

Decentralized Smart Traffic Framework Based on MPI-based Clusters of Autonomous Vehicles

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INTRODUCTION

BACKGROUND

Smart Traffic has become more and more feasible under the advancement of **Autonomous Vehicles (AVs)** and the **Internet of Things (IoT)**. To optimize traffic congestion, researchers invest a lot of effort into developing **data transfer protocols** and frameworks to put AVs and IoT together for use.

MOTIVES

What are the existing problems?

Most data transfer protocols nowadays are **centralized**, meaning that the vehicles rely on a centralized system or a centralized node, such as Cloud and Smart Lamppost, for traffic control. With the increasing number of AVs, those centralized systems are required to have a high computation power, which comes with a **high computation** and **maintenance cost**.

What are we trying to achieve?

Propose a framework that resolves these issues by distributing the computational task to a cluster of edge devices through **Message Passing Interface (MPI)** protocols, achieving network decentralization. This framework ensures **low-latency** communications between nodes and **low computation time** through parallel computing.

PROPOSED SOLUTION

DECENTRALIZED

Making a node to be the **HOST** and **SLAVE** at the same time. (Inspired by **Blockchain**)

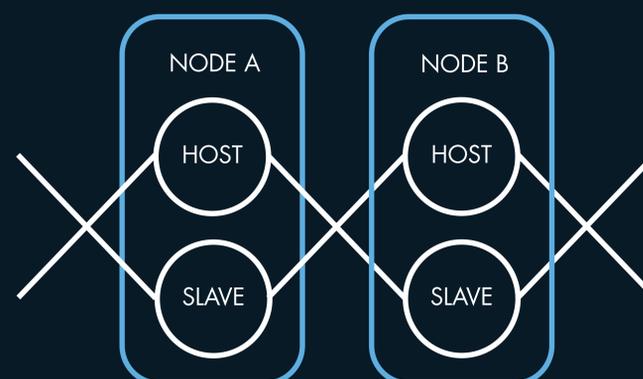


FIGURE 1: Decentralized Network

MPI IMPLEMENTATION

The **HOST** will initiate the receiving protocol built within the **SLAVE** when it sends the commands.

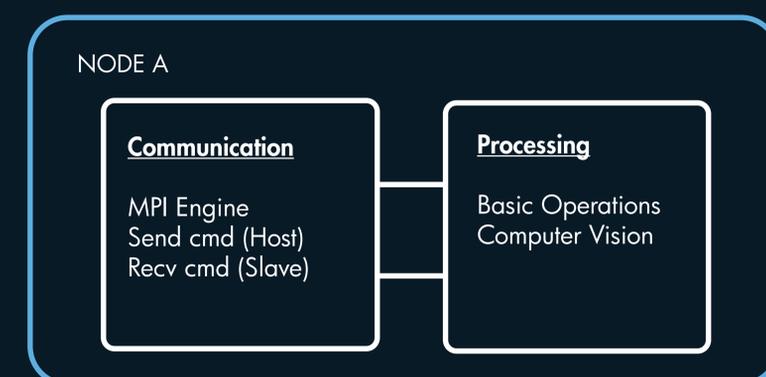


FIGURE 2: Engine Architecture

MATERIALS



Small Scale Implementation:
Waveshare JetBot with Nvidia
Jetson Nano Card (As the AVs)

RESULTS & DISCUSSION

RESULTS

The concept is **implemented, proven, and tested**. The MPI Engine can be implemented in the edge devices to achieve decentralization.

FUTURE DIRECTION

E.g. Establish **parallel training** in edge devices.

ACKNOWLEDGEMENT: This project was sponsored by the National Science Foundation through Research Experience for Undergraduates (REU) award, with additional support from the National Institute of Computational Sciences at University of Tennessee Knoxville.