ZINC ROOFED HOME COOLING SYSTEM

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ABSTRACT

Zinc is a great metal roofing material, is well used around the world, particularly for commercial buildings and period roof renovations. The objective in this project is to reuse rain water in cooling system, to upgrade the product by improvising the flaws the product had before and to measure the temperature after installing the cooling system by comparing results with previous researcher. The methodology based on the planning process is started to solve the problems. Temperature will take after the material has set up. The idea is being implemented and analysis is carried out regarding the innovated zinc roofed home cooling system. We hope our product is more effective than the product of previous researcher. Our product will satisfy from users.

Keywords: zinc, cooling systems, rain water.

1. Introduction

Zinc is a great metal roofing material, is well used around the world, particularly for commercial buildings and period roof renovations. Weather and zinc closely associated. Malaysia is a tropical country characterized as warm and humid located within the Tropic of Cancer and Capricorn [1]. The latitude of 1°-7° N and longitude 100°-119° E. The climate is recorded as high temperature and uniform diurnal pattern throughout the year. The annual mean temperature is 26.4°C with average daily maximum temperature is 34°C and average daily minimum at 23°C.

Weather data analysis in term of building design for warm humid climate is overheating is not as great as in hot–dry areas but it is aggravated by high humidity and small diurnal temperature variation [2]. Coupled with global warming effect which already increases ambient temperature higher than normal, the level of thermal discomfort will be unbearable especially in the afternoon[3].

As a consequence, the changes of heat balance in the environment will increase air temperature especially in built-up urban areas compared to suburban or rural areas [4]. The wind flow pattern over the country is generally light and inconsistent with uniform intermittent changes. Due to this climatic changes, distinguish the four seasonal monsoons in Malaysia known as the northeast monsoon, southwest monsoon, and two shorter periods of inter-monsoon seasons. The weather in Malaysia is hot and it always causes discomfort for house resident.

Since it is hot all year around, cooling is the main issue regarding Malaysian homes and the residents. The fan that is available today for the roof is always on in order to keep roof compartment cool whether it hot or cool. According to the previous researcher, the majority of householder still lived in house covered with roofing made from corrugated zinc sheet. This selection has the advantage of being cost effective as it is cheap, easy to construct and durable. However, this selection also has it own drawback when thermal comfort in the living space covered by the roof is sacrificed. This happens because zinc, is

good heat conductor and will efficiently absorb heat from sunlight and release it down into the living space through conduction process[5].

Civil Engineering student of Ungku Omar Polytechnic expressed a problem where the gazzebo beside the Brick Laboratory are high temperatures during afternoon. The gazzebo used for student to relax after doing practical in lab. Therefore, we suggest to create a suitable system to reduce temperature in the gazebo.

1.1. Objectives

i. To reuse rain water in cooling system.
ii. To upgrading the tank by choosing Polyethylene Water Tanks to store the rain water.
iii. To measure the temperature after installing the cooling system.

1.2. Scope of Study

Experimental field data will be collected over a period of time at Gazebo of Brick Laboratory in Politeknik Ungku Omar, Ipoh (PUO).

1.3. Significance of Study

The primary data will be done by us by conducting the experiment. Secondary data is from previous researcher. The journal was taken from internet.

2. Methodology

To make more clear view of proposal it is essential to provide a simple and clear picture of our project where describing, explaining and predicting phenomena are called methodology. This chapter will cover the details explanation of methodology that is being used to make this project complete and working well. Many methodologies or finding from this field mainly generated into journal for others to take advantages and improve as upcoming studies.

The method is used to achieve the objective of the project that will accomplish a perfect result. In order to evaluate this project, the methodology based on System Development Life Cycle (SDLC), The technical activities include system definition (analysis, design, coding), testing, system installation (e.g., training, data conversion), production support (e.g., problem management), defining releases, evaluating alternatives, reconciling information across phases and to a global view, and defining the project's technical strategy. The planning process is started to solve the problems. Temperature will take after the material has set up. The idea is being implemented and analysis is carried out regarding the innovated zinc roofed home cooling system.

2.1. Data Collection

The test system was done by taking three observations on different days to get a pattern of temperature change. The analysis involves comparing the rate of temperature decrease. While the water temperature and the surrounding temperature is used as a comparison of the entire system. Figure 2.1 shows the top view plan of data collection.

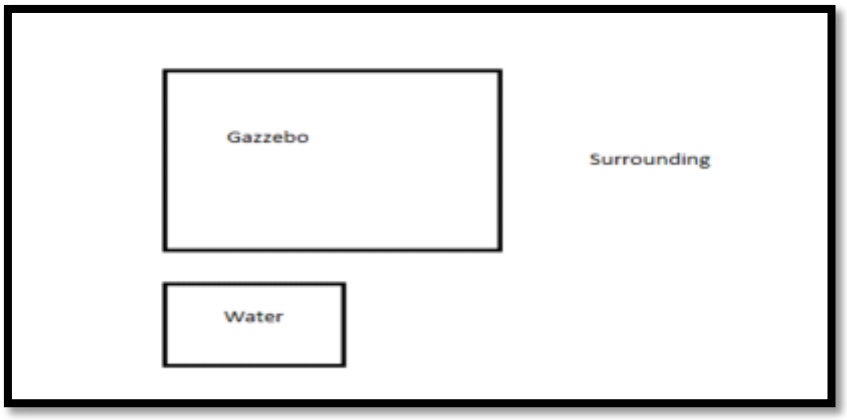

Figure 2.1. Top View Plan of Data Collection

2.2. Step to take measurement

Place the indoor thermometer 5 feet above the ground (+/- 1 ft.). The indoor thermometer too low will pick up excess heat from the ground and a thermometer too high will likely have too cool of a temperature due to natural cooling aloft. The thermometer must be placed in the shade. If put the indoor thermometer in full sunlight, direct radiation from the sun is going to result in a temperature higher than what it should be.

Have good air flow for indoor thermometer. This keeps air circulating around the thermometer, maintaining a balance with the surrounding environment. Therefore, it is important to make sure there are no obstructions blocking your thermometer such as buildings.

2.3. Expectation

We hope our product is more effective than the product of previous researcher. Our product should be able to reduce temperature more than the product of previous researcher.

3. Finding

For this chapter, we need to focus on objective three to measure the temperature after install all equipment on the gazebo. The data took in three times from 11.00 am until 3.00 pm. We need to identify the temperature at three different places. The equipment to measure the temperature that we used is indoor thermometer for gazebo and surrounding (outside the gazebo) while mercury thermometer for rain water in tank. All ways to collect the data refer from previous researcher.

3.1. Analysis

Table 3.1. Temperature Data for the first Day

Day 1			
Time	Temperature		
	A	B	C
11.00 am	35.1	35.3	28.3
11.10 am	33.2	35.4	28.5
11.20 am	31.7	34.4	28.4
11.30 am	31.9	34.4	28.2
11.40 am	31.4	36.4	28.7
11.50 am	32.9	36	28.4
12.00 pm	33.1	35.8	29.6
12.10 pm	32.7	35.7	30.4
12.20 pm	33.8	36.8	30.6
12.30 pm	34.7	36.7	30.4

12.40 pm	32.4	37.4	30.1
12.50 pm	32.4	37.4	30.1
1.00 pm	32.1	35.4	30
1.10 pm	32.7	36.2	30.6
1.20 pm	30.1	36.4	30.7
1.30 pm	34.4	37.1	31.8
1.40 pm	33.6	37.8	32.4
1.50 pm	32.4	35.2	33.1
2.00 pm	31.5	37.1	33.6
2.10 pm	36.8	36.4	33.8
2.20 pm	34.1	37.3	34.4
2.30 pm	36.4	36.2	35.1
2.40 pm	35	37.2	36.2
2.50 pm	35.2	35.4	36.7
3.00 pm	35.4	36.1	36

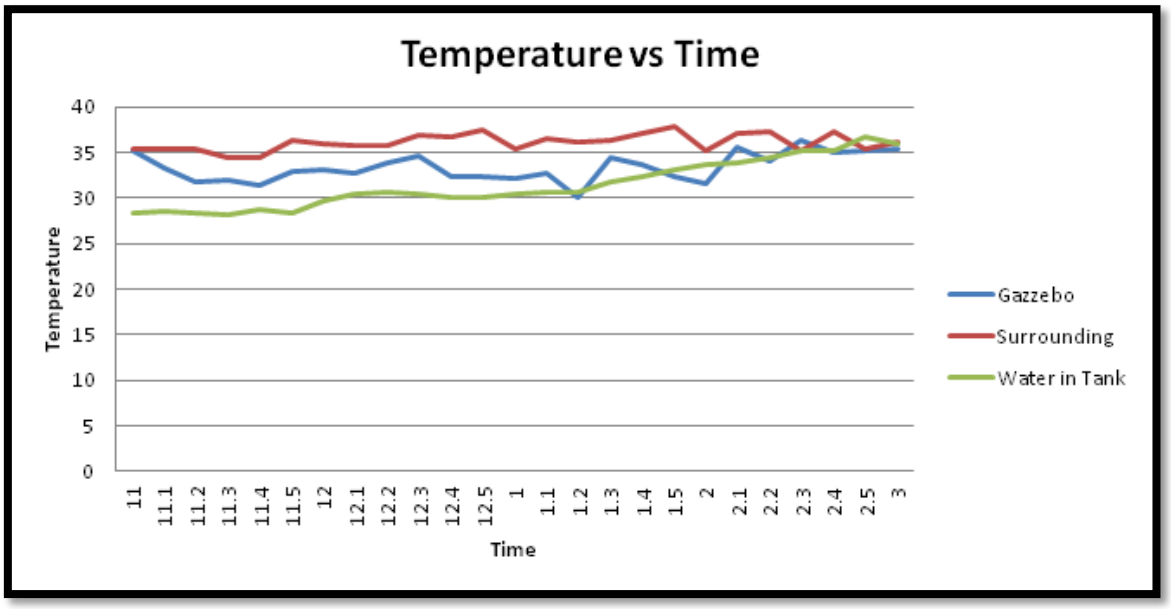

Figure 3.1. Temperature versus Time for the first day

Table 3.1 shows the data for the first day. While the Figure 3.1 shows the graph for first day. At the x-axis shows time while the temperature appears on the y-axis. The temperature of water in the tank increased slightly from 28 ^{o}C to 37 ^{o}C at time 11.00 am to 3.00 pm with 37 ^{o}C as the maximum temperature. The temperature at gazebo was 35 ^{o}C at 11.00 am and still same 35 ^{o}C at 3.00 pm but the maximum temperature for gazebo was 36.4 ^{o}C on 2.30 pm and minimum temperature was 30 ^{o}C at 1.20 pm.The temperature for surrounding was 35 ^{o}C at 11.00 am and still same 35 ^{o}C at 3.00 pm but the maximum temperature for surrounding was 37.0 ^{o}C on 1.50 pm minimum temperature for surrounding was 34.4 ^{o}C on 11.20 am.

Table 3.2. Temperature Data for the Second Day

Day 2			
Time	Temperature		
	A	B	C
11.00 am	28.1	29.2	27.4
11.10 am	28.3	28.2	27.8
11.20 am	28.1	29.1	27.4
11.30 am	29.1	29.3	27.5
11.40 am	28.6	29.9	27.1
11.50 am	28.1	29.5	27.3
12.00 pm	29.6	31.2	28.3
12.10 pm	29.8	31	28.5
12.20 pm	29.8	32.1	28.3
12.30 pm	30.1	33.5	28.1
12.40 pm	31.6	35.2	28
12.50 pm	31.7	33.2	28.7
1.00 pm	31.6	31.4	28.7
1.10 pm	31.4	35.4	28.6
1.20 pm	31.9	35.6	29.4
1.30 pm	32.1	36.4	29.1
1.40 pm	33.4	36.4	29.1
1.50 pm	33	35.8	29.6
2.00 pm	34.1	36.7	30
2.10 pm	35.2	36.7	32.1
2.20 pm	34.3	37.1	33.2
2.30 pm	35.2	35.5	34.2
2.40 pm	34.9	34.6	35.5
2.50 pm	33.8	33.2	35.2
3.00 pm	34.5	34.1	35.8

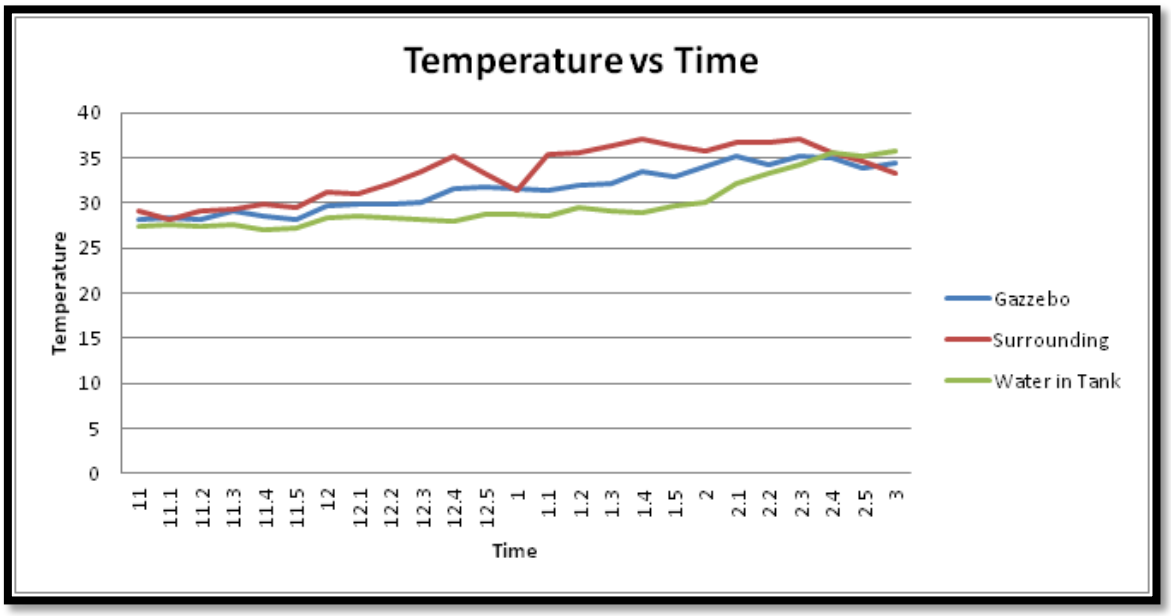

Figure 3.2. Temperature versus Time for the second day

Figure 3.2 show the graph for second day. At the x-axis shows time while temperature appear on y-axis. The temperature of surrounding at 12.40 pm until 1.10 pm was fluctuated mildly with maximum temperature 37 ^{o}C at 1.40 pm and minimum temperature of 29 ^{o}C at 11.00 am. The temperature of water in tank increased slightly from 11.00 am to 3.00 pm with the maximum temperature 36 ^{o}C at 3.00 pm and minimum temperature of 27 ^{o}C at 11.00 am. The temperature at gazebo was increasing from 11.00 am till 3.00 pm with maximum temperature of 34 ^{o}C at 3.00 pm and minimum temperature of 28 ^{o}C at 11 am.

Table 3.3. Temperature Data for the Third Day

Day 3			
	Temperature		
Time	A	B	C
11.00 am	34.3	35.1	28.8
11.10 am	35.2	34.7	28.4
11.20 am	33.1	34.4	28.7
11.30 am	33.6	35.8	28.4
11.40 am	34	35.6	29.1
11.50 am	36.7	37.2	28.9
12.00 pm	34.2	36.8	29.7
12.10 pm	35.4	36.5	29.4
12.20 pm	35.4	36.1	29.6
12.30 pm	35	35.9	29.4
12.40 pm	34.9	35.8	29.9
12.50 pm	32.3	34.2	30.3
1.00 pm	34.2	35.7	30.1
1.10 pm	35.3	35.7	30.6
1.20 pm	34.4	35.8	30.4
1.30 pm	33.7	34.9	30.6
1.40 pm	33.8	35.7	31.2
1.50 pm	33.6	34.7	30.7
2.00 pm	34.1	36.1	31.8
2.10 pm	35.2	37.2	32.4
2.20 pm	35.6	36.9	34.1
2.30 pm	35.4	36.5	34.7
2.40 pm	35.4	36.2	34.7
2.50 pm	36.7	37.1	35
3.00 pm	35.1	36.9	35.3

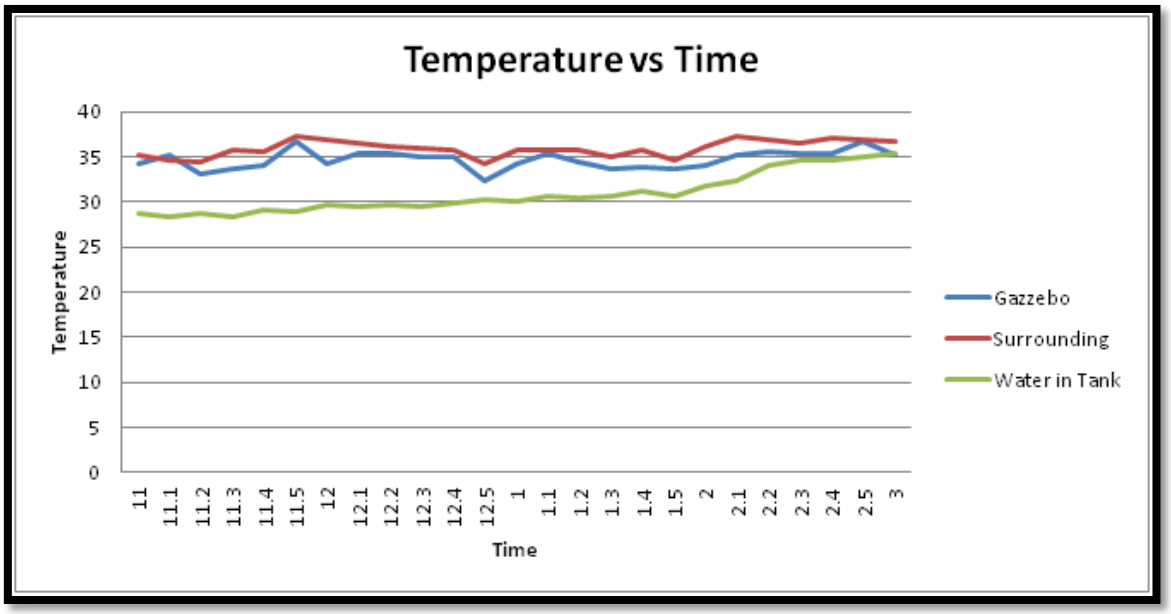

Figure 3.3. Temperature versus Time for the third day

Figure 3.3 shows the graph for the third day. At the x-axis is the time while the temperature is on the y-axis. Its look like both temperature at gazebo and surrounding most same. The maximum temperature of surrounding was 37 ^{o}C at 11.50 am and minimum temperature of 34^{o}C at 12.50 am. The temperature of water in tank increased after a while from 1.00 pm to 3.00 pm with the maximum temperature 35 ^{o}C at 3.00 pm and minimum temperature of 29^{o}C at 11.00 am. The temperature at gazebo was increasing gradually with maximum temperature of 37 ^{o}C at 11.50 am and minimum temperature of 33 ^{o}C at 12.50 pm. Temperature for water still maintain from beginning until end of the project.

4. Conclusion

Based on the result we obtain, the temperature of water in tank almost same on three day. The high temperature for water recorded was 36.7^{o}C. So, our Zinc Roofed Cooling system proved that it was effective but there are still flaws in our product. If the flaws are taken into consider in future projects and improve the project to reduce the flaws then this might make the Zinc Roofed Cooling System Product a better and suitable alternative cooling system for the gazebo at brick works laboratory.

4.1. Discussion

The Zinc Roofed Cooling System was planned and designed in December 2016 and was completed by the end of February 2017. We had some test done with our cooling system and collected the data in order to prove that our cooling system is effective and sustainable. Our Zinc Roofed Cooling System has achieved its objectives and this cooling system can be used on any zinc roofs. Although all the objectives had been achieved, there are some flaws in this cooling system besides all its advantages.

4.2 Advantages

i. Can make a house cooler by reducing its temperature.
ii. Cheaper alternative for cooling homes with zinc roof.
iii. Easier maintenance.
iv. Long lasting on zinc roofs.
v. Uses rain water to cool roofs.
vi. The rain water can be reused again with this system.

4.3. Disadvantages

i. Only works on houses with zinc roof.
ii. Not effective compared to other products and systems in the market.
iii. Electricity is needed for this system to work.

4.4. Suggestion

In this part,we state all the suggestions that we received from respondents or friends. These are the suggestion that was suggested:

i. Use a stronger and more force full pump in order to pump more water so more volume of water can flow high up the roof and can cool the roof faster and better.
ii. Make a cooling system for all types of roof because not all houses are built with zinc roof.

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