ENHANCING URBAN RESILIENCE THROUGH INTELLIGENT SECURITY RESOURCE ALLOCATION: A CASE STUDY ENCOMPASSING COLOMBO BUSINESS DISTRICT, SRI LANKA

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Master of Science in Operational Research

Department of Mathematics

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Dissertation submitted in partial fulfillment of the requirements for the degree Master of Science in Operational Research

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Declaration

I declare that this is my own work, and this dissertation does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other University or Institute of higher learning, and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgment is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the Master's research under my supervision. I confirm that the declaration made above by the student is true and correct.

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Abstract

National security is critical for protecting citizens from various threats, ensuring political stability, promoting economic growth, fostering social cohesion, and maintaining strong international alliances. It also underpins advancements in human rights, public health, education, and infrastructure development. Achieving these objectives requires a resilient and adaptive security infrastructure capable of responding effectively to emerging challenges. The unavailability of a sophisticated model to deploy security sources effectively and efficiently to where multiple terrorist attacks have occurred or vulnerable locations where emergencies can occur is challenging to ensure and enhance urban resilience.

This research focuses on enhancing urban resilience within the Colombo district by optimizing the deployment duration of security resources to multiple places at once to address multiple terrorist threats. The primary objective of the study is to identify vulnerable locations across the district and assess the availability of nearby security units efficiently. By strategically deploying the closest resources with the required number of security personnel, the study aims to minimize response times, thereby mitigating risks and efficiently managing security incidents.

To achieve this, travel distances between security sources and identified vulnerable locations were calculated using Google Maps, with the resulting time data organized and analyzed in Excel. The allocation of security resources was optimized using OpenSolver, applying the Integer Linear Programming (ILP) technique. This approach minimizes the total operational time required to respond to security threats, ensuring effective and efficient deployment of security personnel to safeguard multiple vulnerable areas. By optimizing response strategies, this research contributes to a more resilient security framework with feasible and optimal solutions for the simulated scenarios by satisfying the constraints and the study results show the realisticness of the suggested model.

The study categorizes three types of potential attacks in Sri Lanka, with security allocations based on risk levels, and cultural, and commercial importance at prominent sites. Allocation of the three main security sources is based on the Opensolver optimization tool along with the integer programming.

Keywords: Urban resilience, Intelligent Security Sources, Integer linear programming problem, Route Optimization

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List of Abbreviations

Abbreviation	Description
STF	Special Task Force
SIGINT	Signals Intelligence
HUMINT	Human Intelligence
OSINT	open-source intelligence
UN	United Nations
AI	artificial intelligence
ML	machine learning
SIEM	Security Information and Event Management
AQ	Al-Qaeda
ISIS	Islamic State of Iraq and ash-Sham
HVEs	Homegrown Violent Extremists
IRGC QF	Islamic Revolutionary Guard Corps – Qods Force
NTJ	National Thowheeth Jama'ath
LP	Linear Programming
ILP	Integer Linear Programming
GRG	Generalized Reduced Gradient
NSC	National Security Council
SIS	State Intelligence Service
MIC	Military Intelligence Corps