Vivek Reddy Munnangi

Bloomington,IN | vmunnang@iu.edu | 9303335001 | in - Vivek Reddy Munnangi

Professional Summary

Mechanical Engineer transitioning to Autonomous Systems Engineer with a specialization in state estimation, sensor fusion, and real-time control. Possess production-level C++/ROS2 experience, including EKF estimators, sim-to-real validation, and safety-critical software. Background includes patented motor design and powertrain development for high-performance dynamic platforms.

Skills and Capabilities

- Implement EKF on multi-sensor fusion (IMU, ECU, force, VectorNav, NovAtel) for state and velocity estimation.
- Design multi body dynamics and controller validation workflows for high fidelity sim-to-real transfer.
- Develop C++ system and ROS2 nodes for real-time, safety-critical control and perception.
- Develop closed-loop controllers, perform linear systems analysis, stability proofs, and controller(MPC/PID) design; apply nonlinear control methods for multi-DOF.
- Execute field testing and sensor calibration, analyze signals and telemetry with Pandas, NumPy, SciPy, and Plotly.
- Simulate and model dynamics in MATLAB-Simulink and custom multi DOF frameworks, tune MPC/PID controller.
- Scale compute and train with NVIDIA A100/H100 and Deepspeed for perception and model evaluation.

Experience

Research Engineer, Vehicle Autonomy and Intelligence Lab – Bloomington, IN   Aug 2024

- Produced state estimation pipelines using IMU, LiDAR, GPS, and CAN data to model vehicle dynamics producing <1% error and improving autonomous navigation accuracy by 55% over the predecessor.
- Revamped predictive grip models with MPC/PID controllers in ROS2 coded in C++, improving average lap speeds by 40 mph while maintaining stability under dynamic conditions with $< 5cm$ of cross-track error.
- Developed safety critical fail safe modules that compute optimal stopping trajectories in real time using multi sensor data, and dynamically selecting trajectories based on current instance to ensure safe operation in multi car environments and saving an estimated $15k-50k$ USD in potential damage repairs..
- Assisted localization team fuse state estimation pipelines for robust localization under sensor failures or GNSS dropouts, mitigating velocity spikes to <10cm. Visualized multi-sensor data with Plotly and Foxglove dashboards.
- Collaborated with GM Motorsports performance team to compare human vs. autonomous control behavior on INDY NXT chassis, pursuing sim-to-real transfer analysis using a simulator which saved $500-1000 USD per lap of simulation. Leading development of a 14-DOF robot dynamics model to evaluate multi body dynamics and controller performance to current module.

AI Head, dentalmetrix.ai – Indianapolis, IN   Sep 2024

- Engineered production ETL pipelines (Python, SQL) to centralize patient, billing, and clinical data from OpenDental and CRM(GoHighLevel) systems, enabling real-time analytics and operational dashboards for clinic managers.
- Built interactive BI dashboards (DAX) for workforce and financial analytics, automating key reports and reducing manual reporting effort and saving 25 hours per week, also improving operational decision making.
- Orchestrating an 'LLM-based retrieval + judge' agent (Qwen3 architecture) to answer multilingual questions and domain queries on unstructured data with human-in-the-loop validation, implementing audit trails to support 21 CFR Part 11 compliance and optimized runtime with Deepspeed on NVIDIA H100 to meet real-time SLAs.

Research Assistant, Frontiers of Optical Imaging and Biology Lab – Bloomington, IN   May 2024 – May 2025

- Developed a neural registration pipeline for 3D OCT volumes, achieving 97% registration accuracy without fixed reference points (robust to cell motion). This pipeline processes data at 6.5 MB/s, making it 64% faster than existing algorithm across heterogeneous subject datasets.
- Built automated preprocessing and similarity-matching pipelines that improved data quality and reproducibility for model training and validation, enabling scalable experiments across multiple subjects and time points.
- Conducted validation experiments and ablation studies to quantify estimator robustness to noise, motion, and

sampling variance, communicated results using Matplotlib, Seaborn, Plotly to technical/non-technical stakeholders.

Education

Indiana University Bloomington, MS in Data Science   Aug 2023 – May 2025
- GPA: 3.7/4.0

SRM University Chennai, B Tech in Mechanical Engineering   July 2017 – May 2021
- GPA: 8.47/10.0

Patented Research

3-Phase BLDC motor   May 2022

Vivek Reddy Munnangi,

Invented a high-efficiency 3-phase BLDC wheel hub motor with advanced stator design, achieving 95.03% efficiency and a 210°C max temperature without airflow. Used advanced composite materials and lamination techniques to achieve 36 Nm/kg performance, suitable for e-bike conversions. Currently researching axial flux BLDC motors for improved power, reduced size, and better thermal distribution, alongside analyzing simulation data for performance.

Additional Experience and Projects

Consultant, Economic Development District   Aug 2024 – Jan 2025
- Designed and deployed a generative QA agent that assists Economic Development District staff and CEDS drafters with on-demand drafting, calibration, and quality checks.
- By reducing rework and preventing avoidable rejections, the tool helps protect large grant awards and can translate into six-figure funding preservation per avoided rejection (depends on grant scale and local costs)

QC Intern, RockMan Advance Composites   Nov 2019 – Nov 2020
- Interned in Quality Control, focusing on dimensional accuracy, tolerance, and material testing analysis. Gained hands-on exposure to composite material production processes, emphasizing precision and meticulous evaluation to reduce part rejection by 20% and saving 150USD/hr excluding materials.

Full-Stack Web Application for Restaurants | MERN Stack, Render   May 2024
- Developed a full-stack web application using the MERN stack that reduced data entry rework time for restaurant staff by 45% by centralizing customer information and automating data retrieval for food preferences and allergies.
- This system-wide recall of preferences boosted customer satisfaction, and aiming to achieve a 15% increase in repeat customers and a 10% growth in average bill size by enabling targeted upselling based on historical preferences.

Image Recognition using Deep Learning | Tensorflow, ResNet50, ViT, CNN   Dec 2023
- Restructured and trained a neural network model to predict and classify images using the Caltech image dataset.
- Utilized ResNet50, Vision Transformer (ViT), and CNNs for feature extraction and pattern recognition.
- Implemented Vector embedding to handle large data size. Utilized this project to understand cause effect of tuning parameters and resource allocation comparing calculated vs real-time difference and obtained error of 5% excess.

All Terrian Vehicle | Solidworks, Lotus software, CAD/CAM   March 2019
- Engineered an All-Terrain Vehicle (ATV) for All India Championship event. Worked as Head of the Powertrain department, to design a gearbox retaining off-road characteristics.
- Team was fastest accelerating car over 100 teams. The draft of state estimation and dynamics equation was passed on to junior team.