Muhammad Idrees │ Software Architect | Computational Tool Developer

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Summary

I am an ADAS Software Architect with hands-on experience in C++ tool development and autonomous driving simulations. I graduated with a degree in mechatronics and intelligent systems having focused on research and development of intelligent autonomous platforms. Currently, I am working as a Software Tool Developer (ADAS department) at SW Engineer Level 2 in Valeo, a Tier 1 automotive supplier. My skill set includes ADAS, C++ development, Robotics algorithms, Intelligent Control Systems, Sensor fusion as well as Motion Planning.

Work Experience

- **Software Tool Developer - Valeo (ADAS, Prague Site), March 2023 till present.**
  - Developing software for validation and verification of algorithms and systems.
  - Core development of SIL, MIL and HIL solutions for a wide range of OEMs (BMW, Volkswagen, Renault, General Motors, Daimler Chrysler).
  - Documentation of implemented solutions according to Valeo Standard.
  - Maintaining and customizing implemented solutions according to customer needs.
  - Performing specification reviews, software design-reviews, peer code reviews on a regular basis.
  - Actively participating on the integration and system test (specification, preparation, execution, evaluation, reporting).

- **Platform Developer - Automotive Artificial Intelligence (AAI) - GmbH, Jan 2020-Jan 2023**
  - Helping build efficient and accurate automotive simulations using robust computational sciences algorithms and mathematical modeling at its core.
  - Working on Self Driving Stack from perception to sensor fusion and motion planning, aspiring to see a world where autonomous agents are a norm.
  - Developing ACC and AEB scenarios for autonomous system validation in simulation.
  - ECU Software Development, AUTOSAR and ISO 26262.
  - CAN, LIN, FlexRay, Ethernet
  - Model in the Loop Simulation, Software in the Loop and Hardware in the Loop.
  - **Tools:** UML, STL, Cuda, cuFFT, cuDNN, cuBLAS, Linux Kernel, Boost, Eigen, CMake, Optix Library, cuTensor, Object Oriented advanced C++ and Python, ROS, Simulink, MATLAB, VectorCAST.
    - Agile Process, Jenkins, Jira, Git.

  Products:
  a. Worked on developing sensor fusion pipelines for real time scenario cloning.
  b. Using real time sensor data, created an end to end solution for automotive scenarios extraction. Perform real time analysis on it and cluster those scenarios in identical groups.
  c. Made a full sensor suit hardware box for sensor housing and developed calibration workflow for everyday data collection of data from ego drive cars.
  d. Hands-on experience on Lidar, RGB Cameras, Depth Camera and IMU sensors using Nvidia TX2.

- **Research Assistant - Air University, Islamabad**
  - Worked on a funded project by the Higher Education Commission of Pakistan called "Technology Development Fund - TDF". Designed and developed the entire prototype for a mobile platform for paraplegic patients.
    a. Design and development of Mobile Platform base (Mechanical + Embedded + Control). o Design of Independence Mechanism for Sit Stand Boarding.
    b. State Space and Stability Analysis of Platform.
- **Freelance Software Developer**
  - Worked on various C++ and python based development projects for different remote clients.
    - Implementation of swarm robotics algorithm for formation and behavior control,
    - Trajectory tracking of drones using scrimmage simulator, (Python and C++).
    - Path planning of differential drive mobile robot using ackerman steering drive, (C++).
    - Implementation of 3-DOF Omnidirectional robot using Matlab and simulink.
- **Engineering Practicum Intern — National Institute of Electronics**

    A Great Experience working in an automation and control engineering lab. Worked on the Development of Embedded control systems, based on PIC, AVR and STAMP family of microcontrollers.

Research

1. Understanding vulnerabilities in Cyber physical production systems. (Accepted for publishing, Jan - 2020).

    Journal: International Journal of Computer Integrated Manufacturing, IF: 2.861 (2019) Authors: Azfar Khalid, Zeashan H Khan; **Muhammad Idrees;** Pierre Kirisci; Zied Ghrairi; Klaus-Dieter Thoben; Jürgen Panne.

Education

Self Driving Car Engineer - Udacity's Nanodegree Program   2020
Completed 9 in-depth robotics & AI based self driving car projects, consisting of following modules:
      Module 1: Computer Vision & Lane Detection,
      Module 2: Build Neural Networks with NVIDIA & Google,
      Module 3: Master Sensor Fusion with Mercedes-Benz,
      Module 4: Introduction to Localization,
      Module 5: Motion & Path Planning in the Real World,
      Module 6: Programming Controllers for Vehicle Movement,
      Module 7: Put Your Code to the Test (with a Real Car!).
https://graduation.udacity.com/confirm/GG2FFVJW
Sensor Fusion Engineering - Udacity's Nanodegree Program   2020
Projects included fusing data from three of the primary sensors used for autonomous vehicles: lidar, camera and radar as well as implementing kalman filters for tracking position and localization using C++
https://graduation.udacity.com/confirm/2TJHQ7NC

Master's degree, Mechatronics Engineering - Air University, Isb   2019 — 2021

Specialization: Autonomous Intelligent Systems

Graduate studies focused on Research and Development of Autonomous Intelligent Systems, with specialization in mathematical modeling of complex systems, motion planning architectures and optimal control systems.

Bachelor of Engineering in Mechatronics Engineering - Air University, Isb   2015 — 2019

Final Year Project: *Design, Development and Fabrication of Autonomous Aerial Mine Detector (Minesweeper Drone)*

Technical Skills

Programming Languages: C++, Python

Key Interests: Algorithm Development and Implementation, Software in the loop simulation (SIL), Hardware in the loop simulation, Mathematical Modeling.

Projects

- Implemented multi-agent intelligence algorithms for an AI competition named "Halite 3". My final ranking was 146 worldwide, out of 4000 participants. You can search for" dexter575" in the leaderboard at "2018.halite.io"
- Created my very own Ray-Tracing in both Python and OpenGL(GLSL). I studied how a camera works, how light propagates through a scene and the properties of materials in order to implement this.
- Implementing PID control for tracking robot's trajectory using C++ (Arduino IDE).
- Image Processing based Robot-soccer computer simulation on Webot and Gazebo simulator
- Wrote code to plan a trajectory for non-holonomic (Ackerman drive) using Direct-Multiple-Shooting in CasADi.
- Balanced cartpole (Optimal Control Problem) using CasADi.
- Design, fabrication and implementation of Raspberry-Pi Based 2 wheel differential drive ball tracking and ball potting robot
- IoT Based Real Time Fuel Management System
- Implementation of Simultaneous Localization and Mapping (SLAM) Algorithm for NERC-2k16
- 8-Bit ALU using Discrete Logic.
- Photo-transistor based Line Follower Robot
- Implementation of Artificial Potential Field Algorithm for Path Planning
- Indigenous design of Mobile Robot Base and Integration of Sensors as well as mechanisms for ball potting.

Achievements and Awards

1. Air University ACHIEVEMENT AWARD of Mechatronics Batch F-15.
2. Won EME Fair play award in National Engineering and Robotics Contest, EME NUST, 2018. Participation Certificate in Trice Major Categories (Indigenous, Robowar & Game of Drones) of National Engineering Robotics Contest (NERC 18) held in EME (NUST) Rawalpindi.
3. Winner in Line following Robotics Competition, AirTech-2017, Air University, Islamabad.
4. Winner in Robotics Competition, EME Olympiad-2017, EME (NUST), Islamabad.
5. Winner in Line Following Robotics Competition, AirTech-2016, Air University, Islamabad.
6. Hands on Practice on Arduino And Embedded System Development.