

Vishnu Samadhan Chipade

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EDUCATION

Ph.D. , Aerospace Engineering University of Michigan (<i>expected Apr 2022</i>) GPA: 3.9/4	M.S.E. , Aerospace Engineering University of Michigan (<i>Aug 2021</i>) GPA: 3.9/4	B.Tech - M.Tech , Aerospace Engineering Indian Institute of Technology Kanpur (<i>May 2017</i>) GPA: M. Tech - 10/10, B. Tech - 9.3/10
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RESEARCH EXPERIENCE

- **Distributed Aerospace Systems and Control Lab, Ann Arbor** (Graduate Research Assistant) (*Sep'17 - present*)
 - [Swarm Herding](#): Developed and experimentally demonstrated '*StringNet Herding*', a **multi-agent motion planning** method, in which a swarm of risk-averse, adversarial attackers is enclosed inside a closed formation of defenders and herded to a safe area through an obstacle environment to protect a safety-critical area (see [experiments here](#)).
 - [Multi-Swarm Herding](#): Developed a clustering-based **task assignment** algorithm using **mixed integer programs** to optimally assign defenders to the tasks of herding multiple adversarial swarms to safe areas using '*StringNet Herding*'.
 - [Multi-agent Interception](#): Developed a time-optimal, collaborative strategy for a team of defending robots consisting of collision aware **task assignment** to **safely intercept** as many of the **multiple adversarial robots** (attackers) and as quickly as possible.
 - [Multi-agent Defense \(Herding + Interception\)](#): Combined the multi-swarm herding and multi-agent interception strategies together using mixed integer programs and **computationally efficient heuristics** to provide a defense strategy against wide range of behaviors of the attackers.
 - [LiV-LAM: LiDAR-Visual Localization and Mapping](#): Collaborated with a team of researchers to develop a **simultaneous localization and mapping (SLAM)** method with better accuracy that combines Lidar data with discovered objects from the camera using an unsupervised, proposal matching based object detection algorithm.
 - [Safe Autonomous Overtaking](#): Collaborated with a team of researchers to develop a vector- field based, **real-time implementable motion planning** algorithm for safe autonomous overtaking while taking into account the online inferred intent of other vehicles on road.
 - [Multi-agent Planning for Human Robot Interaction](#) (Ongoing work): Working on the development of a motion planning algorithm for a team of aerial robots equipped with cameras to navigate in the scenes with human actors simulated in AirSim, a photo-realistic simulation environment, to: 1) identify objects or areas of interest by accurately estimating human gaze direction, and 2) **assign tasks** and move robots based on the identified areas of interest.
- **Helicopter and VTOL Laboratory, IIT Kanpur** (Research Assistant) (*May'16- Jul'17*)
 - [Biplane Quadrotor](#): Conceptualized, designed, fabricated and patented a vehicle prototype, combining helicopter characteristics of a quadrotor and fixed-wing characteristics of a biplane, for efficient aerial package delivery.

RELEVANT COURSE PROJECTS

- **Safe Motion Planning for Multi-agent System using Distributed N-MPC** (*Jan'18- Apr'18*)
 - Developed a **distributed motion planning** algorithm using nonlinear model predictive control (N-MPC) framework and **sequential quadratic programming (SQP)** for multiple robots with limited sensing capability to navigate safely from one point to another.
- **Cooperative motion planning for multiple UAVs to improve object detection** (*Jan'21- Apr'21*)
 - Collaborated with a team of students to develop our own python implementation to evaluate the performance of a **cooperative motion planning** algorithm for a team of unmanned areal vehicles (UAVs) to improve quantity and quality of objects detected by YOLO object detection algorithm to improve situational awareness of the UAVs.

TECHNICAL SKILLS

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| • Programming Languages: Python, C++, MATLAB; | Platforms: Ubuntu, Windows; |
| • Softwares: ROS, Gurobi, AirSim, Gazebo, LabVIEW, \LaTeX . | Hardwares: Pixhawk, Arduino, |

PATENTS

- "Safe autonomous overtaking with intention estimation," US Application No.: 16360572, Dated: 24 Sep 2020
Ozay N., [Chipade, V. S.](#), Shen Q., Huang L., Yong S. Z., and Panagou D.
- "A VTOL Unmanned Aerial Vehicle," India Application No.: 201611015384, Dated: 19 Jul 2019
Abhishek, Kothari, M., Gupta, N., [Chipade, V.](#), Gupta, N., Chaudhari, R., and Singh, R. V.

JOURNAL PUBLICATIONS

3. [Chipade V. S., Panagou D., "Multi-Agent Planning and Control for Swarm Herding in 2D Obstacle Environments under Bounded Inputs," IEEE Transactions on Robotics, 38\(2\), pp.-, May 2021.](#)

2. **Chipade V. S.**, Marella V. S. A., Panagou D., "[Aerial Swarm Defense by StringNet Herding: Theory and Experiments](#)," Frontiers in Robotics and AI, 8, p-81, 2021.
1. **Chipade V. S.**, Abhishek, Kothari M., Chaudhari R., "[Systematic design methodology for development and flight testing of a variable pitch quadrotor biplane VTOL UAV for payload delivery](#)," Mechatronics, 55, pp. 94-114, Aug 2018.

SCHOLASTIC ACHIEVEMENTS

- Received **Academic Excellence Award** for three academic sessions (2012-13, 2014-15 and 2015-16) at IIT Kanpur
- Obtained **All India Rank 19** in GATE (Graduate aptitude test in engineering) 2016 in Aerospace Engineering
- Received **Merit-cum-Means Scholarship** during B.Tech. and **M. Tech. Fellowship** during M.Tech.

TEACHING EXPERIENCE

- **Graduate Student Instructor-** Control of Aerospace Vehicles (University of Michigan) (Sep'21- Dec'21)
 - Conducted weekly office hours to help students with their doubts related to course material and assignments.
- **Graduate Student Instructor-** Fundamentals of Navigation and Guidance (University of Michigan) (Sep'19- Dec'19)
 - Designed and delivered a weekly one hour discussion session on course related material and conducted weekly office hours to guide students with their assignment problems.
- **Teaching Assistant-** Experiments in Aerospace Engineering Lab (IIT Kanpur) (Jul'16- Nov'16)
 - Explained the fundamentals of an experiment on 'photoelasticity' and helped students perform the experiment.