

ABSTRACT

This thesis studies the preparation for the realization of futuristic logistic transportation system based on the technology of Autonomous Aerial Vehicle (AAV) in Indonesia. Traffic congestion, especially in Indonesia, inflicts a serious problem, which cause waste to available resources, such as time and cost. Besides that, Indonesia has not applied state of the art monitoring and management system. To realize a futuristic logistic transportation system, this thesis proposes the use of AAV as the main mode of transportation combined with Sparse Code Multiple Access (SCMA), autoencoder for accelerating the AAVs signal processing, and quantum algorithm for the AAVs route optimization.

Regarding the possible blank spots, which occur in the monitoring process, this thesis analyzes possible blank spot locations to determine relay locations to help connect the AAV and the closest base station (BS). This thesis utilizes SCMA to overcome the scarcity of resources, such as frequency and time-slot, which happens when multiple AAVs are connected to the same BS simultaneously. To achieve more efficient and lower latency signal processing procedure, this thesis also integrates autoencoder. Due to a limited supply of power from the AAV battery, the AAV is required to travel the closest distance between each cities. To solve this problem, this thesis applies a quantum algorithm called the Quantum Approximate Optimization Algorithm (QAOA), which is executed once and the result is stored in the AAV. All techniques used in this thesis are simulated using classical computers using parameters, which are suitable for practical applications in the field.

This thesis has successfully developed a new state initialization design, which is useful in improving the performance of QAOA in the process of the AAV route optimization. The previously mentioned state initialization can be obtained by designing a new $B\left(\frac{1}{k}\right)$ operator for a k -qubits system. This modification makes hardware designing less complex due to a limited number of circuit copies are practical. SCMA, autoencoder, and UAV are still in research stage.

Keyword: unmanned aerial vehicle, quantum algorithm, machine learning, optimization.