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Genetic Algorithm Based Adaptive Control of Traffic Light Systems in Multiprocessor Architectures

H. Kodikara Arachchi



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by

H. Kodikara Arachchi



University of Moratuwa, Sri Lanka.
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Thesis submitted to

*the Department of Electronic and Telecommunication Engineering of
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H. Kodikara Arachchi

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Abstract

The traffic signal is one of the most common control devices used to manage highway traffic. Operating them as isolated units does not exploit their usefulness fully. An advanced system, in which traffic signals at junctions at a close proximity are coordinated, enables a more efficient method of traffic control. This thesis presents the development of hardware and software for the Uniroad traffic signal controller, for interfacing it to the proposed Advanced Traffic Control System (ATCS) for Sri Lanka, and a technique to calculate traffic plans based on the Genetic Algorithm for the coordinated system.



In hardware development, a communication interface and a general purpose input interface (GPII) are designed and implemented for the traffic signal controller (TSC). These are used to monitor the performance and change traffic plans manually or through computer control. The GPII is also used to interface vehicle detectors, pedestrian pushbutton etc. to the TSC.

The firmware platform of the TSC is developed to accommodate the requirements of both coordinated as well as individual systems. Synchronizing routines, temporary overrides and online time plan adjustments as well as error detecting and logging routines are introduced.

A control and monitoring (C&M) software package is developed for the control center. Using this package, the operation of each traffic signal controller can be monitored or optimally adjusted as needed.

A traffic plan calculator (TPC) is developed to calculate traffic plans needed for a set of coordinated traffic signal controllers. A new algorithm, based on well-known evolutionary algorithm, the Genetic Algorithm, was developed for TPC. The TPC provides an optimum set of traffic signal plans for a coordinated traffic signal system. This is a one requirement of proposed Advanced traffic Control System for Sri Lanka.

Thesis supervised by:

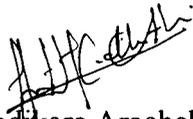
Dr. JAKS Jayasinghe Senior Lecturer, Department of Electronic and
Telecommunication Engineering



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The work included in this thesis has not been submitted for
any other degree at any institution.



H. Kodikara Arachchi
April 2000

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Dr. JAKS' Jayasinghe,
(Supervisor)

The work included in this thesis has not been submitted for
any other degree at any institution.

H. Kodikara Arachchi

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Dr. JAKS Jayasinghe,
(Supervisor)

To you

.....who work for the benefit of this little island



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Abbreviations

| | |
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| ATCS | Advanced Traffic Control System |
| AVL | Automatic Vehicle Location |
| AVL | Automatic Vehicle Location |
| CC | Control Center |
| CCTV | Closed Circuit Television |
| CD | Code Display |
| ComC | Communication Controller |
| CRT | Cathode Ray Tube |
| GA | Genetic Algorithm |
| GPI | General Purpose Input |
| NP | Non-polynomial |
| OF | Objective Function |
| Paramics | PARAllel MICROscopic Simulator |
| PI | Performance Index |
| RNM | Road Network Model |
| Rx | Receive |
| SBC | Single Board Computer |
| SCOOT | Split Cycle Offset Optimization Technique |
| TMod | Traffic Model |
| TPA | Traffic Plan Analyzer |
| TPC | Traffic Plan Calculator |
| TPG | Traffic Plan Generator |
| TPG&A | Traffic Plan Generator and Analyzer |
| TRANSYT | TRAffic Network StudY Tool |
| TRRL | Transport and Road Research Laboratory |
| TSC | Traffic Signal Controller |
| TSim | Traffic Simulator |

| | |
|-----|---------------------------------|
| TU | Timer Unit |
| Tx | Transmit |
| UTC | Urban Traffic Control |
| VRC | Vehicle/Roadside Communications |



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