ISSN : 2321-7480
Volume 6. No. 2
April - June 2018

i-manager's

Journal on Digital Signal Processing

Enabling Technology for the generation and interpretation of information

i-manager® Publications

ISSN : 2321-7480
Volume 6. No. 2
April - June 2018

i-manager's

Journal on Digital Signal Processing

About the Journal

Digital Signal Processing has enabled unprecedented levels of interpersonal communication and of information availability. It is a mathematically rigorous but accessible treatment of digital signal processing that intertwines basic theoretical techniques with hands-on laboratory instruction, and i-manager's Journal on Digital Signal Processing focuses on the broad areas of a variety of both digital and analog technologies, spanning a broad range of Applications, bandwidths, and realizations and welcomes scientific research on these areas.

i-manager's Journal on Digital Signal Processing is presently in its 6th Year. The first issue was launched in 2013.

i-manager's Journal on Digital Signal Processing is published by i-manager Publications, one of India's leading Academic Journal Publisher, publishing 28 Academic Journals in diverse fields of Engineering, Education, Management and Science.

Why Publish with us

i-manager Publications currently publishes academic Journals in Education, Engineering, Scientific and Management streams. All of i-manager's Journals are supported by highly qualified Editorial Board members who help in presenting high quality content issue after issue. We follow stringent Double Blind Peer Review process to maintain the high quality of our Journals. Our Journals target both Indian as well as International researchers and serve as a medium for knowledge transfer between the developed and developing countries. The Journals have a good mix of International and Indian academic contributions, with the peer-review committee set up with International Educators.

Submission Procedure

Researchers and practitioners are invited to submit an abstract (200 words)/full paper on or before the stipulated deadline, along with a one page proposal, including Title of the paper, author name, job title, organization/institution and biographical note.

Authors of accepted proposals will be notified about the status of their proposals before the stipulated deadline. All submitted articles in full text are expected to be submitted before the stipulated deadline, along with an acknowledgment stating that it is an original contribution.

Review Procedure

All submissions will undergo an abstract review and a double blind review on the full papers. The abstracts would be reviewed initially and the acceptance and rejection of the abstracts would be notified to the corresponding authors. Once the authors submit the full papers in accordance to the suggestions in the abstract review report, the papers would be forwarded for final review. The final selection of the papers would be based on the report of the review panel members.

Format for Citing Papers

Author surname, initials (s.) (2018). Title of paper. i-manager's Journal on Digital Signal Processing, 6(2), xx-xx.

Copyright

Contact e-mails

editor_jdp@imanagerpublications.com
submissions@imanagerpublications.com

ISSN : 2321-7480
Volume 6. No. 2
April - June 2018

i-manager Publications

i-manager's

Journal on Digital Signal Processing

Abstracting / Indexing

ProQuest · ULRICHSWEB GLOBAL SERIALS DIRECTORY · OCLC WorldCat

ISSN : 2321-7480
Volume 6. No. 2
April - June 2018

i-manager Publications

i-manager's

Journal on Digital Signal Processing

OUR OFFICES

Registered Office

3/343,Hill view,
Town Railway Nager,
Nagercoil, Kanyakumari District - 629001
Ph : 91-4652- 277675
E-mail : info@imanagerpublications.com

Editorial Office

13-B, Popular Building,
Mead Street, College Road,
Nagercoil, Kanyakumari District - 629001
Ph : (91-4652) 231675, 232675, 276675
E-mail : editor_jdp@imanagerpublications.com

Join with us

https://www.facebook.com/imanJDP/

https://www.facebook.com/imanagerPublishing/

https://twitter.com/imanagerpub

CONTENTS

RESEARCH PAPERS

EDITORIAL

Dr. Kim Ho Yeap
Associate professor,
Department of Electronic Engineering,
Faculty of Engineering and Green Technology,
Universiti Tunku Abdul Rahman,
Malaysia.

With great pleasure and honour, all of us in the editorial team would like to welcome you to Volume 6 issue 2 of i-manager's Journal on Digital Signal Processing. I am eagerly looking forward to this coming issue. The journal has the privilege to share papers presented in the second International Conference on Information and Communication Technology and its Applications (ICTA) to a wider scientific community. The 2nd ICTA was held on 5th and 6th September, 2018 in Nigeria. It was organized by the Department of Cyber Security Science, School of Information and Communication Technology, Federal University of Technology, Minna, Nigeria and the chair of which was Dr. Joseph A. Ojeniyi. The theme of the conference was "Digital Economy: Harnessing the Benefits and Tackling the Challenges for Sustainable Development". In correspond to its theme; the conference served as an avenue for sharing the latest scientific advancement on the core areas of information and communication technology (ICT) – particularly, on the implementation of ICT in digital economy, with the aim of achieving sustainable development. The ICTA conference has been very well received. It has successfully attracted researchers around the world to participate in it. In this coming issue, we have carefully selected five extended versions of the papers presented in the conference. These papers have been very well-written and we believe that the discoveries shared by the authors of these papers would, in some ways, inspire researchers working in the relevant fields in making further scientific advancement.

Allow me to take this opportunity to provide you with a sneak preview of the content of the five papers included in this journal. In the first paper, the authors have proposed the employment of a card-less automated teller machine (CATM) in replacement of the conventional automated teller machine (ATM). The algorithm of the CATM is based on a tuple finite machine. By incorporating thumb print biometric feature into it, a more effective and secured system for monetary transactions can thus be developed. The second paper will come in handy for young mothers who are inexperienced in identifying the cues given by infants. The cry patterns of infants vary depending on the different needs of the infants. The authors demonstrated that infant cry patterns can be recognized by extracting the autoregressive model coefficients and subsequently using them to train an Artificial Neural Network (ANN) recognition system. The third paper would be of particular importance in easing traffic congestions. The authors of the third paper proposed a novel method to optimize traffic control flow. The method incorporated genetic algorithm (GA) into a modified round robin scheduling algorithm. The fourth paper gave a detailed review on blockchain technology. The authors also performed a feasibility study on the application of blockchain technology to replace the existing voting system. In their study, the authors adopted the Blockchain Enabled E-Voting (BEEV) system which was based on the qualitative SWOT (Strengths, Weaknesses, Opportunities and Threats) and PEST (Political, Economic, Social and Technological) analysis approaches. The fifth and last paper presented a novel approach in maintaining data privacy and security. By applying Fully Homomorphic Encryption (FHE) technique on privacy preserving decision tree classifier, the authors demonstrated that their model gave better efficiency and higher accuracy of the ciphertext classifier. The classification process was able to be completed within a very short span of time, i.e. less than five seconds.

We sincerely hope that, these papers could receive wider readability by having them published in this journal. It is our belief that new scientific breakthroughs could only be attained when knowledge is generously shared."

Dr. Kim Ho Yeap
Editor-in-Chief
i-manager's Journal on Digital Signal Processing

EDITORIAL

ABOUT THE EDITOR-IN-CHIEF

Dr. Kim Ho Yeap is currently as an Associate Professor in the Department of Electronic Engineering (DEE), Faculty of Engineering and Green Technology (FEGT), Universiti Tunku Abdul Rahman, Malaysia. He is a senior member of the IEEE, a Chartered Engineer (CEng) registered with the UK Engineering Council and a Professional Engineer (PEng) registered with the Board of Engineers Malaysia. Throughout his career, he has served in various administrative capacities, including the Head of Programme of Master of Engineering Science, the Head of Department of Electronic Engineering and the chairperson of the Self-Assessment Committee (SAC). Dr. Yeap's research areas of interests are in Signal Processing, Electro Magnetics, and Microelectronics. Since 2006, he has published about 63 International refereed Journal papers, 4 local refereed Journal papers, 37 International Conference Proceedings, 4 books, and 8 book chapters. He is also the external examiner of Wawasan Open University. He has been given various awards, which include the University Teaching excellence award, 4 Kudos awards from Intel Microelectronics and 18 research grants.

ADAPTIVE TRAFFIC CONTROL SYSTEM USING MODIFIED ROUND ROBIN AND GENETIC ALGORITHM

By

NASIR MOHAMMED SADIQ * OLUWASEUN ADENIYI OJERINDE ** SOLOMON A. ADEPOJU ***

*-*** Department of Computer Science, Federal University of Technology, Minna, Nigeria.

Date Received: 11/01/2019 Date Revised: 25/01/2019 Date Accepted: 06/03/2019

ABSTRACT

Adaptive Traffic Control System (ATCS) serves as a main element in the constituents with which traffic control flow is achieved in fast developing, and developed urban areas. ATCS, however causes more delays on vehicles due to the fact that it is made up of intersecting points. Ensuring maximum efficiency at intersections has remained a challenge due to its dynamic nature of traffic. Additionally, a number of different methods that can be used to achieve higher performance at road traffic intersections have been recently proposed to engineers. In this study, a new and different method based on modified round robin scheduling algorithm through genetic algorithm technique to optimize the performance (in terms of timing) of a signalized intersection in one of the busiest and most crowded roads of Minna, Niger State - Nigeria (at Obasanjo shopping complex area). The technique uses an initial timing pattern to generate newer offspring (in terms of delay duration) to analyze cost function and to check if a global optimum is reached. This technique outweighs current techniques because the data upon which the nature of the system is built is relatively more phenomenal, as it puts into consideration the exact nature of the lane in many possible occurrences. In this work, a global optimum was reached at only a few number of iterations on the whole Genetic Algorithm process.

Keywords: Component, Optimization, Round Robin, Genetic Algorithm, Signalized Intersection.

INTRODUCTION

The continuous rise in the growing number of automobiles on the road has necessitated the need to have a control system that can better manage the population upsurge experienced in the traffic domain (Vahedha & Jyothi, 2017), which is an efficient way to optimize the utilization of road capacities. Exorbitant fuel costs, road accidents, nonchalant attitude of road users, and environmental concerns have necessitated the provision of a traffic system with minimized traffic delay timings. In this disposition, computer technology and its paradigms have been largely and widely used to curtail road excess and to come forth with optimized traffic control system with better timing system to enhance traffic transitions.

Gündoğan et al., (2014) analyzed the performance of an adaptive traffic control system in one of the busy road networks in Turkey. The traffic control system was based on the fuzzy logic, and genetic algorithm, which handled traffic exceptions and signalized optimization, respectively. It was observed that the performance of the adaptive control system was 10% improved as concerned with cycle time and also, an improvement of 15% was recorded in terms of travel time.

Also, (Hasan, Saha, Hoque, & Majumder, 2014; Pandit, Doshi, Mehta, Mhatre, & Janardhan, 2014) worked on proposing a technique that can be used in determining congestions in traffic through the application of image processing. A model that can be used for the control of traffic signals as a function of traffic data received from video camera was developed. Traffic density extraction of the road was based on the area occupied by the vehicles in the pixels of acquired image. Two parameters were used as output in the proposed model such as traffic cycle and time for every lane in terms of how dense the

traffic is.

With a view to create an even swift movement access to emergency vehicles, Kabir and Salam, (2016) have proposed a system for reducing the delay times and providing quicker paths for emergency vehicles. A combination of field programming gate array - System on Chip (SoC) and infrared radio frequency identification sensor was used to implement the system. The system during the simulation stage was observed to respond almost immediately when emergency vehicles were added to lane for which it paved a least delay time of exit (Kabir & Salam, 2016; Mahajan, Atiwadkar, Patil, Lande, & Choudhari, 2016).

(Mishra & Singh, 2015; Ou & Wang, 2016) proposed a framework for optimizing the traffic control system dynamically. According to the model, infrared sensors were introduced on either side of the road. The presence of vehicles was thus detected and sent to a centralized microcontroller, which determined the delay and movement times.

It was with the view of improving the movement of emergency vehicles that (Vahedha & Jyothi, 2017) proposed a system for the intelligent control of traffic, whereby every vehicle gets to carry a Radio Frequency Identification (RFID) at all time. The signal conditions are studied by the RFID reader after which, an exit pathway is created for the exit of the emergency vehicles.

Round robin scheduling algorithm has been broadly used to describe the basic nature of a signalized road traffic intersection (Nipa & Islam, 2015). Round robin is a starvation free computer scheduling algorithm, which implies that every process waiting on the queue for access to some resources would get their fair share once processing gets to their turn.

Genetic algorithm has been widely used to solve optimization problems that rather seem unsolvable. It is very ideal for problems involving series of objective functions governed by certain constraints. Genetic algorithm is able to start with an initial population, perform a crossover function, analyze new generation for presence of better offspring, do mutation and selection all with the view to be achieving a global optimal result (Carr, 2015).

In this study, data were collected from the signalized road intersection point (Obasanjo shopping complex area, Bosso road) and critically analyzed using a round robin and genetic algorithm. A mathematical model was deduced and inferences were drawn from the model. The study aimed at reducing the travel time and the experienced delays posed by the current traffic control system through the application of modified round robin and genetic algorithm.

1. Proposed Methodology

Optimization of multi objectives based system can be easily handled by Genetic algorithm. Vehicle lengths in terms of density, vehicle delay lengths, and other constraints in terms of driver behaviours with respect to obedience to traffic control system can all be modeled into genetic algorithm according to the period; under-saturated and over-saturated dynamics. This set of concepts is adopted in this work and used in data capture, representation, and interpretation.

The inspiration of Genetic algorithm was derived after evolution of life itself (Carr, 2015). Three major stages denote its searching space:

- Stage 1: Crafting an initial population of chromosomes.
- Stage 2: Evaluating a cost function
- Stage 3: Producing a new population

Figure 1 shows the GA for the traffic system. Taking the average of extra delay caused by take off, size and other unstructured behaviours of vehicles plying the road intersection arrived at a resulting constraint value of 5.

2. Modification on Round Robin Scheduling Algorithm

In this work, the modification implemented on the normal traditional round robin scheduling algorithm is based on the logic gate of NOR. When two vertically connected lanes are of no activity in terms of vehicles, instead of the traffic system to switch the movement to them, it instead switches to the other lanes with at least one vehicle waiting to ply the road. The round robin upon recipient of two nulls, processes the two 0s inputs as 1 using the

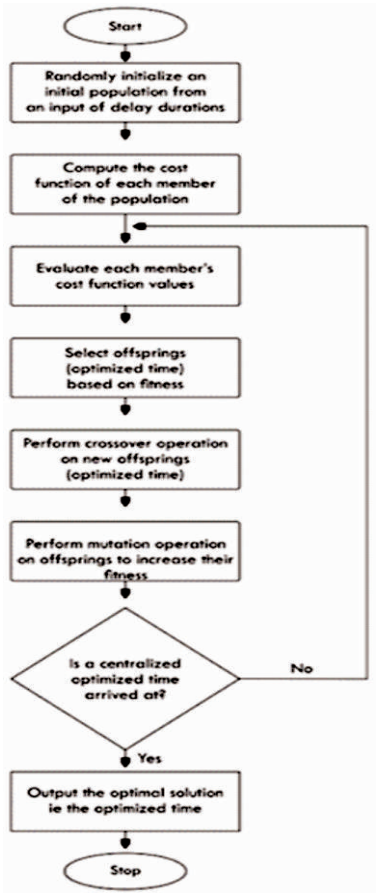

Figure 1. Genetic Algorithm Flowchart for the Traffic Control System

alternative logic gate, NOR and therefore skips the two vertical lanes providing such inputs.

The motivation behind this technique is derived from the phenomenal occurrences of two opposite lanes being empty at the same time. This occurrence, according to the data gathered from the traffic analysis occurs twice everyday.

The modification on Round Robin would exceptionally help to prevent waste of time as no allocation of service time is given to two parallel lanes without at least a waiting vehicle. The impatient attitude of motorists would be curbed in this technique as it signifies that no one waits for nothing.

In Figure 2, the modified round robin scheduling algorithm comes into play when no activity in terms of vehicles are waiting to ply the road on points A_0 and correspondingly parallel A_{01}. The control thereby switches movement permission to the same A_1 and correspondingly parallel A_{11} and vice versa. Figure 3 shows the lights at the intersection points.

3. Location and Data Collection

The location of the adaptive traffic control system to be optimized is in the heart of Minna, Niger State - Nigeria. It is one of the busiest road intersections in the city due to existence of banks, shopping malls, a hospital, and other business enterprises set up along the road. The road also serves as the main route to schools. Obasanjo shopping complex area's signalized traffic control system is shown in Figure 4.

To capture the traffic flow and delay at each of the four lanes of the junction, a set of traffic counts were carried out at three specific periods (morning, afternoon, and evening). These counts lasted 20 minutes for each (of the

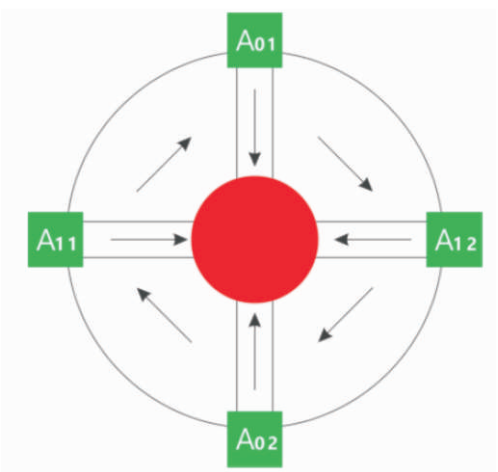

Figure 2. The Concept of Modified Round Robin Scheduling Algorithm

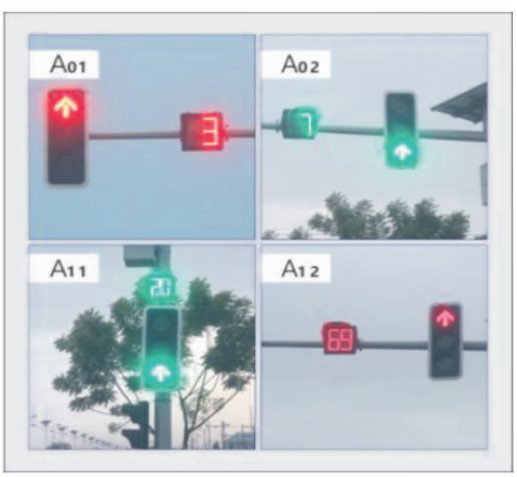

Figure 3. Traffic Light Display at the Road Intersection Point

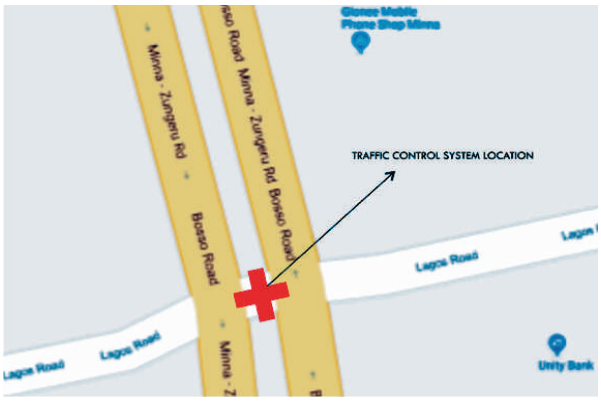

Figure 4. Obasanjo Shopping Area Intersection Location

three periods).

For Lane A, at morning peak period (from 7:00 am - 9:00 am), an average of 1210 vehicles were observed to be moving per 20 minutes. An average of 38 vehicles were noticed to accumulate at the stop point with delay duration of 103 seconds.

For Lane B, at morning peak period (from 7:00 am - 9:00 am), an average of 872 vehicles were observed to be moving per 20 minutes. An average of 34 vehicles were noticed to accumulate at the stop point with delay duration of 103 seconds.

For Lane C, at morning peak period (from 7:00 am – 9:00 am), an average of 452 vehicles were observed to be moving per 20 minutes. An average of 31 vehicles were noticed to accumulate at the stop point with delay duration of 97 seconds.

For Lane D, at morning peak period (from 7:00 am - 9:00 am), an average of 456 vehicles were observed to be moving per 20 minutes. An average of 27 vehicles were noticed to accumulate at the stop point with delay duration of 97 seconds.

During peak period at noon (from 12:00 – 1:00 pm) on Lane A, it was recorded that an average of 1245 vehicles ply the road per 20 minutes, 27 vehicles at stop point and a delay duration of 96 seconds.

During peak period at noon (from 12:00 – 1:00 pm) on Lane B, it was recorded that an average of 1103 vehicles ply the road per minute, 24 vehicles at stop point and a delay duration of 96 seconds.

During peak period at noon (from 12:00 – 1:00 pm) on Lane C, it was recorded that an average of 392 vehicles ply the road per minute, 15 vehicles at stop point and a delay duration of 80 seconds.

During peak period at noon (from 12:00 - 1:00 pm) on Lane D, it was recorded that an average of 508 vehicles ply the road per minute, 15 vehicles at stop point and a delay duration of 80 seconds.

The peak evening period of the road intersection was taken a between 4:15 - 6:30 pm.

Averagely, it was observed that 858 vehicles ply Lane A of which a build-up of 37 vehicles was noticed with stop duration of 109 seconds.

Averagely, it was observed that 933 vehicles ply Lane B of which a build-up of 41 vehicles was noticed with stop duration of 109 seconds.

Averagely, it was observed that 285 vehicles ply Lane C of which a build-up of 24 vehicles was noticed with stop duration of 109 seconds.

Averagely, it was observed that 330 vehicles ply Lane D of which a build-up of 21 vehicles was noticed with stop duration of 109 seconds.

4. Mathematical Model

Considering a single lane L_1 that stops for the time STL_1 of red light and moves for duration of time MTL_1 of the green light, if the average arrival time of vehicle in L_1 is λ_1 and the service time for vehicle is S_1 (time between departure of vehicles in the queue), then that R_1 will last until the green light of the remaining three lanes, i.e.

$$STL_1 = MTL_2 + MTL_3 + MTL_4 \quad (1)$$

$$STL_2 = MTL_1 + MTL_3 + MTL_4 \quad (2)$$

$$STL_3 = MTL_1 + MTL_2 + MTL_4 \quad (3)$$

$$STL_4 = MTL_1 + MTL_2 + MTL_3 \quad (4)$$

Total delay TD_1 in L_1 is the sum of delay D_{1i} of all vehicles in the queue, ie:

$$TD = \sum_{i=1}^{N} D1l \quad (5)$$

where,

N is the number of vehicles in the queue

D_{1i} is the delay of i^{th} vehicle in L_1, i=1,2,3,…

Average delay per vehicle is:

$$ADV_1 = \frac{TD_1}{N_1} = \frac{1}{N}\sum_{i=1}^{N_1} D1i \quad (6)$$

Number of vehicles:

$$N_1 = \frac{STL_1 + MTL_1}{\lambda_1} \quad (7)$$

$$N_1 = \frac{MTL_1 + MTL_2 + MTL_3 + MTL_4}{\lambda_1} \quad (8)$$

The TD_1 can be expressed as the sum of an arithmetic progression:

$$S_n = \frac{n}{2}\left(a + l\right) \quad (9)$$

where:

$$a = \lambda_1 - S_1 \quad (10)$$

$$l = STL1_{-1} \quad (11)$$

$$n = \frac{STL_1 - 1}{\lambda_1 - S_1} \quad (12)$$

i.e.

$$S_n = \frac{STL_1 - 1}{2(\lambda_1 - S1)}\left[(STL1_{-1}) + (\lambda_1 - S_1)\right] \quad (13)$$

$$= \frac{STL_1 - 1}{2}\left[1 + \frac{STL_1 - 1}{\lambda_1 - S_1}\right]$$

$$\frac{STL_1 - 1}{2}\left[1 + \frac{STL_1 - 1}{\lambda_1 - S_1}\right] \quad (14)$$

Then

$$ADV_1 = \frac{\lambda 1\left(STL_1 - 1\right)}{2(STL_1 + MTL_1)}\left[1 + \frac{STL1 - 1}{\lambda_1 - S_1}\right] \quad (15)$$

$$ADV1 = \frac{\lambda 1(MTL2 + MTL3 + MTL4 - 1)}{2(MTL2 + MTL3 + MTL4 + MTL1)}\left[1 + \frac{MTL2 + MTL3 + MTL4 - 1}{\lambda_1 - S_1}\right] \quad (16)$$

By induction average delay per vehicle of the second lane L_2, ADV_2 is:

$$ADV2 = \frac{\lambda 2(MTL1 + MTL3 + MTL4 - 1)}{2(MTL1 + MTL3 + MTL4 + MTL2)}\left[1 + \frac{MTL1 + MTL3 + MTL4 - 1}{\lambda 2 - S2}\right] \quad (17)$$

By induction average delay per vehicle of the second lane L_3, ADV_3 is:

$$ADV3 = \frac{\lambda 2(MTL1 + MTL2 + MTL4 - 1)}{2(MTL1 + MTL2 + MTL4 + MTL3)}\left[1 + \frac{MTL1 + MTL2 + MTL4 - 1}{\lambda 3 - S3}\right] \quad (18)$$

By induction average delay per vehicle of the fourth lane L4 , ADV4 is:

$$ADV4 = \frac{\lambda 2(MTL1 + MTL2 + MTL3 - 1)}{2(MTL1 + MTL2 + MTL3 + MTL4)}\left[1 + \frac{MTL1 + MTL2 + MTL3 - 1}{\lambda 4 - S4}\right] \quad (19)$$

The objective function F, therefore implies:

$F(MTL_1, MTL_2, MTL_3, MTL_4) = ADV_1\, ADV_2 + ADV_3 + ADV_4 + C$

Hence, the task to use Genetic Algorithm to minimize the functions, F_1, F_2, F_3, F_4. i.e.:

Minimize $F_1(G_1, G_2, G_3, G_4)$

Minimize $F_2(G_1, G_2, G_3, G_4)$

Minimize $F_3(G_1, G_2, G_3, G_4)$

Minimize $F_4(G_1, G_2, G_3, G_4)$

5. Results

Before the optimization of the road traffic network, the following was observed as the traffic behaviour as shown in Table 1. During the optimization initialization phase, the Morning, Afternoon, and Evening peak periods were set at 10 seconds each. A dummy value of 5 was added to each of the periods to provide for flexibility. This therefore, brings the initial population to 15 seconds for each of the periods. Each of these timing units gets evaluated with respect to the cost function, which in this case is the minimum amount of time it requires to have vehicles exit the lanes across all connected lanes. The mutation operator running at the background of the algorithm increases the exploration of the process. A new set of optimized timing plan gets created, and again, gets evaluated by a cost function to check if it meets a global optimum. This iteration continued and it was observed that the Genetic Algorithm converged at a value less than 10^{-6}. At the end of the optimization, the obtained results are presented in the tables below (Tables 1 - 8):

Table 2 shows the analysis of the traffic after optimization.

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	38	103
Afternoon	30	96
Evening	42	109

Table 1. Traffic Analysis of Lane A before Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	34	103
Afternoon	24	96
Evening	41	109

Table 2. Traffic Analysis for Lane B before Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	31	97
Afternoon	15	80
Evening	24	109

Table 3. Traffic Analysis for Lane C before Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	27	97
Afternoon	15	80
Evening	21	109

Table 4. Traffic Analysis for Lane D before Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	38	55
Afternoon	30	52
Evening	42	30

Table 5. Traffic Analysis for Lane A after Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	34	54
Afternoon	24	52
Evening	41	35

Table 6. Traffic Analysis for Lane B after Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	38	46
Afternoon	26	43
Evening	40	34

Table 7. Traffic Analysis for Lane C after Optimization

Peak Periods	Vehicles per Stop Point	Delay Duration
Morning	38	46
Afternoon	24	43
Evening	38	34

Table 8. Traffic Analysis for Lane D after Optimization

Based on the achieved results, it is not outlandish realizing that it is very feasible to reduce the travel time experienced by motorists plying Obasanjo shopping complex road through the adjustment of the timing delay pattern as presented in Figures 5, 6, 7, and 8.

Conclusion and Future Work

As judged from the optimization route, a combination of

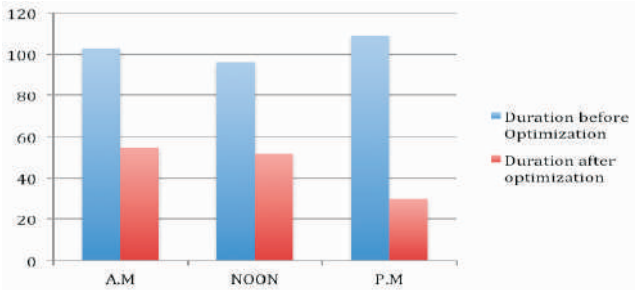

Figure 5. A Chart of Lane A showing the Traffic Delay before and after Optimization

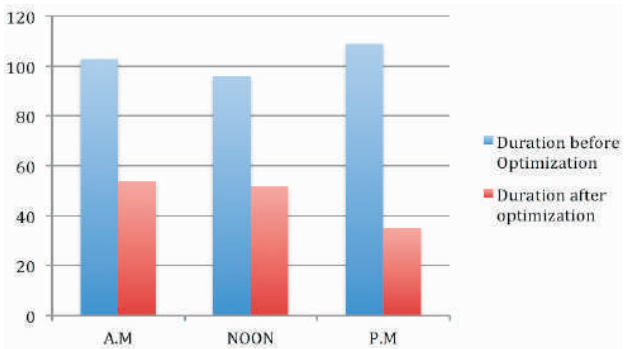

Figure 6. A Chart of Lane B showing the Traffic Delay after and after Optimization

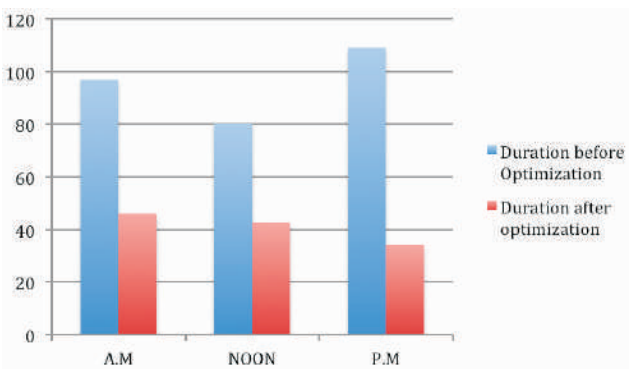

Figure 7. A Chart of Lane C showing the Traffic Delay after and after Optimization

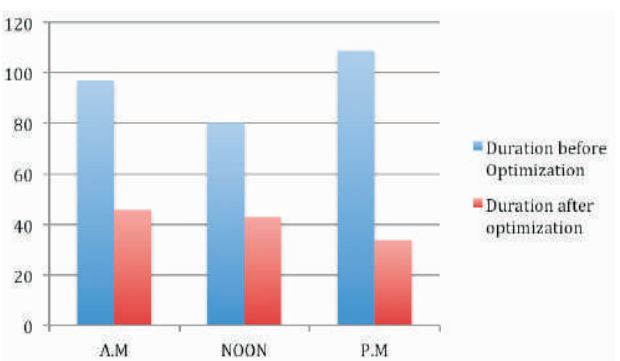

Figure 8. A Chart of Lane D showing the Traffic Delay after and after Optimization

modified round robin and genetic algorithm has revealed new timing plan for the Obasanjo shopping area intersection. The plan has proposed a decrease in the delay time experienced by motorists while plying the road. The delay durations at morning, noon and evening peak periods have been cut down to 40%, 35%, and 50%, respectively.

Combination of modified round robin and genetic algorithm to optimize Adaptive traffic control system is the contribution of the work.

The research has also proved that to increase the efficiency of a signalized traffic control system, a reduction in the service time can help in the actualization of such efficiency. This is in the case that an accumulation of service time contributes directly to the delay experienced by connected lanes in the traffic.

This work only puts into consideration the behaviour of the traffic on Mondays, Tuesdays, Wednesdays, and Thursdays. Further work to ascertain and optimize the behaviour of the traffic system is encouraged for Fridays, Saturdays, and Sundays. It would be very interesting to see how the optimization of the traffic system would look like for Fridays, considering the fact that there exists a central mosque, (which greatly contributes to the traffic flow) just few meters away from the signalized intersection.

Further works could focus on the simulation of the achieved results in the work with the purpose of fine-tuning uprising bottlenecks.

References

[1]. Nipa, L. N., & Islam, M. (2015). Intelligent Traffic Control System based on Round. *Int. J. Sci. Res. Publ.,* 5(8),1-8.

[2]. Carr, J. (2015). *An Introduction to Genetic Algorithms.* senior project, 1-40.

[3]. Gündoğan, F., Karagoz, Z., Kocyigit, N., Karadag, A., Ceylan, H., & Murat, Y. Ş. (2014). An evaluation of Adaptive Traffic Control System in Istanbul. *Turkey. J. Traffic Logist. Eng.,* 2(3), pp-198-201.

[4]. Hasan, M., Saha, G., Hoque, A., & Majumder, B. (2014). Smart Traffic Control System with application of Image Processing Techniques. *3rd Int. Conf. Informatics, Electron. Vis.* (pp. 1-4).

[5]. Kabir, A. N., & Salam, K. M. A. (2016). Implementation of an Intelligent Traffic Control System: The use of FPGA and Verilog HDL. *J. Mod. Sci. Technol.,* 4(1), 154-162.

[6]. Mahajan, S., Atiwadkar, A., Patil, K., Lande, T., & Choudhari, P. S. (2016). Universal Network for Intelligent Traffic Control System: Stolen vehicle detection, Emergency vehicle clearance, Fine Collection and Dynamic Traffic Light Control. *Int. Res. J. Eng. Technol.,* 3(6), 543-547.

[7]. Mishra, A., & Singh, K. (2015). Density based Intelligent Traffic Control System using IR Sensors. *Int. J. Sci. Res.,* 4(5), 2277-2278.

[8]. Ou, H., & Wang, Y. (2016). Development of Intelligent Traffic Control System based on Internet of Things and FPGA Technology in PROTEUS, *Int. Conf. Educ. Manag. Comput. Soc. (EMCS)* (pp. 405-409).

[9]. Pandit, V., Doshi, J., Mehta, D., Mhatre, A., & Janardhan, A. (2014). Smart traffic control system using image processing. *Int. J. Emerg. Trends Technol. Comput. Sci. (IJETTCS),* 3(1), 280-283.

[10]. Vahedha, & Jyothi, B. N. (2017). Smart traffic control system using ATMEGA328 micro controller and arduino software. *Int. Conf. Signal Process. Commun. Power Embed. Syst. SCOPES 2016 - Proc.* (pp. 1584-1587).

ABOUT THE AUTHORS

*-*** *Department of Computer Science, Federal University of Technology, Minna, Nigeria.*

3/343, Hill view, Town Railway Nager, Nagercoil
Kanyakumari Dist. Pin-629 001.
Tel: +91-4652-276675, 277675

e-mail: info@imanagerpublications.com
contact@imanagerpublications.com
www.imanagerpublications.com

I-manager Printing Press