**Androids Dream of Electric Mice:**

**Navigating Mazes with Anki’s Cozmo**

Maxwell McMahon

Department of Computer Science

UNC Asheville

mmcmahon@unca.edu

**ABSTRACT**

Understanding and optimizing algorithms are cornerstones of computer science. Teaching these concepts can be a challenge for educators, due to the difficulty of creating effective visualizations. For Example, educators often demonstrate maze-solving algorithms via two-dimensional computer simulations, in which a disc navigates a maze. Using Anki’s Cozmo robot, we have developed software that navigates through a maze using pledge, coin-flip, wall-follower, and Trémaux’s algorithm. Using This software, we are able to visually complete a maze and compare the runtimes of each algorithm.

# **INTRODUCTION**

When discussing algorithms and robotics, one oft-mentioned example is maze-solving. To demonstrate these algorithms, educators often use animated simulations of mazes, in which a disc solves a maze step by step. Another alternative is having a robot demonstrate the maze. to accomplish this end, teachers often have their students create their own robots or use pre-made kits such as M-bot. however, Robot maker Anki has recently released their Cozmo robot. Cozmo is equipped with a front-facing camera, an accelerometer, and several sensors. Cozmo also is packaged with a python-based SDK. Due to Cozmo’s popularity, and powerful sensors/development tools it comes packaged with, we decided to use Cozmo to demonstrate several maze-solving algorithms. Using Cozmo’s SDK, we have have created a framework for users to create and test their own algorithms. We also demonstrated pledge, coin-flip, wall-follower, and Trémaux’s algorithms. Using this framework, we ran Cozmo through a three-dimensional maze.

# Background

# PROJECT DESCRIPTION

Cozmo is a robot created by Anki. Cozmo is controlled via smartphone and is able to perform several different functions, using a camera, and several other sensors. Cozmo is packaged with a python-based SDK. In order to demonstrate maze-solving algorithms, we created a framework using Cozmo’s SDK that allows users to solve mazes in accordance to different maze-solving algorithms. our program allows Cozmo to react to his environment by registering walls, modifying a graph by severing connections between nodes. we used this framework to demonstrate coin-flip, pledge wall-follower and Trémaux’s algorithms.

## Methodology

We developed a program using python and Cozmo SDK to have Cozmo navigate mazes in accordance to different algorithms. the program maps the robot’s position to a two-dimensional graph. this graph determines the robot’s position, and connections between nodes are severed when walls are encountered. each algorithm uses this structure to path the maze.

In order to provide a variable maze for the robot to navigate, we created a modular design using foam board, push-pins and 3-D printed plastic columns. each wall is labeled with a marker, allowing Cozmo to detect it with its forward facing camera.

We generated five different mazes and ran each algorithm on each maze three times. during these trials we compared the time elapsed and the number of moves made each time.

## Test Plan

In order to test the robot, we had five colleagues generate their own maze using the modular maze, and run each algorithm on the maze several times, determining whether the robot was able to successfully exit the maze.



# **FIGURES/CAPTIONS**

# CONCLUSION

## **Subsections**

### **ACKNOWLEDGMENTS (optional)**

We would like to thank:

Dr. Marietta Cameron

Hann Henson

Dr.Adam Whitley

# **REFERENCES**