



## **WATER CLOSET RETRACTABLE HOSE**

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**JUN 2020**

**POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH**

**WATER CLOSET RETRACTABLE HOSE**

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## AKUAN KEASLIAN DAN HAK MILIK

**TAJUK : WATER CLOSET RETRACTABLE HOSE**

**SESI : JUN 2020**

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Adalah pelajar tahun akhir **Diploma Kejuruteraan Mekanikal, Jabatan Kejuruteraan Mekanikal, Politeknik Sultan Salahuddin Abdul Aziz Shah**, yang beralamat di **Persiaran Usahawan, 40150, Shah Alam, Selangor**. (selepas ini dirujuk sebagai 'Politeknik tersebut').

2. Kami mengakui bahawa "Projek tersebut di atas" dan harta intelek yang ada di dalamnya adalah hasil karya/reka cipta asli kami tanpa mengambil atau meniru mana-mana harga intelek daripada pihak-pihak lain.
3. Kami bersetuju melepaskan pemilikan harta intelek 'projek tersebut' kepada 'Politeknik tersebut' bagi memenuhi keperluan untuk peanugerahan **Diploma Kejuruteraan Mekanikal** kepada kami.

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Firstly, I want to express my gratitude to Allah SWT for giving me His blessings and a good health to complete my final project.

I would like to express my heartfelt thanks to my Supervisor, En Zulkarnain Bin Hamid for his continuous guidance, advice, knowledge and support in completing this project. Without the help, I would be unable to complete my project in timely manner.

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## **ABSTRACT**

Since 1994 the Malaysian government has launched clean toilet campaign. However, there are still many public toilets that haven't reach satisfactory hygiene. From 2014-2016, the government has spent nearly RM60 million on repairs and construction of new toilets. However, the attitude of some people is still the same even though most toilets have been upgraded. The components in public toilet were damaged and caused other users to feel uncomfortable using the toilet. Spraying water everywhere and flooding the cubile. Leaving the water hose on the floor or in the toilet bowl causing the water hose being disgusting to touch as it contacts with dirty water and urinate. Water hose holder being frequently broken and not being replaced for a long time especially in public toilets causing hose to be left on the floor. The objectives to this research are to create a method where waterhose rolls back in place with minimal human effort. The methodology of the pipe is pulling the pipe to desire length when used, pull again the pipe will roll back into its original position. Through the research, we found a component called clockwork spring, as you rotate the spring the sturdy metal springs tightens storing up potential energy, as you let go the stored energy converts into kinetic energy causing it wind up back. The project is limited by the usage in toilet.

Key word:

1. Attitude
2. Hygiene
3. Pipes
4. Roll
5. Clockwork spring

## ABSTRAK

Sejak tahun 1994, kerajaan Malaysia telah melancarkan kempen tandas bersih. Walaubagaimanapun sehingga ke hari ini masih terdapat banyak tandas awam yang belum mencapai tahap kualiti yang memuaskan. Dari tahun 2014-2016, kerajaan Malaysia telah membelanjakan hampir RM60 juta untuk membaikpulih dan membina tandas baru di seluruh negara. Namun, apa yang menyedihkan, sikap segilintir masyarakat masih lagi sama walaupun kebanyakan tandas sudah dinaiktaraf. Hal ini bermaksud tandas awam tidak bersih sehingga menyebabkan imej yang buruk kepada negara kita. Komponen seperti hos di tandas menjadi rosak kerana tidak dijaga serta menyebabkan pengguna lain tidak selesa ketika menggunakan tandas awam. Kesalahan meninggalkan hos air di atas lantai dalam tandas menyebabkan hos kotor untuk disentuh pengguna lain dan menyemburkan air ke semua tempat menyebabkan membanjiri tempat tersebut. Penyangkut hos air kerap rosak/pecah dan tidak diganti untuk masa yang lama terutamanya di tandas awam menyebabkan hos air ditinggalkan atas lantai. Objektif kajian ini adalah untuk merekacipta hos air dikembalikan ke tempat asalnya dengan tidak menggunakan tenaga kerja yang banyak. Metodologi hos air ini adalah dengan menarik hos paip air dengan panjang yang dikehendakinya apabila digunakan, menarik sekali lagi dan hos bergulung kembali. Melalui kajian ini, kami dapati komponen "Torsion Spring/Clockwork spring" dapat mengumpul tenaga keupayaan apabila spring diputarkan, ini menyebabkan spring logam yang kukuh mengetat. Semasa melepaskannya tenaga yang dikumpul bertukar kepada tenaga kinetik menyebabkan hos kembali balik. Projek ini terhad kepada penggunaan tandas.

Kata Kunci :

Tingkah laku

Kebersihan

Paip

Gulung

Clockworkspring

## **CONTENT**

<b>CHAPTER</b>	<b>CONTENTS</b>	<b>PAGES</b>
	FRONT PAGE	
	ACKNOWLEDEGEMENT	
	ABSTRACT	
	ABSTRAK	
	CONTENTS	
	LIST OF FIGURES	
	LIST OF TABLE	
1	INTRODUCTION	
	1.1 Research Background	1
	1.2 Problem Statement	2
	1.3 Research Objectives	3
	1.4 Scope of Research	3
	1.5 Chapter's Summary	3
2	LITERATURE REVIEW	
	2.1 Introduction	4
	2.2 Material(water hose)	4-6
	2.3 Studies for Clockwork spring	7
	2.4 Chapter's Summary	7
3	METHODOLOGY	
	3.1 Introduction	8
	3.2 Flow Chart	9
	3.3 Flow Chart Explanation	10-18
	3.4 Interview and Research	19-21
	3.5 Project Design	22
	3.6 Operational Methodology	23-24
	3.7 Methodology Phase	25
	3.8 Budget Calculation	26
	3.9 Project Activity	27
	3.10 Chapter's Summary	28
4	FINDINGS AND ANALYSIS	
	DISCUSSION AND CONCLUSION	29-30
	REFFERENCES	30

## LIST OF FIGURES

CONTENT	PAGES
Figure 1.1: Dirty Public Toilets	2
Figure 2.1: Rubber pipes	4
Figure 2.2: Improved rubber water pipes	5
Figure 2.3: Stainless steel pipes	5
Figure 2.4: Flexible stainless steel pipes	6
Figure 2.5: stainless steel pipes with sprayer	6
Figure 3.1: HDPE pipe	10
Figure 3.2: Bearings	11
Figure 3.3 : Hand spray	12
Figure 3.4: clockwork spring	12
Figure 3.5: Types of sockets and method of connecting	15
Figure 3.6: stainless steel pipes	16
Figure 3.7: PVC Pipe	17
Figure 3.8: Cake acrylic board	18
Figure 3.9: Result Question 1	19
Figure 3.10: Result question 2	20
Figure 3.11: Result question 3	20
Figure 3.12: Result Question 4	21
Figure 3.13: Exploded view	22
Figure 3.14: Top View	22
Figure 3.15: 3D Drawing	22
Figure 3.16: Side View	22
Figure 3.17: Front View	22
Figure 3.18: Pro tape	23
Figure 3.19: Clockwork spring	23

## LIST OF TABLES

<b>CONTENT</b>	<b>PAGE</b>
Table 3.1 – Flow chart	9
Table 3.2 – Budget Calculation	26
Table 3.3 – Project activity	27

# CHAPTER 1

## INTRODUCTION

### 1.1 RESEARCH BACKGROUND

Do u ever see the pipes in public toilet did not hang at where it should be? Do you ever think if there are some worms or creature hiding in pipe or the pipe is left unclean with human excrement is that disgusting for u? Do you dare to use the pipe?

Well, I believe every one that goes to public toilet had that thought. So do I! Before we get started, we need to first discover why people did not want to hang the pipe on the hanger. We did a survey to public (mostly PSA students) to see why and how this happen. According to the data, we found that most of them did hang the pipe to the hanger. Someone said they want to hang but the hanger if either broken or stolen. But there is still certain person state that they did not hang just because the last user did not hang it. From the data, we found the main problem. It is because of selfishness of human being. They just left the pipe after used.

We have to find a solution for this. In our mind the product could roll its way back so that it will not lying on the wet dirty floor. We have thought to use electricity as power source to rolls the pipe in, but it requires a lot of study about circuit. Furthermore, using electricity with flowing water is dangerous, so we have to think of another way to make the roll back mechanism work.

After some research, we found a perfect mechanism to fit in our design, the clockwork spring. It is widely used in our daily life such as tape ruler, vacuum cleaner wires, and etc. With this method, we don't have to worry about electricity leaking or circuit, which is really suitable for our design.

After a few meeting and discussion with our lecture, we finally finalize our design prepare with proposal, drawing and methodology. Our product had the advantage of hygiene, easy used, less space taken and low maintenance fee. This design is not just limited in toilet pipes, even welding pipes, hose and etc. Everything that had the problem of wire cleaning, storing long pipes or hose could use our design to increase the efficiency of work. We believe this product could bring a big change to the traditional idea of toilet is dirty. If this product is greatly used in industries, public facilities, and more, the working efficiency of Malaysia will impress the foreigner, increase the reputation of our country at the same time.

## 1.2 PROBLEM STATEMENT

- 1) Dirty fixtures, soiled toilet seats, and water or urine on the floors also contributed to users perceiving a restroom as unclean (Fig 1)
- 2) Spraying water everywhere and flooding the cubicle.
- 3) Leaving the water hose on the floor or in the toilet bowl. Causing the water hose being disgusting to touch as it contacts with dirty water and urinate/human excrement.
- 4) Water hose holder being frequently broken and not being replaced for a long time especially in public toilets causing hose to be left on the floor.



Figure 1.1: Dirty Public Toilets

### **1.3 RESEARCH OBJECTIVES**

*The objectives to this research are:*

- i. To create a method where water hose rolls back in place with minimal human effort.
- ii. To avoid leaving the water hose on the floor or in the toilet bowl. .
- iii. To minimize the wreck of water hose in public toilet.

### **1.4 SCOPE OF RESEARCH**

*The scopes and limits to this research are:*

- I. This product only fulfills the work of water hose in toilets.
- II. Still require men power to pull the water hose.
- III. Not suitable for cleaning/washing toilet/cubicle.
- IV. Suitable for public toilet use.
- V. Uses clockwork spring to roll back water hose.
- VI. Could last for a long time with a good care.

### **1.5 CHAPTER'S SUMMARY**

In this chapter, the studies were explained about its origin of ideas and inspirations. All the objectives were made out of all the problem statements. The objective for this project along with the importance will be causing it to be more convenient for amputees, and even the scope of this project only focusing at the Clockwork spring water hose. Thus, this product could be used for daily routine with a really good care for a longer lifetime.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 INTRODUCTION

A **hose reel** is a cylinder spindle that features plastic, metal, or even fiberglass. Its goal is to store your hose when you're not using it, so it doesn't have to stay sprawled across your space.

The most commonly used hose reel is motor-driven and hand cranked with each manufacturer trying to produce a more convenient hose reel every time they bring a new one to the market.

Most hose reels are categorized by their hose length capacity, the thickness, how it rewinds, and the pressure rating.

#### 2.2 Water Hose

Hoses are used to carry fluids through air or fluid environments, and they are typically used with clamps, spigots, flanges, and nozzles to control fluid flow (Figure 2.1).

The original rubber pipes



Figure 2.1: Rubber pipes

- no hanger
- easy to break in extreme temperature condition
- diameter of pipes is concern
- head of pipe is open
- water flow can't be control

### Improved rubber water pipes



Figure 2.2: Improved rubber water pipes

- with hanger
- still easy to break in extreme temperature condition
- diameter of pipes dose not limit the usage
- head of pipes is open
- water flow can't be control

### Stainless steel pipes



Figure 2.3: Stainless steel pipes

- with hanger
- extreme temperature change dose not affect the strength of pipes
- head of pipes is open
- structure of the body made it hard to bend
- water flow can't be control

### Flexible stainless steel pipes



Figure 2.4: Flexible stainless steel pipes

- with hanger
- extreme temperature dose not affect the strength of pipes
- head of pipes is open
- more flexible and easy to manipulate the direction
- water flow can't be control

### Flexible stainless steel pipes with sprayer



Figure 2.5: stainless steel pipes with sprayer

- with hanger
- extreme temperature dose not affect the strength of pipes
- head of pipes is closed
- more flexible and easy to manipulate the direction
- water flow can be control

## 2.3 Clockwork Spring

Clockwork means, literally, "working like a clock" but most modern clocks are electronic: powered by electricity and regulated by quartz crystals, they have relatively few moving parts. If you want to understand clockwork, you need to understand how clocks used to work in the days when you wound them with a key. Like an old-fashioned clock, a clockwork device is completely mechanical and has these essential parts:

A **key (or crown)** you wind to add energy.

A **spiral spring** to store the energy you add with the key. (Pendulum clocks store energy with weights that rise and fall, but other clocks and windup wristwatches use springs instead.)

A set of gears through which the spring's energy is released. The gears control how quickly (or slowly) a clockwork machine can do things, but they also control how much force it can produce (for climbing inclines, perhaps).

A mechanism the gears drive that makes the device do useful or interesting things. In a clock, the mechanism is the set of hands that sweep around the dial to tell you the time. In a clockwork car, the gears would drive the wheels that power it over your floor.

Adding and storing energy

A basic law of science called the conservation of energy tells us that we can't do anything without energy. If you want a clockwork car to drive across your carpet, you have to give it enough energy to do just that before you release it; in other words, you have to wind it up.

The mainspring

What happens when you wind? If you've ever wound a clockwork toy, you'll know that the key (sometimes it's a little plastic knob called a crown) can be quite stiff and hard to turn. Why is that? When you turn the key, you're tightening a sturdy metal spring, called the mainspring, and storing up energy; the mainspring is the mechanical equivalent of a battery. Clockwork springs are usually thick twists of steel, so tightening them (forcing them to occupy a much smaller space) is actually quite hard work in both the everyday and the scientific senses of the word. With each turn of the screw, your fingers are doing work (as we say in science): they're moving a force (pushing against the spring's tendency to expand) through a distance in other words, compressing the spring.

## 2.4 CHAPTER'S SUMMARY

As to conclude this chapter, literature review is important to showcase all the studies of materials and ways to enhance the knowledge on this project. Every explanation that are related to this is really helpful especially for us to understand .

After a lot of materials and ways were discussed and researches were done, the material that is compatible for our project is using the clockwork spring for the wind up effect and using the flexible stainless steel pipe. This is because of its low cost benefits and easy mechanism and maintenance process.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 INTRODUCTION**

What is methodology? A methodology is a plan-of-attack, especially when that plan-of-attack is used repeatedly. This might be obvious, but the word methodology is related to the word method. In fact, a methodology is a system of methods followed consistently. Scientists, for example, use various methodologies as they perform experiments. It might seem like the world is nothing but chaos and disorder. But actually, sometimes there is a method to this madness. And sometimes there's a methodology.

In this chapter, there will be a information about the process. There will be flow chart showing the process of making the whole project. Next, is the Gantt Chart, which will show the actual and planning throughout all the 13 weeks of our final year project journey.

### 3.2 FLOW CHART

The step wise progress planning is represented in table 3.1 in the form of a flow chat

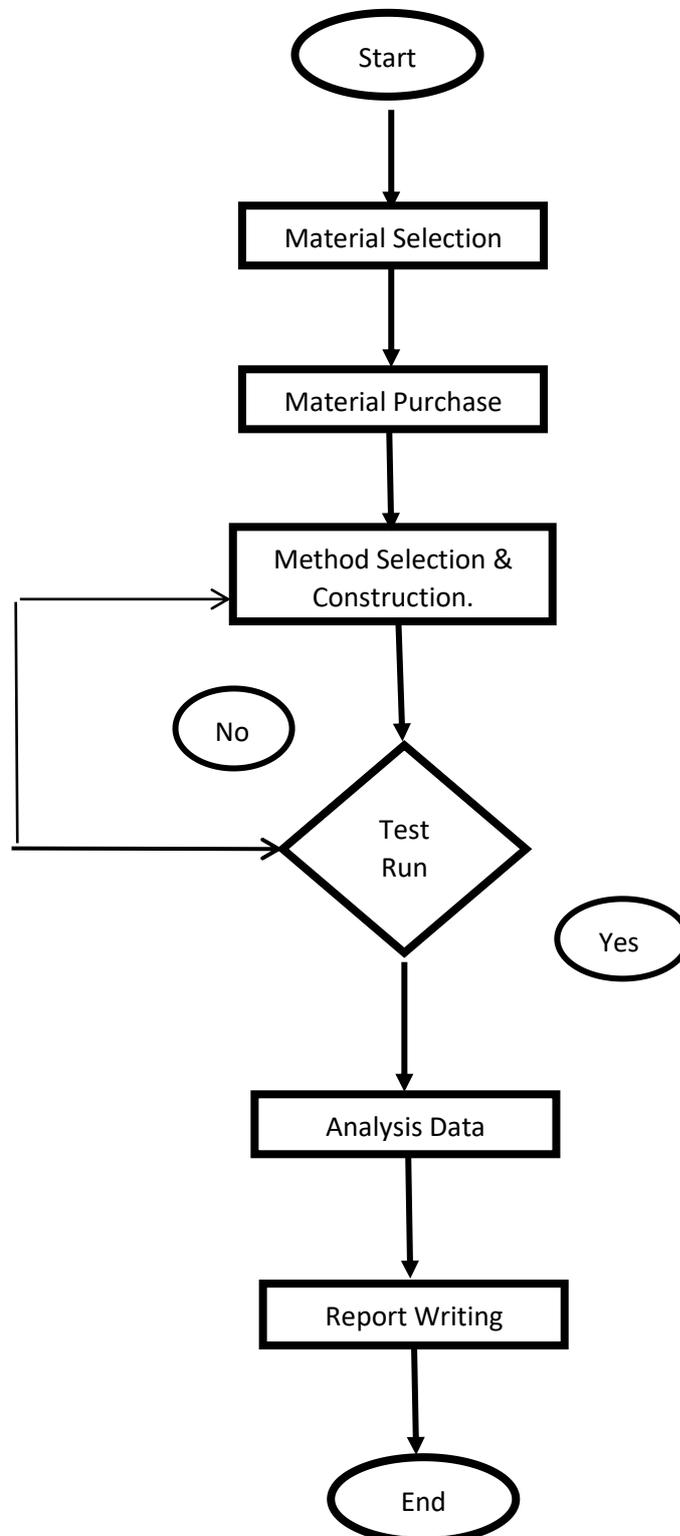


Table 3.1

### 3.3 FLOW CHART EXPLANATION

- **Material Selection**

The process of material selection is one of the most important process in this final year project. The main factor of material selection is to discuss and finalized which materials that will be use in the project in order to avoid wasting of money and time. The material selection need to be done precisely so that the risks could be avoided.

1) PVC Hose



Figure 3.1:PVC Hose

**PVC hose**(figure 3.1) is **tubing** made from **PVC** material. ... Hydraulic **PVC hose** can be found in machine shops and manufacturing plants. For high pressure applications, **PVC hose** may be reinforced with wire. Some types of **PVC hose** include lay flat **hose**, steel wire braided **hose**, suction **hose** and rubber lined fire **hose**.

## 2) HAND SPRAY



Figure 3.3 :Hand spray

Hand bidet shower(Fig3.3) is a hand-held triggered nozzle that is placed near the toilet and delivers a spray of water used for anal cleansing and cleaning of the genitals after using the toilet for defecation and urination. The device is similar to that on a kitchen sink sprayer. It was reputedly invented by Thai living in the US who adapted a sink sprayer for toilet use.

## 3) CLOCKWORKSPRING

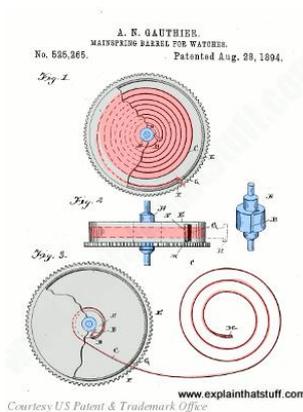


Figure 3.4: clockwork spring

What is clockwork spring?

Arrangement of parts in a clockwork toy. Clockwork spring(Fig3.4) means, literally, "working like a clock"—that much is obvious! But most modern clocks are electronic: powered by electricity and regulated by quartz crystals, they have relatively few moving parts. If you want to understand clockwork, you need to understand how clocks used to work in the days when you wound them with a key. Like an old-fashioned clock, a clockwork device is completely mechanical and has these essential parts:

A key (or crown) you wind to add energy.

A spiral spring to store the energy you add with the key. (Pendulum clocks store energy with weights that rise and fall, but other clocks and windup wristwatches use springs instead.)

A set of gears through which the spring's energy is released. The gears control how quickly or slowly a clockwork machine can do things, but they also control how much force it can produce for climbing inclines, perhaps,

A mechanism the gears drive that makes the device do useful or interesting things. In a clock, the mechanism is the set of hands that sweep around the dial to tell you the time. In a clockwork car, the gears would drive the wheels that power it over your floor.

Adding and storing energy

A basic law of science called the conservation of energy tells us that we can't do anything without energy. If you want a clockwork car to drive across your carpet, you have to give it enough energy to do just that before you release it; in other words, you have to wind it up.

The mainspring

What happens when you wind? If you've ever wound a clockwork toy, you'll know that the key sometimes it's a little plastic knob called a crown can be quite stiff and hard to turn. Why is that? When you turn the key, you're tightening a sturdy metal spring, called the mainspring, and storing up energy, the mainspring is the mechanical equivalent of a battery. Clockwork springs are usually thick twists of steel, so tightening them forcing them to occupy a much smaller space is actually quite hard work in both the everyday and the scientific senses of the word. With each turn of the screw, your fingers are doing work as we say in science they're moving a force pushing against the spring's tendency to expand through a distance in other words, compressing the spring.

Since you're doing work with your fingers, you're using energy, but that energy doesn't vanish into thin air: it's stored in the spring as potential energy. Tightening the mainspring in a windup toy is like pushing a roller coaster car up a hill. Just as you can get the energy in a roller coaster car back by letting it roll down the hill, so you can get the energy back from a mainspring by releasing it to drive a clockwork mechanism the potential energy is converted into kinetic energy as well as heat and sound energy in the whirring gears.

If you want a clockwork device to entertain you or do something useful for a while, you need to give it plenty of energy. Windup clocks and watches are designed to have springs that will store enough energy to keep the mechanism working for a day or more. Clockwork toys aren't anything like as well made or as impressive and if you get more than a minute or two's entertainment for your thirty seconds or so of winding you're doing well. Generally, more interesting clockwork devices that run for longer have bigger and sturdier springs capable of storing much more energy.

**So in this project, as you pull the pipe the sturdy metal springs tightens storing up potential energy, as you let go the stored energy backs and converts into kinetic energy causing it wind up back.**

#### 4) 3D Printing



After having the clockwork spring, we will need a case to put it in. The case is specially design to fit in our product. The case requires a few precise cutting so we have to find a way to custom make it. If for large producing, machining and molding will be the better choice because it requires low afford and time and be able to continue produce in a very long time. But for our prototype, we're using 3D printing because it is cheaper than the other method and take a very short time to see the final product which make it the best choice of ours. 0.12mm of accuracy allow us to create any kind of casing we want including different size of circle, triangle and other complicated shape.

## 5) CONNECTOR

Be the first to clip this slide

### Penyambung Paip Penyuai Soket Injap

BG	PVC	Poli
		

Menyambung dua jenis penyambung atau alat kelengkapan yang berdekatan yang berlainan diameternya.

### Kaedah Penyambungan Paip Poli

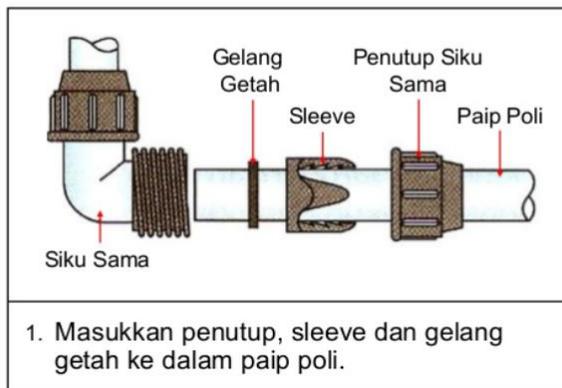


Figure 3.5: Types of sockets and method of connecting

## 6) PVC Hose



Figure 3.6: PVC Hose

- Temperature change dose minor effect to the strength of pipes
- head of pipes is open
- more flexible and easy to manipulate the direction
- able to hold curtain amount of water pressure
- lower cost

## 7) Plastic connector



Figure 3.7: plastic connector

Plastic connectors (figure 3.7) offer more options for material selection, user interface and customized design than metal connectors. Plastic tube-to-tube connectors are a popular choice for applications that do not require the disconnection of equipment or parts at any point during production or use.

## 8) Acrylic Board



Figure 3.8: acrylic board

Acrylic(Fig3.8) is a transparent plastic material with outstanding strength, stiffness, and optical clarity. Acrylic sheet is easy to fabricate, bonds well with adhesives and solvents, and is easy to thermoform. It has superior weathering properties compared to many other transparent plastics.

Acrylic(Fig3.8) refers to a variety materials polymers or chemical compounds which are generally transparent forms of plastic. It's used in fabrics, paints and sheets of clear plastic.

- **Material Purchase**

The process of materials purchasing is crucial to collect and obtains all the materials needed. In this process a lot of research on the places and suppliers that the materials are going to be purchase is done. This step is important so that the risk of material wasting or money loss will not happen. However, to carry out material purchasing, a purchasing plan needed to be made. First, the suppliers will be contacted to verify the availability of the materials. Then, the calculation of the amount of materials needed and also the price of the materials. After that, surveys of price must be carried out to determine the better selling prices. Then finally, the purchases could be made.

### 3.4 Interview and research

#### From our survey of 42 respondents : GRAPHICAL ANALYSIS

1)

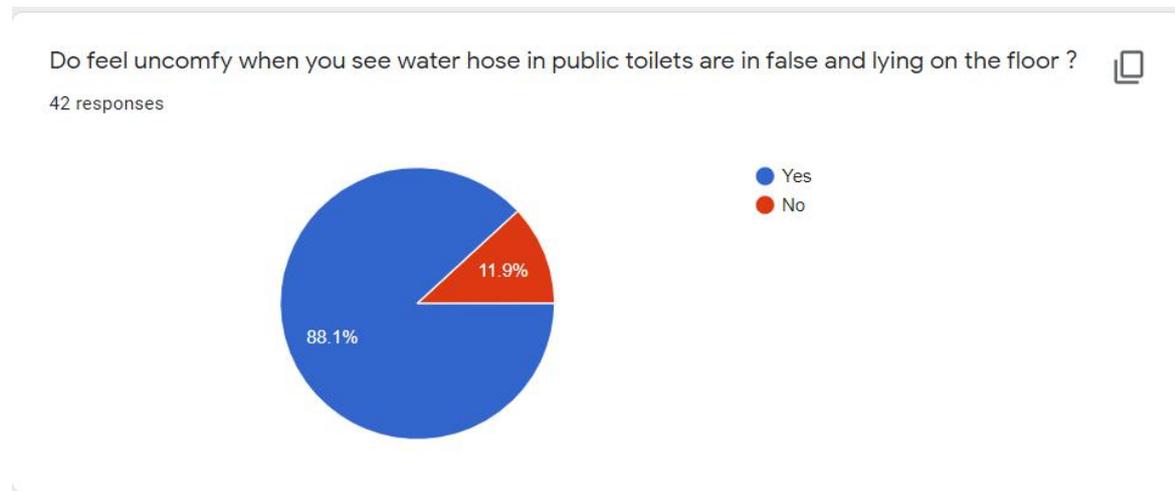


Figure 3.9: Result Question 1

◆ 37people=YES, 5people=NO

2)

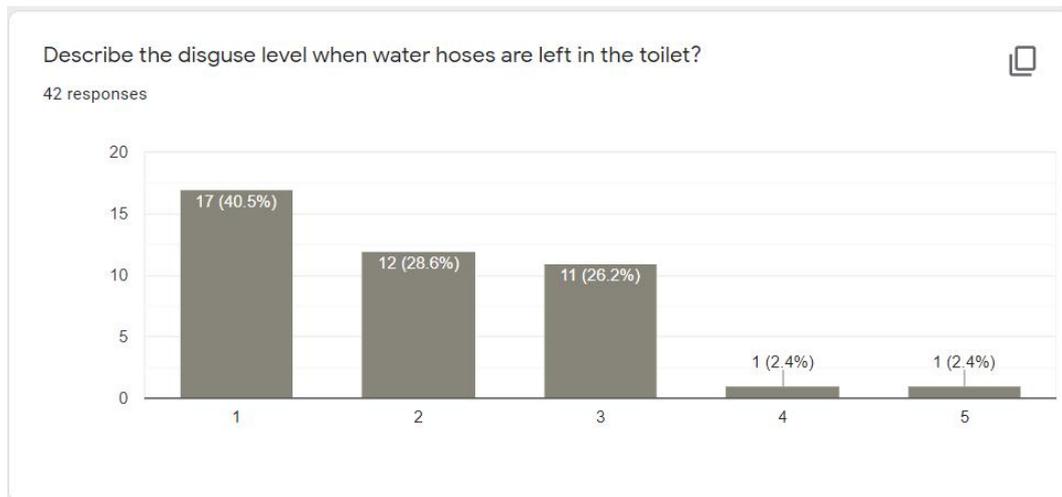


Figure 3.10: Result question 2

- ◆ Rate 1(very disgusting)-5(very hygiene).
- ◆ Out of 42 respondents 17 rated **1**, 12 rated **2**, 11 rated **3**, 1 rated **4** and 1 rated **5**.

3)

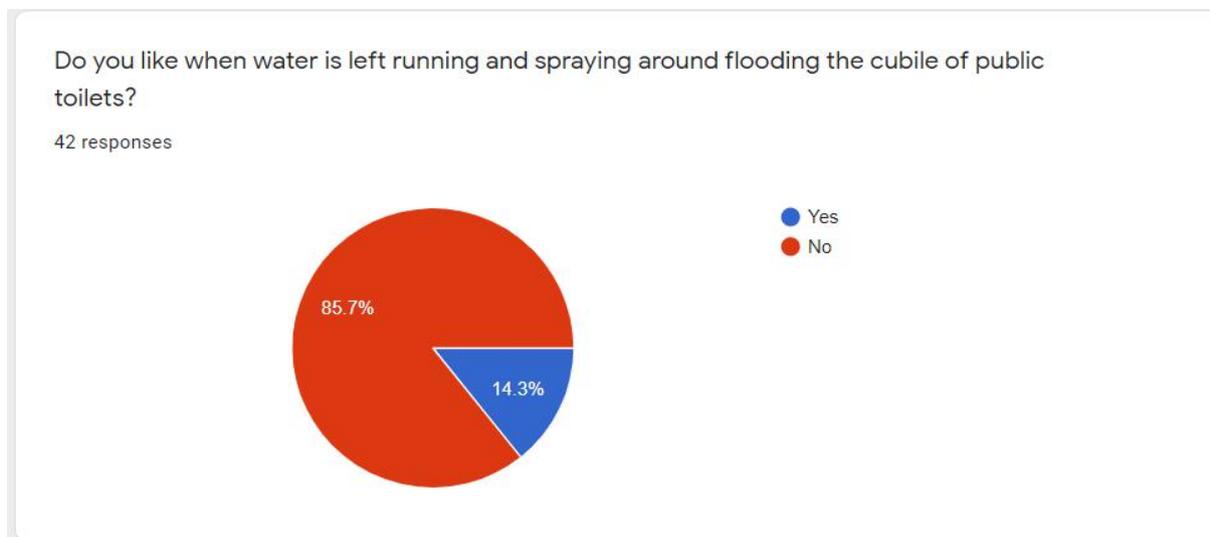


Figure 3.11: Result question 3

- ◆ Out of 42 respondents 85.7% / 36people answer **NO**, 14.3% / 6people answered **YES**.

4)

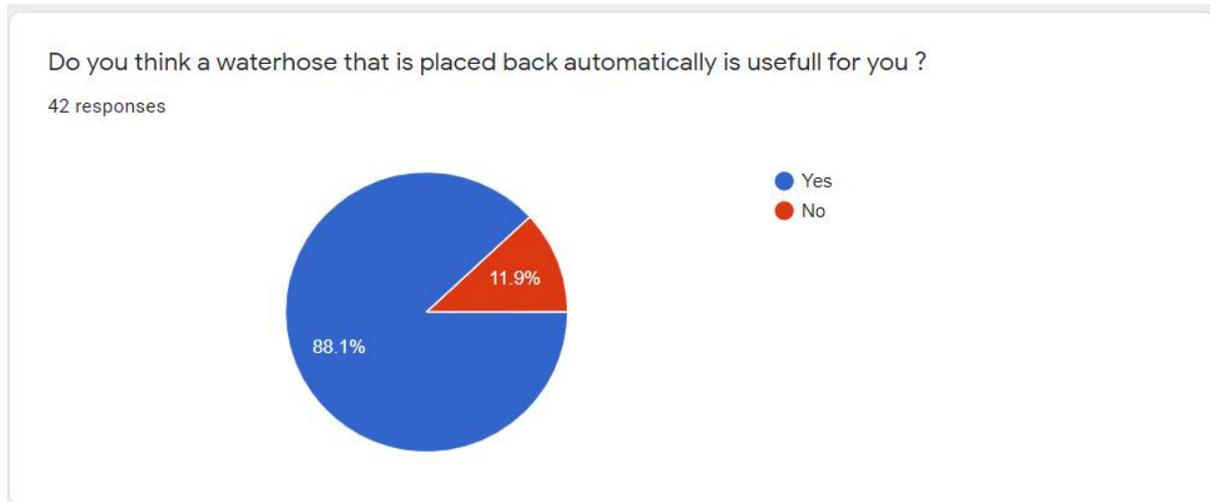


Figure 3.12: Result Question 4

- ◆ Out of 42 respondents 88.1% / 37people answered **YES** , 11.9% / 5people answered **NO**.

**So from this survey we can conclude that the majority from 42 respondents feels uncomfortable when water hose lies on the floor(Fig3.9) of toilets and feels disgusting when hoses are left into the toilets(Fig3.10).The majority from this survey also dislikes when water is left running flooding the cubicle(Fig3.11)and agrees that water hose in toilets are use full when it winds up automatically(Fig3.12).**

### 3.5 PRODUCT DESIGN

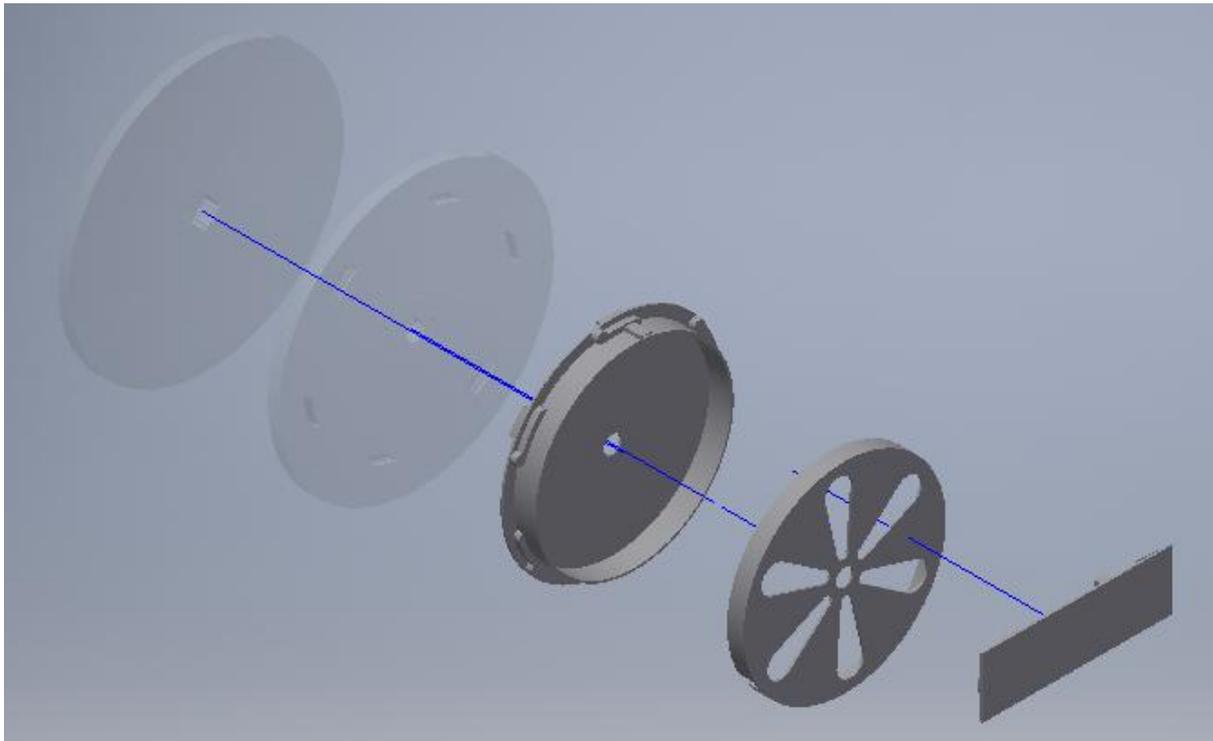


Figure 3.13: Exploded view

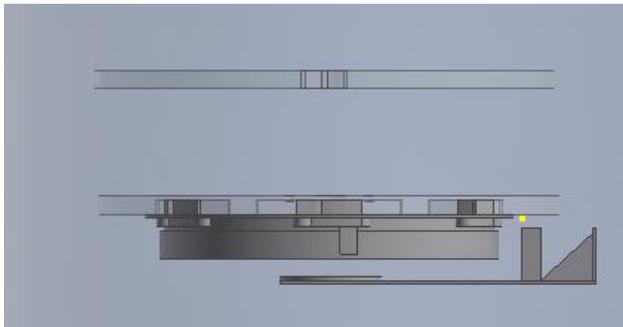


Figure3.14:Top View

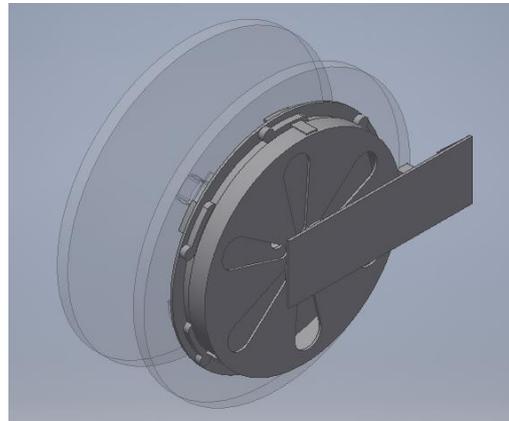


Figure3.15:3D Drawing

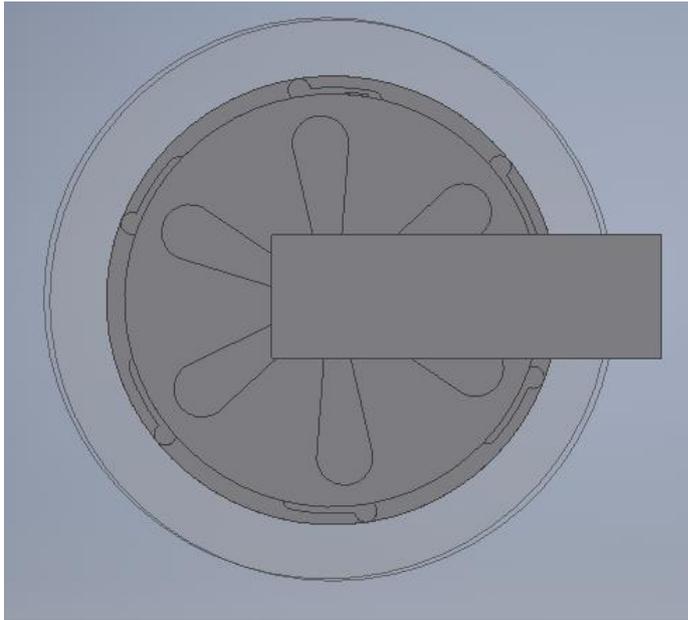


Figure3.16:Side View

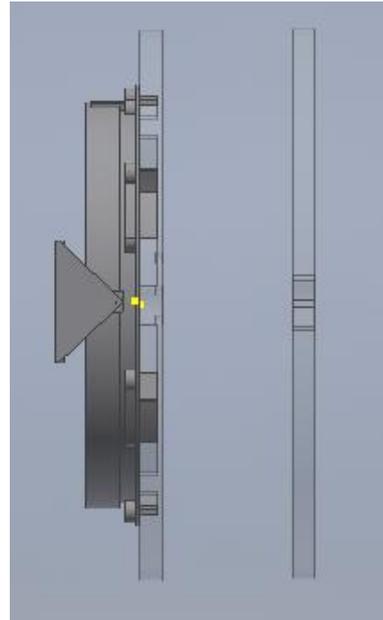


Figure3.17:Front View



### 3.6 OPERATIONAL METHODOLOGY/CONSTRUCT

Our idea is to not using electric as power source to activate the “roll back” mechanism. We found a perfect example as our base design, tape ruler(Fig3.18)



Figure3.18: Pro tape

Without using electricity, the tape still can roll back itself. We start go deeper in to the design of the tape ruler to find the secret. We found that there is a metal tape rolls in the middle of the ruler. The rolled metal tape is called clockwork spring(Fig3.19)



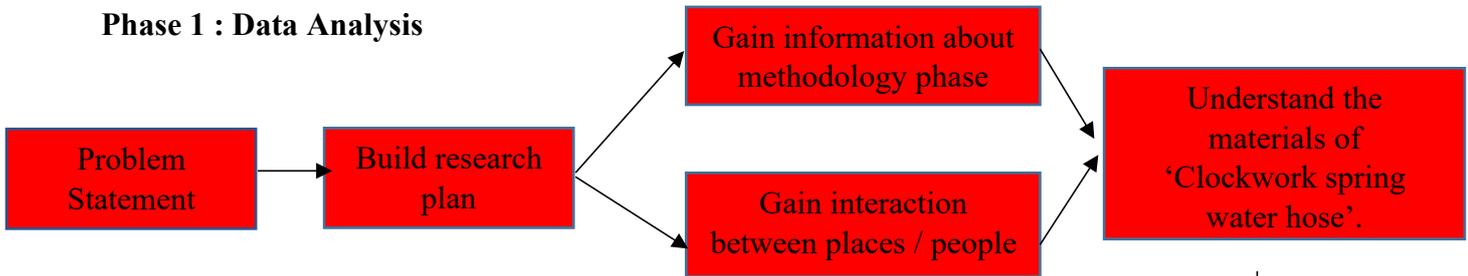
Figure 3.19: Clockwork spring

When the spring(Fig3.19) is pulled in its rotation direction, the spring tightens and create an elastic force to pull it back to its original position. The longer you pull, the stronger the pulling force is, the shorter you pull, lesser the pulling force will be. So we don't have to worry the speed of the pipes when it tries to roll back. The wire of vacuum cleaner is also using the same mechanism.

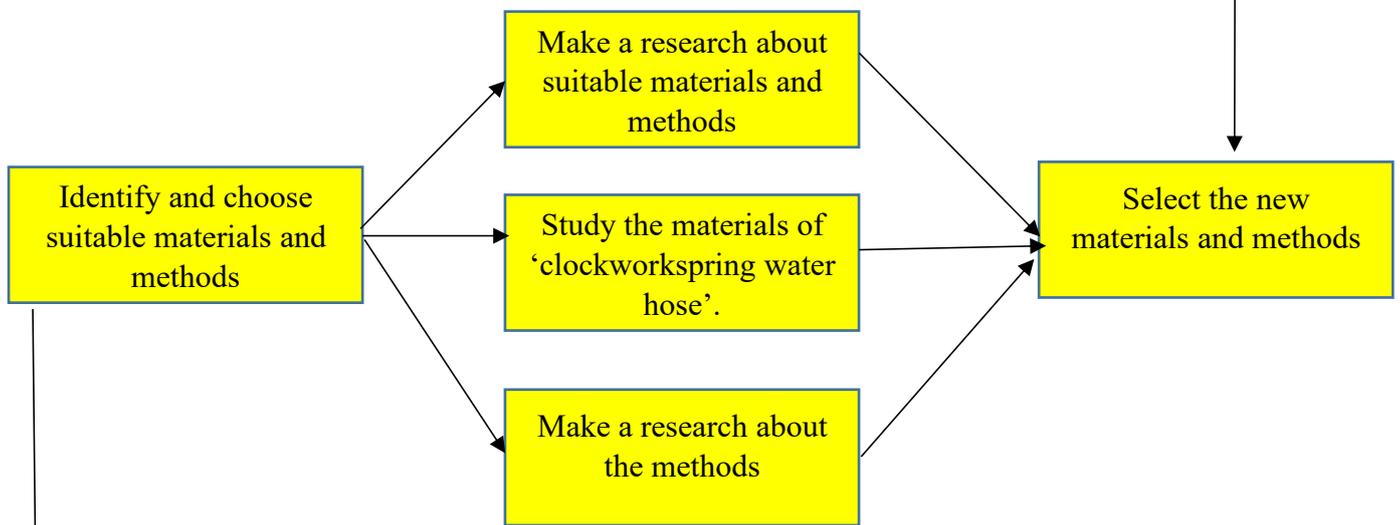
- Acrylic board in a circle shape cut into desire holes.
- Both board have a different cutting because they have different usage.
- The left acrylic board is to connect to the water inlet, so we cut a hole at the middle like in figure so that the hole is fitting to the pipe
- The right pipe is holding the pipe and holding the clockwork spring at the same time. So the hole is cut in both directions as in figure.
- Both acrylic board's main usage is to hold the pipe in place. The holes are just costume made to fit in our design and save cost of using other replaceable but unused material such as bearing.
- One acrylic board will join with a clockwork spring. The fix point of clockwork spring is aligned with the inner holes of the acrylic board. the rotating part is aligned with outer diameter of the board.
- Join both acrylic board on the pipe, clockwork spring stay outside, and let the pipe stay between the acrylic boards.
- Water source will connect directly with the pipe but still able to rotate freely.
- Put the pipe stopper and roll the pipe manually for first time using.
- Done.

### 3.7 METHODOLOGY PHASE

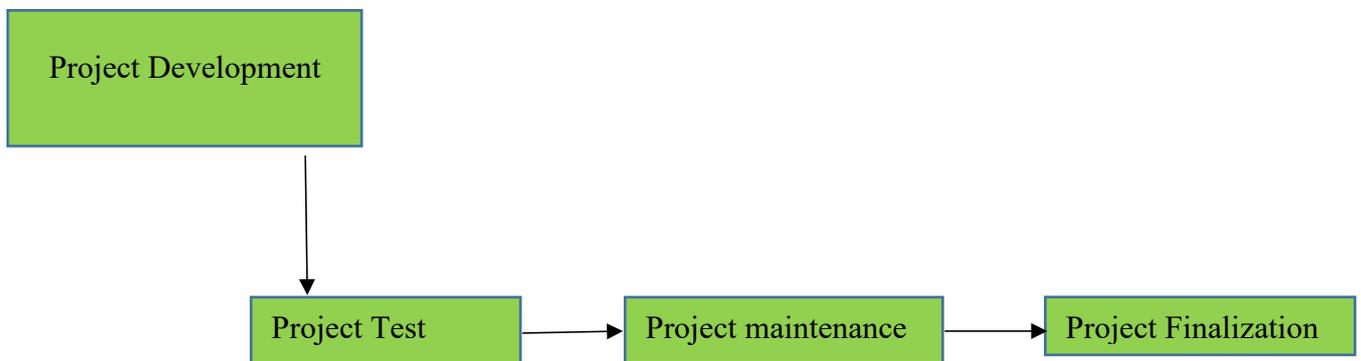
#### Phase 1 : Data Analysis



#### Phase 2 : Method and Material



#### Phase 3 : Preliminary Study



### 3.7 BUDGET CALCULATION

No	Materials / Equipment	Amount	Price	Decription
1.	3D Printed Parts	2 unit	RM100	25mm
2.	Clockwork spring/Torsion spring	1 unit	RM50	
3.	Pipe connectors	2 unit	RM15	-
4.	PVC Pipe	2 unit	RM20	LENGTH:1.5m RADIUS : 0.5cm
8.	Acrylic board circle	2 unit	RM60	RADIUS:25cm
Total			RM245	

Table 3.2

**3.8 PROJECT ACTIVITY** The project activities has been design for 15 weeks as show in the following table in the form gantt chart

PROJECT ACTIVITY	week															
	s	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Briefing and Project Planning		Grey														
Project Design		Black	Grey	Grey												
Material Selection			Black	Black	Grey											
Materials Purchase					Black											
Method Selection/construct						Grey	Grey									
Test Run								Black	Grey							
Analysis Data									Black	Grey						
Report Writing										Black	Black	Black				
Report completion&sub mission												Black	Black			
Video&Slide making														Black	Grey	
Preparations & Presentation																Black

Planning (GREY)

Actual (BLACK)

Table 3.3: Progress Gantt Chart

### **3.9 SUMMARY**

As a conclusion, the methods implemented in this project are very crucial and important to complete the project. Thus, as stated in the survey this project is liked from the majority of the respondents , The materials used in the project creates a light and easy mechanism for the product yet at reasonable price, making this project is convenient to the amputees.

## CHAPTER 4

### DISCUSSION

For this project, there are several crises we met. The product we design should be suitable to use in a toilet, which involved usage of water. Electricity is banned in this project because there is an electric hazard.

So the first problem we met is to make the pipe rotate without electricity. This is not a big deal because our initial idea is to try not to use electricity as a power source to activate the mechanism. First idea of us is to use a mechanism in a pen, press once it came out, press again it goes back. But that doesn't solve the problem at all, the users still need to press a button to activate the mechanism, which doesn't count as auto roll back. Then we found a perfect example of an auto roll back mechanism, the clockwork spring. It is a widely used mechanism on tools such as a tape ruler, clock, and even wire of a vacuum cleaner. Through observation, one single roll of a clockwork spring is able to roll a copper wire back to its original place. So it should be possible to roll just a water hose. Although we have some argument about that, but we managed to get through that.

The second crisis we met is how to rotate the whole pipe without rotating the water source. After a few weeks of discussion, we decided to use bearings in our design. The movement at the middle of a bearing is fixed, and the outer bearing is free to rotate, so we can connect the water source to the inner circle of a bearing while the outer bearing is connected to the rotating pipe. The friction of a bearing is small, so it doesn't affect the force of a clockwork spring. We discussed that the bearing could rust as time goes. So we chose a waterproof bearing. As the name says, the bearing is water proof so we don't have to worry about the rusting problem. Although the price of the waterproof bearing is higher, but it could ensure our product's quality.

Our project involved a lot of joints between different materials. So usage of silicone sealant is necessary. This joining way can make sure the joints are strong, and its flexibility allows it to absorb forces and hold for longer time.

Because of some design problem and misunderstanding, we only started our design a few weeks after the semester starts. Which makes our design rough and lack of beauty. There would be some design and mechanic problem for sure. But we believe we could and we will solve it perfectly and complete the product in time.

## CONCLUSION

Although public toilets are developed by time few people are still uncivilized to return the water hose back to its place/hanger after use. So with the help of our Clockwork Spring Water Hose, Water hose in public toilets can get back automatically after use. This controls the quality and minimizes the damage done to the water hose in public toilets as well comfort the users.

As conclusion, although we met a lot of problem but with our knowledge we solved them pretty easily. And also, through our survey, we found that a lot of people need this new invention to improve their life quality. That is also the motivation that keep us going. We believed that this product could help a lot of people. The design might be insufficient but It will improve through time. We won't know how it works until we really build it out. Keeping a positive attitude, everything will go well

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