Syed Muhammad Alam

• alamsyedmo@gmail.com • +92 322 873 1285 • github.com/alam121 • linkedin.com/in/syedmalam121

Objective

Highly motivated engineer with a strong background in Robotics, Biomedical devices, and Machine Learning. Experienced in **perception** (RGB/Depth cameras, Lidars, SLAMs, CV/DL algorithms), **prediction** (Machine Learning/Probabilistic algorithm development), and **planning** (Motion planning algorithms) with hands-on experience in **ROS/ROS2** development, embedded systems, and biomedical signal analysis.

Master's Degree

Lahore University of Management Sciences- Lahore 2021-2023
MS Electrical Engineering (Major Courses**: Robotics, Embedded Systems, Machine Learning**)

Bachelor's Degree

University of Engineering & Technology- Lahore 2016-2020
BS Electrical Engineering (CGPA: 3.47)

Publication & Grants

- *S. M. Alam and M. U. Faheem, "PID controller for tracking of autonomous mobile robot combined with Artificial Potential field and Iterative learning control," 2022 International Conference on Recent Advances in Electrical Engineering & Computer Sciences.* ***(Link)***
- *S. M. Alam, A. Raza, H. Fayaz, and F. Mehmood. "Visual Path Planning for Mobile Robots: Leveraging the Pure Pursuit Algorithm with Camera Feedback and Control Integration," Robotics and Autonomous Systems (Under Review)*
- *S. M. Alam and H. Jaleel, "Unstructured Terrain Navigation for Mobile Agricultural Robot using Online Self-Supervised Learning". Journal of Field Robotics (Currently working)*
- *S. M. Alam, S. Khan, Z. Nasir, A. Iqbal, S. Anwar, W. Saadeh and S. Chaudhary. "Minimally invasive low-cost continuous glucose monitoring system for the developing world" (Currently working)*

Skills

- Keras, TensorFlow, OpenCV, PyTorch, NLTK, Spacy
- Python, ARM, Java, C, C++, CUDA Programming
- Embedded Systems: KIEL, IAR, Segger, Raspbian, STVD
- PCB Designing, IC Designing
- Robotic Operating System, Linux
- MATLAB Simulation tools, Gazebo, V-Rep
- Proteus, ETAP, Multisim
- Slicer 3D
- EAGLE CAD, Altium PCB designer
- Cadence Tools

Employment History

Centre for Water Informatics & Technology - Lahore University Management Sciences

10/2021 – present
Research Associate

- Member core team **Development of Unmanned Ground Robot for precision agriculture**
- Developed ROS based Visual path planning on **Jetson Nano using Intel realsense camera** with RTK GPS.
- Interfaced motor drivers, odometry, IMU, Pixhawk, and other sensors for ROS.
- Developed neural network approach to detect optimal paths in unstructured terrain.
- Developed navigation algorithm based on RGB/Depth data, DWA algorithm combined with differential flatness concept.
- Implemented Extended Kalman Filter, ORBSLAM2 for improved localization and mapping.
- Developed source files for interfacing DJI Robomaster EPcore, DJI AR Drone and other Robotics Lab equipment.
- Performed duties of **Teaching Assistant** for graduate course Mobile Robotics, Embedded Systems.

Bioinformatics Research Lab (BIRL) - Lahore University Management Sciences

Embedded Systems Engineer/Team lead (Full time) 09/2020 –10/2021

- Member core team Higher Education Commission **Continuous Glucose Monitoring Sensor (CGM)** project
- Successfully developed CGM sensor based on Potentiostat, NRF, ESP and STM boards, resulting in a 30% reduction in production costs compared to existing commercial solutions.
- Development of wearable custom PCB boards based on low power consumptions SMD components.
- Successfully fabricated electrode needles based on photolithography and electro-sputtering.
- Collaborated with veterinarians for animal testing and **Byonyks** medical devices startup for sensor manufacturing.
- Created signal processing algorithms for EEG data calibration for further machine learning clustering.

Vision Processing Lab (VISPRO)-Information Technology University (ITU) Lahore

Research Intern 06/2019 - 08/2019

- Worked on CNN for Image Recognition & Semantic Segmentation for Deep Learning on Edge.
- Worked on NYU Satellite Image Segmentation project under the supervision of Dr. Mohsen Ali (ITU) and Dr. Rumi Chunara (NYU).
- Created a public repository of semantic segmentation maps of the landscape features in Pakistan.

Projects

Master's thesis: Unstructured Terrain Navigation for Mobile Agricultural Robot using Online Self-Supervised Learning

Main Features: *ROS, Computer Vision, Deep learning*
Language*: Python, C++*

- Successfully created a BLDC base differential drive autonomous ground robot capable of moving through crop rows.
- Interfaced sensors for odometry, IMU, Realsense camera, GPS for ROS (Data further used for training).
- Developed an online self-supervised network to learn a terrain's surface properties to compute a robot-specific 2D surface cost map.
- Developed a visual crop row navigation algorithm that computes dynamically feasible trajectories by accounting for different surface costs.

Bachelor's Senior Year Project: Autonomous Navigation System (Link)

Main Features: *YOLOV5, Linux, ROS, Nearest Neighbor Algorithm, Control Systems, Power Electronics*
Language*: Python, C++*

- Implementation of ROS based autonomous navigation with traffic signal classification & coordinates mapping using Rosserial.
- The control is implemented through Nearest Neighbor Algorithm, PID, Yaw Controller, Pure Pursuit Algorithm, and Low pass filter.
- Use of H bridge, Stepper motor, DC Gear Motor, Motor Controller, Boost converter for *Carla simulator* and an *Electric cart.*
- The Cart autonomously moves around 800 meters round the track on campus through obstacles and traffic signal with 92% accuracy.

Configuring DJI RoboMaster for ROS Navigation Stack to generate map and navigate autonomously (Link)

Main Features**:** *ROS, LIDAR, Gmapping* **|** ***Language****: Python*

- Configuring the robomaster EP core with RP LIDAR A3 along with teleoperation keyboard for robot movement.
- Configuring the Robomaster to implement Gmapping algorithm to map an arena with obstacles Adaptive Monte Carlo Localization is used to localize the robot.
- Implementing ROS navigation stack to autonomously move the robot from initial position to goal position while avoiding obstacles.

Self-driving car behavior cloning (Link) & Vehicle Detection project (Link)

Main Features**:** *Computer Vision, Deep Learning* **|** ***Language****: Python*

- Udacity simulator was used to clone driving behavior and then trained a CNN based on NVIDIA supervised regression model.
- The project includes data pre-processing, data augmentation, and training on Google Colab.
- The end result is predicted steering angles based on road images in front of a car with 95% accuracy with custom videos.
- Implementation of Histogram of Oriented Gradients (HOG) feature extraction on labeled images and training a Linear SVM classifier for detection and tracking of a vehicle.

IoT based Smart farming using ARM-Cortex M4 TIVA microcontroller (Link)

Main Features**:** *UART****,*** *ADC, PLL, LCD interface, MATLAB, ThingSpeaks IOT* **|** ***Language****: ARM Programming (KIEL/IAR), MATLAB*

- Farming sensors deployment for Temperature, Humidity, Soil moisture and Light on Tiva Launchpad (TM4C123).
- The data is displayed on 16x2 LCD module and transmitted on the ThingSpeak IoT platform for analysis using ESP8266.
- The project enabled higher agricultural yield with 50% decrease in cost than traditional farming methods.

Virtual Telepresence Robot Using Raspberry Pi (Link)

Main Features: *Linux****,*** *Raspbian, A-FRAME framework, Virtual Reality* **|** ***Language****: Python*

- Wireless control of Pi-Cam through the IMU accelerometer sensor of a mobile phone.
- The phone sensor data is transmitted to Raspberry Pi through Wi-Fi UDP communication, which controls the servo motor.
- The live feed of the camera is available online through A-Frame web framework for virtual reality experience.

Hobbies

- Scientific communication: writing & mentoring (Spectra Magazine)
- Volunteer work: Pakistan Speaks NGO
- Music instruments/sports
- Chess

References

- Dr. Abubakr Muhammad, Professor: Lahore University of Management Sciences, Lab Director: Center for Water Informatics & Technology, PhD: Georgia Institute of Technology, Postdoc: Caltech & UPenn, email: abubakr@lums.edu.pk **(Instructor and Supervisor)**
- Dr. Safee Ullah Chaudhary, Associate Professor: Department of Life Sciences, Lahore University of Management Sciences, Lab Director: Bioinformatic and Biomedical Research Lab, PhD: KAIST, email: safeeullah@lums.edu.pk (BIRL) **(Supervisor)**