SHAKTHIBALA SIVAGAMI BALAMURUGAN

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ACADEMIC QUALIFICATIONS:

Degree & Branch	Institution	Board/University	CGPA/ Percentage	Year of Graduation
MS Robotics	Worcester Polytechnic Institute	WPI	-	**2027**
B.E. Robotics and Automation	PSG College of Technology, Coimbatore	Anna University, Chennai	**8.43**	**2025**
Higher Secondary	Narayana Olympiad School, Chennai	CBSE	**91.4%**	**2021**
Secondary School	Narayana Olympiad School, Chennai	CBSE	**91.6%**	**2019**

AREAS OF INTEREST:

- Computer vision
- Robot Operating System (ROS)
- Digital electronics
- Machine learning
- Hydraulics and Pneumatics
- Embedded systems
- Mobile Robotics
- Sensors and Instrumentation

SKILL SET:

Programming Languages	C, C++, Python, MySQL, MATLAB
Platforms worked on	Windows, Ubuntu (20.04,22.04)
Software/Libraries	SolidWorks, Auto CAD, ROS, OpenCV, Yolo, Gazebo, Fusion 360, Proteus, PTC Creo, Fluid Sim, Blender, TIA Portal v15, MATLAB, CIROS
Hardware	Arduino, Siemens PLC, RP Lidar, Zed2i, Intel RealSense, Festo MMS, Robotino3, Fanuc Arcmate, ABB arm, Jaco arm, Wadhog

WORK EXPERIENCE/INTERNSHIP:

- **Remote internship** - Internezy, Machine learning with Python
  Period: 10th June 2022 to 10th July 2022
- **Research internship** - Singapore University of Technology and design (SUTD), Worked at Product development cell on project titled collaborative robot for food processing industry.
  Period: 27th May 2024 to 19th July 2024
- **Industry internship** - Pricol Pvt Ltd, Working on Development of Machine User Interface for Automated Assemble line
  Period: 2nd August 2024 to 30th October 2024
- **Research internship** - Singapore University of Technology and design (SUTD), Worked on Dual arm Collaborative robot for Food processing industry, Secured 3rd place at Simsort ICRA.
  Period: 3rd February 2025 to 31th July 2025

PAPERS:

- **Research paper**- Alexa controlled 3DOF Robotic arm – International Journal of Innovative Research in Technology (IJIRT)
  Paper ID: 167673, **Status:** Published
- **Research paper**- Solar Panel Cleaning Robot- International Journal of Creative Research Thoughts (IJCRT)
  Status: Accepted, On Process for Publication

PROJECTS:

- **Hybrid Motion Planning via Reinforcement Learning and NLP:**

  Built a language-guided **hybrid grasping** system for a **UR16e** that pairs **MoveIt (IK)** with a **PPO** policy as an automatic fallback. Voice commands are parsed by an **LLM** into structured goals, while perception supplies object IDs and 3D grasp targets; a central controller selects IK or PPO based on feasibility. Developed and tested in **NVIDIA Isaac Sim**, the PPO fallback **improves success in cluttered, IK-failure scenarios**.

  Skillset: ROS2, Perception, Reinforcement Learning, NLP, Motion Planning, LLM Integration

- **Design and Development of a Multipurpose Vertical and Horizontal Surface Cleaning Robot:**

  Our approach involved designing a **mobile unit** and a **cleaning unit** equipped with high-performance water pumps. The cleaning unit adheres to walls using a vacuum generator that creates a vacuum chamber, with a nozzle positioned at the front alongside a nylon bristle roller for efficient cleaning. To enhance mobility and cleaning efficiency, **all heavy components were housed in the mobile unit**, keeping the cleaning unit lightweight.

  Skillset: Mechanical Design, Embedded systems, Finite State Automata (FSA)

- **RRT* for Autonomous Aerial Robot:**

  The aim of the project is to **traverse** a known **3d map** from a start point to the stop point. To achieve this we develop a **path planner** with RRT*, a **trajectory generator** for the planned path with **cubic spline** and tune **PID** gains in cascaded controller where outer loop controls position and inner loop controls velocity..

  Skillset: Path planning, Controller Tuning, Docker

- **ICRA's SIMSORT:**

  Large-workspace pick-and-place uses **7 fixed camera lookups** and five region modes (static, orientation-change, in-box, object-change, out-of-reach). **YOLOv4 (85%, MATLAB)** → deprojection → **IK** with class-based sorting; static is scripted, orientation/object-change use **PCA on point clouds** for pose, and out-of-reach follows **2–3 surface-clearing cubic-spline waypoints**

  Skillset: Motion Planning, Perception, MATLAB, Deep Learning

- **Coffee Serving Robot:**

  Developed a **robot prototype** aligned with Hatti Kappi's vision, facilitating smooth operations in coffee service alongside providing **employment opportunities** for **visually impaired** and **physically challenged individuals**. Additionally, presented this innovation at the **Bangalore Tech Summit**, the largest tech summit in Asia.

  Skillset: ROS (Navigation stack), NLP, Frame fabrication

- **Voice assistant integration with Robotic arm on ROS:**

  An **Articulated arm** is constructed based on the model created in SolidWorks and then imported as URDF into RViz. Through the **Amazon Developer Console**, specific intents like **Wake Intent, Sleep Intent, and Pick Intent** are set up.

  Skillset: ROS (Trajectory planning of arm, motor control), Voice assistant integration

- **Rover for ISRO's hackathon:**

  Designed and constructed a rover from scratch, incorporating a rocker-bogie mechanism and differential drive system for ISRO's national-level robotics challenge. The objective was to pick up three samples and deposit them into a container within the designated environment.

  Skillset: Computer vision, ROS2, Microros, Trajectory planning, Exploration algorithms

- **Optimization Technique on mobile robot:**

  Optimization techniques such as **PSO** (Particle Swarm Optimization) and **ACO** (Ant Colony Optimization) have been implemented and assessed on **Robotino3**, a mobile robot, for tasks pertaining to autonomous navigation using **ROS**. Presently, **MOEPSO** (Multi-Objective Evolutionary Particle Swarm Optimization) is in the testing phase.

  Skillset: ROS, Navigation stack, Optimization techniques

- **Sign Language detection:**

  An algorithm for detecting **sign language** has been created to **extract key points** from the body and interpret various messages conveyed, such as **expressions of gratitude, greetings, apologies**, and more from the video frames provided as input.

  Skillset: Computer vision (Video frame segregation, local feature detection)

- **Image Deblurring using GAN (generative adversarial network):**

  During the training process, two distinct neural networks, namely **the Generator and the Discriminator**, undergo training. The Generator functions by creating an image through **noise filtration** via convolution techniques. Meanwhile, the Discriminator **evaluates the generated image** against the original image during training, aiming to enhance the **model's accuracy**. Ultimately, this iterative process results in the production of a final deblurred image.

  Skillset: GAN, Image processing, Deep learning

- **Ball Throwing robot:**

  The objective of the bot is to **position the ball** onto the basket at a **height of 1.5m**. The robot is manually guided using a joystick and has a trail mechanism to successfully place the ball on the basket (goal position).

  Skillset: Building robot for given problem statement, Holonomic drive mechanism on base

CO-CURRICULAR:

- **2nd Runner up** on ICRA RGMC's Simulation Sorting 2025**.**
- **Winner** of **SIMO** Olympiad at **school level.**
- **Winner** of **Science Olympiad** conducted at **school level,** following that **participated** on **State level**.
- **Runner up** in Circutrix event conducted by **Robotics and Automation Association**.
- Secured **Elite world record** for most no of participants colouring parts of Human body simultaneously.
- Secured **Tamilan Book of Records** for greatest no of participants writing Key concepts, Definitions, Formulae simultaneously
- Participated on **International maths Olympiad** after clearing **National level.**
- Participated on hackathon conducted by **ISRO (Finalist).**
- Participated on hackathon conducted by **Ashok Leyland (stage 1 cleared).**
- Participated on Smart India hackathon conducted by **Gov of India.**
- **Executive member** on Higher Education forum club (Previous)

EXTRA-CURRICULAR:

- **Winner** of Interschool **Football** tournament conducted by Narayana Olympiad school
- **Secured State and national level** prize(**consolation**) on Abacus competition conducted by UCMAS.
- Participated on **Open state Badminton** on the category under 17