

CONTROL AND PREDICTION OF TRAFFIC CRASHES IN THE RESIDENTIAL  
STREETS IN IRAQ USING THE EXPERT SYSTEM

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## DEDICATION

To the one who suffered a lot to overcome my difficulties.....

To the one who was burning day and night to make me shine and glitter.....

To the one who stayed up nights to give me a moment of happiness.....

To the one who was with my side by side and never leave me behind .....

To the one who supported me a lot during my research journey.....

To my beloved wife.....

I wish to dedicate my research to my children Hussein and Larrein for their endurance throughout my Ph.D journey.

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## ABSTRACT

Residential streets suffer from various traffic safety problems related to traffic accidents, especially in low and middle-income countries. This research's objective was to develop a novel system for controlling and predicting traffic accidents in the residential streets using the expert system (CPTCRSI-ES). Knowledge of the CPTCRSI-ES was collected from domain experts and published sources. The system comprised nine modules: the module to identify types of car accidents—causes—preventive actions effects, module to identify safety problems and related solutions, module to find the speed calculation, module to find the cut-through traffic calculation, module to find the Equivalent Property Damage Only (EPDO), module to find residential density calculation, module to rank traffic safety parameters, module to control the traffic accidents, and module to find the traffic accidents prediction. Verification, validation, and evaluation process (V, V and E) was conducted. Results were statistically analyzed using Number Cruncher Statistical Systems (NCSS) version 26. Verification was done by asking three groups of experts involving 20 professional engineering computers and domain experts. The arithmetic mean for evaluators' responses was higher than 4.2 out of 5, indicating a strong agreement. The Cronbach's alpha was 0.960, and internal consistency reliability (ICR) showed excellent reliability. Results for verification demonstrated the satisfaction of the experts with the proposed system. In the validation process, the experts were requested to propose appropriate strategies and solutions to address the safety problems and reduce traffic accidents. The arithmetic mean for matching the experts' answers and the outputs of CPTCRSI-ES was higher than 4, and the Cronbach's alpha was 0.917 and ICR, indicating excellent reliability. Finally, evaluation of the system by its end-users showed that the overall assessment rating was more than 4, Cronbach's alpha was 0.932, and ICR showed excellent reliability. Results for V, V, and E demonstrated that the system had met its primary objectives. The proposed system adopted in this research can help traffic safety authorities control and predict traffic accidents.

## ABSTRAK

Jalan-jalan kawasan perumahan mengalami pelbagai masalah keselamatan lalu lintas yang berkaitan dengan kemalangan jalan raya, terutama di negara berpendapatan rendah dan sederhana. Objektif penyelidikan ini adalah untuk mengembangkan sistem baru untuk mengawal dan meramalkan kemalangan jalan raya di jalan kawasan perumahan menggunakan sistem pakar (CPTCRSI-ES). Pengetahuan mengenai dikumpulkan dari pakar domain dan sumber yang diterbitkan. Sistem ini merangkumi sembilan modul: modul untuk mengenal pasti jenis kemalangan kereta - kesan tindakan pencegahan-penyebab, modul untuk mengenal pasti masalah keselamatan dan penyelesaian yang berkaitan, modul untuk mencari pengiraan kelajuan, modul untuk mencari pengiraan lalu lintas, modul untuk menentukan Kesetaraan Kerosakan Hartabenda Sahaja (EPDO), dan penilaian (V, V and E) telah dilakukan. Hasilnya dianalisis secara statistik menggunakan Sistem Perangkaan Number Cruncher (NCSS) versi 26. Pengesahan dilakukan dengan meminta tiga kumpulan pakar yang melibatkan 20 profesional komputer kejuruteraan dan pakar domain. Purata aritmetik untuk tindak balas penilai lebih tinggi daripada 4.2 daripada 5, menunjukkan persetujuan yang kuat. *Cronbach's alpha* adalah 0.960, dan kebolehpercayaan ketekalan dalaman (ICR) menunjukkan kebolehpercayaan yang sangat baik. Hasil pengesahan menunjukkan kepuasan para pakar dengan sistem yang dicadangkan. Dalam proses validasi, para ahli diminta untuk mengusulkan strategi dan penyelesaian yang sesuai untuk mengatasi masalah keselamatan dan mengurangi kemalangan jalan raya. Purata aritmetik untuk padanan jawapan pakar dan output CPTCRSI-ES lebih tinggi daripada 4, dan *alpha Cronbach* adalah 0.917 dan ICR, menunjukkan kebolehpercayaan yang sangat baik. Akhirnya, penilaian sistem oleh pengguna akhir menunjukkan bahawa Penilaian keseluruhan penilaian lebih dari 4. *Cronbach's alpha* adalah 0.932, dan ICR menunjukkan kebolehpercayaan yang sangat baik. Hasil untuk V, V, dan E menunjukkan bahawa sistem telah memenuhi objektif utamanya. Sistem cadangan yang digunakan dalam penyelidikan ini dapat membantu pihak berkuasa keselamatan lalu lintas mengawal dan meramalkan kemalangan jalan raya.

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## LIST OF ABBREVIATIONS AND SYMBOLS

<i>CPTCRSI-ES</i>	-	Control and Prediction of Traffic Crashes In The Residential Streets In Iraq Using The Expert System
<i>EPDO</i>	-	Equivalent Property Damage Only
<i>AI</i>	-	Artificial Intelligence
<i>CSO</i>	-	Central Statistical Organization
<i>TRS</i>	-	Transverse,rumble,dtrips
<i>AADT</i>	-	Annual Average Daily Traffic
<i>FL</i>	-	Fuzzy logic
<i>KA</i>	-	Knowledge acquisition
<i>TRB</i>	-	Transportation Research Board
<i>FHWA</i>	-	The Federal Highway Administration
<i>ITE</i>	-	Institute of Transportation Engineers
<i>NHTSA</i>	-	The National Highway Traffic Safety Administration
<i>BAC</i>	-	Blood Alcohol Concentration
<i>APM</i>	-	Accident Prediction Model

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