

Problem Statement

In today's world where integration of technology into our day-to-day tasks has changed the way how we perceive our existence and also has led to a wide scale upliftment of both the rural and urban spaces. Making a self-sufficient city is the call for the day, which uses its resources judiciously, is eco-friendly and has a solution to most of its small day-to-day problems. To improve the quality of life of its citizens and improve the efficiency by which the city functions and make it more accessible and mobile are some of the aims that the present government keeps in mind while developing a smart city. If we can use what we have learnt in terms of fuzzy logic, genetic algorithms or neural networks in solving any one aspect of a normal city, we can make it a smart one.

Abstract

The proposed model tackles the problem and waste disposal, collection and management. What we propose is in using smart sensors in our garbage bins placed all around the city, we will receive its data in the form of percentage volume filled and the instantaneous rate at which it is getting filled. We will take these two inputs in our fuzzy control system where we fuzzify it and the defuzzify it to get a single output on the basis of 9 different rules which will determine whether the said garbage bin is filled enough that it is needed to be emptied. This process will be repeated out over a fixed time gap. Once we identify the garbage bins that needs to be emptied we will enter this data in our optimization program based on the principles of genetic algorithms which will assist the garbage truck drivers in finding the shortest path that they should take so as the optimize all the resources that are required in completing this task.

This approach not only helps in keeping our city clean as we will always be able to identify the garbage bins that are completely filled before it causes litter on the streets but also helps in optimizing the amount of garbage trucks, diesel intake and also the manual work that is required to complete this task making it truly a SMART CITY.

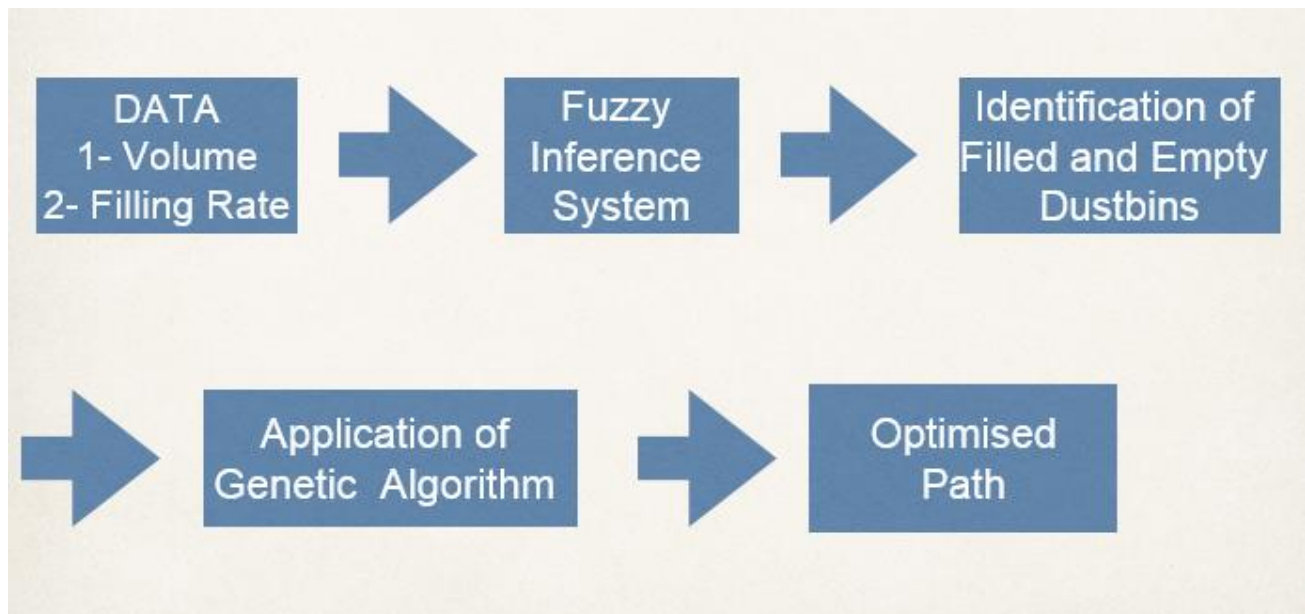
PART 1: FUZZY LOGIC

- ❖ For this model, we have assumed that the layout of the bin in our city is in the form of a $n \times n$ matrix.
- ❖ The said dustbins are located inside each cells of this $n \times n$ matrix.
- ❖ We take two input values, namely Volume percentage (where $0 < V < 1$) and Filling rate (where $0 < R < 1$) for each of our decided dustbin and put it through an Inference System in MATLAB.
- ❖ This gives us an output matrix of same $n \times n$ size with each value ranging from 0 to 1 based on pre-decided fuzzy rules.

PART 2 : GENETIC ALGORITHM

- ❖ This helps us to find the optimal solution by setting up a genetic algorithm to search for the shortest route.
- ❖ A single truck travel to each of the garbage bin and completes the route by returning to the starting point.
- ❖ Each garbage bin is visited by the truck exactly once.
- ❖ This helps us save money, manual labour and diesel.

WORK FLOW



Summary-

The main aim of the model is to successfully use the theories of Fuzzy System and Genetic Algorithm in providing a viable solution to our waste disposal and collection problem. We provide an optimized timetable for the whole collection process, keeping in mind when a garbage bin is completely full or predicting when it will get filled up in future and the shortest path that needs to be taken up so as to cover all the filled garbage bins without going through the redundant task of checking the empty or nearly empty garbage bins, saving up the diesel and the man work required, using small amount of trucks to complete the whole task smartly while keeping our city clean and disease free.