

**IMPROVE OF DESIGN AND ANALYSIS OF HYDRAULIC HOUSE FENCE
OPENING USING TAP WATER PRESSURE**

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**A report submitted
in fulfillment of the requirement for the degree of
Bachelor of Mechanical Engineering (Design and Innovation)**

Faculty of Mechanical Engineering

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DECLARATION

I declare that this project report entitled “Improve of Design and Analysis of House Fence Opening” is the result of my own work except as cited in the references

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APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design & Innovation).

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Date : 12th JULY 2017

DEDICATION

To my beloved mother and father

ABSTRACT

This thesis discussed the improvement of design and analysis of house fence opening. The objectives of this thesis are to improve the design for existing hydraulic fence product, to fabricate the prototype, and to analyze and compare the capability of the improvement product. The main problem of existing product made is the cost and the previous researcher does not use automatic system to operate the fence movement. The cost can be divided into two categories, which is manufacturing cost and operating cost. The existing product need to operate using variety of manual valve. Next, method that have been used to solve this problem is started with finding all related information about the fence opening system. The information is taken from internet, books, journals, newspapers and thesis. Then, the House of Quality was used to identify the characteristic that need to improve and listed the specification in product design specification. In conceptual design, the process start with morphological chart to provide the analytical and systematic concepts. Five concept design was generated based on product design specification and one best concept have been choose using Pugh method. Concept 4 was selected based on reliability, cost and ease of replacement of the components. The selected design was simulated using FluidSIM software and the simulation works correctly according to design. From the result, the prototype was working and the system was controlled using automatic remote control to open and close the fence. The system operates with 30 kg fence with pressure of 33 psi.

ABSTRAK

Tesis ini membincangkan peningkatan reka bentuk dan analisis pembukaan pagar rumah. Objektif tesis ini adalah untuk memperbaiki reka bentuk produk pagar hidraulik sedia ada, untuk menghasilkan prototaip, dan untuk menganalisis dan membandingkan keupayaan produk pembaikan. Masalah utama produk sedia ada yang dibuat adalah kos dan penyelidik terdahulu tidak menggunakan sistem automatik untuk mengendalikan pergerakan pagar. Kos boleh dibahagikan kepada dua kategori, iaitu kos pengeluaran dan kos operasi. Produk sedia ada perlu beroperasi menggunakan pelbagai injap manual. Seterusnya, kaedah yang telah digunakan untuk menyelesaikan masalah ini bermula dengan mencari semua maklumat berkaitan dengan sistem pembukaan pagar. Maklumat ini diambil dari internet, buku, jurnal, akhbar dan tesis. Kemudian, 'House of Quality' digunakan untuk mengenal pasti ciri-ciri yang perlu diperbaiki dan menyenaraikan spesifikasi dalam spesifikasi reka bentuk produk. Dalam reka bentuk konseptual, proses bermula dengan carta morfologi untuk menyediakan konsep analitis dan sistematik. Lima reka bentuk konsep dihasilkan berdasarkan spesifikasi reka bentuk produk dan satu konsep yang terbaik telah memilih menggunakan kaedah Pugh. Konsep 4 dipilih berdasarkan kebolehpercayaan, kos dan kemudahan penggantian komponen. Reka bentuk yang dipilih disimulasikan menggunakan perisian FluidSIM dan simulasi berfungsi dengan betul mengikut reka bentuk. Dari hasilnya, prototaip berfungsi dan sistem dikawal menggunakan kawalan jauh automatik untuk membuka dan menutup pagar. Sistem ini beroperasi dengan pagar 30 kg dengan tekanan 33 psi.

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LIST OF ABBREVIATION

n.d.	No date
mm	Millimeter
V	Volt
m	Meter
RM	Ringgit Malaysia
n/a	Not available
kg	Kilogram
PSM	Projek Sarjana Muda
PSI	Pound per square inch

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Fence is one of design technology that help people to solve problem by adding barrier to cover the area needed. The main purpose of the fence is to protect and secure the place. Nowadays, the production of the fence does not only for security only, the fence need to have good aesthetic value, easy to operate and friendly user. In general, fence can be operating manually or automatically. For manual operating, it used men power to open and closed the door. It is not suitable for people that have pack schedule or need to rush for works. The automatic fence opening was invented to solve the problem and it also more safe to the user while opening the fence.

In 1974, the student in Toledo, Ohio was investing 100 dollars to build the companies of garage door and automatic gate system. This college student was most successful entrepreneurs when George Elbe make the advertisement on local newspaper, he wants to sell 13 automatic door openers. All the door had been sold and installed. According to the company philosophy, the company was focused on satisfaction and customer needs (D. Janbu,nd).

The theory of automatic gate or fence as shown in Figure 1.1 is very simple by pressing the open button, the signal is sent to the main circuit board and its allow the current flow pass through the motor or hydraulic pump to run and the gate will open. After the gate fully open, the motor will stop running and the gate will stop moving. The operation will be same when pressing the close button. The gate is used commonly at residential area as point of entry to a space enclosed by walls. It controls point of entry and exit (C.K. Primus et al,2015).

From the previous research, the source of power supply is from water pressure. The water supply is from Syarikat air Melaka berhad. The pressure and load of fence is related to each other because the pressure should be higher than the weight of the fence. The water pressure use to extend and retract the cylinder at the fence (M. Yusuf,2016)

Previous researcher emphasizing several important factors for using tap water in his project. The main factor is to increase safety awareness and improved the environmental protection by using the tap water. The water can reduce the pollution compared to hydraulic oil. The manufacturing cost also can be reduce because the manufacturer can replace the cost of hydraulic oil with tap water (M. Yusuf,2016).

In summary of previous researchers, they invented the most useful to assist the human work. The basic concept on the system is quite same but the component is different based on the design of the system. All the design have their own objective to produce the system to solve the problem.

This project was focused on producing the automatic fence that operates using water pressure source from water supply. The water supply is the low cost energy and it is usually having in all house in Malaysia. On literature review, the researcher was focused on device that can used for manufacturing the automatic system. The researcher also finds the information about the other automatic fence system and the type of fence in market.

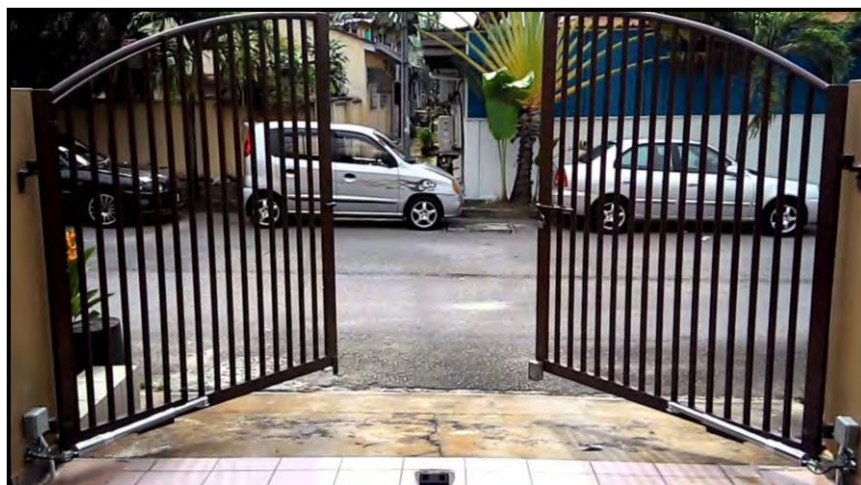


Figure 1.1: Swing automatic fence
(Source: autogate swing arm type,2013)

1.2 PROBLEM STATEMENT

The main problem of the existing product is the system does not use an automatic system for opening and closing the fence. It needs to be closed and open the variety of valves to operate the fence. Each operation needs to control two valves, which are one valve to control the release valve and another one valve to control the source of water as shown in Figure 1.2. It will increase the time to operate the fence and the valve controller can only operate inside the house only as shown in Figure 1.3. The other problem with the existing fence is the cost. It includes the manufacturing cost and operating cost. The manufacturing cost is the cost when making the product including materials, labor, and manufacturing overhead cost. The operating cost includes the source of power supply and it will be compared with electric and battery. To solve this problem, this project will improve the system by using automatic remote control to open and close the fence.

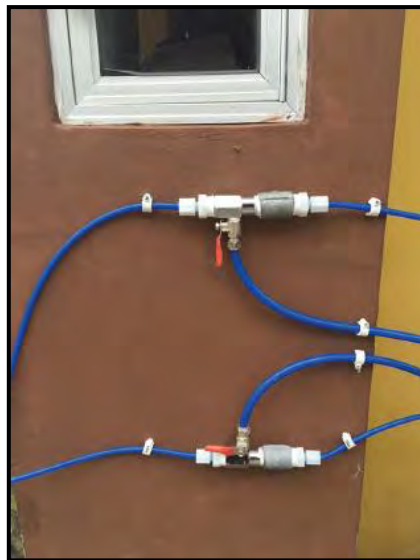


Figure 1.2: Control valve
(Source: M. Yusuf, 2016)

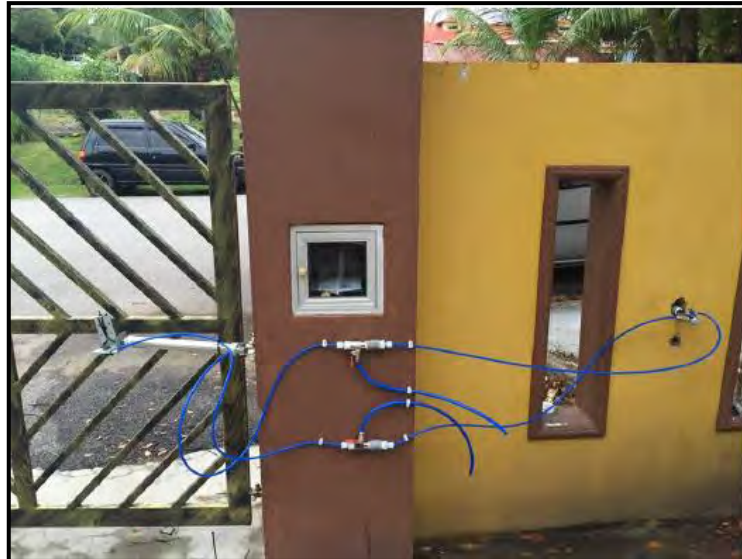


Figure 1.3: Location of control valve
(Source: M. Yusuf,2016)

1.3 OBJECTIVE

The objectives of this project are as follows:

1. To improve the design for existing hydraulic fence product.
2. To fabricate the prototype of the hydraulic house fence opening.
3. To analyze and compare the capability of the improvement product.

1.4 SCOPE OF PROJECT

The scopes of this project are:

1. The improvement only included the swing type fence opening for terrace house.
2. Fabricate and install the new automatic system for fence opening.
3. The testing of the project also including the slide fence type for further research.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The automatic fence is the popular technology that Malaysian peoples used for their home nowadays compared to manual fence. The main purpose of automatic fence is to assist human to open and close the fence for saving time and safety. The common automatic fence uses electrical system for control and generate power for movement. It is combine with mechanical system for moving the part, gear and linkage (M. Yusuf,2016).

In this project, the electrical system or battery as alternative energy source is only use for open and close the valve. The main energy is from pipe water pressure for moving the hydraulic system. The main purpose of this project is for improve the manual hydraulic system to automatic hydraulic system that using tap water. This project also to reduce the product cost and operating cost of automatic fence system.

2.2 TYPE OF FENCE

There are several type of fence that commonly used in Malaysia which is swing fence, slide fence, vertical lift fence, vertical pivot lift fence, and barrier arm fence. This project is focus on swing opening type fence only. The other type of fence is for guideline and finding the suitable type of fence that can use this system for further research.

2.2.1 Swing fence

The swing fence is divide into two type which is single and double swing fence opening. This type of gate is common use for home because it is easy to install and the cost is less than other type of fence. The fence can open inwards or outwards (M. Hagaman,2013). When the automatic system attach to this type of fence, the fence usually can open in one direction, either inwards or outwards.

Single swing gate usually 16 inch to 20 inch wide and it must have installed on a level flat plane for the fence driveway. The double swing gates can decrease the wide of the fence and it is having high aesthetic value compared to single swing fence (What are the Different Types of Driveway Gates,n.d.). The swing fence can hit the people or vehicle near the driveway when it is moving, so it need additional security system to prevent the it happen (M. Yusuf,2016).



Figure 2.1: Swing type fence
(Source: Sivakumar. S,n.d)

2.2.2 Slide fence

The slide gate use wheels to slide left to right or right to left depends on the space available for the fence driveway. The space needed for driveway must at least same as the width of the fence. There are three types of slide fence, it is V-track, rear pipe track and cantilever. The V-track is the most user choice of slide fence because it is being quite reliable. There is some problem with this type of fence when the track has some debris especially at snow and ice area. It also need 3 inch wider than

the opening of fence in order to save the space for installing the automatic gate system. The rear pipe track type is usually use with lower chain link fence. It also need 3 inch wider than the opening of fence for installation. For the cantilever type, it does not have any wheels on the ground. It can move on the driveway without care about the debris. The cantilever slide fence preferable especially in snow or ice area because the wheels is on the post of the fence (What are the Different Types of Driveway Gates,n.d.).



Figure 2.2: Cantilever slide type fence
(Source: Security/Fences/Gates,n.d.)

2.2.3 Vertical lift fence

In industrial application, the vertical lift fence always used to secure their place according to the cost. The fence is usually 8 inch tall and 16 inch wide and lift vertically above the vehicle. It is allowing the vehicle pass under the fence directly. The gate is the most secure fence compared to other type fence. For increase the aesthetic value, it can use any type of fence panel (What are the Different Types of Driveway Gates,n.d.).



Figure 2.3: Vertical lift fence
(Source: unknown,nd)

2.2.4 Vertical pivot lift fence

The vertical pivot lift fence is supported only by the operators of the fence and it does not require any support to hold the fence. It will rotate in and out to open or close the fence opening. The Figure show the fence in open position (M. Yusuf,2016).



Figure 2.4: Vertical pivot lift fence
(Source: Vertical Pivot Gates & Automatic Gate Operators,n.d.)

The vertical pivot fence is suitable in small area place. If there is not enough space for swing or slide fence and the barrier fence does not enough security, the vertical pivot fence is best choice to solve this problem (What are the Different Types of Driveway Gates,n.d.).

2.2.5 Barrier arm fence

In general, the barrier arm fence commonly used in parking lots and garages. It is also in a lot of commercial application including airports or public facilities. This fence can operate manually by using man power. It also can be operated automatically by using card reader, keypad or telephone entry system (Selling the best in Electric Driveway Gates,n.d.)). Figure 2.5 shows the barrier arm fence with card reader access.



Figure 2.5: Barrier arm fence
(Source: Parking/Barrier Gates,n.d.)

The barrier arm fence is the efficient fence operator to reduce unwanted traffic due to the cost. This fence does not provide any security to secure the place (What are the Different Types of Driveway Gates,n.d.). The other type of fence should be considered to use if the place need high security

2.3 AUTOMATIC FENCE OPERATOR

The fence operator usually placed at the end of the fence to open and closed the fence by using mechanical device. The hydraulic or electromechanical usually been assist by electric system to operate automatically. The operator can be setup for open or close using wireless transmitter or using manual device. In emergency purpose, the automatic fence operator use solar power for generates energy when loss of electricity or blackout as shown in Figure 2.6.