Modeling COVID-19 Outbreak Dynamics in Public Transit Systems

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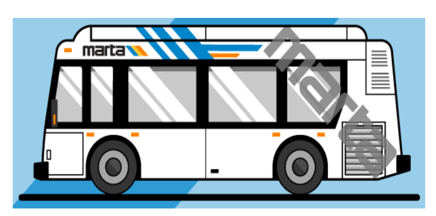
INTRODUCTION

Public transportation, particularly in large cities, can be significant to the spread of viruses during a worldwide pandemic. Passenger contact plays a crucial role in disease transmission. For public transportation systems like metros and buses, COVID-19 epidemic posed challenges of its own

This project focuses on studying and understanding the dynamics of disease transmission within a specific public transport vehicle we will be using an Agent Based Model to demonstrate the outbreak COVID-19 in public transport. We assume the population inside a transport vehicle with entry and exit point. With attributes (like vaccination status and proximity of passengers) to individual agents and use this model to simulate the interactions of individuals wit others. we work to gain a better understanding of how the utilization of public transport networks, combined with group interactions, affects susceptibility to COVID-19

DATA

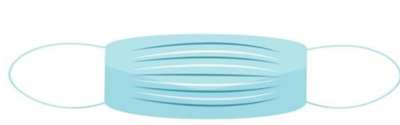


For this project, we are utilizing the for MARTA bus system in Atlanta, Georgia as the public transit system to study the covid transmission

The new MARTA bus have the seating capacity of 33 and can accommodate up to 48 passengers

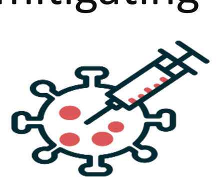
ADDITIONAL KEY FACTORS

Masks usage : use of masks can impact the transmission of virus to other passengers.



Bus Boarding Dynamics : Speed of boarding and crowdedness are also the key contributors to the transmission patterns

Vaccination status : vaccination status plays a crucial role in in preventing and mitigating the spread of COVID-19 within the transit environment.



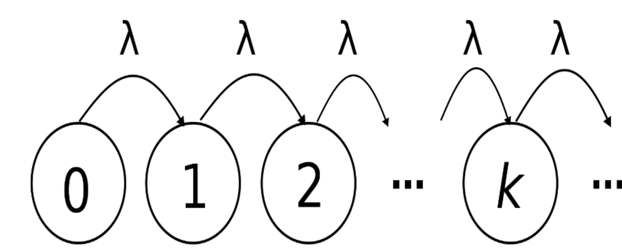
METHODS

We propose the **Agent-Based model** for passenger dynamics Using virus transmission model, we estimate number of infections from exposure time

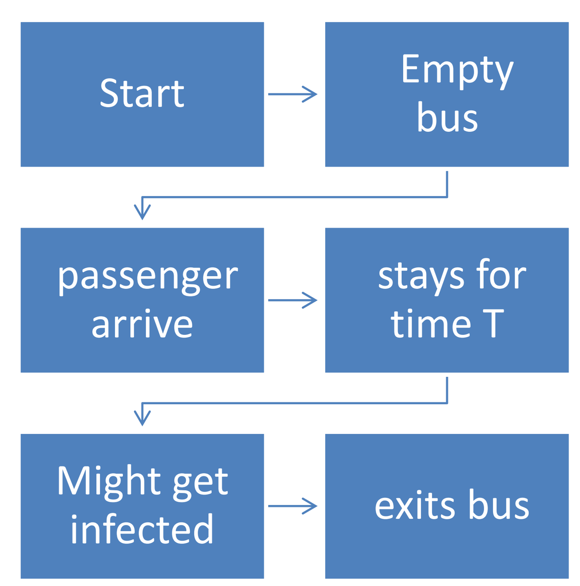
Representing bus as network and nodes as the seats. There will be an entry point and the exit point for bus.

ABM with 3 major components

1. *Passenger Mobility Model*
2. *Virus Transmission model*
3. *Face Mask Protocol*



Passengers board the bus according to a **Poisson process** with constant rate "passenger/min"



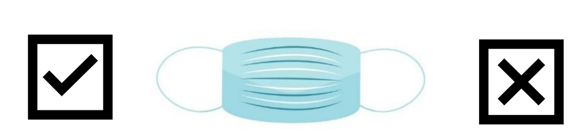
Assumptions

1. Direct transmission (respiratory)
2. No Airborne/fomite transmission

Infection Probability → Linear function of exposure time

Inputs

- **Seat coordinates (.csv file)**
- **Transmission rate**
- **% of infected customers**



Can turn on/off mask setting to study the transmission in each case

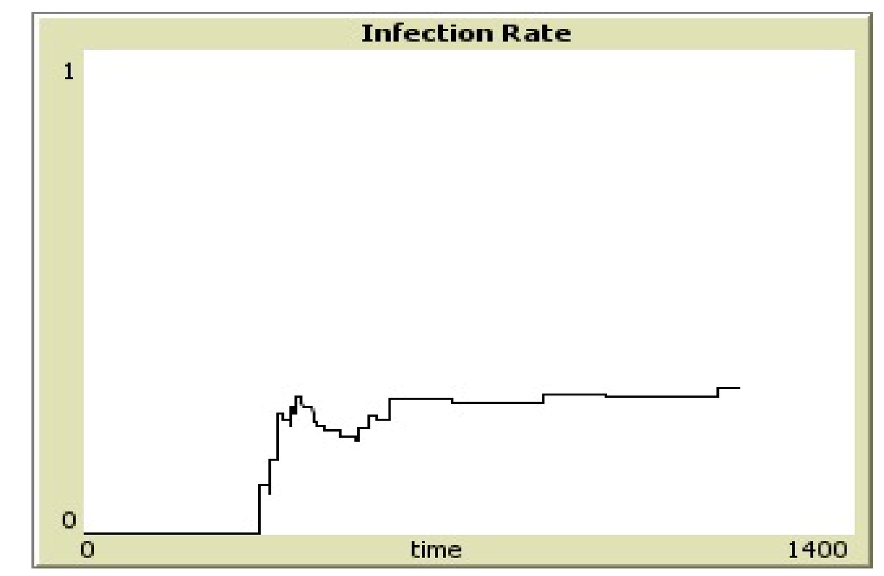
FUTURE STEPS

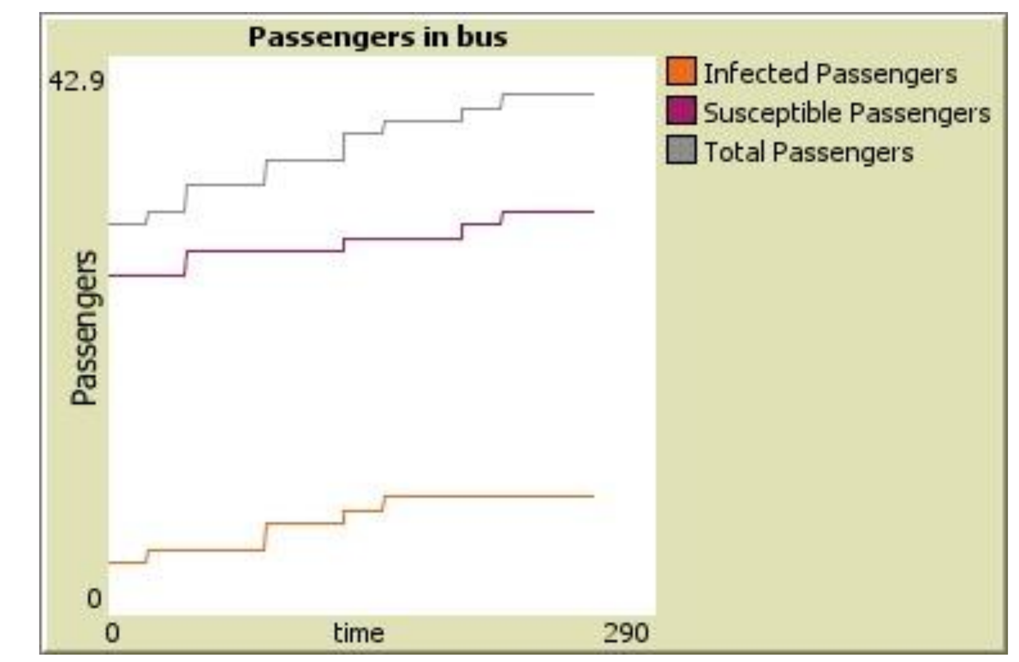
- To extend the model for studying the interaction between different modes of public transportation
- To explore integration with real-time data for dynamically updating the simulation with current infection rates

RESULTS

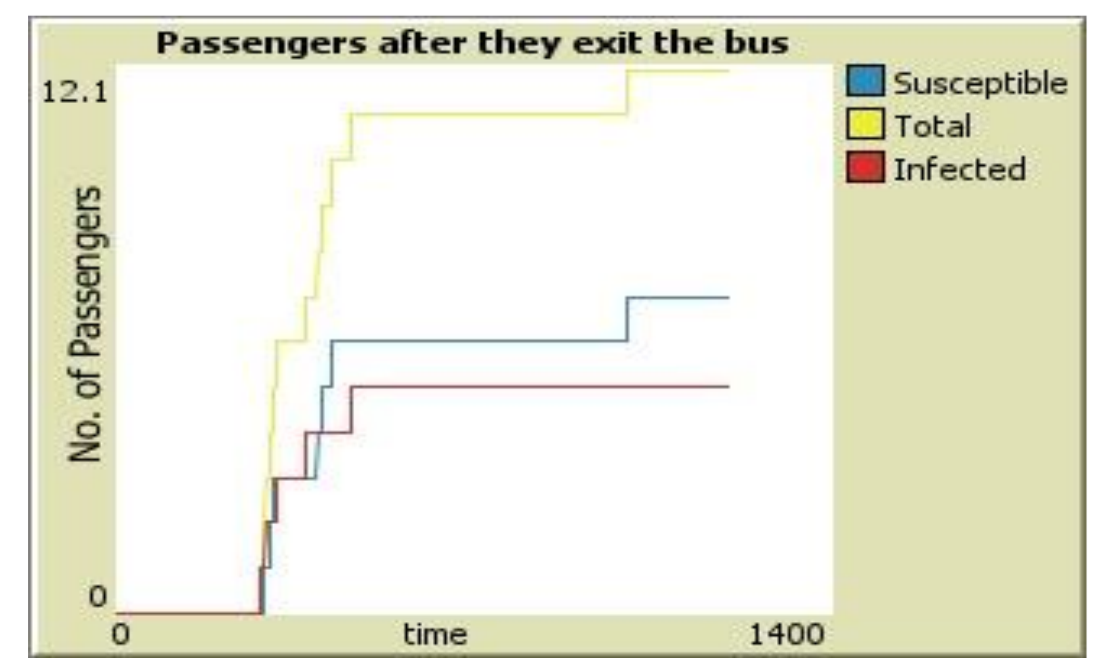
Avg

Total Passengers	91
Susceptible	49
Infected	11
Inside bus	28

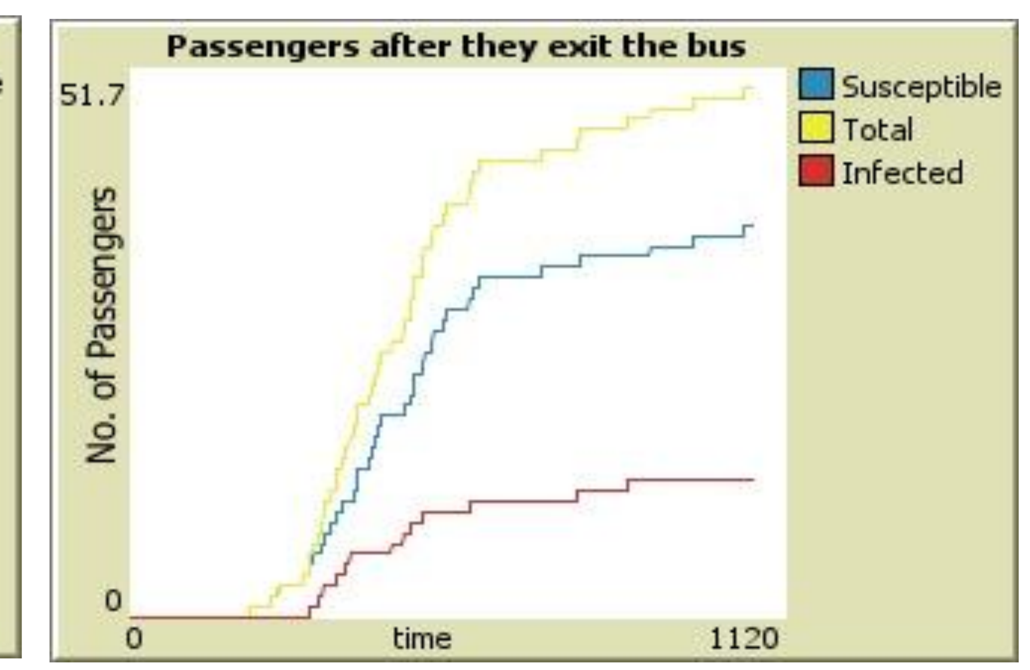




No Face Mask Protocol



With Face Mask



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