

Arunkumar Byravan

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EDUCATION:

University of Pennsylvania, Philadelphia

Master of Science in Mechanical Engineering, Expected May 2011, GPA: 4.00/4.00

College of Engineering, Anna University, Guindy, Chennai, India

Bachelor of Engineering in Mechanical Engineering, April 2009, GPA: 8.82/10.0

COMPUTER SKILLS:

Programming Languages C/C++, Python, MATLAB

Tools Stage, Gazebo, Simulink, Gstreamer, Coriander, Maple

Design & Analysis Packages AutoCAD, Solidworks, ANSYS, Eagle, Fluent

Working Platforms Windows, Linux, ROS

RELEVANT COURSES:

Advanced Robotics, Learning in Robotics, Advanced Dynamics, Modern Feedback Control Theory, Robotics and Automation, Mechatronics, Advanced Methods in Applied Mathematics, Vibrations, Finite Element Analysis

EXPERIENCE:

Teaching Assistant, MEAM 520 – Robotics and Automation, Spring 2011

- Currently designing projects involving the control of a PUMA 260 arm. Also in charge of grading assignments and holding office hours
- Course covers robot control, kinematics, motion planning and simple vision algorithms

Research Assistant, Kodlab, University of Pennsylvania, May 2010 onwards

- Working on projects related to the bio-inspired hexapod robot – the RHex
- Currently developing new and innovative methods to solve the odometry problem in legged robots

Intern, Larsen & Toubro, Pondicherry, India, Summer 2008

- Did a detailed study on the manufacturing and assembly processes in the plant
- Optimized the manufacturing process of L-angles used for transmission line towers
- Identified the bottlenecks in production and proposed changes for it

PROJECT WORK:

Visual Compass for localization in indoor environments (ongoing):

- Currently working on stable tracking of a legged robot's orientation in indoor environments using vanishing points
- Proposed system can track well even in presence of bouncy motion & highly blurred images
- Developed a novel algorithm for detecting long, straight edges in a fisheye image

RASC-AL Exploration Robo-ops competition (sponsored by NASA):

- Presently handling the planning and perception components for Penn's entry to NASA'S Revolutionary Aerospace Systems Concepts Academic Linkage(RASC-AL) competition
- Tasks include manipulator control, odometry, map building, object detection etc

Fisheye camera calibration (ongoing):

- Developed a new and simpler model for representing fisheye cameras with the lens distortion modeled as a polynomial function of the field of view parameter
- Model is flexible enough to be easily extended to include perspective cameras as well

Simultaneous Localization and Mapping (SLAM) using IMU, LIDAR and Kinect:

- Built a 2D occupancy grid map & a 3D visualization of indoor environments with ramps
- An Unscented Kalman Filter using IMU data was used to track the robot's pitch & roll
- Scan matching using a Hokuyo LIDAR and an Iterative Closest Point (ICP) algorithm to match point clouds from the Kinect were used for the remaining estimates

Energy efficient gaits for the RHex robot:

- Developed gaits to allow the RHex robot to turn-in-place without much effort
- Gaits were developed using Python in a Linux based environment. Automated tuning of parameters was achieved using the Nelder-Mead algorithm and a VICON system

Planning paths for a mobile robot with differently structured upper and lower bodies:

- A planning algorithm for large, complex shaped mobile robots in cluttered spaces was developed by incorporating obstacle data from different heights
- Implementation was done in C++/ROS using an inbuilt model of the PR2 in ROS
- Plans were evaluated by simulations on many 3D maps/situations using Gazebo and Stage. Project done as part of the Advanced Robotics course

Autonomous robot arm capable of color recognition:

- An autonomous robot arm with five degrees of freedom was designed and built as part of the senior design project
- Using images to find an object's centroid and an inverse kinematics routine to compute joint angles, the arm would stoop down to touch the objects
- A simple proportional controller with position feedback from joint encoders was used for motion control. Circuits for operation using the parallel port were fabricated

Autonomous Hockey playing Robots & Balancing Robot:

- Built a team of three robots capable of playing hockey autonomously. Robots used IR sensors to detect the puck, had wireless communication capability and received global position information from an external webcam
- Balancing robot used a simple PID controller with feedback from a single 3-axis MEMS accelerometer to keep itself from falling

Analysis and design of stirrer for stir-casting of Metal Matrix Composites (MMCs):

- Did a CFD analysis on the effect of stirrer parameters on the composition of MMCs
- Optimal parameters were found using simulations in Fluent/MIXSIM and verified by casting Aluminium - Silicon Carbide MMCs with the fabricated stirrer

Other projects:

- Consensus based flocking algorithm in MATLAB and Graph search algorithms in MATLAB/MEX to generate paths for a target tracking problem as part of the Advanced Robotics course
- Built a synchronized Panning system for a pair of stereo cameras. Variable frame rate, one-shot/continuous mode capabilities for the cameras
- Trajectories for the PUMA 260 arm, algorithm for navigating a slalom course based on image data for the Robotics and Automation course
- Line follower, Maze solver, Pick & Place robot for Shaastra '08 and Kurukshetra '09

ACHIEVEMENTS, AWARDS & OTHER ACTIVITIES:

- Passed a set of certified courses in Hindi to attain a standing, equivalent to a B.A in Hindi, by my ninth grade. Certified to teach Hindi
- Studied the violin for a period of nine years. Performed on stage in a number of local events and once on the Television
- Received the Indian Audit & Accounts Department (IA&AD) Benevolent Fund award during all four years of my undergraduate education
- Organized "Alcatraz", an event that challenged participants to break out of a prison like setting using their engineering skills and other robotics events during my senior year
- Was an active member of the Society of Mechanical Engineers at the College of Engineering, Guindy