DRONE-BASED PACKAGE DELIVERY: OPTIMAL PATH PLANNING AND COST ESTIMATION

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NOVEMBER 2018

OVERVIEW

The objective of our project is to develop a small-scale modular software which can be helpful for a small business company to optimally transport lightweight items(less than 5 kg) in a range of (10 km). My work is on software aspect of project which has been shown below -

- Formulated problem statement in the group with the appropriate assumptions
- Selected the appropriate algorithm for our problem objective
- Implemented the genetic algorithm and Improved the performance using a clustering approach
- Integrated the cost model of drone with an optimal path planning model
- Validated the result with standard data sets available online
- Built a visualizer to animate the optimal solution
- Documented codes on Github and made the final presentation on working on software

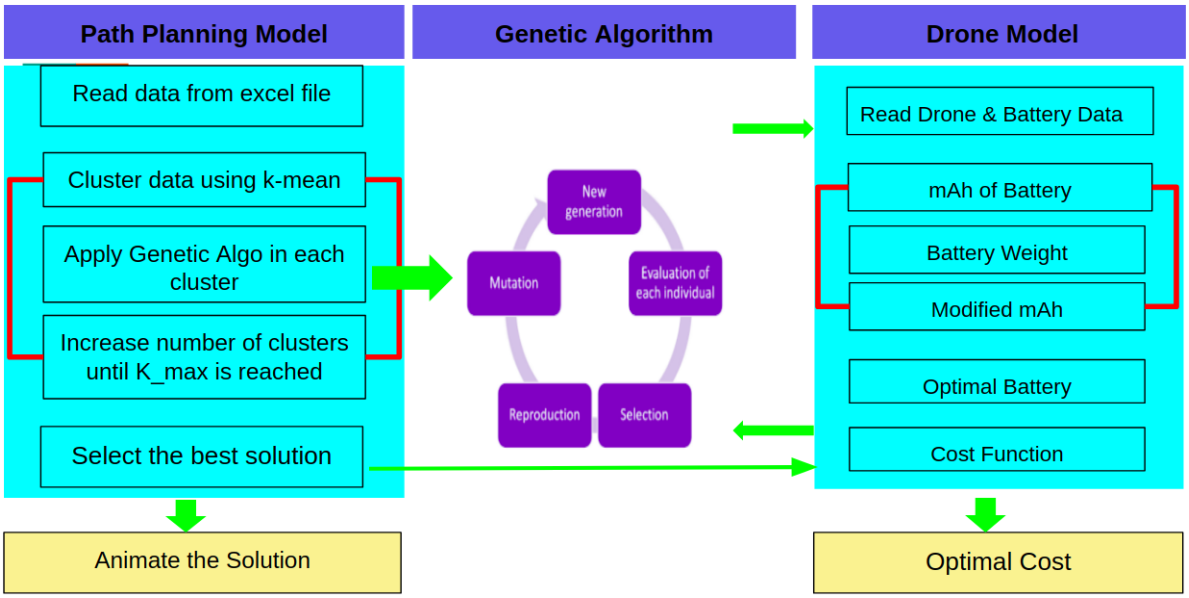
The individual contribution has been explained in details with the help of the following sections -

Literature Review & Problem Formulation

Based on the various assumptions listed in the main report, our problem has been converted into a standard capacitance vehicle routing problem. The problem has been mathematically formulated with the help of literature. Various approaches of solving the CVRP has been studied which involve exact algorithms like Branch and Bound, Heuristics approaches like two-phase methods and meta-heuristics methods which either takes some solution and improves it or randomly make searches in solution space. After the literature review of state of art methods for cvrp which give approximate solutions on larger nodes, we decided genetic algorithm to implement for our purpose. After more review on recent papers, we found that performance can be improved if we cluster the nodes and then apply the genetic algorithm which will avoid the problem of local minimum

Implementation of Genetic and K-Means Algorithm

The algorithm has been developed in five modules where the main module applies the genetic algorithm and takes cost function from the drone model module, clustering function from k-means module and send the optimal result to animation module. There is one additional module which creates clusters on the scattered data to help in visualization. The flow diagram of our algorithm has been shown below which was developed by me -

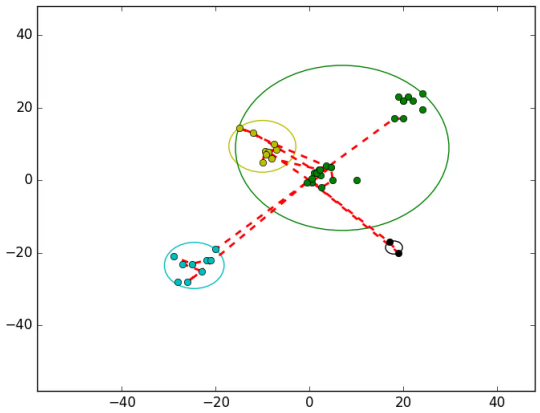


Validation of the Path Planning Model

Model was validated using the online available datasets.[1] Result of the validation has been described in the main report which shows our algorithms gives a result with optimality level of 70 - 80 %

Visualization of the Optimal Solution

The visualizer is a simple python based program which uses an image processing module and invokes functions from k-mean plot file



Documentation on Github

The project has been properly documented on my personal GitHub account shm4771[2] with the instructions to run the codes.

Learnig from the Project

Analysis of real world problem, mathematical modeling and implementation, report writing, documentation, literature review and coordination among team are the key skills gained in the project

[1] Used Dataset A for validation of the model
[2] Drone-based-package-delivery-project of the github user shm4771