**Scholars Journal of Engineering and Technology (SJET)** **ISSN 2321-435X (Online)**
**Sch. J. Eng. Tech., 2015; 3(8):715-717** **ISSN 2347-9523 (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublisher.com

## Research Article

# Development of Smart Breast Milk Incubator

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**Abstract:** This paper described the development of Smart Breast Milk Incubator. It is a portable container for breast milk storage. The container is mainly use for all working mothers to help their problem to keep their breast feeding milk quality in a good condition. This device has many benefits such as it has cold and hot temperature mode as well as it can be carry anywhere because of its small design and can be rechargeable. The idea of the development of this device is due to the fact of the problem facing by working mother to breast feeding their babies because of their work and time constraint at their workplace. Most mothers send their babies at nursery and keep their babies until end of office hours that makes the breast feed become. Therefore, this device is designed to ease all mothers to store breast milk in a long time and the babies could continuous benefits through it. It fully utilized the capability of thermoelectric cooler that could function as a cooler and heater for breast milk storage.
**Keywords:** Breast Milk, Breast Feed, Babies, Working Mother, Thermoelectric Cooler.

## INTRODUCTION

Smart Breast Milk Incubator is a device that can be used by all mothers that need to store their breastfeeding milk while they are performing their daily job as a professional worker. This device is a efficient device because it can be rechargeable and can be change to the cool and hot temperature mode, besides that it can be easily carry anywhere. This device also is an eco- friendly due to the use of peltier cooler that does not used any gas to coolant the device that could harm the environment.

Users need to push the switch from cold to hot temperature mode. The thermoelectric cooler has 2 sides which is hot and cold. The aim of this development project is to create a simple device capable of keeping components as cool as possible using common parts and materials . The device is capable of maintaining a temperature of approximately20-50˚c.

## METHODS

The approach to complete this project is shown in Figure 1. Planning is the most important step to start a project because it can affect the time, cost and effectiveness of the project.

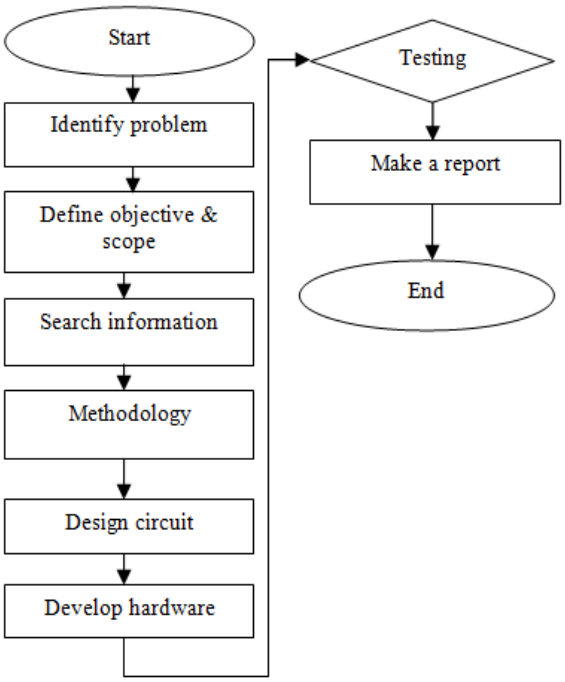


**Fig. 1: Flowchart of the project**

A selection of peltier heat pumps are stacked on a large heat sink (with fan) and surrounded by insulating material as shown in Figure 2, except for the cold face. Using the thermoelectric effect of the peltier elements as shown in Figure 3, heat can be rapidly drawn away from this surface, but only as long as the heat sink is able to dissipate into the surrounding air. A

large heat sink and fan can be found in computer shops as they are necessary for keeping your computers processor cool [2].

Simply sticking a component to the surface of the heat pump will provide quite effective cooling, but only if there is a large amount of contacting surface area. For more rounded or uneven shaped components, such as laser diodes, it is possible to use a very cold liquid to surround the device. This liquid must be able to withstand very low temperatures without freezing, and be highly volatile (evaporates easily). Something like liquid Nitrogen or Helium would be great, but that's not something you can just pick up from your local hardware store. This device uses 'Freezer Spray' which can usually be found in shops selling plumbing accessories. This spray evaporates rapidly on contact with room temperature objects drawing the heat way from it. By slowly spraying the Freezer Spray into a small container such as its lid, it is possible to collect it as a liquid. The liquid can be put in a small metal container which sits on the surface of the cold heat pump. This metal container is also surrounded in insulating material such as polystyrene [2].

When the heat pumps and fan are active it should be possible to prevent the liquid from evaporating, allowing components to be submerged for cooling. Most peltier heat pumps / thermoelectric modules require some odd not standard DC .While such a device would work fine on a lower voltage you would not be getting the full cooling potential of the peltier element. A good way to power these devices is by using pulse width modulation so that you can adjust precisely the average power flowing through the device. Our power pulse modulator makes an ideal power supply for peltier modules.

**Fig. 2: Super cooler**

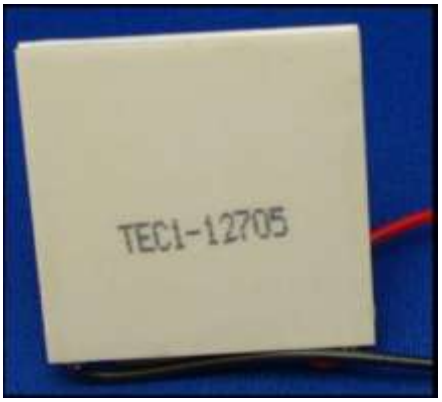


**Fig. 3: Thermoelectric cooler/ Peltier**

**RESULTS AND DISCUSSION**

This section discusses the design and development of the project result. The result is shown in Table 1. In this project, we use 3 switches, firstly for hot part of peltier, secondly for cold part of peltier and thirdly for 12VDC fan. When we switch on the 12VDC fan, we need to switch on the thermoelectric cooler. Next, when we turn on the cold part of switch, the cold temperature from the peltier will surround inside the box and it will make the cup cold and same goes to hot part of switch, the hot temperature from the peltier will surround inside the box and it will make the cup hot.

**Table 1: Output temperature result of the device**

| Time (minutes) | Hot temperature(c) | Cold temperature(c) |
|---|---|---|
| 5 | 37c | 34c |
| 10 | 38c | 32c |
| 15 | 40c | 30c |

Overall observation , the cold side need to take 15 minutes to be cold to 30c and hot side need to take about 15 minutes to be cold to 40c. Figure 4 shows the construction of the inner part of the device.

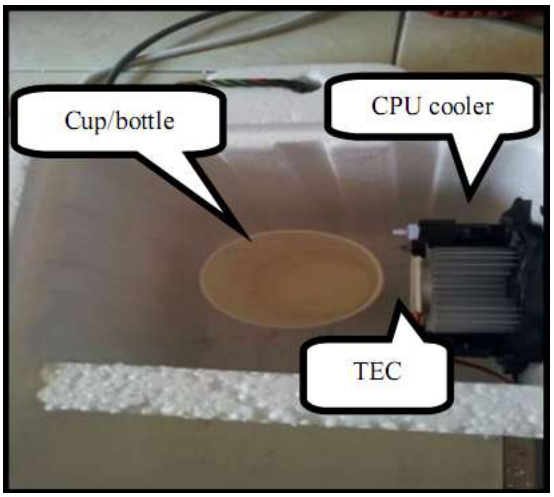


**Fig. 4: Construction of the inner part**

Figure 5 shows the construction of the outer part of the device. The switch is connected to the rechargeable battery and power supply circuit. The circuit is placed inside that black casing.

We will put cup/ bottle into this box and the thermoelectric cooler (TEC) that place at the CPU cooler will function to cold and hot the box surrounding when we switch ON the circuit.

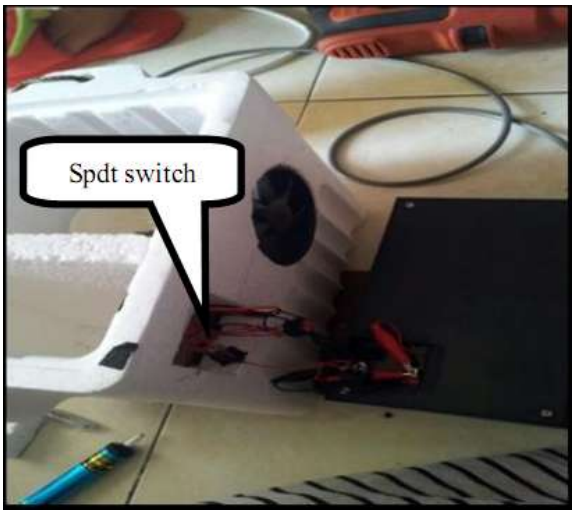


**Fig. 5 : Construction of the outer part**

## CONCLUSION

In conclusion, Smart Breast Milk Incubator could perform well in assisting working mother maintaining the quality of the breast feed milk. It could help them during frost and de-frost their milk while they are performing their daily professional jobs. Therefore babies could continue having their mother breast milk that un-doubtfully have better nutrient compared to formula milk. Overall, it can help all working mothers to store their breast milk when their babies at nursery even though they are busy with work and lifestyle, besides this container is eco-friendly and not harmful to the environment.

**Acknowledgment**

The authors would like to thank Universiti Teknikal Malaysia Melaka (UTeM) and Ministry of Higher Education, Malaysia for the financial supports given through Research Grant no. RAGS/2013/FKE/TK02/04//B00027.

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