Smart City

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EECE 2560 Fundamentals of Engineering Algorithms

Project Scope

- Efficiently optimize resource allocation so usage is maximized and waste is minimized.
- Account for the dynamics presented within a city.
- Completely automate the process of allocating resources.

Literature Review

The key issues of any city:

- Energy management: optimization of use, conversion, transportation, and losses. One of the future practices will be the management of electric vehicles' batteries to take in the energy when there is surplus of energy and give off when there is shortage.
- Trash management. One of the solutions is diligent sorting of trash with further burning to get the energy, and reuse of remnants.
- Water purification. Chemicals in detergents, cleaning, fertilizers, pesticides, byproducts of production and heavy metals cause many illnesses. The policies and proper filters are of high priority for a smart city.
- Real estate development. New facilities and apartment complexes require infrastructure of energy, water ways, and waste connections and facilities which are usually not present in abundance.

Methodology

Combination of resource allocation logic and graph representation.

Functions

Allocator

1. **ResourceAllocator(const string& file)**
   Initialisation of the allocator and call of loadResources to parse input.
2. **void loadResources(const string& file)**
   Parsing of input file and populates resource-specific vectors with data.
3. **void allocateResources()**
   Calling allocation methods for electricity, water, gas, waste.
4. **void allocateElectricity()**
   Sorting of electricity resources and adjusting availability by peak demand.
5. **void allocateWater() and void allocateGas()**
   Reduction of water and gas availability by a fixed amount for each district
6. **void allocateWasteManagement()**
   Deduction of waste management availability with adjustments in the districts.

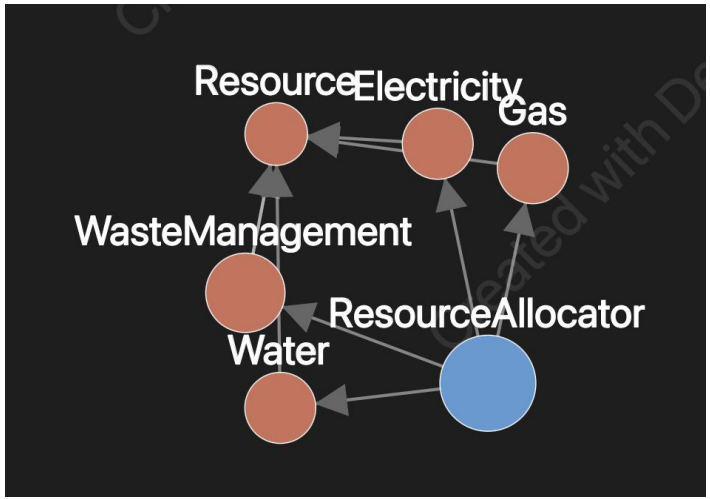
Flow graph

1. **ResourceFlowGraph(int n)**
   Constructs a flow graph with specified node count and adjacency list.
2. **void addEdge(int from, int to, double capacity)**
   Addition of edge and reverse edge to support capacity and flow modeling.

Analysis and Results

resources_data.csv

Type	District	Cost	Importance	Availability	PeakDemand_MW	AverageDemand_MW	WaterQuality(pH)	GasPressure_kPa	GasUsage_MillionCubicMeters	WaterUsage_MillionLiters
Electricity	1		0.4	20	30	20				
Electricity	2		0.3	70	50	35				
Electricity	3		0.5	200	400	220				
Electricity	4		0.3	300	210	130				
Electricity	5		0.6	190	350	200				
Water	1		0.5	30			7.4			10
Water	2		0.5	40			8			80
Water	3		0.4	500			7.8			56
Water	4		0.3	200			6.8			89
Water	5		0.5	15			6.56			210
Gas	1		0.3	100000				4	60000	
Gas	2		0.6	300000				3	200000	
Gas	3		0.5	100000				2	300000	
Gas	4		0.5	200000				5	450000	
Gas	5		0.4	1500000				11	1100000	
Waste management	1		0.3							
Waste management	2		0.5							
Waste management	3		0.3							
Waste management	4		0.6							
Waste management	5		0.5							



Discussion

Conclusion

Designing and building Smart Cities is one of the most crucial objectives of humanity in the 21st century. Developments in this area can greatly enhance the living conditions, efficiency and security. Well designed interconnected systems can also allow for much work to be distributed to robots and automated machines.

References

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