Kovvali Sai Sourya Varenya

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EDUCATION

Bachelor of Technology

Department of Mechanical Engg.
Indian Institute of Technology Madras

CGPA – **9.52**
(till 6th semester)

Ranked **3**[rd] among the undergraduates of the department

Major Mechanical Engineering
Minor Robotics

SKILLS

CAD	Fusion 360, PTC Creo, AutoCAD, Inventor
Programming	Python, Java, C#
Scientific	MATLAB, Mathematica
Electronics	Eagle PCB Design, Arduino, Raspberry Pi, TI Tiva C
Manufacturing	3D Printing, CNC Machining

Basic Experience

3D Modelling	3DS Max, Mudbox
Game Engines	Unity, Unreal Engine 4
Web Dev.	HTML, CSS, PHP
Media	Photoshop, DaVinci Resolve
Android Dev.	Android Studio

KEY COURSES

Mechanics of Human Movement	**9**/10
Virtual Reality Engineering	**10**/10
Machine Vision and Applications	**10**/10
Design of Machine Elements	**10**/10
Digital Manufacturing	Ongoing
Microprocessors in Automation	Ongoing

Robotics (Minor)

Introduction to Robotics	**10**/10
Field Robotics	Ongoing
Creative Engineering Project	Ongoing

Economics

Principles of Economics	**10**/10
Financial Economics	**8**/10
Econometrics	Ongoing

Enrolled Courses

- Machine Learning for Engineering
- Mech. & Control of Robot Manipulators

Research Interests

Manipulators and Graspers, Field Robots, Space Exploration, Assistive Technologies, Exoskeletons, Mechanism Design

Research Projects

Stance Control Knee Orthoses *(Bachelor Thesis)*   *Jun '17 - Ongoing*
Guide: Prof. Sujatha Srinivasan, IITM ↗

Knee joint mechanism for providing natural gait among patients with weak knee extensors

- Devised an electromechanical clutch-based mechanism for achieving selective unlocking the orthoses and performed FEA for load verification
- Prototyped the knee joint with easily machinable materials and necessary electronics for validating the mechanism and the control strategy
- Interfaced ESP32 microcontroller with force sensor to identify gait events
- Currently embedding lightweight linear actuator on existing orthosis for implementing locking and unlocking, based on the Force sensor reading.

Future Work: Design iterations for improved manufacturability, Able-bodied trials to evaluate the performance

GraspMan, Robotics Lab, IITM   *Jan '17 - Ongoing*
Guide: Prof. Asokan Thondiyath, IITM ↗

Novel serial chain manipulator robot with locomotion and hybrid grasping

- Simulated PID control on model - Lagrangian Mechanics in Mathematica
- Designed and fabricated a prototype containing 2 grippers linked by redundant serial chain providing the ability to locomote, grasp and perform in-hand manipulation enabled by intricate roller belt grasping mechanism
- Experimented on the grasping force for objects of different sizes and shapes to use it as a parameter for comparison across grippers

Future Work: Addition of reconfigurability at the gripper to enhance the mobility

*Co-authored conference paper – "**GraspMan – A Novel Robotic Platform with Grasping, Manipulation, and Multimodal Locomotion Capability**" for **ICRA 2018** (Under Review)*

Technical Experience

Team Anveshak, IITM   *Oct '15 - Ongoing*

The Mars rover team of IIT Madras which engineers a powerful semi-autonomous all-terrain vehicle for the scientific exploration of Mars

Member, Electronics Team   *Oct '15 – Aug '16*

- Developed locomotion algorithms for speed and steering control of rover
- Fabricated modular PCBs to implement a scalable electronic architecture

Technical Lead   *Sep '16 – Jan '17*

- Lead the development of chassis, incorporating hybrid rocker-bogie mechanism for superior maneuverability & suspension for impact resistance
- Proposed 3R serial manipulator actuated by novel 4 link kinematic chain for performing tasks such as turning a knob, refueling a tank & pushing buttons

Team Head   *Feb '17 – Aug '17*

- Conducted a successful crowdfunding campaign, raising INR 1.75L ($2700)
- Efficiently administered team finances and initiated monthly finance reports
- Introduced new avenues – Public Relations Team and Design & Media Team

Team President   *Sep '17 – Ongoing*

- Networked with companies - Maxon and Pololu for exclusive discounts
- Co-heading the design of *TeRA – Tele-operated Robotic Arm,* a unique manipulator constructed for rover with end-to-end design analysis

*Headed the team for its **maiden** visit to **Mars Desert Research Station, Utah, USA** for participating in the **University Rover Challenge 2017 –** Placed among **Top 30** teams*

Project Chronos, Centre for Innovation, IIT Madras — *May '15 – May '16*

Suite of affordable products engineered to create smart, connected ecosystem of devices

- Designed, manufactured and assembled the smart plugboard for housing plug sockets, PCB with microcontroller and relays and wireless module
- Carried out extensive prototype testing for ensuring reliable operation and prepared electric circuitry and schematic for the PCB
- Scripted the first version of control webpage using *PHP* and *MySQL*

Industrial Internship, Detect Technologies — *Dec '15 – Feb '15*

Product development intern at Detect Tech., a pipeline monitoring and inspection startup

- Successfully ported thermal camera hardware into GoPro form factor for compatibility with existing gimbals
- Adopted iterative designing and 3D printing cycles for achieving accurate tolerances and optimized weight distribution

Semester Projects

Inverse Dynamics Analysis of Normal Human Gait — *Mar '17 – Apr '17*
ME6012 – Mechanics of Human Movement

- Derived kinematic parameters of the gait from raw force plate sensor data and motion capture data for inverse dynamics calculations
- Utilized MATLAB's smoothening functions to smoothen the raw data

Grinding Wheel Wear Analysis — *Feb '17 – Apr '17*
ME7180 – Machine Vision and Applications

- Developed edge detection based thresholding algorithm to isolate the loaded area from a grayscale photo of the grinding wheel
- Scripted code for filtering over 500 observation images to extract wear indicative parameter & executed regression to determine redressing phase

Topographical Simulation of Virtual Surfaces — *Sep '16– Dec '16*
AM5011 – Virtual Reality Engineering

- Compiled android app for tracking touch and mapping on to the virtual surface to compute surface normal vector and transmit it over Bluetooth
- Achieved desired physical surface orientation by implementing servo control using data received from Bluetooth stream
- Successfully demonstrated the simulation of spherical surfaces

Econometric Study – Ageing of Nations — *Oct '17– Nov '17*
HS4011 – Econometrics

- Aimed at identifying factors affecting Old-Age-Dependency-Ratio of a nation
- Acquired and filtered data from World Bank and Migration Policy Institute
- Explained influences of factors – Migration rate & healthcare expenditure
- Inspected and corrected data for multicollinearity and heteroskedasticity

Remote Localization System — *Sep '17– Nov '17*
ED5315 – Introduction to Field Robotics

- Conceptualized temporary and easily deployable beacon mesh system for employing in areas like extraterrestrial exploration and indoor positioning
- Interfaced ESP8266 – wireless microcontrollers to build multiple beacons connected to an HTTP server on the host computer
- Implemented weighted centroid and least square error trilateration

Computer Aided Manufacturing — *Sep '17– Nov '17*
ME5303 – Digital Manufacturing

- Developed Boundary Representation framework on Python for storing solids and implemented MAKE and KILL operations to manipulate the solid
- Built an efficient animation pipeline for displaying tool movement in the finishing pass of free-form surfaces
- Executed slicing algorithm for 3D printing, with STL files as input

ACHIEVEMENTS

Gold Medal
IoT segment,
Inter IIT Tech meet 2016
Represented IIT Madras and competed against other IITs by demonstrating Chronos

2nd Position
Product Development,
Inter-hostel tech event
Exhibited scalable security system for hostel rooms

RESPONSIBILITIES

Club Strategist
Robotics Club, IIT Madras
(Nov '15 - Nov '16)

- *Conducted workshops on CAD with Fusion 360, Arduino and Eagle PCB design*
- *Supervised and nurtured several projects in the club*

Tech Coordinator
SHAASTRA 2016
(Oct '15 - Jan '16)

- *Built a remote controlled robot with Raspberry Pi and camera module and deployed for the coverage of SHAASTRA 2016*

VOLUNTEER

Math Instructor
Udaan, Central Board for Secondary Education (CBSE)

Recorded Lectures on topics - Conic sections and Calculus for distributing to unprivileged girl population of India

Member
Engineers for Life

Actively participated in building solutions for problems faced by laborers of the institute