CU's Exploration Experience

Austin Moss, Jibril Burleigh, Emmanuel Mong, Ifeanyi Kalu
Claflin University
Selvarajah Mohanarajah

***Abstract*—This paper explains Claflin University's exploration of ROS and its' capabilities to sustain competiveness in the NASA swarmathon competition. During the duration of the NASA swarmathon preparation stages we tested and implemented numerous techniques to achieve the goal of strongly finalizing our methodology for the challenge presented to us.**

I. Introduction

Claflin University's ultimate goal is to learn, implement, and to execute. We have discussed and implemented numerous search algorithms. However, we had to look deep in our bag of tools to find the solution to the search problem presented to us. Ultimately, we were able to develop an effective algorithm using Calculus concepts. We hope that we will be able to use this algorithm to win this competition and bring recognition to our university.

II. Related work

We are familiar with the Random Brute force search, as well the Ant-Hill search. Both of these searches will find solutions, but are timely and would most likely bare a lot of wear and tear on robots. The random brute force search randomly permits swarmies to search the search area until it finds a tag, and then potentially start the process over again. This pathfinding search is inelegant and costly. A modified Ant-Hill search method would be feasible We considered a colony of ants searching for food.We considered this approach, though, this method would be ineffective because we can't assume that all the tag(s) are located in the same area. The goal of our swarmies would be to get the robots to the center of the stage. They would begin by randomly searching in the stage until they encounter a pickup. When the pickup is found, the swarmie would scan it; then continue back to the base. If a pickup is encountered on the new path the robot will remember that location. When the old pickup is deposited, it will return to the free pickup location. This process will repeat until no pickup is found, then begin the modified search again. Potentially, the swarmie will avoid already visited coordinates, as long as there is nothing to be found. We then came to the conclusion that this technique would not be effective in completing the required task at its maximal potential.

III. Methods

The method we used is based on Calculus principles. At the beginning of the competition, we were given that the arenas would be squares, with the preliminary arena being 15 m^2 and the final arena being 22m^2. So, we began by finding the area of the arenas and transcribing a circle of best fit, where the radius of the circle is the length of half of a side. From that, we divided this circle into a smaller circle with a decreasing radius, then one robot looks through circle with radius r2 and the other looks through radius r1-r2. The remainder of the open terrain would be given to the last robot. Each of the robots will go in a straight line to the radius. When the radius is reached, the robot has a few constraints .These restraints are listed below:

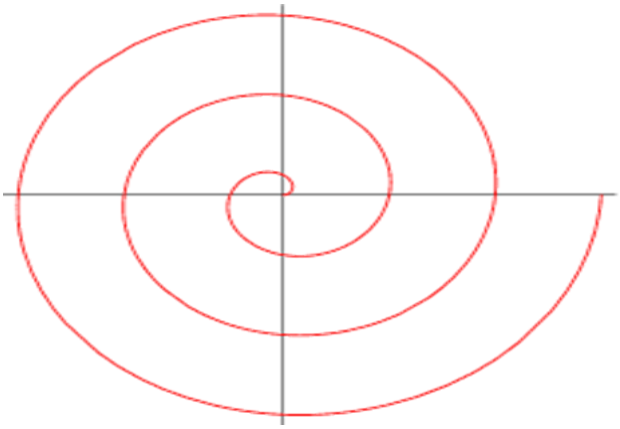
Unless returning tag to a base, it is not allowed to go past the radius or the stop.

2). If swarmie knows the location of a tag, go to the tag.

3). If it neither is holding a tag nor does it know the location of a tag, it returns to its designated search area..

As shown in Figure-1 the Swarmies will perform a spiral movement through the area for the (x, y, z) coordinates, it is assumed that the Swarmies will be moving on a flat plane: swarmie y will be unaffected, swarmie x is any value between radius and the stop point. Below, Figure 1 illustrates the spiral pattern, in which the swarmies will travel to achieve the goal of collecting the maximum Apriltags during the allotted time.

Figure 1



IV. Experiments

The virtual experimental setup was used to run, test and analyze the method. The setup was used to reveal any malfunctions in the algorithm and assist in the enhancement of our search technique. The simulation

allowed us to test our robot before implementation, making it more convenient to alter our procedures; this allowed us to break our potential methods into testing stages to successfully complete this complex project. This type of flexibility is pivotal in developing algorithms for robot operation systems.

V. RESULTS

.An Archimedean spiral technique was used to search our improvised version of the squared arena in a spiral motion using polar equation. More testing is likely needed due technical difficulties and various external factors.

VI. CONCLUSION

The opportunity given to Claflin University to participate in the Swarmathon, allowed us as students to strengthen our creative frame of mind while conducting research to solve complex problems. This event has been an eye opening experience and will drive us to continue to conduct additional research in the future to insure competitive success for Claflin University.

VII. REFERENCES

[1] George F. Simmons(1996), "Calculus with Analytic Geomentry, 2nd Editon " McGraw Hill .