

ABSTRACT

As known, Egypt faces many grand challenges such as saving energy, Water and air Pollution, poverty and housing problem. In our capstone's project, we have tried to find a solution for over-population by exploiting Egypt's vast areas of deserts to build integrated houses that are refurbishing for air, eco-friendly, self-cleaning and cheap. The project's design requirements are to make the temperature suitable for residents in deserts and make the house resistant to the natural disasters. We made a prototype for our original design by using foam instead of rammed earth. We prove that the design has met our design requirements through the test plan. And the results were fantastic and unexpected.

We have chosen North Plateau in The western desert to apply the Project where underground water and fertile soil found. We use wastes as a key to generate biogas and electricity. In addition, we use a hydrogen fuel cell technology as a second source. We are supposed to use rammed earth and palm fronds materials in building as they are found in that area



INTRODUCTION

In the last decade, there are more than 90% of Egyptians live in the Delta and Nile valley (about 8.4% of Egypt's area). So, it led to overpopulation which grows up continuously. As result, it has led to the emergence of slums in big cities that have turned big cities into awfully crowded places specially in Cairo and Giza. It also proves that Egyptians live wherever water found (concentrated in Delta & Nile valley), so we tried to change this statement. We found that the best way to face these challenges is to build comfortable, self cleaning, refurbishing for air and eco-friendly house, exploiting rabid areas, and clean source of energy, so we will use wastes to produce biogas to get rid of dirty streets. In the other hand, we can see the big empty areas in the western and the eastern desert that we do not benefit from which must be well-used to help our country like Marmarica plateau. Also, water and green house are related with the solution, that's why we tried to use technology that doesn't undermine development but ensures its survival and growth. Our solutions will make an integrated house to achieve two design requirements (Weight and thermal management) with ability of bearing 6 floors and contain 6 persons. In addition to adapting with desert's climate. To make sure that our project is to achieve the design requirements, we made a prototype to test them.



MATERIALS AND METHODS

Materials

Ruler and pencils	Models of trees	Good gum (UHU)	Cutter, and scissors
Plastic sheets	4 Foam boards	Colored paper	

Methods

- we chose our design shape
- we drew our house in 2-d situation on the paper
- we did it in 2-d situation on sweet home
- we did it in 3-d situation on sketch up and sweet home.
- we drew it in 2-d situation on the foam by scale 1:30 cm
- we used the other 3 foams board to complete our prototype.



test plan

OVER LOAD TEST

We did it to make sure that our house has the ability to carry large number of people

Tools

10 lap tops	balance	prototype	Camera	Vernier caliper
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First we measured the mass of each laptop by balance, then we measured the height of the prototype by Vernier caliper then we put laptop by other on the prototype until they were 10 laptops and we measured the height of the prototype in each time by Vernier caliper then we took photos for this experiment by camera.

THERMAL MANAGEMENT TEST

We did it to make sure that the temperature inside our house is suitable for people to live in during the

Tools

prototype	Stop watch	camera	2 thermometers
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First we put one thermometer inside the prototype and the other out side, then we turned the stop watch on, and after 10 minutes we saw the measurement inside and outside the prototype, then we record them, we also repeated this experiment nine times, three times in cloudy day, three times in sunny day, and three times in windy day, at different intervals each day and we take photos for them with camera.

RESULTS

Over load test

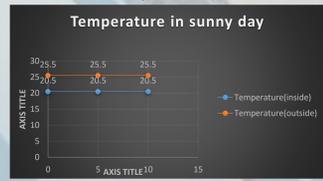
The mass which we put on prototype { +/- 1g}	The force which acting on prototype to the down word { +/- 0.009 N }	The amount of shrinkage(strain) { +/- .01 mm }
2.3 Kg	22.54 N	0
9.2 Kg	90.16 N	.17mm
11.5 Kg	112.7 N	.23mm
16.1 Kg	157.78 N	.33mm
23 Kg	225.4 N	.4mm



we found direct proportional between the force acting on prototype and strain

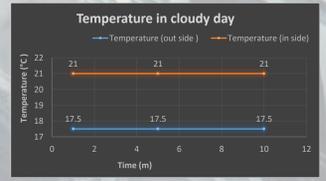
Thermal management test

These three figures for two experiments from the nine experiments that we made



Temperature { +/- .1 °C }

Sunny day (morning)		Cloudy day (night)	
Inside the house	Outside the house	Inside the house	Outside the house
20.5°C	25.5°C	21°C	17.5°C



DISCUSSION

Conclusion

OVER LOAD TEST

We focused on the distances between each wall and contact one, that the greatest distance between walls is 7 meters (in the scale 20 cm), and the suitable distance ranges between 3 and 8 meters (in the scale 10 and 26.6 cm) and use good glue to fix foam walls with each other. As a result, our house will bear 720 tons.

THERMAL MANAGEMENT

We focused on the height of the house which equals 4 meter (in our scale 13.3 cm), every door opposite to window. Also, we made the air vent in the roof, so we don't have to use air conditioner.

The location

The best place of our house will be the north Plateau in the western desert (29°46'N 30°21'E, 30°15'N 29°36'E, 29°44'N 28°37'E, 30°17'N 30°24'E) which are stable and natural disasters like volcanoes and earthquakes do not happen. It will attract people from the near crowded places such as the Nile valley and Cairo. In addition, Cairo, Tanta and El Fayom axis in the collider of development passes in it. It has good agricultural soil and underground water. We can manufacture building materials, taking advantage of its raw materials.

Water sources

There is abundant in groundwater where people used to be the completion of the establishment of Sheikh Zayed Canal. Also there are 500 springs of drinkable water so our house will depend on the underground water and rain water

The food

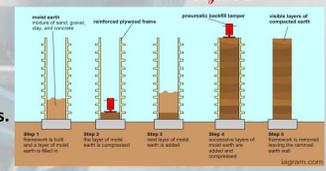
As there is abundance of groundwater so it formed the bottom of the earth deposits beneficial to the soil and formed Tami. In addition, we decided to provide the fertilizer to the soil from burning kitchen wastes and wheat and straw to produce urea that we can grow many crops such soil dates, olives and wheat. Also we will use green houses.



The building materials

RAMMED EARTH

It consists of 30% clay- 70 % sand combo has proven reliable for raw rammed earth. It characterized by its density has ability of store heat energy, slowly releasing it as the day gets cooler. It will suitable for the climate of deserts. Also, its properties that the sound doesn't transmit or echo between rooms, withstands and proof fire and it has the strength so it resistant a major earthquake.



PALM FRONDS

We will use palm fronds rafter instead of iron rafter because: 1- Top grade quality as 80% of steel's hardness that it is flexible that makes it the best in the cases of earthquakes. 2- Conductor of heat, making the temperature inside the building in which the user is less 12 degrees compared with a building built with rebar and competitive price.



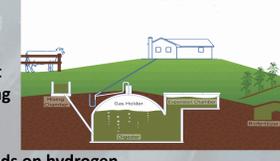
TIERRAFINOI PAINT CLAY

Tierrafinoi paint is an ecological and healthy alternative to regular wall paint. It can be rolled or brushed on almost any surface and decorative and 100% environment-friendly interior clay paint to prevent from harmful rays. The clay constituent of this clay paint comes from quarries and this provides the breathtaking, matte structured finish. These can enhance individual colors and give endless color possibilities.



Electricity

We use wastes to generate energy by: First recycling wastes then burning the wastes under 3.000F by making hole in the ground and extending it by layers of mud or linings of plastic material, pushing the waste to increase density to converted into methane biogas to generate electricity. We also use Hydrogen fuel cell as a second source. This cell depends on hydrogen.



the waste to increase density to converted into methane biogas to generate electricity. We also use Hydrogen fuel cell as secondary source. This cell depends on the Hydrogen

Nano technology

NANO SILICA WITH BLENDED CEMENT (NS)

The properties of blended cement with nano-SiO₂ (NS). As result of making many reaction they indicated that setting times increased with the increase in percentage of nano-SiO₂ in cement blended with silica fume. A combination of 6% SF + 3% NS was given the best performance in compressive strength cement.

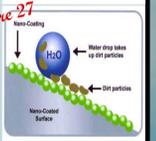


Table 1: Physical properties of cement

SL.No	Property	Result
1	Specific gravity	3.17
2	Fineness	229 µm/kg
3	Initial setting time	114 minutes
4	Final setting time	214 minutes
5	Compressive strength	30Pa
6	Setting time	33
7	Setting time	43
8	Setting time	54
9	Setting time	0.5 mm

NANO-GLASS

Nano-glass is a product of nanotechnology With important properties like: *Water repellency, Self-cleaning long against the impact of water and soil and Protection against ultraviolet rays. Also, we will use CARBON NANO TUBE WIRES and little amount of copper to transport electricity more than traditional copper In addition to That improving the efficiency and reducing the cost of fuel cells. s. These catalysts produce, hydrogen ions from fuel such as methanol. Nanotechnology is also being used to improve the efficiency of membranes used in fuel cells to separate hydrogen ions from other gases, such as oxygen.



Learning outcomes

- SOCIAL STUDIES** Gives us information about Marmarica plateau
- MATH** Calculate the area of our house, using the scale to build Our prototype and drawing experiments graphs.
- PHYSICS** measurement errors and how to correct them, and drawing experiments graphs.
- GEOLOGY** Choosing the material that we will build our real house with
- CHEMISTRY** Information about hydrogen fuel cell, and nano technology
- TECHNOLOGY** Learning about sketch up, floor planner, and sweet home

LITERATURE CITED

URL:	Article Title:	Website Title:
http://www.sepuplhs.org/high/hydrogen/fuelcell_sim.html	SEPUP Fuel Cell Simulation	SEPUP Fuel Cell Simulation
http://www.ecomena.org/egypt-water/	Egypt's Water Crisis - Recipe for Disaster	EcoMENA
http://www.rammedearth.info/rammed-earth-benefits.htm#Benefits	Benefits of Rammed Earth Construction	by Clifton Schooley

ACKNOWLEDGMENTS

First, we sincerely thank the great God then we thank for all school staff particularly Eng. Ahmed Tewfik for his effort with us also thanks for all student that helped us from other grads, Eng. Ahmed Elkady, and all Literature cited that gives us clear information.

FOR FURTHER INFORMATION

- Please contact us at,
- Mahmoud Alsayes (14135@stemegypt.edu.eg)
 - Mahmoud ebead (14131@stemegypt.edu.eg)
 - Abdullhalim Osman (14055@stemegypt.edu.eg)
 - Elsayed Ahmed (14001@stemegypt.edu.eg)