Towards the Design of a Real Time Traffic Management System Using Divide and Conquer Technique

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ABSTRACT

This research is directed towards the development of an Algorithmic Framework using the Divide-and conquer Technique for Resolving Traffic Congestion in Urban Centres. The implementation of the system developed is expected to analyse traffic situation at intersection and predict vehicular distribution and be able to resolve traffic congestion situation in real time situations. What is presented here is a primer to the research

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1. INTRODUCTION

The growing demand for mobility and the continuous increase of population in big cities have created severe transportation problems. The existing transport infrastructures are unable to handle the amount of vehicles, resulting in heavy congestions for significant periods of time each day. These traffic congestions can be incidental due to special circumstances on roads, such as accidents or extreme weather conditions or recurrent congestions occurring periodically during rush hours. In both cases, the negative implications are spread to many different areas.

Many urban cities in Nigeria are bedeviled with traffic congestion which tends to defy various remedial measures adopted by different government over the years. Journey times from one point to another within a town have remained unreliable and residents have continued to face disturbing inconveniences in transportation. These are accompanied by noise and air pollution and the high costs associated with burning of fuels from stationary vehicles.
Urban transport problems remain one of the most nagging problems in urban transportations today. All over the world, attempts have been made to tackle the problems, yet the situation seems to get worse. Cities are centres of economic, social, cultural and intellectual activities. These activities result in the drift of the population from rural to urban centres and these congregations have caused cities to expand without control in many areas, causing congestion, environmental and social problems.

Various approaches have been taken to combat urban transport problems. In ancient Rome for example, Julius Caesar once prohibited the movement of cars during day light to relieve traffic congestion on roads (Joseph O. et. al. 2012). Congestion was also common place in seventeenth century London and nineteenth century New York. In the United States, various studies were carried out in cities with traffic problems with the aim of reducing urban traffic congestion problem. In 1973, the Organization for Economic Cooperation and Development Report discussed the widespread uses of Restraint of Road traffic techniques in the developed countries as a means of reducing heavy urban traffic problems (Joseph O. et. at. 2012)

1.1 Historical Background

In Nigeria, many scholars have also carried out studies on urban transport problem al aimed at proffering solution. These include Adedamila (1977); Adenle (1977); Olayemi (1977); Ogunsaya (1984, 1993); Aderamo (1998). Many of these scholars who worked on urban transport problems in Nigeria have identified congestion as the most serious. Cities are locations having a high level of accommodation and concentration of economic activities and are complex spatial structures hat are supported by transport systems (Rodrigue, 2009). The larger the city the greater its complexity and the potential for disruptions if this complexity is not effectively managed. The most important urban transport problems take place when transport systems for a variety of reasons cannot satisfy the numerous requirements of urban mobility. Urban productivity is highly depended on the efficiency of its transport system to move labour, consumers and freight between multiple origins and destinations. All these result in congestion and environmental problems. Among the most notable urban transport problems are traffic congestion and parking difficulties; longer commuting; public transport inadequacy; difficulties for non-motorised transport, less of public space, environmental impacts and energy consumption, accident and safety, land consumption and freight distribution. Also many dimensions of the urban transport problem are linked with the dominance of the automobile. The objective of this paper is to assess the urban transportation problems and challenges in Nigeria with a view to proffering palliative measures to reduce the problem.

1.2 Problem Statement

As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in . when vehicles are fully stopped for period of time, this is colloquially known as a **traffic jam** or **traffic snarl-up**. Traffic congestion can be lead to drivers becoming frustrated and engaging in **road rage** which is aggressive or angry behavior by a driver of an automobile or other motor vehicle. Such behavior might include rude gestures, verbal insults, deliberately driving in an unsafe or threatening manner, or making threats. Roads rage can lead to altercation, assaults, and collisions which result in injuries and even deaths. It can be thought of as an extreme case of aggressive driving ("*Road rage meaning and origin, Phrases.org.uk*". Retrieved 5 October 2014).
Some other of the basic problem encountered are;

1.3 Heavy Traffic Jams:

With increasing number of vehicles on the road, the heavy traffic congestion problem increased in cities. This usually happened in the morning, and in the evening. Due to this, people spend unnecessary time on the road.

1.4 No traffic, but still need to wait:

At certain junctions, the traffic is clear, meaning there is no traffic but people have to wait until the green light comes up. If people want to go in the red light, they have to pay fine.
The proposed traffic control system solves the above problems in the most effective way, by sensing the number of vehicles in each traffic lanes and giving priority to lanes with highest vehicular traffic, thus decongestion the traffic and also avoiding a scenario where people have to wait for a long period even where there is no traffic.

2. RESEARCH OBJECTIVE & SCOPE

The aim of this project is to develop an Algorithmic Framework using the Divide-and conquer Technique for Resolving Traffic Congestion in Urban Centres. The implementation of the system developed is expected to achieve the following specific objectives;

1. Analyse traffic situation at intersection
2. Predict vehicular distribution and be able to resolve traffic congestion situation in real time situations.

This proposed work focus on developing and implementing an intelligent traffic controller algorithm using multiple platforms. The algorithm will incorporate mechanism to sense the presence or absence of vehicles within certain range by setting the appropriate duration for the traffic signals to react accordingly by employing mathematical functions to calculate the appropriate timing for the green signal to illuminate. The system can help to solve the problem of traffic congestion.

3. METHODOLOGY

A framework will be developed that simulates the control of large-scale traffic networks Coding will be done using Java script, CSS, HTML5 for intelligent traffic control management with special attention to the roadside infrastructure. The system will be simulated to provide a resemblance of real time traffic congestion resolution.

4. DEFINITION OF TERMS

This is a process of generating or bringing together, information that has been systematically observe, recorded organized, categorized or defined in such a way that logical processing may occur and some of them are used interchangeably e.g ITS meaning intelligent traffic system and intelligent transportation system.

- **Traffic:** This is the passage of people or vehicles along a route of transportation.
- **Control system:** A control system is a device or set of devices that manages, commands, direct or regulate the behavior of other devices or system.
- **System:** A system is a set of interacting or interdependent components forming an intergrated whole or a set of element.
- **Junction:** This is a place where two or more roads come together.
- **Traffic control signal:** This is signaling devices positioned at road intersections, pedestrian crossings and other locations to control competing flows of traffic.
- **Fuzzy logic:** It is a form of many valued logic. It deals with reasoning that is approximated rather than fixed and exact.
- **Design:** It is the creation of a plan or convention for the construction of an object or a system.
- **PLC:** Programmable Logic Controller
- **IT:** Intelligent Traffic
- **ITCS:** Intelligent Traffic Control System.
- **ITS:** Intelligent Transportation System
- **Congestion:** Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing.
- **Simulation:** Simulation of a system is represented as the running of the system's model. It can be used to explore and gain new insights into new technology and to estimate the performance of systems too complex for analytical solutions.
- **Fatalities:** This can be defined as a fatal error in computer.
- **Deteriorate:** Deteriorate describes anytime something gets worse.
- **Protocols:** a **communications protocol** is a system of digital rules for data exchange within or between computers.
- **Computational:** Computation is any type of calculation or use of computing technology in information processing.
- **Complexity:** It is generally used to characterize something with many parts where those parts interact with each other in multiple ways.
- **Tractable;** is something easy to manage, control or handle.
- **Automated:** Automation or automatic control, is the use of various control systems for operating equipment
- **Hierarchical:** The definition of *hierarchy* is a group of things arranged in order of rank.
- **CCTV:** Closed-circuit television (CCTV), also known as video surveillance, is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors.
- **Disruption:** is a disturbance or problems which interrupt an event, activity or process.
- **Analysis:** Analysis is the process of breaking a complex topic or substance into smaller parts to gain a better understanding of it
- **Infrastructure:** Infrastructure is the basic physical and organizational structure needed for the operation of a society or enterprise.

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