

A Synoptic View of Intelligent Traffic Management Issues in Nigeria

Adedibu, O & Adeshipo, M.E.

Department of Electrical/Electronic Engineering
The Polytechnic, Ibadan
Ibadan, Nigeria
E-mail: ibuacademy@yahoo.co

ABSTRACT

Traffic Control Systems are interconnected with electronics system that controls traffic signals. Road traffic control involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public. Traffic control also includes the use of CCTV and other means of monitoring traffic by local or State roadways authorities to manage traffic flows and providing advice concerning traffic congestion. In this paper, we provide a synoptic view of traffic control systems, their related issues and elucidate the need for the adoption of intelligent traffic control systems as a proactive solution to some of the challenges being faced by the existing systems.

Keywords: Logic, CCTV, Electronics, Traffic, Control, Management and Systems

Aims Research Journal Reference Format:

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1. INTRODUCTION

The contributions of road transportation to environmental degradation in urban cities of Nigeria have been highlighted by Onokala (2008). The problem is no longer limited to traditional cities such as Lagos, Ibadan, Benin-City, Port Harcourt, Abuja, Kano, and Kaduna (Ogunsaya 2002; Ogunbodede nd). Virtually every state capital city in Nigeria today faces the problem of traffic congestion (Moses 2011). For example, Calabar city which was not previously associated with traffic congestion is now facing considerable traffic congestion on many of its urban roads, particularly when the schools are in session.

Although many researchers have conducted studies on traffic congestion and delays in Nigeria, most of these studies concentrate on specific cities such as Lagos (eg. Aworemi *et al* 2009; Bashiru & Waziri 2008), Ilorin (e.g. Aderamo & Atomode 2011), Akure (eg. Ogunbodede N.D.) etc. All these fall under only the south-western part of Nigeria with different cultural practices and behaviours compared with other geo-political regions of the country.

Also, a review of previous research shows that the views of expert transportation engineers have not been considered. Hence, the annual conference of the Nigerian Society of Engineers (NSE) with the theme "*Effective Transportation System in Nigeria: The Way Forward*", which took place between 5th and 9th of December 2011 at the Calabar Tinapa Business and Leisure Resort, provided an opportunity for this study. The survey covers a variety of respondents ranging from commuters, drivers to experts on transportation planning and engineering from all parts of Nigeria and beyond. This is intended to provide a wider perspective to the problem of traffic congestion in Nigeria.

It has been argued that there is no single widely accepted definition of traffic congestion. The reason for this is associated with operational and user perspectives. The Joint Transport Research centre (2007) of the Organization for Economic Cooperation and Development (OECD) and the European Conference of Minister of Transport (ECMT) Provide the following definitions of traffic congestion to reflect the different board perspectives:

- Congestion is a situation in which demand for road space exceeds supply.
- Congestion is the impedance vehicles impose on each other, due to the speed-flow relationship, in conditions where the use of a transport system approaches capacity.
- Congestion is essentially a relative phenomenon that is linked to the difference between the roadway system performance that users expect and expect and how the system actually performs”

Just as the definitions of traffic congestion are broad so are the causes. There are many causes of traffic congestion and these differ from place to place. The study attempts to investigate the main causes of traffic congestion associated with Nigerian urban cities with a view to suggesting solutions to help governments and policy makers towards better cost and effective management of this problem. Traffic congestion is sometimes the result of urban development, housing, employment and cultural policies which cause people to live and work relative to one another in close proximity (ECMT, 2007). Ogunsanya (2002) argues that traffic congestion is a major transportation problem of Nigerian cities. At international level, it has been argued that “dynamic, affordable, liveable and attractive urban regions will never be free of congestion” (ECMT 2007:7). If this is true then efforts will be geared towards cost effective management of the problem. The first step towards such effective management is the identification of the problem causes.

The finding from this study can provide independent information to guide the Federal and State government, including concerned private companies and international agencies in responding to the challenges of traffic congestion in Nigeria. Besides, it will also trigger further studies in attempt to find solutions to the issues raised by this study.

2. THE ERA OF INFRASTRUCTURE SYSTEMS DEVELOPMENT (1980-2000)

Traffic regulations really took off in the '80s when traffic engineers were able to base car detection on inductive loops embedded in the road surface. Those new sensors strengthened the management of road infrastructure. Using the theoretical contributions of researchers, throughputs were made in flow modeling. Simple first-order models were based on volume equilibrium, second-order equations governed the evolution of flow and density. The third order involved a change in volume, density, speed. Based on these more or less models, advances were made with control systems (micro control algorithms of single intersections and macro-control including synchronization between intersections). Output flow volumes of the regulated area or overall waiting time were used as mathematical control criteria. Other control principles were based on artificial intelligence and fuzzy sets related methods (Jean-Marc & Mathieu, 2014). Gradually, traffic scientists and engineers developed practical control tools that covered large urban and suburban areas: streets, intersections and freeways.

2.1 New sensors, new applications

The results obtained from inductive sensors were too restricted (providing measurements at very restricted sets of locations) and therefore researchers began looking at other detection possibilities, notably between 1990 and 2000. Work based on video cameras and image processing techniques was particularly successful. These techniques allowed access to vehicle detection in large areas, to queue lengths, to movements and stops, to presence of pedestrians, etc. Those novel sensors opened new traffic control possibilities and new applications like incident detection (Kay, 2010). Although traffic science has evolved considerably during the period 1980-2000, the practical implementation of traffic control was quite slow. Around 2000, the automobile sector showed a high momentum with huge and attractive research projects (Baskar, 2009). The slow development on roads caused by minimal financial investment is in stark contrast to the rapid progress achieved with cars.

Many researchers have, however, continued to work on intelligent systems but many have moved from working on road network control to vehicle control to try to solve traffic problems.

2.2 What Is Programmable Logic Controller (Plc)?

A PLC (Programmable Logic Controller) is a device that was invented to replace the necessary sequential relay circuits for machine control. The PLC works by looking at its inputs and depending upon their state, turning on/off its outputs. The user enters a program, usually via software, that gives the desired results.

2.2.1 PLC and Its Applications

Intelligent traffic control system are divided into two main parts, Programming and hardware. Ladder logic Programming technique is used. PLC T100MD2424+ is used for attaching with proto type hardware. In hardware photoelectric sensors is used for sensing the presence of vehicles on the square in proto type.

3. TRAFFIC CONTROL SYSTEM

Traffic Control Systems are interconnected with electronics system that controls traffic signals. Road traffic control involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public. Traffic control also includes the use of CCTV and other means of monitoring traffic by local or State roadways authorities to manage traffic flows and providing advice concerning traffic congestion (Ashwini, 2013).

Traffic Control Systems depend on logic which can be divided into two categories:

- i. The signal phases and cycle length depends on the traffic flow on the desired track
- ii. The system responds to interrupts or timing base system and opens the desired signal according to the priority requirement.

3.1 Advantages of Traffic Control Systems

Traffic signals help control the flow of vehicles, pedestrians and bicycles by giving "right-of way" to the various movements in an orderly manner. Signals that are properly located, designed and maintained can:

- I. Provide for orderly movement of traffic.
- II. Increase capacity of the intersection.
- III. Reduce frequency and severity of certain types of crashes, especially right-angle collisions.
- IV. Provide for continuous movement of traffic at a definite speed along a given route.
- V. Interrupt heavy traffic at intervals to permit other vehicles or pedestrians to cross.
- VI. Effectively perform traffic management
- VII. Overall, traffic signals help us get where we're going safely and in a timely manner.

3.2 Disadvantages Of Traffic Control Systems

Traffic signals are sometimes considered problems at intersections. In fact, traffic signals that are poorly located can adversely affect the safety and efficiency of vehicle, bicycle and pedestrian traffic. Improper or unjustified signals can result in one or more of the following:

- I. Significant increase in the frequency of some types of collisions
- II. Increased congestion, air pollution, and fuel consumption.
- III. Excessive delay.
- IV. Excessive disobedience of the signal indications.
- V. Increased use of less adequate streets as motorists attempt to avoid the traffic signals.
- VI. Frustration especially in hot weather.

4. INTELLIGENT TRAFFIC CONTROL SYSTEM (ITCS)

An Intelligent Traffic Control System senses the presence or absence of vehicles and reacts according to the sensors output. In this system PLC takes data from sensors and checks the priorities. After that the PLC provides signal to traffic signals. The intelligent traffic control system works in four different modes which are Normal flow, peak time, off time and manual operation. Peak time and off time modes are depended on the sensors outputs then change the status. Our intelligent traffic control system totally depend on the sensors output and take decisions (Muhammad, 2011).

In prototype design Photo electric sensors are used, for prototype it is not possible to design an induction loop. As the basic function of induction loop in Intelligent Traffic Control System is used to provide an interrupt signal to controller unit. We use Photo electric sensors rather than induction loops. In our design, photo electric Sensors provide an interrupt signal to controller unit. In case when vehicle reaches in front of sensors, then it provides an interrupt.

5. CONCLUDING REMARKS

In this paper, we provide a synoptic view of traffic control systems, their related issues and elucidate the need for the adoption of intelligent traffic control systems as a proactive solution to some of the challenges being faced by the existing systems.

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