DESIGN AND DEVELOPMENT OF HIGH PERFORMANCE HAND DRYER

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For my understanding project supervisors and family, especially to my Anis Maisarah & Muhammad Al Fateh also their Ummi. Thank you for your sacrifices……

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ABSTRACT

In general, current hand dryers are lacking in term of performance because they are less effective or require longer time to dry. One alternative is to use tissue papers to dry hands but this option requires expensive running cost for toilet owners and they have a negative effect to the environment. There are effective hand dryers such Dyson Airblade or Mitsubishi Jet Towel but they are expensive. In this study a new concept of hand dryer technology has been developed. It is a new form factor design which contributes to less cost which improved efficiency. The development of the new hand dryer follows a structured product design and development phases which begins with the identification of customers' needs and ends with a concept testing of a prototype. The new development hand dryer can function as specified with less components involved in the fabrication. This new hand dryer effectively dries both hands in less than 15 seconds and fulfils a part of National Sanitation Foundation (NSF) Protocol P335 criterion for effective hand dryer standard. It creates more value as having less carbon footprint and high energy efficiency due to no heating element being used and avoiding the use of tissue papers. The significant benefits are more on affordability and low operating cost.

ABSTRAK

Umumnya, mesin pengering tangan hari ini kurang berkesan kerana ianya memerlukan masa yang panjang untuk kering. Alternatif lain ialah menggunakan kertas tisu untuk mengeringkan tangan tetapi opsyen ini memerlukan kos operasi yang tinggi kepada pihak pengurusan dan meninggalkan kesan negatif kepada alam sekitar. Terdapat juga pengering tangan yang efektif seperti Dyson Airblade atau Mitsubishi Jet Towel tetapi harganya mahal. Dalam kajian ini, satu konsep baru bagi teknologi pengering tangan dibangunkan. Ianya satu 'form-factor' baru yang murah untuk dibangunkan tetapi lebih efisien. Pengering tangan baru dibangunkan secara rekabentuk dan pembangunan produk berstruktur, bermula dengan mengenal-pasti kehendak pengguna sehingga ke peringkat pengujian prototaip konsep. Rekaan baru ini berfungsi sebagaimana spesifikasi yang ditetapkan dengan komponen yang minimum. Ianya dapat mengeringkan kedua-dua tangan dengan berkesan kurang dari 15 saat dan memenuhi sebahagian daripada Protokol P335 National Sanitation Foundation (NSF) bagi kriteria pengering tangan yang efektif. Pengering tangan ini juga mempunyai lebih nilai-tambah kerana 'Carbon Footprint' yang rendah dan kadar kecekapan tenaga yang tinggi kerana tidak mempunyai elemen pemanas. Dengan ini dapat mengelak penggunaan kertas tisu untuk mengeringkan tangan selepas ke tandas. Kelebihan yang paling ketara ialah ianya lebih mampu dimiliki dan kos operasi yang rendah.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

It is a normal phenomenon when we enter the bathroom and find an electrical device used to dry our hands. However, most of the time the hand dryer is not a popular drying method among users. Most of them felt that it does not serve the required purpose.

As technology advanced, there are many new companies developing more effective hand dryers. The new generation of hand dryers perform better but come with premium cost. Thus there is an opportunity to design and develop effective hand dryer which perform equally or better at a lower cost. Such motivation also comes in line with the current trend when people are becoming more concern about protecting the environment and reduce cost.

The proposed product can be redefined as a green technology device. Overall, it consumes less energy, lower cost and minimise the degradation to the environment.

1.2 Problem Statement

Currently, many people prefer to use tissue to clean and dry their hands, one of the measures is that the current scenario of the ineffectiveness of the hand dryers (Knights, B et al, 1993). It has been quite embarrassing to notice people in certain cases tried to dry their hands but after few minutes of disappointment will decided to withdraw their hands and with a sign of discontenting and rather decided to rub their wetted hands with either paper towels (if available on the spot) or in some cases rub their hands on their trousers or clothes. This particular incidence is not a healthy situation to the person concerned and also to the environment in particular. (Hutdugaikarsui, 2010).

In such a situation, most of the toilet operators could at their best, satisfy consumer demands with minimum cost. But the problem is that most hand dryers do not justified their cost as they are not effective. Most of current hand dryers in the market are not really fit the purpose.

Thus, the above scenario creates new opportunities to improve by develop new hand dryer based on the users complaints and needs.

Once the fundamental evaluation on the opportunities shows a satisfaction result, the next step is to determine the mission statement for this project. This will keep a clear direction to be followed until the completion of the project. Table 1 summarise the mission statement which include environmental goals, market size, technologies identification and target users.

1.3 Objective of the Study

The objectives of this study are stated as follow;

(i) To design and develop a new concept of high performance hand dryer.

(ii) To fabricate and perform concept testing of a working prototype of the hand dryer by employing an international standard practise, NSF P335.

Table 1: Mission Statement

Mission statement:	**High performance hand dryer**
Product description:	Effectively dry hands less than 15 seconds.
Benefit proposition:	Machine that cost effective and really functional.
Key business goals:	• To capture market through innovative design. • As main product to establish an 'advance design/technology company/brand.
Primary market:	• As ideal replacement for old generation machine. • Complement for any future 'green building'.
Secondary market:	• Home/kitchens. • Operation theatres/hospital.
Assumptions & constraints:	• High performance machine from competitors are expansive • New form-factor. • Cheap generic product flooding the market. • Green product design.
Stakeholders:	• Public toilet owners (restaurants, airports, bus stations). • Service operation companies (cleaning companies). • Home users.

1.4 Scope of Study

The scope of this study is to introduce a new hand dryer design or form factor. Current high performance hand dryers are limited in form factor making it very difficult for innovation. It is due to so many patents registered by manufacturers to gain market advantages and slow down the competitors from introducing better products into the market.

In developing new design or technology, it is very important to ensure it works as specified (K. Dorst, 2007). In order to consider a hand dryer is a high performance unit, it has to fulfil the international standard specification (NSF.org, 2010). So it has be able to dry hands effectively within the targeted time constrain. Therefore in this study, a physical product need to be fabricated to demonstrate suggested drying technique is functional.

Before fabrication of the actual product, it needs be tested virtually using a Computational Fluid Dynamic (CFD) method to verify the behaviour of the jet air. So a clear prediction on the overall performance can be visualised and better understanding on the air behaviour obtained.

Finally, the design philosophy of the product is minimalist, functional and green. To ensure the success of the product, current and future design requirements are laid out in this study. The electrical hand dryer by itself is a greener product comparing to a paper towel solution (A. Bono and Wang, 2007). To add better value proposition, it uses much less energy in terms of its operation stage and also from design stage to manufacturing and end-of–life (EOL) cycle.

For the green design feature assessment, two green tools are used. They are Life Cycle Assessment (LCA) and Carbon Footprint (CFP). Both enable any interested parties to evaluate ‘greenness’ of this product design. LCA and CFP also give quantitative values for members of public to understand how the result of this study is an environmental friendly product.