information about plants, energy sources, global warming are made and developed my research skills. There were limited time and due dates which are given by the supervisor and the due dates given by myself to complete this project in time with a successful result. Separating time and doing all steps in a certain timeframe developed my time management skills. The project is mentored by the rubric of the "personal project" and my supervisor. All the requirements are learned and continued based on the information written on the rubric and by the recommendation of my supervisor.

04.11.2019	Project topic is chosen: Designing a model of an eco-greenhouse
05.11.2019	A global context related with the project topic is chosen: Globalization and Sustainability
25.11.2019	Researched about sensors will be used in the greenhouse is done: heat sensor and humid sensor
08.12.2019	Plants' requirements are researched to create a healthy habitat: water, soil pH, heat and humidity requirements
5.01.2020	All researched information is organized to make a research report
28.01.2020	Sustainable energy type, making compost and their usage's benefits are researched
14.02.2020	The production of the greenhouse model is started.
20.02.2020	Product is finished: production of the greenhouse model

Section 4 – Criterion D –Reflecting

The main goal was creating a greenhouse that does not have harmful effects on nature. To design an eco-greenhouse; first plants, sensors, and other requirements had to be planned and then it had to be turned into more ecological. Because first the items which are destructive for nature must be detected and then find a solution. From the founded solutions project developed a lot. Turning soils into compost, using solar energy and collecting rainwater are very simple things but these changes have lots of effects. Also, they are more beneficial at plants' growth because compost and rainwater are more nutritious. This way was the best way to create an eco-greenhouse, first planning then rearranging. In the end, all the needed information is found. In summary, at the end of the project besides learning information about planting, planning, facts about our world, this project taught me how it is easy to anything into more ecological how much necessary it is. The project taught me for this global crisis (global warming), sustainability is the best solution. The project's quality is good enough based on the research it contains and the things it taught me. But its quality would be higher if I would be conferred with an environmental engineer. An environmental engineer is more knowledgeable than me so he/she

could detect more items that can turn into more ecological or he/she could give me the advice to improve the greenhouse. Also, the sensors which are using in the greenhouse could be more professional to be able to control the plant's condition better in changing weather but because of the limited time, using Arduino was the most qualified choice and it is easier to learn. The quality of the project is the best could be done, because during the process always dependable resources are tried to be found to have the right information. During the process, criteria written on the rubric are examined. In the end, enough information is found and the design of the greenhouse is done based on these information. Because doing qualified research is also a criterion to achieve a successful product, the target is achieved. During the project, from the learning skills of IB, thinking skills are developed, videos about designing a greenhouse are watched and greenhouse examples are searched to have an idea about how to design a greenhouse and learn its requirements to build one. Communication skills are developed, always been in communication with the supervisor and the teachers which could help me to get new information, get advice and develop my project. Self-management skills are developed, a schedule that separates the projects into steps is followed to have enough time to complete every step of the project. Research skills are developed, detailed information about plants, requirements of the plants, solar energy and ideas to turn a greenhouse into an eco-greenhouse are researched in a detailed way. From the IB learner profiles, the balanced attitude was taken, the time-plan and the rubric of the project always tried to be obeyed. Caring behavior was taken, the quality of the research report's and the product's quality is cared for to do the best work. It felt successful to end this project in this way because everything which project was aiming is achieved based on the criteria the goal had and the project rubric have. Thus, the project improved my skills and after the process, I gain knowledge to explain all the information about greenhouses, the way they work, their reason why they used, global warming and what to do to prevent it.

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Section 6 – Include your Appendices

RESEARCH REPORT

WHAT IS GREENHOUSE?

An outdoor structure which is used to house plants is called as greenhouse. It is often made with simple frame covered with plastic or glass. You can have plants inside your greenhouse, but greenhouse maximize the comfort of the plants in required conditions. A greenhouse can make adequate growing condition in summer and winter alike. Their main usage reason is to extend the growing season. Greenhouses are specialized by the amount of light, controlled temperature and amount of moisture plants receive to growing plants that require strict growth condition. Some of the greenhouses are only dedicated to crops, plants which cannot be eaten, such as flowers. Some of the greenhouses are dedicated to the edible plants, such as fruits and vegetables. Companies use commercial greenhouses which significantly large and high-technologically designed in order to have high quality of lighting, cooling, heating. Greenhouses have ceilings which conserves high amount of heat and light inside the structure. When the sun goes down heat does not dissipate as quick as outdoors in greenhouses. (What Is Greenhouse?;Waterwoth)

“Shorter wavelength infrared light enters the structure through the glass, and after these invisible rays bounce around, they become longer wavelength electromagnetic energy and tend to stay inside absorbed by the surrounding. These surroundings use sunlight to drive photosynthesis, or the creation of glucose for energy.” (Beck)

LIGHTNING OF THE GREENHOUSE

Amount of light is an important factor the growth of the plants. Low light slows the growth of the plant but excessive light can damage the plants. To make them grow healthy plants must be in a place where there is normal amount of light. Light can be increased by minimizing the objects above the plants such as frames, pipes and other equipment. Also, radiation (amount of light) can be reduced by adding screening materials. (*NSW Department of Primary Industries*)

WHY SOLAR PANELS ?

Solarpower is a renewable source of electricity and heat that is derived from the sun. Solarpower is a source of energy that obtained by the sun. The sun release the light.Sunlight's

energy turns into the form of solarenergy. Techonology of solar cells covert sunlight into usable natural energy. (Nunez)

Renewable energy sources such as geothermal,wind and sun does not have any harmful effects on environment because these kind of sources does not contribute to the global warming due to they do not release any sera gas.(United States Environmental Protection Agency)

WATERING THE GREENHOUSE

Best way to irrigate and the plants is to collect water from natural ways: rain. It is a natural and free way to hydrate the garden.It is beneficial for the plants and for yourself. It provide natural quality water fot the plants whereas reducing the bill. (Horton)

PLANTS IN MY GREENHOUSE

GRANIUM: In indoors geraniums requires lots of light to bloom but it can tolerate and live in moderate light condition. Geraniums need indoor temperature around 18-21C during the day and 13C at night. Also, they have to be planted in well-drained potting soil. These plants grow best when their soil is 6.5 pH but they grow poorly in the soil which it's pH is below 5.5. It's pH can be tested with a simple home testing pH kit. The best soil conserves enough moisture the soil does not dry out quickly or does not became soggy and wet. (Tilley;Harrington)

PETUNIA: Growth of petunias requires regular watering and as much sunlight as possible to make petunias have multiple blooms. Petunias can grow in nearly every type of soil but it prefers lightweight good-draining potting mix when you grow them in containers. Also, petunias prefer soil which is 25% organic matter. For instance; peat moss, aged manure or well-rotted compost. Potting mix must be good drained to allow water to run through the roots of the petunias. (Badgett,2015) (Carter,2016)

FERNS: Ferns love moisturized places, so they need to be at humid habitats. Due to the fact that, ferns are forest or woodland plants they are adapted to the light forest soil, which is rich with leaf mold and decayed vegetable matter. Also, soil must be both moist and well-drained. Ferns are suppose to be kept away from strong sunlight because direct sunlight will make them loose their leaves and turn their fronds yellow.

Ferns can appreciate temperature around 15-21C.They prefer mosit and warm conditions. (Mackenzie,2016) (Rhoades,2018)

VEGETABLES IN MY GREENHOUSE

ARUGULA: Arugula grows best in well-drained soil and it prefers lots of moisture and water frequently. Arugula loves cool temperature. All it needs is temperature above 4C at daytime. Also, it can tolerate some shade. Arugulas must be planted in a soil which it's pH is around 6-6.5. (Rhoades,2018)

LETTUCE: Lettuce grows best in moist and cool conditions, at a temperature between 17-18C.It must be planted in soil which it's pH is between 6.2-6.8.

Lettuce is not picky about soil consistency but it grows best at sandy loam soils with a loose consistency and a plenty of organic matter. It prefers well-drained soil that stays moist but never get waterlogged. (Miller,2019)

WHY ORGANIC SOIL?

Considering natural fertilizing methods is the best way to produce healthy plants rather than using chemical fertilizers which cause more harm than good.

Organic means healthy. Healthy soils are rich with microbes that produce aminoacid, the substance that convert into protein by plants. Also healthy soil provide fully the required nutrients for the plants.With healthy soil plants don't need any artificial, chemical fertilizer due to the fact that with organisms live in it, such as bacteria, fungi, and various microbes, creates a natural defens against pests and diseas.

- Composting isa way of benefiting from the waste food by turning the excess food into a soil. Recycling the food is also economical and beneficial for the the environment, if it is done in a propper way. (Central,2016)

- When organic materials are end up in a landfill, they continuesly rot and release methane, a strong greenhouse gas. (Horton,2018) (Central,2016)

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HOW TO MAKE SOIL WELL-DRAINED?

For areas which have poor drainage with inordinary dryness or wetness, mixing these materials will help to make the soil well-drained:

- Peat moss
- Compost
- Shredded bark
- Manure

For a healthy soil which is rich in nutrients and drained accurately is a two basic requirement. (Larum)

HOW TO MAKE SOIL MORE ACIDIC?

To make the compost soil as in required pH level to grow plants properly with healthy conditions here is some ways to adjust pH:

1) Adding sphagnum peat into soil(Adding peat on top of the soiş and around the plants or addıng throughout planting)

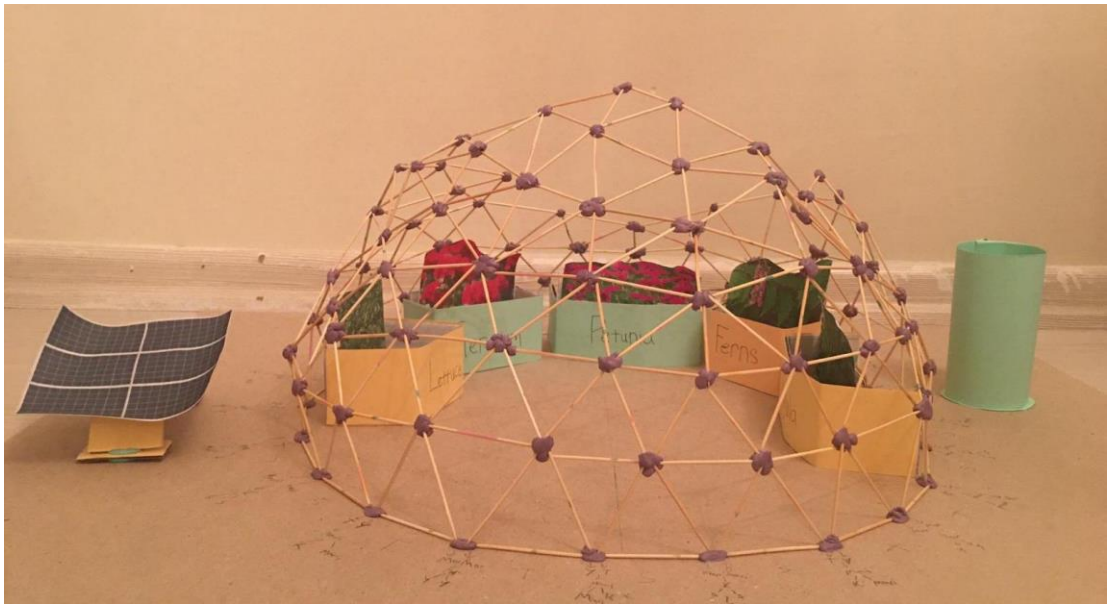
2) Watering the plants several times with a solution of 2 tablespoon of vinegar in to gallon of water. (Rhoades)

HOW TO MAKE SOIL MORE ALKALINE?

To make the compost-soil as in required pH level to grow plants properly with healthy conditions here is is some ways to adjust pH:

1) Adding peat moss, composted wood chips and sawdust can help help to bring down the pH, after settling down the materials for few weeks.

2) Watering plants with hard water contains lime. (Petterson)



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