**Using Genetic Algorithm for Advanced Municipal**

**Waste Collection in Smart City**

**Main Idea:**

The research paper explores the application of genetic algorithms to optimize municipal waste collection in the context of a Smart City. It discusses the concept of the Smart City and the significance of data analysis within its framework. The paper proposes a GA implementation to calculate more efficient routes for garbage trucks, resulting in improved waste management. The goal is to determine the potential for real-world implementation of the GA-based optimization solution for waste collection.

**Data :**

* Collect different types of data such as initial population , weight of roads , weight span from first road to final road ,minimum weight change of road over defined time (iterations) based on three different scenarios.
* Analysis different data based on population throwing and crossover mutation.

**Paper Overview :**

The main focus of the paper was on the optimization algorithms for smart city management and to deal with municipal waste collection considering three different scenarios .

Our reseachers focused on

* related works in the field of GA utilization for waste collection optimization
* implementation of GA and whole issue of waste collection simulation.
* the possibility of using the GA in real scenarios for the waste collection issue, comparing the results with current works and giving a hint for real implementation.

The main objective of the genetic algorithm was

* Representation and generation process for population:

For initial parameters were population size 5000 max , crossing 40% , selection 60%(throwing 40%) and 80 vertices . The size of population impacts the power requirement, time requirement of the algorithm, but also influences the success rate of finding best solution. . This chapter provides measurements analysis regarding the best settings for the population size. Around 50 population we achieve 12.5 % of road weight improvement and only 40 % speed decreased. This means that we achieve 50 % of possible improvement with less than 50 % speed decrease. In Population throwing we can see the that till 40 % is worth to throw the old population, because it has positive impact on the road weight. More than 40 % of throwing has negative impact on the road weight with also continuously growing time requirements for one iteration

* Optimization process of selection, recombination (crossover) and mutation:

It is not possible to deal with the optimization process only with crossover or only with mutation separately. It is also necessary to chose the efficient ratio between these two operations, otherwise the algorithm will be ineffective

* Main criteria for choosing best individual and best solution:

From 50 %, the increasing maximum crossover has negative impact on the road weight. The best ratio from measurements is min. 80 % mutation and max. 20 % crossover setting.

**Result Analysis:**

In this research the measurements were compared for three different scenarios with 40, 60 and 80 nodes (vertices). The estimate cost saving for one cycle of waste collection shows that the average improvement is about 15% from 9.52% to 20.66% looking to the min., max. and average road weight. The 15% costs saving is worthy and it is general cost saving for one travelled km by the garbage truck. These resources might be invested to spread the garbage trucks into the bigger area or more often waste collection.

The best parameters for the GA settings were shown (40 % throwing, 20 % max. crossover, population based on power requirements), when the low-power and powerindependent real implementations were also considered.

**To Sum Up:**

The authors emphasize the importance of paper explores the application of genetic algorithms to optimize municipal waste collection in the context of a Smart City. The researchers collected different data and experimented on three scenarios . Their solution was based on the idea of IoT infrastructure. After experimental measurements and results, our researchers were successful in proving the power of GA and also the possible cost savings (in average 15 %) to handle this Smart City issue more efficiently.