



**FINAL REPORT**  
**FINAL YEAR PROJECT 2**

**SDm CLEANING MACHINE**  
**(SCUPPER DRAIN MAINTENANCE CLEANING MACHINE)**

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**CERTIFICATE OF AUTHENTICITY**  
**SDm CLEANING MACHINE**

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2. We accept that the "Project above" and the intellectual property it contains are the result of my unique effort or innovation, free from appropriation or plagiarism of the ideas of others.

3. In order to satisfy the requirements for the Diploma in Civil Engineering to be granted to me, we agree to transfer ownership of the intellectual property of "The Project" to "The Polytechnic."

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## **APPRECIATION**

Sincere appreciation to TUAN HAJI JASNI BIN MOHD NOOR as the supervisor for our final year project. Because, always give good guidance throughout the study. And gave us a lot of knowledge throughout our studies.

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## **ABSTRACT**

Roads are the principal conduit for trade, industry, agriculture, and other forms of transportation as well as an essential means of communication between locations. Built roads require adequate maintenance to increase their lifespan and guarantee user comfort. The upkeep of road curbs and side-of-the-road drainage alleys is the subject of the study that was done. One of the frequent issues is standing water on the road's surface because of blocked drainage holes. This is because it has accumulated debris, dead leaves, and sand, all of which prevent water from flowing to the main drain. The old approach of using hands and brooms and a lot of labour is still used today to maintain road dams and drainage ditches. The problem statement led to an innovation to create and produce a tool called the SDm machine that can assist in addressing the issue of maintenance and cleaning of road bumps and drainage ditches effectively and efficiently. On roads near Shah Alam, workability testing of SDe machine products were carried out with an emphasis on the upkeep and cleaning of road bumps and drainage alleys. When the two maintenance approaches were compared, it was found that the SDe machine had a short maintenance time of 4 minutes per drain erong as opposed to the traditional method's 10 minutes. In conclusion, this SDm machine is very effective and suited for use in more systematic road repair operations, which also saves time and energy.

**KEYWORDS :** Maintenance of road dams, drainage ledges, and SDm equipment.

# ABSTRAK

Jalan raya adalah saluran utama untuk perdagangan, perindustrian, pertanian, dan bentuk pengangkutan lain serta alat komunikasi penting antara lokasi. Jalan yang dibina memerlukan penyelenggaraan yang mencukupi untuk meningkatkan jangka hayatnya dan menjamin keselesaan pengguna. Penyelenggaraan benteng jalan dan lorong saluran tepi jalan menjadi subjek kajian yang telah dilakukan. Salah satu isu yang kerap berlaku ialah air bertakung di permukaan jalan kerana lubang saluran tersumbat. Ini kerana ia telah terkumpul serpihan, daun mati, dan pasir, yang semuanya menghalang air daripada mengalir ke longkang utama. Pendekatan lama menggunakan tangan dan penyapu dan banyak buruh masih digunakan hari ini untuk menyelenggara empangan jalan dan parit saluran. Penyataan masalah membawa kepada inovasi untuk mencipta dan menghasilkan alat yang dipanggil mesin SDm yang boleh membantu dalam menangani isu penyelenggaraan dan pembersihan bonggol jalan dan parit saluran dengan berkesan dan cekap. Di jalan raya berhampiran Shah Alam, ujian kebolehkeraan produk mesin SDe telah dijalankan dengan penekanan pada penyelenggaraan dan pembersihan bonggol jalan dan lorong saluran. Apabila kedua-dua pendekatan penyelenggaraan itu dibandingkan, didapati mesin SDe mempunyai masa penyelenggaraan yang singkat iaitu 4 minit setiap erong longkang berbanding 10 minit kaedah tradisional. Kesimpulannya, mesin SDm ini sangat berkesan dan sesuai digunakan dalam operasi pembaikan jalan yang lebih sistematik, yang juga menjimatkan masa dan tenaga.

**KATA KUNCI :** Penyelenggaraan empangan jalan, tebing saluran dan peralatan SDm adalah penting.

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# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

In Malaysia, the demand for roads has increased quickly to suit consumer demands. The quality of road construction has occasionally been improved through technological advancements in order to give comfort and guarantee user safety. Every road that is constructed must have a reliable drainage system to allow water to move from the road to the main drain. A drainage ledge that is installed on the inside of the road curb is one of the drainage systems that must be offered. This road barrier serves as both a pedestrian walkway and a drainage system for the road. Routine drainage maintenance is necessary, and the tasks that need to be completed include clearing away trash, tree twigs, leaves, and other debris. When roads are reclaimed without considering the hole element, drainage holes will also become plugged. Rainwater will pool on the road if this drain hole is blocked since there is nowhere for it to flow. The road will suffer damage as a result of this phenomenon, which will also shorten the road's life and weaken it. The neighbourhood may also flood as a result of clogged drainage holes, disrupting the daily routines of the locals.



## **1.2 RESEARCH BACKGROUND**

As is true of other drainage or pumping structures (including relief wells), drainage systems serving dams are rendered less effective by a range of natural mechanisms, including geochemical incrustation and biological fouling. Like other U.S. state and federal agencies, the Bureau of Reclamation (Reclamation) has an inventory of aging dams to manage and maintain. Reclamation has documented clogging in drainage structures that has the potential to reduce drainage function in some structures. Clogging has resulted in changes in hydraulic head profiles and resulted in the need for drain cleaning and replacement. This paper summarizes the available body of recent work related to dam drain clogging and reviews the findings of recent research and demonstration work defining clogging mechanisms and their practical mitigation to improve dam maintenance procedures.

### **1.3 PROBLEM STATEMENT**

Maintenance of road curbs and drainage ditches should be done according to the set time intervals. The Public Works Department (JKR) and the Local Authority (PBT) have prepared a work manual for the maintenance of road curbs and drainage ditches, namely:

- a. Road maintenance work is done 'manually' and no machines are used.
- b. A clogged Scupper Drain will cause water to stagnate and reduce the strength and lifespan of the road.
- c. Causes potholes and cracks.
- d. JKR and PBT have not yet established scupper drain maintenance.

Through observation and study, it was found that the maintenance work of the road and drainage ledge is done traditionally, that is, if it is clogged with leaves and rubbish, the maintenance is using a broom only and if the drainage ditch is clogged due to new paving work, the maintenance is using a hammer and a chisel made by two workers. This work will be time consuming and labor intensive as only manual techniques are used by the workers. Currently, there are no specific machines for the maintenance work of road curbs and drainage alleys.



**Figure 1: Scupper Drain clogged by leaves and rubbish**



**Figure 2: Scupper Drain clogged by new road paving**



**Figure 3: Stagnant water due to clogged drainage**

## **1.4 PROJECT OBJECTIVE**

### **Objective of project :**

- a. Designing SDe for maintenance work on road curbs and drainage alleys.
- b. Test the workability of SDe in carrying out maintenance work on road curbs and drainage alleys.
- c. Comparing the effectiveness of the use of SDe and conventional methods in the maintenance work of road dams and drainage alleys.

In a matter there must be a mission or goal to be achieved by the perpetrator or creator of a study. The main objective for the project we want to create is to introduce to the community about the application of SDm Cleaning Machine in helping the contractor and maintenance worker especially civil engineering in solving the Clogged Scupper Drain at the walkway As we all know, our goal is to help the industry in terms of excellence maintenance work. This matter should not be underestimated because it will burden the contractors and maintenance workers when faced with working situations in this industry.

## 1.5 PROJECT QUESTION

The questions in our study/project are based on what, who, when and how.

- i. What is the significant use of SDm?
- ii. Does working to use the SDm save time?
- iii. Is it true that utilising the SDm makes maintenance works easier for workers?
- iv. What are the barriers that occur when not using the SDm?
- v. What materials are used to produce SDm?

**1.6 SCOPE O F PROJECT**

a.Lawn Mower Machine



b.Hard Steel Brush Broom



c.Scupper Drain



## **1.7 DEFINITION OF TERMS**

### **Scupper Drain**

an opening cut through the bulwarks of a ship so that water falling on deck may flow overboard.

or

an opening in the wall of a building through which water can drain from a floor or flat roof

### **Maintenance Work**

Maintenance work means the repair of existing facilities when the size, type or extent of such facilities is not thereby changed or increased. While “maintenance” includes painting and decorating and is covered under the law, it does not include work such as routine landscape maintenance or janitorial services.

### **Cleaning**

Cleaning is the process of removing unwanted substances, such as dirt, infectious agents, and other impurities, from an object or environment. Cleaning is often performed for aesthetic, hygienic, functional, environmental, or safety purposes. Cleaning occurs in many different contexts, and uses many different methods. Several occupations are devoted to cleaning.

## **Machine**

A machine is a physical system using power to apply forces and control movement to perform an action. The term is commonly applied to artificial devices, such as those employing engines or motors, but also to natural biological macromolecules, such as molecular machines. Machines can be driven by animals and people, by natural forces such as wind and water, and by chemical, thermal, or electrical power, and include a system of mechanisms that shape the actuator input to achieve a specific application of output forces and movement. They can also include computers and sensors that monitor performance and plan movement, often called mechanical systems.

Renaissance natural philosophers identified six simple machines which were the elementary devices that put a load into motion, and calculated the ratio of output force to input force, known today as mechanical advantage.

Modern machines are complex systems that consist of structural elements, mechanisms and control components and include interfaces for convenient use. Examples include: a wide range of vehicles, such as trains, automobiles, boats and airplanes; appliances in the home and office, including computers, building air handling and water handling systems; as well as farm machinery, machine tools and factory automation systems and robots.



## **1.9 SUMMARY**

The summary of chapter 1 discusses the introduction and description of the product or project that will be carried out by our group to complete the Final Year Project (FYP) this year which is a maintenance work -based cleaning machine that is SDm CLEANING MACHINE. This machine is created by using a few special parts such as steel brushes and hard rod. The main problem that inspired us to create this machine is the problems faced by maintenance workers in cleaning Scupper Drain near the roadside. Therefore, the main objective of our project is to solve the problem, that is, to help maintenance workers to clean the Scupper Drain easily and quickly. With this SDm Cleaning Machine can help contractors and maintenance workers, especially civil engineering in improving routine maintenance works with the improvement of technology in this age.

## **CHAPTER 2: LITERATURE REVIEW**

### **2.1 Introduction**

A thorough summary of earlier studies on a given topic is a literature review. Research journals, books, and other resources that are pertinent to a particular study topic are examined in the literature review. In the review, this previous research should be listed, discussed, summed up, and clarified. It ought to offer the study's theoretical underpinnings and help you choose the study's parameters. The literature review acknowledges the contributions of prior researchers, giving the reader confidence in the thoroughness of your work. When a previous study in the field is acknowledged, it is assumed that the author has read, assessed, and incorporated that study into the current work.

## 2.2 Definition of Cleaning

One of the main output of this initial requirements' evaluation process has been the consolidation of a reference high-level system architecture, which has been defined also in order to pave the way for the future cooperative ITS that are going to be largely deployed in the coming years, and that are currently under investigation in this domain in project initiatives like WiSafeCar [6] and CoMoSeF [7] or within the Road Weather Connected Vehicle Applications coordinated by the US Department of Transportation – Research and Innovative Technology Administration. The CLEAN-ROADS system concept, presented in Figure 4, is based on the idea to introduce a full chain among the multiple sources that are in the conditions to gather various road weather measurements (and not only, i.e. environmental data), the MDSS in which most of the validation, elaboration and prediction analysis are computed, and the Advanced Traveler Information System (ATIS) which is capable to distribute relevant road weather information through multiple information channels. As far as the environmental impact is concerned, the focus of the project is mainly on two matrix: (i) air quality, which is going to be assessed through roadside air quality measurements, and (ii) aquatic systems, which is going to be investigated through specific evaluation of the salinity concentration of run-off waters. By putting these measurements in direct relationship with the salting treatments, it will be possible to quantitatively assess the consequences of those actions on the road environment (TIS innovation park, Via Siemens 19, 39100 Bolzano – Italy)

- **technological innovation**, through the introduction and validation of an integrated Road Weather Information System (RWIS) and a MDSS capable to automatically provide user-friendly recommendations, information and alerts to road operators about the current and forecasted road weather situation;

- **organizational innovation**, aimed at improving the current winter road management organizational structure; in particular the intention is to refine and to better codify the existing procedures on the base of the specific decisions that can be determined on top of the outputs coming from the MDSS, and that aim to guarantee at least the today's winter road safety levels

through a more efficient use of road maintenance resources and a clearly demonstrated environmental improvement;

□ **social innovation**, through an intense cooperation with the target audience, to be intended not only in terms of road operators belonging at various levels to the road management staff, but also of local roadtravellers, who have already shown very high requirements and expectations in this field but are on the contrary the first responsible of many situations of inefficiency that may be observable on the local roads during the winter season (Famas System S.p.A, Via degli Artigiani Sud 19, 39040 Egna (Bolzano) – Italy)

This analysis of street and storm drain cleaning practices draws on complex terminology used by the scientific and practitioner communities. To assist the reader, the panel agreed to the following definitions to maintain consistency throughout the report.

**Street Sweeping vs. Street Cleaning:** Both terms are used interchangeably in the literature to describe the use of sweepers to pick up solids off the street surface. In the context of this report, street sweeping is used to denote the more historic approach to the practice (i.e., use of mechanical broom sweepers to improve street aesthetics and safety). The term "street cleaning" refers to the use of advanced sweeper technologies to improve water quality (Sebastian Donner, Bill Frost, Norm Goulet, Marty Hurd)

## 2.3 Cleaning Classification

**Dry Leaves** - Environmental pollution with metals and xenobiotics is a global problem, and the development of phytoremediation technologies for the plant-based clean-up of contaminated soils is therefore of significant interest. Phytoremediation technologies are currently available for only a small subset of pollution problems, such as arsenic. Arsenic removal employs naturally selected hyperaccumulator ferns, which accumulate very high concentrations of arsenic specifically in above-ground tissues. Elegant two-gene transgenic approaches have been designed for the development of mercury or arsenic phytoremediation technologies. In a plant that naturally hyperaccumulates zinc in leaves, approximately ten key metal homeostasis genes are expressed at very high levels. This outlines the extent of change in gene activities needed in the engineering of transgenic plants for soil clean-up. Further analysis and discovery of genes for phytoremediation will benefit from the recent development of segregating populations for a genetic analysis of naturally selected metal hyperaccumulation in plants, and from comprehensive ionomics data – multi-element concentration profiles from a large number of *Arabidopsis* mutants (S.P. McGrath et al. *Curr Opin Biotechnol*(2003) ).

**Branches** - Recently, traffic and pedestrian flow problems have attracted considerable attention [1], [2]. The pedestrian flow is closely connected with the traffic flow [3], [4], [5], [6], [7], [8], [9], [10]. Pedestrian flow is a kind of many-body system of strongly interacting persons. The traffic flow on a highway is typically one-dimensional but the pedestrian flow is two-dimensional. The pedestrian flow within a channel or underpass is closely connected to the granular flow. The granular flow within a hopper is similar to the pedestrian channel flow at a bottleneck [8].

A few models have been presented for simulating the pedestrian flow [4], [9]. The studies of the pedestrian flow are scarce compared with the traffic flow. It is important to know the properties of pedestrian flow in our life. It will be necessary to know the flow rate and the onset of clogging in the underpass. Frequently, it is observed that a clogging occurs at the junction of the T-shaped channel in the merging flow from the branch channel to the main channel. Until now, it is unknown how the flow rates depend on the inlet densities or under what conditions the clogging occurs.

The clogging problem of the merging pedestrian channel flow is similar to the traffic flow on a highway with on-ramp. In the traffic flow, it is well known that the increase of inflow from on-ramp into the highway induces the complex jamming transitions. It will be expected that a distinct clogging transition from the conventional pedestrian flow occurs in the merging pedestrian flow.

In this paper, we study the pedestrian flow under the open boundaries in a T-shaped channel where the branch flow joins the main flow at the junction. We simulate the pedestrian merging channel flow by the use of the lattice-gas model of biased random walkers. We show the dependence of flow rate on both inlet densities by varying the width of the branch channel. We find that the distinct clogging transition from the bottleneck flow occurs (D. Chowdhury et al. Phys. Rep.2000).

**Tree Roots** - Urbanization results in the conversion of pervious spaces to areas of impervious (paved) surface which creates numerous problems such as erosion, flash floods, pollution of rivers and hot island in city. A sustainable solution to this problem is to use permeable pavements which only began to find application in Australia recently. Permeable pavements can facilitate biodegradation of oils from cars and trucks, help rainwater infiltrate into soil, replenish groundwater, allow tree roots to breathe, and reduce flash flooding, but they have not been widely adopted in Australia due to concerns mainly over reduced structural capabilities and clogging. A research project is being carried out at USQ aiming at understanding the influence of pore structures features and particle deposition on clogging resistance and permeability reduction. Clogging is perceived as a major problem for any type of permeable pavement. Even with vigorous maintenance clogging is common. In the paper, some common types of clogging are discussed first, followed by the clogging effect on the performance of porous concrete mainly related to the change of the porosity and the pore structure properties. Testing methods for measuring porosity and hydraulic conductivity which include both physical testing and image analysis are reviewed in detail (Mishra, Krishna and Zhuge, Yan and Karunasena, Karu 2013).

**Sand** - Pervious concrete is an alternative paving surface that can be used to reduce the nonpoint source pollution effects of stormwater runoff from paved surfaces such as roadways and parking lots by allowing some of the rainfall to permeate into the ground below. This infiltration rate may be adversely affected by clogging of the system, particularly clogging or covering by sand in coastal areas. A theoretical relation was developed between the effective permeability of a sand-clogged pervious concrete block, the permeability of sand, and the porosity of the unclogged block. Permeabilities were then measured for Portland cement pervious concrete systems fully covered with extra fine sand in a flume using simulated rainfalls. The experimental results correlated well with the theoretical calculated permeability of the pervious concrete system for pervious concrete systems fully covered on the surface with sand. Two different slopes (2% and 10%) were used. Rainfall rates were simulated for the combination of direct rainfall (passive runoff) and for additional stormwater runoff from adjacent areas (active runoff). A typical pervious concrete block will allow water to pass through at flow rates greater than 0.2 cm/s and a typical extra fine sand will have a permeability of approximately 0.02 cm/s. The limit of the system with complete sand coverage resulted in an effective system permeability of approximately 0.004 cm/s which is similar to the rainfall intensity of a 30 min duration, 100-year frequency event in the southeastern United States. The results obtained are important in designing and evaluating pervious concrete as a paving surface within watershed management systems for controlling the quantity of runoff (October 2006, Liv M Haselbanch).

**Soil** - Nonwoven geotextiles have been used for drainage and filtration in geotechnical engineering works for many years. Concerns related to drainage capacity and clogging potential still remain as factors that restrain a broader use of geotextiles for drainage systems, particularly in major engineering projects. This paper presents the test results of the hydraulic characteristics of partially clogged geotextiles under pressure. Partial clogging can occur during spreading and compaction of soil on geotextiles or throughout the service life of the drainage system. Geotextile specimens, artificially clogged in the laboratory and exhumed from actual field works, were tested to assess their normal and longitudinal permeabilities under different levels of soil impregnation and normal stresses. The results obtained showed that partial clogging significantly influenced the mechanical and hydraulic characteristics of nonwoven geotextiles and that soil impregnation was not necessarily detrimental to the geotextile longitudinal permeability under stress. Comparisons of test and predicted results, confirmed that the expression reported by Giroud in 1996 is a useful tool for the prediction of nonwoven geotextile permeabilities under virgin and soil impregnated conditions. Data on the impregnation levels of geotextile specimens exhumed from actual field works are also presented and discussed (D.T. Bergado, R. Manivannan, A.S. Balasubramaniam 1 Jan 1996 ).



## **2.4 Drain Maintenance Cleaning**

In this research paper the proposed concept is to replace the manual work in drainage cleaning by mechanical drain cleaner. Now-a-days even though mechanical drainage plays a vital role in all industrial applications in the proper disposal of sewages from industries and commercials are still a challenging task. Drainage pipes are using for the disposal and unfortunately sometimes there may be loss of human life while cleaning the blockages in the drainage system. To overcome this problem and to save human life we implement a design “mechanical semi-automatic drainage water cleaner” and we designed our project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages. The Drainage system cleaner is a machine which helps to protect the environment from different kinds of environmental hazards through the promotion waste management by the removal of garbage from the drainage system. These wastes when not removed end up settling in residential places where these wastes are burnt thereby causing climate change otherwise these wastes block the drainage systems thereby causing flooding (Ganesh U L, July 2016).

Water is a basic necessity of humans and all living beings. There is a plenty of water on earth but that is not suitable for human use. Clean water is more important if used for some purpose. The impurities present in water can cause hazardous and disease. As long as the draining system is considered the function of the main drainage system is to collect, transport and dispose of the water through an outfall or outlet. Impurities in drainage water can be only like empty bottles, polythene bags, papers.....etc. These impurities present in drainage water can cause blockage or the drainage system. The drainage system can be cleaned time to time manually or such a system can be designed that will automatically throw out wastages and will keep the water clean. This project is designed to keep clean the drainage system and helps the smooth working of the system. This project automatically cleans the water in the drainage system each time any wastage appears and this form an efficient and easy way of cleaning the drainagesystem and preventing the blockage. It also reduces labour and improves the quality of water that is cleaned. If the garbage are allowed to flow the will end up flowing down to recreational beaches used for tourism purposes making a scene not pleasurable to the eyes else these garbage flow to residential sites where they are burnt in a way of getting ridof them, thereby causing climate change. The drainage systems are cleaned when there is no water in them i.e. when it is not raining, but when it is raining the drainage systems cannot be cleaned because of the harsh conditions of the rain which no one would volunteer to endure toensure garbage does not enter into the drainage systems (Ganesh U L,July 2016)

## 2.5.1 Factors Influencing Machine In Maintenance

The treatment system of drainage Waste water control

by the motor, roller chain and sprocket, lifter and the

collecting bin to achieve semi-automatic control of

sewage waste water treatment. (Ganesh U L,July 2016)

Drainage from industries is treated through this project

to meet the national emission standards, with stable

operation, low cost and good effect.

Drainage wastewater control is treated by this method to

irrigate plants, clean toilets, etc. (Ganesh U L,July 2016)

The cleaner functioned move effectively during the

heavier rains which had more volume of running water

with garbage and high velocity. (Ganesh U L,July 2016)

### **2.5.1.1 Features of the Devices**

Features of the devices were further subcategorized into three aspects, namely: usability, technical and functional (Economides and Nikolaou, n.d.).

In the past and even until now, cutting of grasses in the schools, sports tracks, fields, industries, hotels, public center, etc. was done with a cutlass. This method of manual cutting is time consuming because human effort is needed for the cutting. Also inaccuracy in cutting level was observed using the manual cutting method. This work deals with the cutting of verdant (shrubs, stubborn, grass, flowers, leaves of trees) and also with the design of the machine, its efficiency, rigidity, mode of operation and the selection of materials. The design gives a greater degree of flexible mobility and interchangeability. The aim of this work includes, but not limited to the following:

- To reduce labour input in the cutting of not only weeds or grass but also in the trimming of flowers and trees.
- To reduce cost, time of cutting and also to beautify the environment.

### **2.5.1.2 Usability**

From the usability aspect, machine tools are flexible, light, and portable (Ahonen, Pehkonen, Syvanen and Turunen, 2004; Cavus and Ibrahim, 2009). These features make the persons feel at ease as working is no longer constraints. Such freedom makes the process of transmitting knowledge becomes flexible and can be carried out anytime and everywhere.

### **2.5.1.3 Functional**

Functional Abstract Machine (Fam) is a stack machine designed to support functional languages on large address space computers. It can be considered a SECD machine [1] which has been optimized to allow very fast function application and the use of true stacks (as opposed to linked lists). The machine qualifies to be called functional because it supports functional objects (closures, which are dynamically allocated and garbage collected), and aims to make function application as fast as, say, taking the head of a list. All the optimization and support techniques which make application slower are strictly avoided, while tail re-cursion and pattern-matching calls are supported. Restricted side effects and arrays are provided, but they are less efficient than one might expect. Moreover the performance of the proposed garbage collector deteriorates in the presence of large numbers of updatable objects. The machine is intended to make compilation from high level languages easy and regular, by providing a rich and powerful set of operations and an open-ended collection of data types. This richness of types can also facilitate portability, because every type can be independently implemented in different ways. However the number of machine instructions tends to be high, and in general there is little concern for minimality. The instructions of the machine are not supposed to be interpreted, but assembled into machine code and then executed. This explains why no optimized special-case operations are provided; special cases can be easily detected at assembly time. For efficiency considerations, the abstract machine is not supposed to perform runtime type checking (even if a hardware implementation of it might), and hence it is not type-safe. Moreover, as a matter of principle, there is no primitive to test the type of an object; the correct application of machine operations should be guaranteed by typechecking in the source language. Where needed, the effect of run-time typechecking can be achieved by the use of variant (i.e. tagged) data types (Bell Laboratories Murray Hill, New Jersey 07974).

## **2.6. Pedagogical Advantage**

The researchers highlighted some empirical studies that have proven mobile devices can support the pedagogical approaches or strategies below.

## **2.3 Summary of Chapter**

In conclusion, this chapter reviews previous studies on cleaning the use of machine effectively. The search for this past study aims to be the inspiration to develop a machine for maintenance work. At the same time, contractors and workers will thrive in terms of changes in the technological of new innovation . Thus, this literature review is complete about the authentic sources of the study sought through the article.

## **CHAPTER 3**

### **METHODOLOGY / DESIGN**

#### **3.1 INTRODUCTION**

In creating something must meet the criteria and the right ways to get the desired and satisfactory results. This is because, without using the right materials and methods will have a detrimental effect on the end result of the project and will make the project deflected as a failure. Albert Einstein once said ‘do something thoughtfully and carefully, because people who are not careful always end in failure’. So, in this chapter 3 we will explain in more depth and precisely about the framework and methodology to produce this STRUCDEE mobile application. In addition, we will also describe the methods we used to collect the data and information that will be used to produce this project.

### **3.2 DESIGN PROJECT**

The study was conducted in stages, starting with the collection of information. Our study began by examining and analyzing the current situation and views of students about the learning they face with a somewhat different environment from before that is online learning sessions. The study was also conducted by collecting and reviewing the projects that have been produced with the goal of Maintenance Work to produce new ideas that are better and effective in addressing problems that could not be curbed by previous studies. The purpose of our study is none other than to introduce SDm Cleaning Machine for use by maintenance workers in improving the effectiveness of technology.

Survey methods were also used in this study. This is because, this method is able to collect a lot of information and has been used by many researchers before. apart from surveys, our group also used other methods such as interviews and so on.



### **3.2.1 PROJECT PRODUCTION METHOD**

To produce this product, we will use tools made specifically to create this machine. The tools used are definitely brushes and rod that have the appropriate specs to be used in designing cleaning tools. The use of strength brushes will give problems in the use of heavy loads. Thus will cause damage to the brushes.

In addition, we will also find specialist welder to design this SDm Cleaning Machine. This is because, we trusted the welder can build and make our machine as we have designed. Therefore, we also agree to give trusts on this welder to ensure the success of our products. We will design the basics needed to the machine by way, online video using youtube and many more platforms because at POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH there is no specific study on designing this machine.

### **3.2.2 DATA COLLECTION**

In a study should have data that needs to be collected to study the problem and determine the objectives and solutions to the problem. In this study, we use two methods to help us in collecting analysis and we also use literature review method where we collect information based on previous studies .

### **3.2.2.1 LITERATURE REVIEW**

In the previous chapter 2 we have described about the previous research articles relevant to our study.

### **3.2.3 MATERIALS AND EQUIPMENT**

In this sub-topic we will explain about the tools we use to produce our products. To produce this SDm CLEANING MACHINE product, we use selected tool for build and make our machine which are steel brushes and hard rod. And also about Scupper Drain.

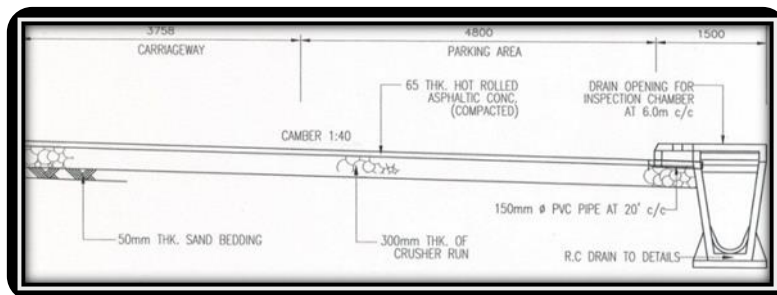
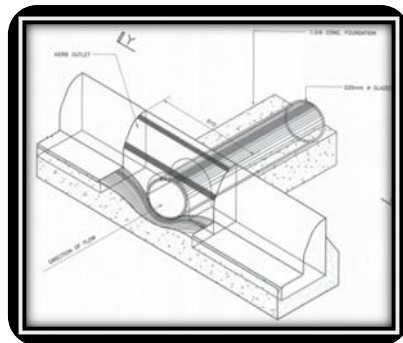
#### **3.2.3.1 Steel Brush/Wire Brush**

A wire brush is a device consisting of many small diameter pieces of metal packed together very closely that is used to clean a material's surface. The small metal pieces are rubbed across a material's surface either manually or by mechanical means. Brushing removes undesirable substances from the surface of the material.



### 3.2.3.2 Scupper Drain

A drainage system called a scupper drain directs water from the road to the main drain. The drainage system crosses beneath the road embankment. The depth varies depending on how the road is shaped and the length ranges from 0.6 to 1.0 metres. The gradient is between 4 and 6 percent, and there are between 15 metres between each drainage channel. There is no systematic way for maintaining drains; instead, manual labour and human force are used.



### 3.2.4 METHODS OF DATA ANALYSIS

once the project is completed we will perform data collection by performing a comparison test between the use of manual method and the use of this SDm CLEANING MACHINE.

The data we have collected will be analyzed and displayed in the form of a mean data scheduled . This is because, with mean data scheduled display it will be easier for us to analyze the data and understand the data that has been collected.

Place	Time of cleaning one Scupper Drain (Manuall) (minutes)			Average (minutes)	Time of cleaning one Scupper Drain (SDm) (minutes)			Average (minutes)
	i	ii	iii		i	ii	ii	
Jalan Opera G	12	9	10	10	4	4	3	4
Jalan Taman TTDI Jaya	8	10	10	9	3	2	4	3
Pangsapuri Jaya, Taman TTDI Jaya	10	12	10	11	3	4	5	4
	<b>Average</b>			<b>10</b>	<b>Average</b>			<b>4</b>

As a result of testing the use of the SDm Cleaning Machine, some conclusions have been drawn. From initial observations, Jalan Opera G is a road that has been built for a long time and the tested location is a road close to the parking area. Drainage holes in the area have been covered with materials such as soil, stones and rubbish. Three blocked drain holes were dug using manual methods and recorded an average working time of 10 minutes per hole. While three more holes in the same area were drilled using an SDm Cleaning Machine and recorded an average of 4 minutes per hole. Before the cleaning work was carried out, the drainage hole was almost covered by soil and dry leaves but after cleaning, the drainage hole was opened to a width of 11cm.

Jalan Taman TTDI Jaya is an old road that has just been paved and is a road inside a housing estate. There are many drain holes that are blocked as a result of the road's new pavement works. The recorded time for cleaning manually is an average of 9 minutes for one hole, while with the use of the SDm Cleaning Machine, an average of 3 minutes has been recorded for cleaning one hole.

Pangsapuri Jaya, Taman TTDI. The road is quite busy due to its location near the houses area. For cleaning using manual methods in the area, an average of 11 minutes was recorded for one hole, while with the use of the SDm Cleaning Machine, an average of 4 minutes was recorded for cleaning one hole.

### **3.2.5 DISCUSSION**

The results of a test comparing the time required to dredge the drainage ditch using the SDm Cleaning Machine and the conventional approach revealed substantial differences. The material used to fill the drainage trough hole contributes to the variation in the drainage trough hole digging time statistics between these three roadways. Because the drain hole at Jalan Opera G been filled with chunks of rock and hard dirt, traditional cleaning takes much longer than using SDm equipment. When comparing Jalan TTDI Jaya to Pangsapuri Jaya, Taman TTDI Jaya, where the garbages is relatively thick, it can be seen that the drainage ditch has been covered by some dry leaves,branches and tree roots. These three roads were picked to demonstrate how this SDm machine may be utilised for cleaning work that can save money and time the garbages that covers the drain hole.

### **3.3 SUMMARY**

The inference drawn from this is that the SDm Cleaning Machine has been effectively created by the modification of a lawn mower, and that its employment in road maintenance tasks, particularly for damming roads and drainage ditches, is very effective and efficient. The results of the use test have shown that this SDm Cleaning Machine has been able to reduce the maintenance time of the drainage trough, where it would typically take 10 minutes for one drainage trough to be completed conventionally. While the repair of one drain took the SDm Cleaning Machine on average 4 minutes to complete. One person will be required instead of two when using the SDm Cleaning Machine to do the maintenance tasks on the drains, as opposed to the usual method that calls for two workers. One can get the conclusion that the SDm Cleaning Machine can perform systematic maintenance work while also saving time and labour.

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