A Systemic Analysis for Development of Smart Transit System: An Indian Prospective

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***Abstract*: Today when India, through the Smart City project, plans to ease the ever-growing pressure of its burgeoning urban population on services, one of the key factors determining its success will be good mobility and transportation system. The pollution levels in Delhi, traffic snarls in Bangalore or low average speed of mobility in Mumbai is a clear indication that out cities must urgently build sustainable public transport systems. Indian cities are already facing a plethora of problems like severe congestion, deteriorating air quality and increasing road rage and road accidents. With an increasing urban population that is projected to more than double to 590 million by 2030, the traffic situation is set to worsen further. The Intelligent Transportation System (STS) is a key area of the Government of India's Smart City initiative. According to a report issued by the Federal Ministry of Transportation on March 22, 2016, some buses were more and more, because the number of passengers was twice, more than RTO's rules and restrictions. Once verified that the model is working properly, you can see the final result. To do this, run immediately and access the results immediately to see everything recorded from the model. The result is a summary that contains a perspective grid table that contains all the objects in the model, and summary statistics for some metrics. A report that also shows details of each object type in the model. It's concluded that SIMIO contains many interactive tools to support the verification phase of the simulation project. Using a combination of animations in the Tracking window, the Monitoring window and / or the Facilities window, whether the model is in error or simply or simply stepping through the model to make the implementation logic work Gain insights about the decisions made in the process and simulation model in progress.**

***Keywords*: Smart City project, congestion, Monitoring window, Intelligent Transportation System (STS)**

1. INTRODUCTION

From the beginning of history, human sensitivity has shown a desire for liquidity, which has led to some degree of social progress. The history of mobility and is history of this civilization. In any country's history, it can be seen that proper, extensive and effective road traffic plays an important role. The "Transmitter" is one of the most important activities in all the stages of advanced civilizations. If the road is considered to be a country's veins and arteries, the passengers and cargo transported are like circulating blood. Passenger Transmission Road Transmission Service (PRTS) is a necessary condition for economic development. Public transport offers a variety of bus options, including buses, light rails, and the subway. These systems are generally available, require freight, and may operate at scheduled times. The purpose of introducing or expanding public transportation is to reduce the mileage and congestion of vehicles while increasing the use and use of public transportation.

1.1 TRANSPORT

Traffic (British English) or Transportation (American English) is a movement of people or things, from one place to another. The term is derived from Latin Trans ("Fill") and Porj ("Lean"). Public transport (also publicly known as public transport, public transport, or public movements) is commonly available for travelers traveling to the group travel system, usually the plan running on the Layout and Default Path. In Asia, North America, and Europe, there are major differences in urban public transport.

1.2 FUNCTIONS OF TRANSPORT

1. Transport helps in the development of industries that require faster marketing of the product. Fish and green vegetables such as fast market transport can be moved quickly to consumers.
2. Transportation helps to increase the demand for goods. Shipping allows you to easily contact new customers in new locations and introduce them. Today, for transportation, the market has become a domestic or international market.

1.3 MEANS OF TRANSPORT

Transportation is classified according to roads, vehicles, electricity usage and terminals.

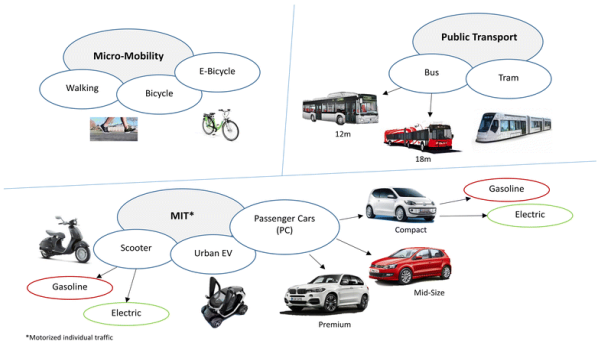

Fig: 1 Means of Transport

Land Transport may be classified as

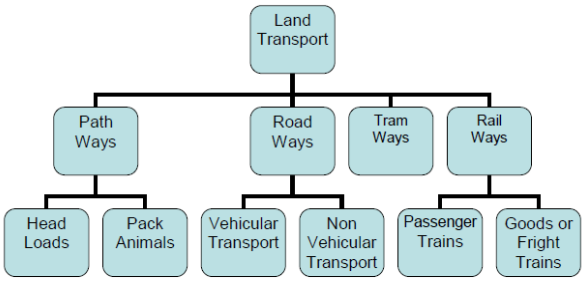

Fig: 2 Modes of Land Transport

Pathways
In remote villages, forests and hilly roads are still an important part of various transportation options. It is also known as head load (also called human transport for even mountainous areas where animals cannot reach) and packed animals (also known as animal transport). Cockroach, buffalo, camel, elephant Yak, sheep etc. are used for this purpose.

Roadways
Road transportation is one of the most important means of transportation. The history of road transportation began with ancient civilization. Over time, it has become an increasingly popular transportation.

Railways
Railway is always a pioneer in modern machine transportation. It brings the biggest transportation revolution. It accelerates the development of commerce and industry in the country. Before the introduction of motor transport, railways monopolized land transport. In India, it is the main source of transportation.

Coastal Shipping: Coastal transmission is a cheap, fast, more flexible and more economical source of transportation of large and heavy equipment. Generally shipping is specific to domestic shipping. In India, coastal shipping has been reserved for domestic vessels only since 1951.

Overseas Shipping: According to their work, overseas transportation can be divided into liners (ships not scheduled for liners), liners (ships without liners), and tankers (most of which are special crude oil cargos). The lining can be subdivided into passenger liners and cargo linings.

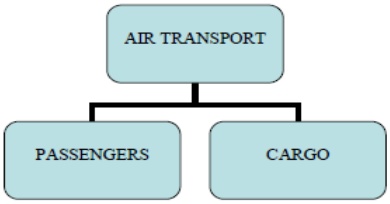

Fig: 3 Means of Air Transport

1.4 TRANSPORTATION IN INDIA
A well-equipped transport system plays an important role in the country's sustainable economic development. India's transportation system provides a variety of models and services such as railway, road, road transport, ports, interior hubs, coastal transport, airports, airlines etc.

Road Transport in India
A good road network is a key infrastructure requirement for rapid growth. It provides connectivity to remote locations, access to markets, schools and hospitals, and opens past trade and investment areas. Roads connect to the airports, stations and ports and contribute to joint transport development. India has the world's largest road network spanning 331,400 kilometers. RR including other district roads and rural roads.

The Indian Railway is the main means of transportation for goods and passengers. Railways play an important role in the development of industry and agriculture. The Indian Railway has a total of 63,221 km of electrified 7031 stations, of which 13,000 km are 7817 locomotives, 5,321 passenger cars, 4,904 other passenger cars, 300 trucks, 2,300 freight and maintenance workshops. It consists of 700 units. And 5.4 million workers. The Indian Railways operates approximately 11,000 trains a day, and as of March 31, 2004, 7,000 of them were passenger trains.

Water Transport in India: The coast of India is long ago, about 90 percent of its sea trade is traded by commercial ports such as Kendla, Mumbai, Navwa Shawa, Marmagao, Kochan, Tokercoran, Chennai, Vesakhapatnam, Paladiash, Haldia, Goa, Kolkata. I am in India's border bull, Bangladesh, Arabian Sea and the Indian Ocean, with more than 7,000 km coast. It has a wide network of internal domains and ports. Internal waterways include river, canals, backwaters and streams

Air Transport in India: Air travel is the fastest way to go anywhere in the world. Indian and private airlines are responsible for domestic aviation services, and Air India is responsible for international airport services. There are four major international airports in Mumbai, Chennai, Kolkata and Delhi.
As of May 31, 1999, India had signed bilateral air service agreements with 93 countries. Air India Limited is an international airline representing the country. It serves the United States Europe, the Russian Federation, the Gulf / Middle East, East Asia, the Far East and Africa.

Airport development is no longer limited to public sector, but private partnership has also been allowed and encouraged. An International Greenfield Airport was developed in the cocaine, with NL donations and loans from financial institutions. The approval of the construction of four metro airports (Delhi, Mumbai, Kolkata and Chennai) is globally. With the help of the private sector, new international airports will be established in Bangla, Hyderabad, and Goa. Over the past few years, the Indian aviation industry has invested heavily to take advantage of its vast and underutilized air transport network. In the last few years, very few low-cost airlines have also entered the Indian market.

1.5 SMART TRANSIT SYSTEM (STS)
The Intelligent Transportation System (STS) is a key area of the Government of India's Smart City initiative. According to a report issued by the Federal Ministry of Transportation on March 22, 2016, some buses were more and more, because the number of passengers was twice, more than RTO's rules and restrictions. Therefore, this project urgently needs today's fast-paced environment. Ideally, an efficient public transport system should have:

Right of Way: The most basic criteria for a successful public transport are that it is better than private transport, with the speed and frequency of public transport uninterrupted. This can be done through a dedicated bus lane so that public transit vehicles can move faster without being disturbed by crowded roads.
Seamless Connectivity: In smart cities, different types of public transportation do not compete with each other, but with each other. This idea should shift from creating a population-based public transport hub to a more analytical approach to explaining travel patterns. Routes and fares should be determined scientifically, not the choice of populist.
Comfort and safety: Make sure that passengers feel safe and comfortable when using public transport. This can be achieved by providing various public transport options (such as AC/non AC bus), improving the CCTV surveillance system and ensuring access to emergency helplines/buttons.

2. MEATHAMETICAL UNDERSTANDING
Traffic jams on the road network will be slower, travel times will increase, and queues will increase. Traffic roots occur when the number of vehicles is more than the road's capacity. Traffic crowd is a major issue in major cities in India. If demand exceeds available road capacity, traffic congestion may occur. This is called saturation. If it does not interfere with traffic, individual accidents such as accidents or sudden braking of vehicles can create ripple effects and lead to traffic congestion. Due to anti-social factors, there are even serious safety issues in the transportation system, which also leads to traffic stagnation. Due to anti-social factors, there are even serious safety issues in the transportation system, which also leads to traffic stagnation. In countries like India, the annual loss of 60,000 rupees (including waste of fuel) due to congestion. India's congestion has also led to slower freight rates and increased waiting times at checkpoints and toll stations. The average fuel consumption of India is only 3.96 kmpl. The main cause of this situation is traffic congestion. India is the second largest population after China. As the population increases, the number of vehicles also increases. Economic growth has certainly affected urban traffic.

2.1 INDUCTIVE LOOP DETECTION
In the Inductive loop detection road, one woolen kit keeps one or more insulated wires and takes the wires to the electronics in the controller and controller's cabin. When the vehicle passes the loop or stops, the line induction changes. The variations vary with

frequency. This change in frequency causes the electronic unit to send the signal to the controller indicating the presence of the vehicle.

2.2 VIDEO ANALYSIS

Video analysis includes deployed smart cameras that include sensors, processors, and communication devices. Monitor traffic conditions continuously with smart cameras. Captured video is compressed to reduce transmission bandwidth. Video analysis extracts scene descriptions from the raw video data.

2.3 INFRARED SENSORS

2.4 SMART TRAFFIC MANAGEMENT SYSTEM

A Radio Frequency Identification (RFID) system consists of RFID controller and RFID tag.

1) RFID Controller:

The RFID Controller also includes RFID investigator. The research is used to communicate with the rf tag. The RFID controller then receives the signal / data received by the research. Messaging interference is used to send command and data messages from controller components. The controller cover can work and write on the RFT tag, or perform monitoring and execution process. Contact to make double radios.

RFID Tag

There are two types of RFID tags: active and inactive. The active RFID battery is connected, but there is no passive RFID. Excessive RFID work needs to be implemented outside the external sources. Tag information can be stored in a non-stable memory.

2.5 APPLICATIONS

Detection and Management of traffic Congestion

In addition to the previous traffic congestion detection methods, other methods can be used. A server can be maintained that can receive specific key data regarding signals calculated by the controller. The main purpose is to track the travel time of one vehicle as it passes a roadside controller and use a system to calculate the average travel time to determine if the area is congested.

Automatic detection of speed limit Violation

Using this method, the driver's speed can be calculated to detect if the driver has violated the specified/set speed limit. If the driver violates the rules, a warning message will be sent to the driver via the audio and/or video interface, a fine will be calculated at the server and the owner will be charged a monthly fee.

Automatic Billing of Core Area / Toll Charges

Automatic charging and automatic cover area is also used by using the same framework. The controller unit is located along the motor path around the tollgate and core area by obtaining its device ID, uniquely detecting each individual vehicle in the area, and the time these vehicles look at the vehicle Record.

Smart Bus System

Wireless communication can be described as transferring information between two or more points without any wire or cables. Various wireless technologies such as RFID, IR, GPS and Bluetooth, Wi-Fi. In the past few days, location announcements were made with the help of speakers, but are currently developed using IVRS at the railway station. The advent of GPS and ubiquitous cellular networks has enabled real-time vehicle tracking to achieve better transportation management. These techniques can be applied to public transport systems, especially buses, which cannot meet scheduled schedules due to traffic jams, malfunctions and the like.

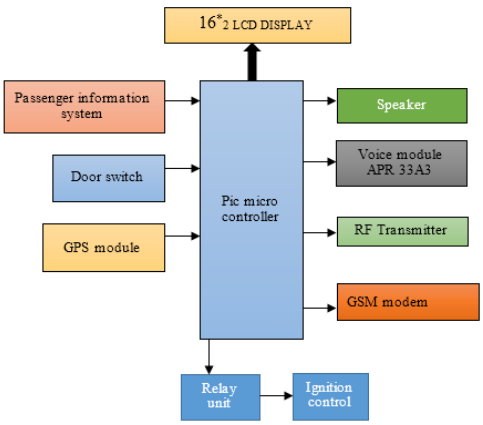

Fig: 3 System in Vehicles (Transmitter).

The transmitter modules include power supplies, RF transmitters, microcontrollers, GPS modules, GSM modems, voice modules APR33A3, LCD displays, door switches, and ignition control relays and drivers.

System at Bus Stand

The receiver module includes a power supply, an RF receiver, a micro console, a GSM modem, an audio module APR33A3 and an LCD display. The RF receiver is connected to the microcontroller.

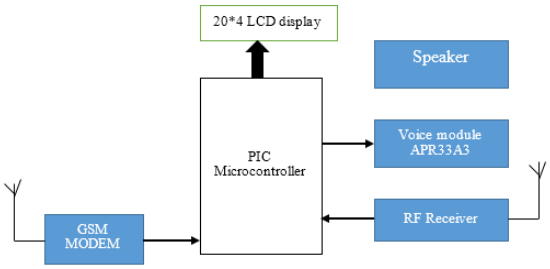

Fig: 4 System at Vehicle stand (Receiver)

The LCD displays the bus details by retrieving the information stored on the microcontroller. The voice notification system integrated in the receiver module is a single chip IC. This IC is useful for voice message recording/playback.

3. Simulation

3.1 TRAFFIC FLOW MODELING

The study of traffic flow, especially in vehicle traffic flow to understand and stop support and in the problems of solved congestion. The first attempt to create a mathematical theory of traffic flow can be traced back to 1930s, but for that day, we are a satisfactory general mathematician to describe the actual traffic flow conditions. This is because traffic trends are complicated and non-linear, depending on the number of vehicles involved. In addition, vehicles not only communicate with physical laws but also affect the psychological response of human drivers. According to the latest report of the Traffic Research Board: Traffic Flow Characteristics Model, human factor model, car model to operate, continuous flow model, macroscopic flow model, traffic effect model, model not signal: Can be divided into mathematical models of traffic flow, signal Intersection models and Traffic Simulation Models.

3.1.1 Traffic stream characteristics

There are various mathematical models that are designed to show the connection between traffic flow variables of speed, flow, concentration or density. Human factor modeling. The environment of human-computer-connected system, the aspects of the main performance of human factors are included. The following modeling means that the driver has adjusted its speed according to the condition of a leading vehicle. In these models, the condition of the vehicle is considered as a constant act, and each vehicle is controlled by a variable difference equation which is at its speed and vehicle distance, of the car in the front as shown in Equation.

$$\ddot{x}_f(t) = \lambda \cdot \frac{\left(\dot{x}_l(t) - \dot{x}_f(t)\right)}{\left(x_l(t) - x_f(t)\right)} \quad (1)$$

Where x_f is the one-dimensional position of the following vehicle, x_l is the one-dimensional position of the leading vehicle, is the *t* time, and λ is a sensitivity coefficient.

Microscopic methods are often very important in computing because each car has an ODE that can be fixed at all times, and the number of vehicles increases. Analyzer mathematics is difficult to review micro modules, but to treat it is to use Microsoft computer simulations. In this Microsoft Traffic Model, the vehicle is considered to be a small driver car unit that runs in computer-simulation environment.

On the other hand, the macroscopic model is supposed to have a continuous process in which the movement is shown that many of the characteristics of the fluid movement have shown that using the flow of traffic flow. . Prepared in middle-class relationship with which traffic flow is consistent with the driver's constant intensity of acceleration or slow downwardly, - generally, they are stimulating flow density mode car units, interactions in units, which will affect the speed of the driver, determine the driver behavior - Follow the car model insulated particles or driver's transport. On the other hand, compared to interaction between continuous models particles, it focuses on the behavior of overall data flow traffic.

Traffic Impact Model Attachments in traffic and safety, fuel consumption and air quality models. The traffic and safety model describes the relationship between traffic flow and crash frequency. Accepting a signaling crossing theory is related to the difference between the difference between acceptance and acceptance in the theory of ideological differences.

At the macro level, we use fluid dynamics models, in which we have a partial equation system, which has variable such as density, speed and traffic flow time and place. In this configuration speed, flow and density will be controlled by the following partial differences equation.

$$\frac{\partial q}{\partial x} + \frac{\partial \rho}{\partial t} = g(x,t) \quad (2)$$

Where q is the traffic flow, *x* is the displacement ρ is the density, and *ρ* is a flow of traffic *g(x, t)* is function for sources and sinks of traffic flow.

The selected of the appropriate model is necessary and depending on the computing power level. As a result, with the development of computer technology, the current trend is to use the micro-mathematical models that use the following models as human factors and cars as a unit of behavior model.

4. RESULT

4.1. DESCRIPTION OF BUS ROUTE OPERATION AND ASSUMPTIONS

At the start of daily travel, each empty bus is sent from the start of the travel design. This is usually a bus stop on the route. Each bus travels along this route and passengers can board the plane and get off at the station. The same service continues to stop from the start of the operation to the end of the daily operation. Fig. 5 illustrates bus movement between stations in a path having a conventional bus inter-vehicle distance and constant residence time set for simplicity.

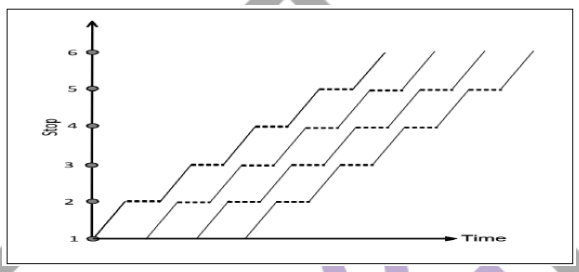

Fig: 5 Bus movement between stops in a regular bus headway

In order to better understand the dynamic interaction between the bus and the passenger when stopping, the following table is described.

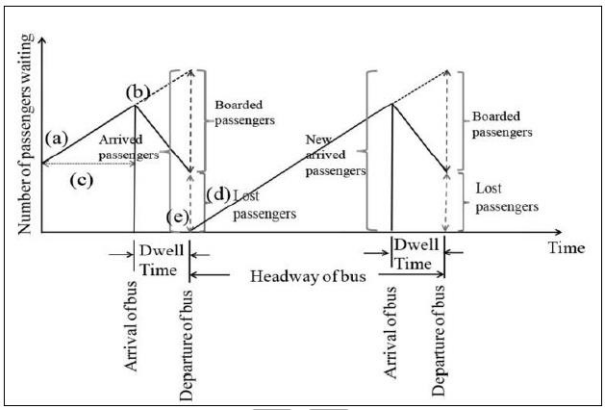

Fig: 6 Dynamic interaction between bus and passengers

As shown above, the vertical axis represents the number of passengers waiting at a particular stop. These are changing dynamically on a regular basis. The horizontal axis represents the discrete arrivals and departures of the bus at the stop, including dwell time and inter-vehicle time. In the dynamic process, random passengers arrive at each site and are waiting for the bus. Meanwhile, the passenger's waiting time is shown as point C in the figure above.

Model Assumptions:

1. The operation time is from 7:00 AM- 11:00 PM as it operates in the real case scenario.
2. The passengers either board the bus or stay in line waiting for the next bus, but might renege.
3. Buses are not allowed to pass each other such that the bus order is kept the same.
4. Bus stop capacity (Queue Length) is assumed to be infinite because of the availability of the Automatic Vehicle Location (AVL) System.
5. Balking passengers' analysis will not be included in the scope of this research.

4.2. Modeling Process Overview

4.2.1. Modeling Objects

In the case of public transport at Akron University, bus stops are modeled as source objects for putting passengers in the bus column. The bus stops are all connected to one another by successive time passes, which are links between nodes (bus stops), which allow you to specify the time each moving vehicle will spend on it. Vehicle objects act as passengers between stops. The following figure shows all model objects displayed in a SIMIO model.

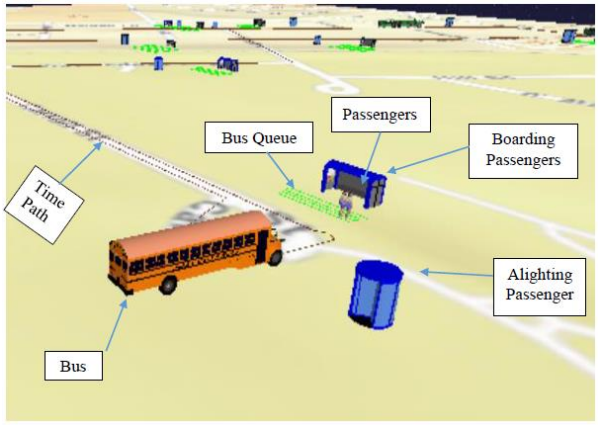

Fig: 7 Simulation model main objects

Passenger Arrival Rates:

To generate randomly the average number of passengers per hour from each bus stop to the stop queue using the Poisson distribution, create a unique table for each bus stop that represents the hourly arrival rate. The following table uses the SIMIO model Student Council price table as an example.

Table 5. 1 Passenger arrival rate table in the simulation model

Starting Offset	Ending Offset	Rate (events per hour)
Day 1, 00:00:00	Day 1, 01:00:00	14
Day 1, 01:00:00	Day 1, 02:00:00	22
Day 1, 02:00:00	Day 1, 03:00:00	36
Day 1, 03:00:00	Day 1, 04:00:00	35
Day 1, 04:00:00	Day 1, 05:00:00	33
Day 1, 05:00:00	Day 1, 06:00:00	35
Day 1, 06:00:00	Day 1, 07:00:00	24
Day 1, 07:00:00	Day 1, 08:00:00	13
Day 1, 08:00:00	Day 1, 09:00:00	17
Day 1, 09:00:00	Day 1, 10:00:00	11
Day 1, 10:00:00	Day 1, 11:00:00	9
Day 1, 11:00:00	Day 1, 12:00:00	7
Day 1, 12:00:00	Day 1, 13:00:00	5
Day 1, 13:00:00	Day 1, 14:00:00	5

The first two columns of Table 5.1 show one hour of this survey, and the third column shows the average number of randomly generated passengers. The start offset indicates the start time (7:00 AM daily) and the end time indicates the end of the first period.

4.2.2. Simulation Process Controls

Object-based tools such as SIMIO have additional process capabilities that allow you to create complex models quickly and easily. Add-on procedures are small pieces of logic that allow you to easily insert objects at selected points to execute custom logic. You can add this custom logic to an object in a specific action instance to add controls to the object or record performance metrics as output from the simulation process.

Control Add-On Process

This process is used at each output node (Source of Entities) of each bus station. As mentioned above, each bus station generates different types of entities based on the destination. This process consists of two basic logical objects, as shown in the following block diagram.

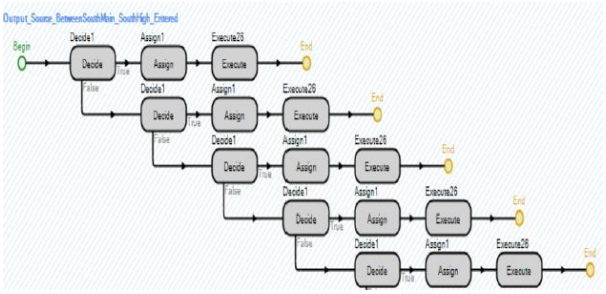

Fig: 8 Passengers' destination process control

Each process starts at the start branch and starts executing each row of the logical block. The "decision" step checks the destinations of the passengers and the "assignment" step inserts them at the appropriate nodes of the destination. The number of lines indicates the expected number of destinations for this bus stop.

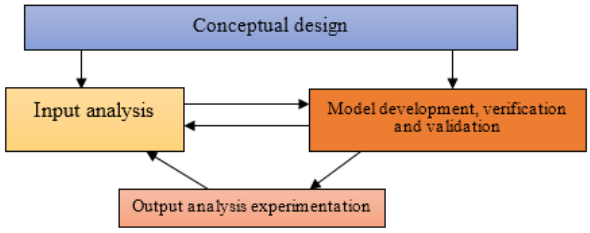

Fig: 9 Simulation Process

5. CONCLUSIONS

Once verified that the model is working properly, you can see the final result. To do this, run immediately and access the results immediately to see everything recorded from the model. The result is a summary that contains a perspective grid table that contains all the objects in the model, and summary statistics for some metrics. A report that also shows details of each object type in the model.

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