Jacob Jack

Hardin/Bankoff Award

Applied Physics and Computer Engineering Majors

First Year ARCS Scholar

MOREHOUSE COLLEGE

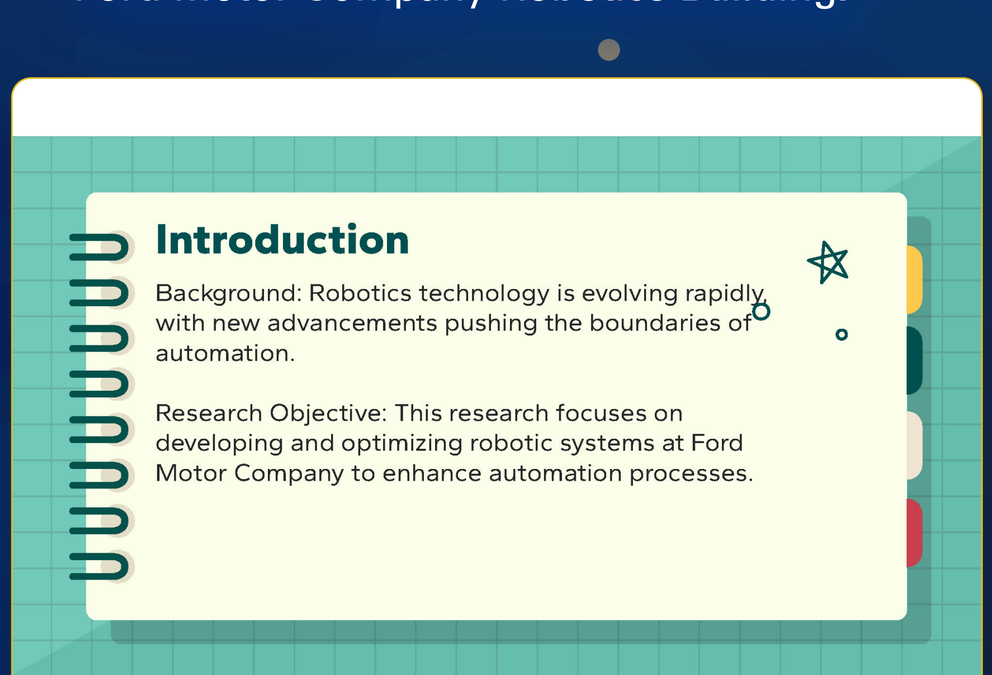
Making Robotics Technology Accessible for all age groups

This research explores the development and optimization of robotic systems within the Ford Motor Company Robotics Building.

Introduction

Background: Robotics technology is evolving rapidly, with new advancements pushing the boundaries of automation.

Research Objective: This research focuses on developing and optimizing robotic systems at Ford Motor Company to enhance automation processes.



M SURE

MBOT AUTONOMOUS NAVIGATION

Tyler Simon (Georgia State University); Jacob Jack (Morehouse College)

SKILLS DEVELOPED

- 1. Programming Skills in C++ and Python for Robotics Applications:
  - Mastery of programming languages essential to robotics.
  - Implementation of algorithms and control systems in C++ and Python.
- 2. Understanding of Feedback Control Systems:
  - Development and implementation of feedback controllers for robotic stability and trajectory accuracy.
  - Application of feedback control in maintaining setpoints and directional tracking.
- 3. Hands-on Experience with Lidar Data Processing:
  - Processing and interpretation of Lidar data for environment perception.
  - Integration of Lidar data into navigation algorithms for obstacle avoidance and path planning.
- 4. Graph Theory Applications in Robotics:
  - Application of graph theory concepts (e.g., BFS) for robotic path planning in complex environments.
  - Understanding graph traversal techniques for optimizing navigation routes.

CONTACT

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INTRODUCTION

Through this Robotics summer internship, we have had the privilege to delve into autonomous navigation systems, honing essential skills and tackling complex challenges in robotic control and decision-making algorithms. Dr. Jenkins's Distributive Learning Initiative has been instrumental in shaping our learning journey, fostering collaborative efforts aimed at expanding educational opportunities in robotics.

This poster presents a comprehensive overview of our experiences and achievements throughout this internship. Each section focuses on specific objectives, skills developed, topics covered, the distributive learning initiative, and the broader implications of our research in the field of robotics. From foundational concepts to advanced algorithms, this internship has provided invaluable hands-on learning opportunities and insights into the practical applications of autonomous systems.

DISCUSSIONS & IMPLICATIONS

- Real-World Implications Explored at MCITY:
  - Visited University of Michigan's MCITY for firsthand exposure to autonomous vehicle testing.
  - Witnessed large-scale Lidar-equipped cars, mirroring our robotic navigation principles in real-world applications.
- Enhancing Autonomy and Reliability:
  - Crucial advancements for autonomous robotics in dynamic environments.
  - Potential applications in industrial automation, search and rescue, and autonomous transportation systems.
- Educational Impact and Outreach:
  - Designed to inspire and educate students in robotics and autonomous systems.
  - Contributing to distributive learning initiatives for broader educational accessibility.
- Future Expansion and Collaboration:
  - Partnering with University of Michigan to expand MBOT curriculum and educational outreach.
  - Envisioning broader adoption across diverse educational settings and communities.

TOPICS COVERED

1. Feedback Control Systems
   - Objective: Develop and implement feedback controllers for robotic tasks.
2. Lidar and Sensor Data Processing
   - Objective: Process sensor data for navigation and control.
3. Algorithm Development for Robotics
   -Objective: Develop algorithms for autonomous navigation.
4. Sensor Integration and Odometry
   -Objective: Integrate sensor data for accurate navigation.
5. **Graph Theory Applications**
   -Objective: Apply graph theory to robotic path planning.

PICTURE OF MBOT

PICTURE OF OUR LAB AT MCITY

PICTURE OF MBOT MAZE

AUTONOMOUS TOUR BUS AT MCITY

DISTRIBUTIVE LEARNING INITIATIVE

- Developed as part of the Robotics 102 (ROB102) course.
  - Intended for widespread adoption by other educational institutions.
- Course Partnership with University of Michigan
  - Collaborating to expand the course curriculum.
  - Seeking to broaden access to educational robotics through the MBOT platform.
- Student Involvement:
  - Engaged in the course, providing feedback to project mentors.
  - Participated in review sessions to assess successes, challenges, and needed resources.
- Module Development for Non-Profit Schools:
  - Creating educational modules tailored for non-profit schools.
  - Designed for children within a specified age range (details to be confirmed).

CONCLUSIONS

Throughout the Robotics102 summer internship, we gained insights and practical skills in autonomous navigation and robotics. This experience has enhanced our technical proficiency and opened doors to innovate in the dynamic field of autonomous robotics. We're eager to apply these skills to solve complex problems and contribute to the future of robotics.

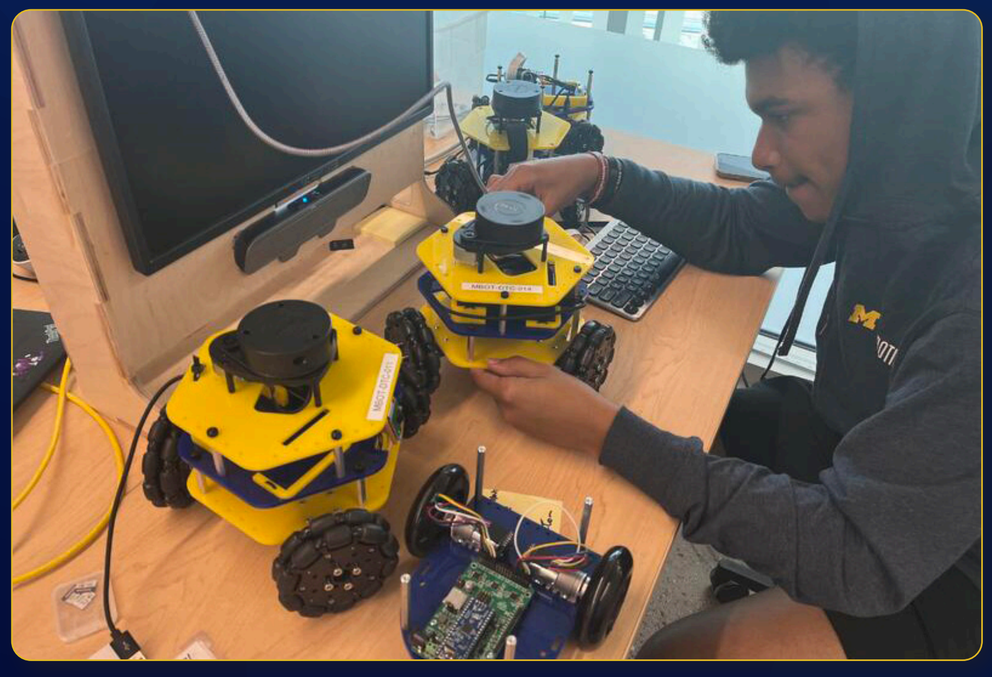
ACKNOWLEDGMENTS

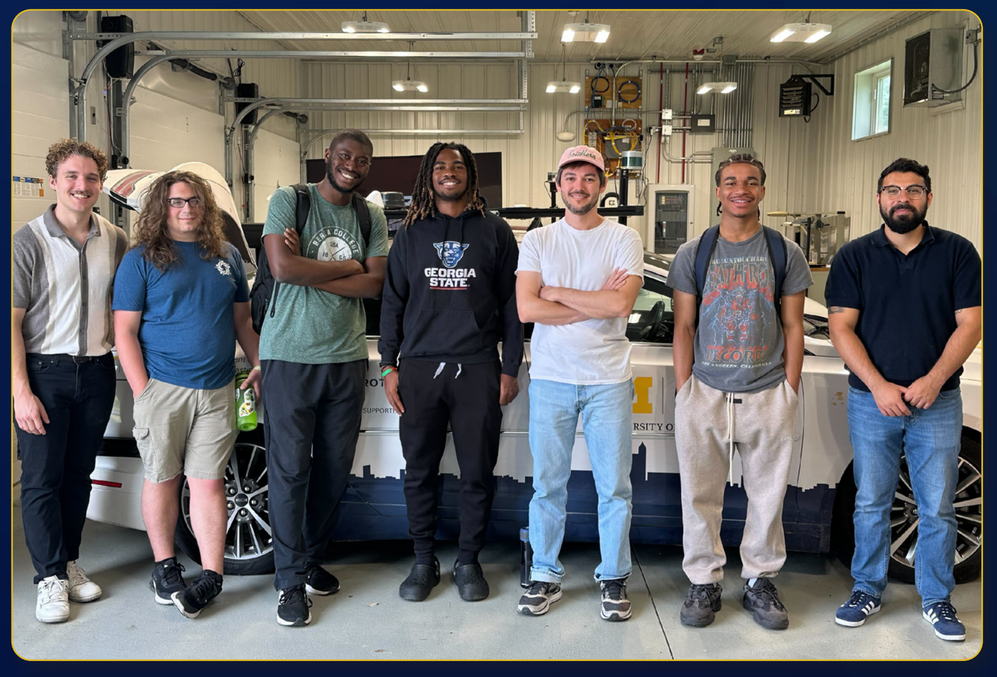
Department Head: Dr. Chad Jenkins

Project Mentor: Brody "Living Legend" Riopelle

Lab Head: Abhishek Narula

Lab Members: Tyler S., Jacob J., Blade H., Jurgen B., Kori K., Tray N.





Scholar Awards Celebration

November 13, 2024

SCHOLAR AWARDS CELEBRATION ARCS FOUNDATION ATLANTA

Igniting Innovation in Georgia