Form 3: Methodology

1. Team No:22

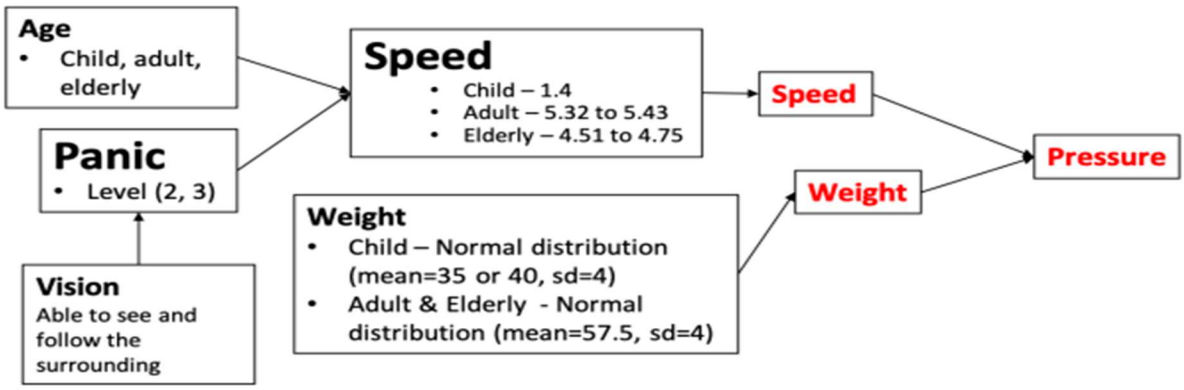
2. Project Title: Emergency Evacuation Simulation using ABMS.

3. Proposed Method:

Model each human individual as an agent with its own varying characteristics and interactions with a virtual environment and with other agents. Each agent has a limited vision of the world Simulate how the human agents continuously sense the surrounding environment to make decisions based on their own rules. The crowd social behaviour can then be collectively observed as the emergent phenomena. Need to analyse impact of behavioural factors such as panic.Using MAS will help to more accurately model the decision-making processes present in real-world crowd behaviour in emergency situations.

4. Proposed Method illustration

The NetLogo world is a 2-D replication of stadium of seating capacity 14,178. The seating area can be divided into six sections, each with a distinct color. Lime-colored patches at the bottom of the staircases represent exits. The starting location of the fire can be set to a fixed or random location. Each tick represents a second, and each patch corresponds to a meter. The fire expands its reach every 10 ticks and consumes the entire stadium in approximately half an hour. Agents are spawned on the seats (we assume a full house) and are colored according to their seat sections. Each agent is given a set of characteristics during setup such as age group, gender, weight, and vision. These parameters are used to calculate the individual's panic level, speed, health, and force.



There are two different strategies of how survivors are escaping, namely the "Smart" strategy and the "Follow" strategy.

The "smart" strategy assumes that all survivors are equipped with the knowledge of the nearest exit location from where they are, and will try to proceed to the nearest possible exit with the use of the best-first search algorithm. In the event that the designated exit has been blocked by the fire, they will locate the next nearest exit.

The “follow” strategy is used to model the ‘herding behavior’ of survivors, as similar in the flocking library. In this strategy, survivors only have limited vision with no knowledge of the nearest exits, and they will follow the exact action of the other survivors 1 patch in front of them. If the fire is within their vision, they would run in the opposite direction from the fire. If they see an available exit, they will run straight for the exit.

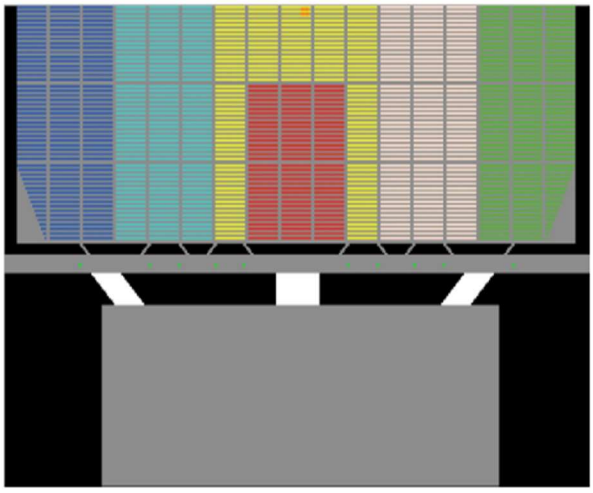


Figure 1: The Float Model

5. Parameter Formulas:

Force/Pressure :

$$F_p = \sum_{a \in A} mass_a \times speed_a$$

Health:

$$heath_a = mass_a \times speed_a \times threshold$$