Achyuth Reddy Domreddy

WORK EXPERIENCE

SYSTEMS RESEARCHER, Aug 2022 - Present
Automation Robotics & Control for Aerospace (ARCA) - LAB,
Sapienza Università di Roma, Italy.
Initial Orbit Determination project employing Star Tracker and Deep Learning with Attention:

- Developed space debris orbits generator for LEO, MEO and GEO including observers on earth and in orbit. Created large dataset with over 1 million orbits and 50 million data points.
- Performed dataset feature engineering and developed proper data encoding methods compatible with models.
- Researching applications of Transformer Architecture for orbit determination with less than 0.5% of orbit data and created proper training and validation pipeline for distributed training on 2 GPUs.

Assembling and Integration of Lunar Rover Platform**:**

- Assembled mechanical structures, wired electrical components, installed and configured micro-controller software
- Calibrated IMU, wheel encoder and camera sensors and quantified errors of readings including image distortions.
- Implementing Dense Extended Kalman Filter based data fusion of visual odometry and IMU data for localization.
- Implementing Model Predictive Control algorithm based on skid steering model for trajectory and attitude control.

SPACE SYSTEMS & ROBOTICS INTERN, Jan 2021 - May 2021
Automation Robotics & Control for Aerospace (ARCA) – LAB,
Sapienza Università di Roma, Italy.

- Designed and manufactured rover mechanical system using CATIA within constraints of weight and 3D printer.
- Studied rover wheel actuator performance requirements using wheel soil interaction models and created an MS Excel tool for calculation and quick design iterations. Selected optimal motors and tested them.
- Designed electronic system stack, selected sensors and micro controllers. Calculated power budget and selected optimum battery. All components procurement within 70% of project budget.
- Optimized design of electronic components and software for reduced cost, complexity and future expansion.

INDUSTRY PROJECT EXPERIENCE

Stabilized Payload Delivery Platform for Sounding Rocket Jun 2014 - May 2016
Indian Space Research Organization (ISRO) - VSSC

- Conceptualized design of Stabilized Payload Platform for payload delivery for Rohini (RH-200) sounding rocket.
- Led responsibility for design of entire electronic sub system meeting design requirements within allocated time.
- Implemented spin control program with Kalman filter for data fusion and a Proportional Integral Derivative (PID) algorithm to stabilize payload platform by reading deflection input from 6-axis IMU.
- Presented whole electronics and algorithm design to ISRO Chairman Mr. Somnath S and collaborated with navigation and telecommunications engineers for system integration.

EDUCATION

SECOND MASTERS IN AEROSPACE ENGINEERING Sep 2020 - Jun 2022
Sapienza Università di Roma, Italy Grade - 108/110
Thesis: Deep Learning based Visual Inertial Navigation for Lunar Rover.
Developed following systems for Autonomous Navigation for ARCA Lab Lunar Rover Project at University.

- Visual Odometry based state estimation algorithm leveraging camera sensor with mean error 2.7% at 10 Hz.
- Deep Neural Network (DeepLab V3+ with Resnet 50 encoder) based Binary Semantic Segmentation of Lunar Surface Images to identify rocks and obstacles with an accuracy score above 95%, implemented in Pytorch.
- D Star based path-planning algorithm for obstacle avoidance for low latency (~100 ms) trajectory replanning.
- Integrated all software modules in Python and C++ with Robotic Operating System (ROS2) in LINUX. Configured system of Raspberry Pi and Arduino together for parallel asynchronous execution.
- Communication system between micro controllers written in C and python for transfer of commands and data.

Courses:
Design of Electronic Systems for Space,
Space Exploration Robotic Systems,
Attitude Dynamics Determination and Control.

MASTERS IN AEROSPACE ENGINEERING Jun 2017 - May 2019
Indian Institute of Technology Bombay, India Grade - 8.44/10
Thesis: Particle in Cell Simulation (PIC) of Hall Thruster.

- Constructed a 2-D Particle in Cell Solver in C++ to simulate collisional less plasma sheath in Hall Thrusters.
- Simulated plasma sheath was compared with analytical predictions and other research publications.

Course Projects.

- Recreated mission profile of Pioneer Venus 2 applying gravity turn ascent, earth parking and Hohmann Transfer orbits. Calculated required Delta V for each mission stage.
- Modeled a hypothetical 2 stage Launch Vehicle based on Falcon 9 (first stage) and Ariane 6 (second stage) rockets and studied its performance metrics.
- Devised Smoothed Particle Hydrodynamics (SPH) simulations in Python for 1D shock tube and wing tip vortices
- Built a Ray Tracing Game Engine to render a scene on NVIDIA GPU with CUDA at 480p resolution and 20fps.

Courses.

- Introduction to Plasma for Engineering.
- Particle Methods for Fluid Flow Simulation.
- High Performance Scientific Computing.

OTHER WORK EXPERIENCE

DATA ANALYST, Jun 2019 - Dec 2020
Aspect Ratio, Pune, India

- Created and maintained software applications to forecast COVID-19 vaccine demand for North America, Europe and Asia for Merck Sharp & Dohme (MSD).
- Developed SpotFire, Python based automated tools for data collection, modeling (Monte-Carlo Simulations) and data visualizations using Agile Software Development Methodology to help drive business insights.
- Improved requirement analysis, development, testing and documentation processes in company resulting in 20% reduction in turnaround time.
- Proactively led the team to apply code standardization and agile software development methodologies. Created a standard high performance library written in R and C++, resulting in 50% reduction in simulation runtime.

LANGUAGE SKILLS

	Listening	*Reading*	*Speaking*	*Writing*
ITALIAN	A1	A1	A1	A1
ENGLISH	C2	C2	C2	C2

DIGITAL SKILLS

Programming Languages:
Python | C++ | R | C

Softwares:
MATLAB & SIMULINK | ANSYS | CATIA | IBM DOORS

Python Libraries:
Numpy | Pytorch | MQTT | OpenCV | Pandas

Operating Systems:
LINUX | Windows | ROS

Productivity:
Git | Microsoft Office

PERSONAL DETAILS

- Date of birth: 5 Apr 1995
- Nationality: Indian.

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