Avoiding Road Traffic Congestion using Dynamic Traffic Assignment Approach.

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Problem Statement

Devise a Decentralized system to solve the Traffic Assignment Problem on City Roads.

Architectural Diagram

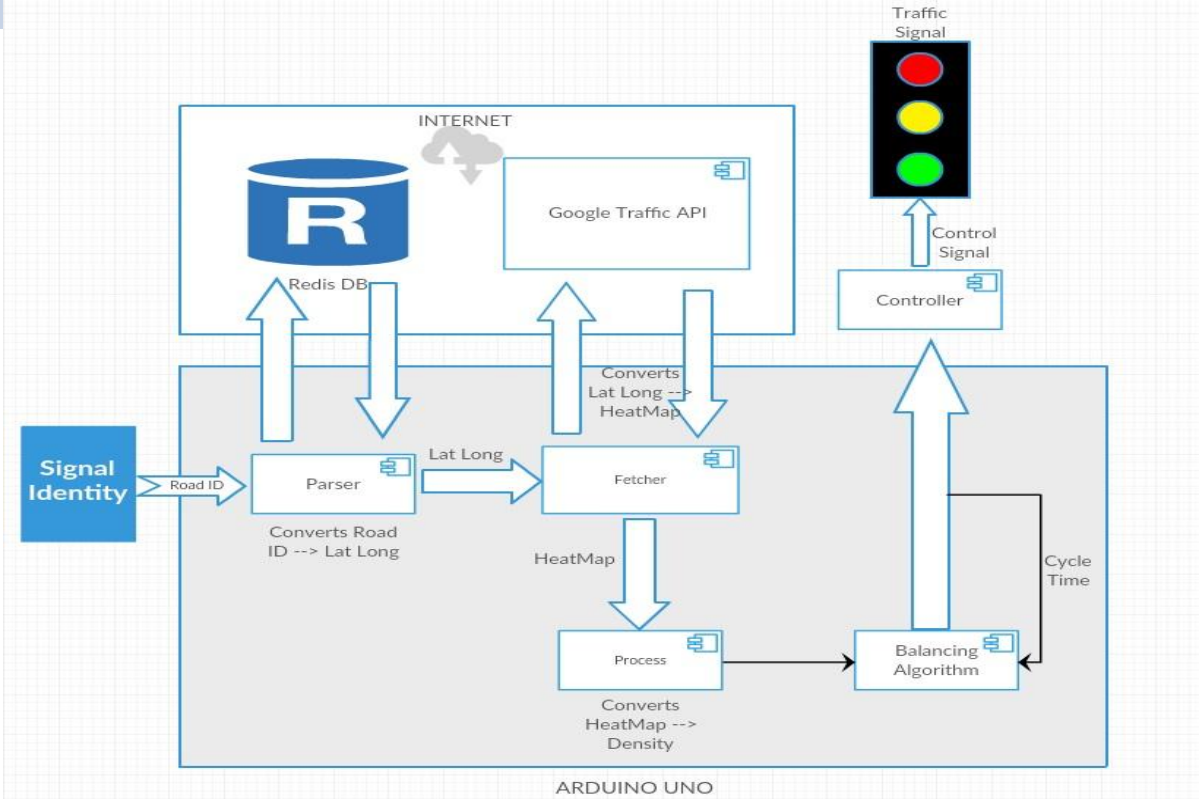

Fig 1: Architectural Block Diagram

Architectural Diagram (Modified)

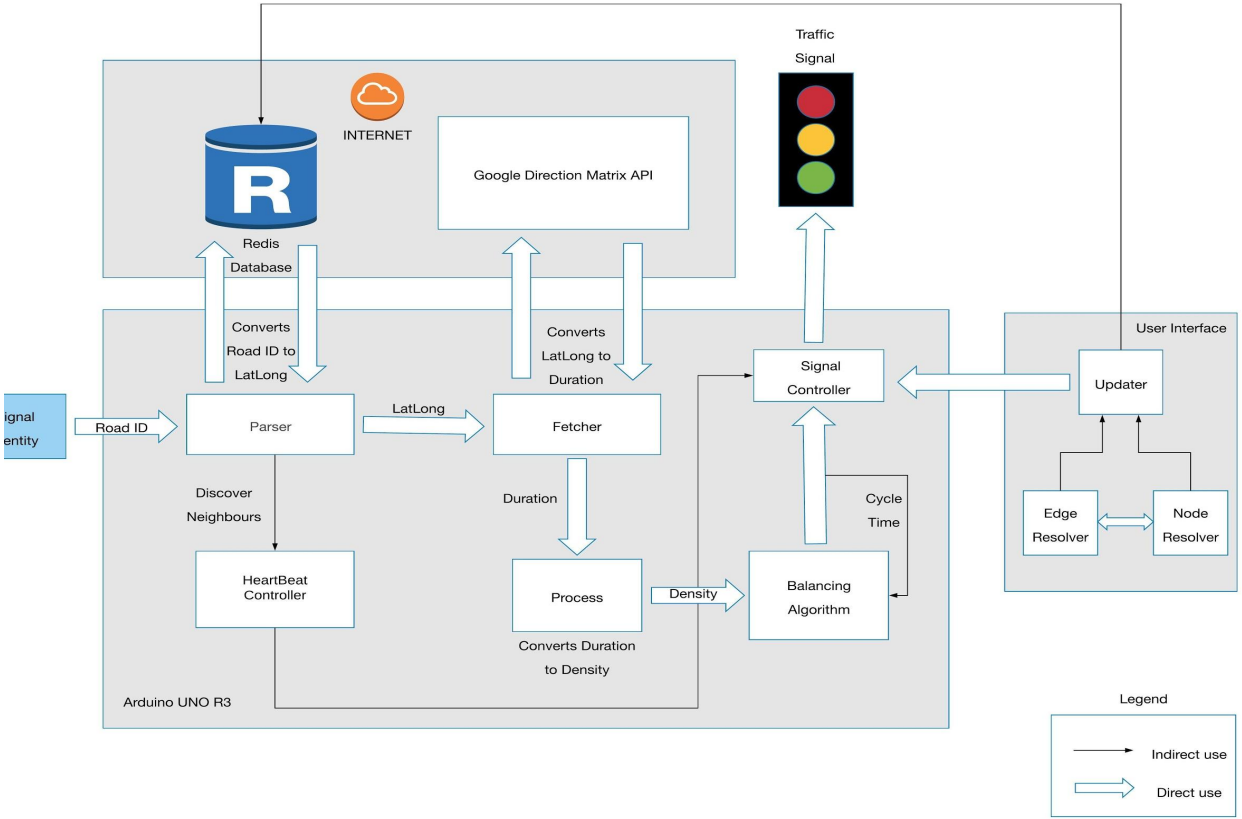

Fig 2: Architectural Block Diagram (Revised)

Project Workstation

- Arduino Uno R3.
- Python Socket Server on Arduino (custom built).
- Node.js/Django or Apache2/nginx web server (using official documentation).
- Web Database: RedisDB (using official documentation).

Mathematical Model

Our mathematical model is based on Particle Swarm Optimization. We migrate/translate our problem using the following Mathematical Model.

Let N be our network with S nodes named s_i ($i \in [3,S]$). For each node s_i we calculate the quantity called drift (d_i). The drift is the imbalance (backlog) of traffic flow, which also represents the direction opposite to the traffic flow. Now we define a neighbourhood of any node s_i as n which is the set of nodes directly connected to s_i.

Over the neighbourhood n,we apply PSO as follows:

$$v_i^{t+1} = v_i^t + c_1 r_1 (d_i^{p,t} - d_i^t) + c_2 r_2 (d_i^{g,t} - d_i^t) \quad \text{.....(1)}$$

$$d_i^{t+1} = d_i^t + v_i^{t+1} \quad \text{.....(2)}$$

Here, the objective of this PSO model is to:

- Decrease v_i^t to 0.
- Reduce magnitude of d_i^t as much as possible.

The terms c_1 and c_2 represent the corresponding accelerations coefficients to describe how a node s_i' own opinion and group's opinion influence it's next decided drift. These two are modified as per how the node s_i is related to its neighbours and how important its own performance is.

Implementation

- Imported the road coordinates of some specific locations of peak traffic congestions around Pune.
- Started gathering real-time traffic data for input to the simulation tool (MOTUS).
- Algorithm partially designed.
- Searching a method for peer-to-peer communication between traffic signals.
- UI Layout and controls being finalized.

Input & Performance Parameters

The Input parameters are d_i^0, v_i^0, c_1 and c_2.

The Performance parameters are d_i^t, v_i^t.

Future Planning

- Mid January 2018 : Algorithm Design Complete.
- January 2018 End : Hardware Design and Testing Complete.
- February 2018 End : Data Collection Complete.
- February 2018 End : UI Design and Testing Complete.
- Mid March 2018 : Algorithm Testing using Data Collected.

Paper Publication and Project Competition

1. Paper planned to be published in the Springer Journal - Swarm Intelligence.
2. Draft of 1st Paper is 70% ready, algorithm is the factor that needs more attention.
3. Project's core operational section is under work to finish on or before mid February.
4. Project Competitions to be applied for are in CoEP, PCCoE, PICT, PESMCoE.

Summary

Our project is beginning to materialize with each step we take.
Work of different parts of our project is being performed simultaneously.
We expect our project’s core modules to be ready by or around most project competitions.