CHAPTER I
INTRODUCTION

I.1 Background

Urbanisation and growing population always concerns on economic, health, environmental, education and transportation issues. These topics are keys role in sustainable development. Transportation as one of the key stone in sustainable development attract many researchers to find the best way to reduce the energy consumption. Public transportation is one of the solution to move people quicker and more efficient. The good system of public transportation attract people to move from private car or motorcycle into a transportation mode that can carry more people. It is also reduce the CO_2 in the air that will increase the society's quality of life. Mass Rapid Transit System (or usually we called it by railway transportation) is one of the mass transportation that comes as the solution of the public transportation issue. The development of the future railway network and the wise use of resources require that this network be utilized in an appropriate manner.

Energy consumption has become into the attention of the stakeholders. The less energy consumption leads to the less CO_2 produced by the power plant. It also spare more budget to the government (if the public transportation manage by the region company) so that they can use the money to build the rural area and attract more people to come and live in the city. It leads to a bigger tax collected by the government. The less energy consumption also leads to the "green transportation", while we are talking about the energy consumption on the system, the engineers will always associate this problem with the mechanical system of the itself. Let say the energy consumption is depend on the mechanical friction between the rolling stocks and the rail, the driver's habit and the running time between one station to another station. The energy consumption and the running times are a major concern for the stake holders, the railway company, the scheduler, and more over to the passengers. The shortest time to spend from one station to another station will be one of the reasons why the passengers would like to sit on the public transpotation. While for the railway company, the shortest running time will increase the energy consumption which is a cost and from that they will determine the ticket price for each passenger, the price itself will become one of the preference for the passengers, the railway company should find the balance point between the price and the number of the passengers. While for the stakeholders (ex: local government), they have to control the price (make a limitation) for taking care of the inflation and the transportation itself should be affordable.

The cheapest and efficient way to perform studies on the energy consumption and the running times of the is by doing a simulations. Therefore, it is very important to have an adequate data to calculate the energy consumption and the running time. The simulation itself will be based on the computer simulation because of the complexity of the model and the railway network. The accuracy of the simulation depends on the algorithm and the ability of this algorithm to be upgrade in the future for future research. The upgrade means that it should be very easy for the future researcher to try to control the parameter of the algorithm, for example the technological improvement such as aerodynamics, weight, rolling ressistance, engine efficiency or emission control can be readily incorporated into future calculations. The accuracy also depends on the input data into the simulation, for example the model, track and signaling data, data and particular running resistance data. It is also important to describe the driver behaviour and driving strategy in a systematic and realistic way.

This study will focus on the modeling and the driver behaviour. For the accuracy of the simulation, the author will include the running resistance, characteristic of the traction and braking, mechanical and electrical efficiency. A method for determining energy consumption, running times are proposed. Validated models for prediction of the energy consumption and running time simulations are developed, and used to study some basic driver behaviour by means of simulations.

I.2 Research Project

This research project start from evaluating the current system. The efficiency and effectiveness of the will be the first area in evaluating the current system because it determines the service quality and the movement of the people that related to the energy consumption. This research project evaluating all the factors that related to the energy consumption of the train like mechanical movement, batteries, pantograph, braking resistor, the regenerative braking system of the train and the aerodynamic aspect. All of the factors will be include in the research to determine how does the system works. For example, the applied battery has the corelation with the mass of the train that corelate to the force needed to push the train to accelerate. It is finally related to the energy consumed to push the train. The batteries itself also has the corelation with the regenerative braking system to determine how much the energy that could be save to by this system to accelerate the train for the next station. The battery also has the correlation to the ability for the train to move in several area like a preserved area (old town) because this area usually has the law that regulate for not putting or construct any cables. It is finally determine the long of inter-station, the longest distance of inter-station will reduce the energy consumption because it will cut the energy needed to accelerate the train.

I.3 Intellectual Challange

Most of the research comes with the idea of reducing the energy by improving the kinetic energy recovery system which is known as the regenerative braking. The idea is to

save the energy by the by converting the kinetic energy into the electric. On the conventional method, the excess energy of the braking is convert into the form of the heat by friction. In the train application, the mechanical braking of the convert into electrical energy and feed it back into the catenary or the third rail. This energy can be only use if there are in the neighborhood of the braking vehicle simultaneously others with high energy demand.

I.4 Research Objectives

There are three objectives for this research, i.e.:

1. To know the current train performance system.
2. To identify element that contribute to the energy consumption of the train.
3. To know the performance and the traveling time that could be reduced with the proposed approach.
4. Create a software that use theorical model to easily investigate the energy consumption.

I.5 Steps of Research

Therea are three steps for this research, which are:

1. Collecting Data

    On this part, the researcher collecting the data that will be used for the simulation. The data that will be required for this research are weight of the train, path of the train, the length of the interstation railway, a control strategy, traction of the train, velocity of the train, braking force of the train, pantograph, catenary, A/D – converter, circuit breaker, commuter rail, disconnector, direct

current, material of the rail, etc.
2. Processing Data

    The data will be processed with Microsoft Excel, MatLAB, and Toaster System.
3. Verification of the proposed approach

    The verification of the proposed approach is to identify whether the proposed has reduced the energy consumption or not.

I.6 Scope and Limitations

There are several assumptions of this research, which are:

1. No measurement of voltage and current are performed on individual trains, as the interesting part to investigate is the rectifying stations.
2. The current measurement is performed on the negative cable returning the current from the track. By measuring the returning current instead of the output of the current, a negligible measurement error is introduced.

There are several limitation of this reasearch, which are:

1. No measurement of the energy consumption of the heater, air-conditioning, and light applied on the train.
2. This research doesn't include the assessment of the proposed approach control strategy.
3. This proposed approach of this research is only focus on the control strategy while in the planning

systems, we can try to simulate the traffic condition of each track in each inter-station.

I.7 The Advantages

The research could give advantages to both the researcher and the company. There are some advantages from this research which are:

I.7.1 The Advantages for the Researcher

There are several advantages that could be gained from this research for the researcher, which are:

1. The researcher could apply the knowledge of engineering in order to participate in urban and regional planning.
2. The researcher could know how to identify element that contribute to the energy consumption of the train.
3. The researcher could know how to minimalize energy consumption of the train that leads to green transportation.
4. The researcher could know what is the main problem in the railway network systems.

I.7.2 The Advantages for the Company

There are several advantages that could be gained from this research for the company, which are:

1. The company can know the way to minimalize the energy consumption.
2. The company can reduce the energy cost that could lead to a higher profit.

3. The company can increase passengers satisfaction by reducing the travelling time of the train.

I.8 Research Methodologies

The methodology in this research could be examine by several steps, which are:

I. Problem Identification

In this phase, the researcher doing problem identification according to the topic that has been choosed.

II. Problems Limitation

To keep focus on the issues, the researcher determined some limitations according to the problems.

III. Data Retrieval and Data Calibration

In this phase, the researcher go directly to the company that runs the train in each cities and ask for the data that will be used to conduct this research. There are several data that can be obtained on the website of the company as well.

IV. Analysis

In this phase, the researcher is going to do analysis to all steps starting from the data that has been obtained. Analysis for the calibration of the data.

V. Conclusion and Recommendataion

This step is the final step to conclude the data analysis that has been made previously and the give advice as an input to the company for further research and development.

I.9 Systematic of Writing

The preparation of this research is made in a systematic way so that it could be easily understood in its presentation. Systematic study is made as follows:

CHAPTER I: INTRODUCTION

Chapter I provides the background issues, identification and formulation of the problem, assumptions and limitations issue, the purpose of the research, the benefits of the research, research methodologies and the systematic of writing. In this chapter, the author explains the reasons for the selection of topics, find out the purpose and benefits of the selection of topics, as well as the author knows how to solve the problem based on a topic that is taken.

CHAPTER II: LITERATURE REVIEW

Chapter II contains concepts that can be used as the theoretical foundation for the author in making this reserch. This chapter contains the general knowledge about the modeling, railway system, mechanical, and simulation. With the existence of this chapter is expected to assist in resolving issues that have been formulated. This chapter will also lead in determining the steps performed in obtaining and improved proposal.

CHAPTER III: COLLECTING AND PROCESSING DATA

Chapter III contains the processing of data, testing data, the present system modeling, and modeling the proposed system to be able to answer the problem.

CHAPTER IV: ANALYSIS

Chapter IV contains the analysis of the data collection, analysis of data processing, analysis of the present system modeling, and analaysis of the propose model.

CHAPTER V: CONCLUSIONS AND RECOMMENDATIONS

Chapter V contains the conclusions derived from the research that was done, the advice is addressed to the company for further research and development.