**The Simulation of Queuing Model for Bangkok Rapid Transit Train Ticket System Using Python**

***Abstract*-**This paper proposes the simulation model for ticket system of Bangkok rapid transit train. The proposed analysis model is applied by using queuing theory to analyze main queuing delay problem rapid transit train ticket machines. This analysis model has been developed by using python programming language to create software tool for analyzing the existing ticket system comparing with the desire variable condition or redesign the ticket system. Since, proposed software tool use for analyze the effect of existing ticket system by modification to visualize the queuing, delay time, waiting time and etc. The software tool with the simulation model can visualize the 2D animation results and graph for analyzation. The proposed analysis model could be used to any rapid transit train ticket system for impact analysis own existing ticket system.

***Existing system-***Bangkok is the capital of Thailand and has a population near to ten Million in 2019. Like all other large cities in the world, road traffic congestion is a common and very serious problem. The government of Thailand came to realize that mass rapid transit is necessary to serve as a public transportation system for moving passengers, thereby reducing road congestion. It was not until 19 November 1996, just before the Thailand economic crisis in 1997, the construction of a massive rapid transit system in Bangkok commenced which spans over 19.8 kilometer, covering 18 stations from Bang Sue to Hua Lamphong. After several delays, on 3 July 2004 the line was officially opened. Over the last decades, the number of passengers using mass rapid transit is increasing so significantly that more construction of mass rapid transit lines soon follow using underground, elevated or surface trains. At present, mass rapid transit in Bangkok consists of three networks, the Bangkok Mass Transit System (BTS), the Metropolitan Rapid Transit (MRT) and the Airport Rail Link (ARL). According to the statistics in 2017, this Chaloem Ratchamongkhon (Blue) line carries more than 360,000 passengers daily. This huge number of passengers has indeed caused negative impact on the ticketing system at each station. At peak hours, passengers face difficulties in purchasing ticket due to inadequate ticket machines resulting long queueing delay. This causes unsatisfaction particularly among tourist travelers. In response to this problem, applied some basic queueing model to approximately analyze and able to roughly identify the main causes of delay. An analysis model or simulation model of the ticket machine was proposed. They discuss issues that focus on specific criteria in each country. In this paper, we propose to develop a more accurate simulation model that incorporates actual traffic data from major stations during peak hours. While collecting real traffic, we observe that congested and long queues can build up at the entrance/exit gates between the ticket system and the trains. Therefore, this nontrivial observation has been included in to our simulation model to achieve more realistic investigation. The proposed simulation model has been implemented in python and extensively tested with real traffic data. Our developed software tool provides graphical visualization for the queuing analysis with 2D Graph and animation. Which includes ***Average waiting time of 35.78 .***

**Disadvantage**

The existing system consist of many disadvantages for which passengers are facing time and cost efforts which includes-

* More waiting time for a passengers who are arriving in peak time.
* From the simulation we have analysed that existing system taking more service time for individual passenger.
* Meanwhile existing system is more costlier and time consuming for both BTS and their passangers.

**Proposed system:**

The proposed analysis model can be used to evaluate the service time of railway companies, which enables for the operators to form a proper policy and decide on different ticket system operations based on cost requirements. The proposed simulation model has been implemented in python software tool for analyzing the effect time delay of queues or average waiting time for passengers by comparing ticket existing system and desire modification system. Since, the proposed simulation of queuing model presents the results to show the impact of time delay in queue of passengers when ticket machines are modified by number or feature upgrading. The proposed analysis model could potentially be used to any rapid transit train ticket system for impact evaluation on the existing ticket system.

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**Advantages:**

The desired advantages of modified system includes-

* Less waiting time for a passengers who are arriving in peak time.
* Achieved increased service rate of ticket machine
* Passengers ofBangkok Rapid Transit Train are getting more tickets in less amount of time which will gradually increase the financial growth of railway.

**Modules:**

Queuing Theory:

Queuing theory is the mathematical study of the congestion and delays of waiting in line. Queuing theory (or "queueing theory") examines every component of waiting in line to be served, including the arrival process, service process, number of servers, number of system places, and the number of customers—which might be people, data packets, cars, etc.

**Libraries Used**

**Pandas:** pandas is an open source, BSD-licensed library providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language.

**Numpy:** NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays. It is the fundamental package for scientific computing with Python.

**MatPlotLib**: matplotlib.pyplot is a plotting library used for 2D graphics in python programming language. It can be used in python scripts, shell, web application servers and other graphical user interface toolkits

**Turtle**:

Why is it called turtle in Python?

Why is the turtle module in Python called that? As it says in the Python Standard Library Doc, it's because Turtle graphics is a popular way of introducing programming to children. It was part of the original Logo programming language developed by Wally Feurzig and Seymour Papert in 1966.

What is the use of turtle in Python?

“Turtle” is a Python feature like a drawing board, which lets us command a turtle to draw all over it! We can use functions like turtle.forward(…) and turtle.right(…) which can move the turtle around

**SYSTEM SPECIFICATIONS AND SOFTWARE REQUIREMENTS:**

OS : Windows or Linux

Python IDE : python 3.x and above

**HARDWARE REQUIREMENTS:**

RAM : 2GB and Higher

Processor : Intel i3 and above

Hard Disk : As per system