II. Experiment

The following section contains in-depth reports of our experiments with integrating innovative blockchain technology into the field of wide-area navigation. The experiment simulates a blockchain network in which several nodes, which are robot individuals, collaborate to reach a consensus and use transactional data for navigation. This bypasses the requirement for regular maps or GPS and instead relies on the perspectives that robots communicate through transactions. Through studying the actions of these robots in various contexts, the goal is to derive useful knowledge about the effectiveness and efficiency of using blockchain in a cooperative multi-robot navigation program.

The experiment comprises a static environment with a team of robots navigating through a landscape dotted with landmarks. Each iteration of the loop represents a unique test scenario, wherein robots interact with their surroundings and each other. The actions of the robots are probabilistically determined, mimicking real-world uncertainty and randomness. The simulation and evaluation process is incorporating the following key components:

1) **Initialization**: The experiments initialize parameters such as the size of the team (number of robots = 10), model name ("P"), and the environment (number of landmarks = 30).
2) **Main Loop**: At the heart of the experiment, this loop iterates through a set number of random operations 100 times, each iteration representing a unique simulation scenario.
3) **Robot Actions**: Within each iteration, robots undertake actions randomly chosen from a set of possibilities, including observing the environment (looking around), searching for common landmarks with others, and updating their views based on observed landmarks in blockchain, replacement, etc.
4) **look for home**: in each loop, a random robot looks for its home through the blockchain, and the shortest paths will be selected.

In our experiment, it's noteworthy to mention that landmarks are depicted as points, whereas in real-world scenarios, landmarks occupy space and are consequently more likely to be within the field of view of multiple robots. Additionally, in our current study, we solely factor in distance as a parameter affecting landmark visibility, while in real-world cases, there are other factors at play. However, we disregard these factors as they do not impact the specific aspect of the project under evaluation.

During each iteration of the main loop, for each robot in the team, a random number between 0 and 100 is generated. If this number exceeds 50, the robot initiates a search. It looks around, examining the field of view of other robots to identify any common landmarks that trigger the generation of new transactions. Once all team members have completed their random searches, one robot is chosen at random to locate its designated home, predetermined at the outset of the experiment. This robot then traverses the blockchain and transactions to locate its home, utilizing the field of view information submitted by other robots in the blockchain. After determining the shortest path, another random process is executed, involving the movement of robots within the environment. In this process, the replacement of robots is constrained to their current positions, mirroring real-world actions more closely. In this scenario, there's a 66 percent chance of robots being moved to enhance their dynamism within the environment. Subsequently, a new iteration of the loop begins.