Sai Sourya Varenya Kovvali

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Research Interests

Robotics, Bipedal Locomotion, Manipulation & Grasping, Energy-free Systems, Mechanism Design, Exoskeletons, Assistive Technology

Education

Indian Institute of Technology Madras (2014 – 2018)

Bachelor of Technology - Mechanical Engineering (Minor - Robotics)
CGPA – **9.51**/10 (3rd rank in the department)

Research Experience

Biped Test Bench | Indian Institute of Technology Bombay (Aug '18 – Present)

Guide – Prof. Vivek Sangwan

Research Assistant

- Designed bipedal robot and a rotating testbench for conducting experiments on locomotion
- Setup simulation environment and interfacing hardware and developing control architecture for the biped

Stance Control Orthosis | R2D2 Lab | IIT Madras (Jun '17 – Jul '18)

Guide – Prof. Sujatha Srinivasan

Undergraduate Researcher | Bachelor Thesis Project

- Developed a purely mechanical knee-joint mechanism that utilizes human weight to achieve selective locking
- Validated the mechanism using FEA and fabricated multiple knee joints for evaluating real-life performance
- Improved affordability and ease of assembly by constructing an interlock-based fastener-free joint manufactured fully using laser-cutting

GraspMan: Mobile Manipulator | Robotics Lab | IIT Madras (Jan '17 – Oct '17)

Guide – Prof. Asokan Thondiyath

Undergraduate Researcher

- Designed and fabricated 1st prototype containing 2 grippers linked by redundant serial chain providing the ability to locomote, grasp and perform in-hand manipulation
- Simulated dynamics using Lagrangian mechanics and implemented PID control on model in Mathematica
- Experimented on the grasping force for objects of different sizes and shapes to establish a parameter for comparison across grippers

Publications and Patents

- [Conf. Paper] Govindan, N., ***Kovvali, S. S. V.***, Chandrasekaran, K., & Thondiyath, A. (2018, May). **GraspMan-A Novel Robotic Platform with Grasping, Manipulation, and Multimodal Locomotion Capability**. In 2018 IEEE International Conference on Robotics and Automation (ICRA) (pp. 7354-7359). IEEE.
- [Patent - Applied] Nagamanikandan Govindan, ***Sai Sourya Varenya Kovvali***, Karthik Chandrasekaran, and Asokan Thondiyath, **'A versatile hybrid robotic system for multimodal locomotion and grasping'**, Application Number: 201841008257, filed on 06/03/2018

Technical Experience

Mars Rover Design | Team Anveshak | IIT Madras (Oct '15 – Jul '18)

Team Lead

- Lead the team for its maiden attempt in showcasing Mars rover design, at *University Rover Challenge '17*, Utah, USA (29th position among 82 teams globally)
- Conducted successful crowdfunding campaign, raising 1.75 lakh rupees ($2700) & networked with companies - Maxon and Pololu - for sponsorship deals and discounts
- Administered finances transparently by developing fully custom *Finance Web Portal* and generating automated monthly finance statements

- Initiated and lead the media team – responsible for video composing, graphic design and webpage development & maintenance

Technical Lead

- Headed design of a tele-operated robotic arm for rover with end-to-end design analysis (2017 – 18)
- Lead the chassis design and manufacturing for the first version of the rover – Aurora v1 (2017)
- Developed locomotion algorithms for control of rover and implemented a modular and scalable instrumentation architecture using multiple microcontrollers networking over I^2C (2016 - 17)

Arc-Welding Simulator | Skillveri Training Pvt. Ltd., Chennai, India (Jan '18 – May '18)

Product Design Internship | Part-time

- Designed arc welding torch for VR simulator setup that utilizes retracting rod mechanism for electrode feed
- Integrated and programmed microcontroller for PID controlled retraction rate & IMU orientation feedback

Product Development | Detect Technologies, Chennai, India (Dec '15 – Feb '16)

Product Design Internship | Full-time

- Ported **thermal camera to GoPro form-factor** for compatibility with existing gimbals on surveillance drones
- Adopted **iterative designing and manufacturing process** to achieve accurate fits & balanced mass distribution

Smart Home Devices – Project Chronos | IIT Madras (Feb'15 – Oct'15)

- Designed and tested prototypes for *Smart plug socket*, *Universal IR remote* and *Air monitoring system*
- Represented IIT Madras at inter-IIT tech meet and secured Gold medal in the IoT segment

Teaching and Mentoring

Indian Institute of Technology Madras

ME2400 – *Measurements, Instrumentation and Control* (Jan '18 – May '18)

Conducted sessions on the basics of microcontrollers – preparing students for the course project

ME6230 – *Mechanics of Human Movement* (Jan '18 – May '18)

Mentored course project group – Inverse-dynamics analysis of vertical jumping using motion capture

iBot Club, CFI, IIT Madras (Nov '15 – Nov '16)

Mentored 4 projects and conducted workshops on CAD with Fusion 360, Arduino and Eagle PCB design

Udaan, CBSE India (Oct '15 – Dec '15)

Recorded lectures on math topics - conic sections and calculus for distributing to unprivileged girl population

Course Projects

Computer-Aided Manufacturing, ME5303 – Digital Manufacturing (Jul-Nov 2017)

Developed B-Rep framework on *Python* and implemented MAKE and KILL operations to manipulate the solid
Built an efficient visualization pipeline for displaying tool movement in the finishing pass of free-form surfaces
Implemented slicing algorithm for 3D printing – with *STL* files as input

Remote Localization System, ED5315 – Introduction to Field Robotics (Jul-Nov 2017)

Interfaced multiple 2.4GHz radios as beacons to build an easily deployable trilateration system using *RSSI* value

Inverse Dynamics Analysis of Human Gait, ME6012 – Mechanics of Human Movement (Jan-May 2017)

Processed motion capture and force plate date and performed Inverse-dynamics for analyzing the gait

Topographical Simulation of Virtual Surfaces, AM5011 – Virtual Reality Engineering (Jul-Nov 2016)

Simulated spherical surface by manipulating surface orientation based on the position of touch

Skills

CAD – Autodesk Fusion 360, Autodesk Inventor, PTC Creo
Programming – Python, Java, C++ (Generic), MATLAB, Mathematica (Scientific), ROS
Hardware – Arduino, Raspberry Pi and other SBCs, TI Tiva-C, ESP8266/ESP32
Web Development – HTML/CSS, PHP, NodeJS, Vue JS, Jekyll
Other – V-REP Simulator, PhaseSpace Motion Capture