Sambad Regmi

Curriculum Vitae

Personal Web Page

Research Interests

Theory: Data analysis; Experiment design; Human biomechanics; Kinematics and dynamics of robots and robotic manipulators; Manipulator design; Rehabilitation robotics; Robotics, mechatronics, and controls (alphabetical order)

Application: Control applications such as impedance control; Data acquisition system; Motors, motor drives, sensors, and controller systems; real-time systems; Rehabilitation robotics; Robotics and mechatronics (alphabetical order)

Summary

My research interests mainly lie within the field of:

- Mechatronics, Robotics, and Control
- Human-Human and Human-Robot Interaction
- Robotic Manipulators
- Rehabilitation Robotics
- Kinematics and Dynamics of the System

Education

May 2022 **Ph.D, Mechanical Engineering**, *Missouri University of Science and Technology*, Rolla, MO, (GPA: 3.933).
Dissertation Title: "Development of an Interactive Robot for Overground Physical Human-Robot Interaction"
Advisor: Dr. Yun Seong Song

Jun 2016 **B.E, Mechanical Engineering**, *Visvesvaraya Technological University*, Bangalore, India, (85%).

Professional Experience

May 2022 – Present **Senior Mechatronics Engineer**, *ASML*, Wilton - CT.

- Working with system architects in a multi-discipline project team to develop concepts, perform engineering analysis, and build and test mechatronics prototypes.
- Creates budgets, set requirements and facilitate development of the module.
- Act as a technical leader and contribute to breakdown of complex technical problems, analyze the problems from different angles and find multiple solutions to choose from.
- Understand team goal, provide deliverable on time and take responsibility for the decisions.
- Define, plan and priorities tasks and follow-up on results.
- Communicate clear to technical team (and broad audience), about directions and expectations and follow up and feedback on results.

Aug 2017 – Apr 2022 **Graduate Research Assistant**, *Missouri University of Sci. and Tech.*, Rolla, MO.

- Designed and developed robotic manipulator for physical human robot interaction experiments; Selected required hardware and software for the robot; and, currently trying to implement various force, position, and velocity control strategies on the robot
- Developed a "dynamics" simulator of a robotic manipulator using Lagrangian method; estimated the friction/damping of rotational joints, and verified its accuracy using the effective inertia estimate; developed a method to estimate the output impedance of a manipulator using the robotic simulator

- Designed a data acquisition and analysis technique for the overground physical human-robot interaction experiment
- Designed and conducted the the human-robot interaction experiment, including acquiring an IRB approval, recruiting and interacting with the participants, preparing and maintaining the experiment setup, collecting and analyzing the data, and reporting results
- Published journal article about our research progress and update; Presented our research progress as posters and conference presentations

Sep 2021 – Dec 2021 **Engineering Intern, (Mechatronics)**, *ASML*, Wilton - CT.

- Worked on sub-systems involving robotics, mechatronics, and precision mechanics, which involved understanding the functional requirements and deriving specifications

Publications

[1] **Regmi, S.**, Song, Y. S., "Design methodology for robotic manipulator for overground physical human-robot interaction", *ASME Journal of Mechanisms and Robotics*, **12**(4), p. 041002, 2020.

[2] **Regmi, S.**, Song, Y. S., "Estimation of Endpoint Impedance of a 2D Parallel Manipulator using Numerical Simulation Experiment", *ASME International Mechanical Engineering Congress and Exposition,* **Vol. 84522**, American Society of Mechanical Engineers, 2020.

[3] **Regmi, S.**, Burns, D., and Song, Y. S., "A Robot for Overground Physical Human-Robot Interaction Experiments", *PLoS ONE,* **Vol. 17**(11), p. e0276980, 2022.

[4] **Regmi, S.**, Burns, D., and Song, Y. S., "Humans modulate arm stiffness to facilitate motor communication during overground physical human-robot interaction", *Scientific Reports, **Vol. 12**, p. 18767, Nature, 2022.*

[5] Kamma, T. K., **Regmi, S.**, Burns, D., and Song, Y. S., "Validation of the Human Arm Stiffness Estimation Method Developed for Overground Physical Interaction Experiments" *45th IEEE Engineering in Medicine and Biology Conference, Sydney, Australia.*, IEEE, 2023.

[6] Alluri, S. R., **Regmi, S.**, Rashid, F., Burns, D., and Song, Y. S., "Balance Assistance Without Mechanical Support Using a Virtual Cane", *submitted*

[7] Mohammadi Beirami, M., **Regmi, S.**, Burns, D., and Song, Y. S., "Exploring Kinematics Contribution to the Arm Stiffness Modulation During Overground Physical Human-Robot Interaction" *46th IEEE Engineering in Medicine and Biology Conference, Orlando, Florida, USA*, IEEE, 2024 *(submitted).*

[8] Mohammadi Beirami, M., **Regmi, S.**, Rashid, F., Burns, D., and Song, Y. S., "Uncovering Human Arm Stiffness Modulation during Unpredictable Overground Physical Human-Robot Interaction Task through Kinematics Analysis", *not submitted, in preparation*

Conference Abstract

[1] Presented a poster "Design Methods for Robots for Overground Physical Interaction" at 41st IEEE Engineering in Medicine and Biology Conference (EMBC 2019), Berlin, Germany.

Patent

Sep 2023 **Regmi, S.** and Song, Y. S., "Mobile robot configured to determine human arm stiffness during overground interaction", *US Patent App. 17/939,698, pending.*

Awards

Mar 2022 **3MT, Missouri S&T**, *Received the people's choice award.*

Dec 2021 **3 Minutes Poster Presentation, Missouri S&T Council of Graduate Students**, *Presented a summary of my PhD research, and grabbed 5th place for the best presentation .*

Nov 2020–Apr 2021 **John W. Claypool Fund for Medical Research**, *Received student research funding to advance research on human-human and human-robot interaction at Missouri S&T.*

Jul 2012–May 2016 **COMPEX Scholarship Scheme 2012, Embassy of India**, *Got selected through an open competition to pursue BE (Mech.) in India.*

Teaching and Mentoring Experience

Jan 2020 – May 2021 **Graduate Teaching Assistant**, *Missouri University of Sci. and Tech., Rolla, MO.*

- Provided guidance during lab sessions of Control System Laboratory for undergraduate seniors in understanding physical concepts of control systems
- Assisted students in hardware implementation of control algorithms using PLC/LabVIEW software
- Evaluated students' performance and provided detailed feedback on conceptual understanding
- Maintained regularly scheduled office hours to advise and assist students
- Taught a laboratory-heavy class online during Covid-19 situation using different strategies (whichever is feasible) such as remotely accessing the hardware, using simulated environments, and making video demos
- Experience with course management software like Canvas, and online teaching via Zoom

Skills

Dev Tools MATLAB, Simulink, LabVIEW, Python, SOLIDWORKS, Mathcad, Maplesoft, PLC

Software Vicon Nexus, Kollmorgen Workbench, Microsoft Office, Latex, proCalc, JMP, SAS, SQLite

Hardware Experience Motion capture system (Vicon Motion Systems); Speedgoat Real-Time systems for HIL and rapid prototyping; LabVIEW Real-Time and associated control systems; LabVIEW SoftMotion, LabVIEW FPGA, and other Modules; Brushless DC motors (Kollmorgen, Anahiem Automations (AA) and others); Motor drives and contollers (Kollmorgen-AKD and AA); ATI Force/Torque sensor, and controller; Data acquisition systems (RS232, NI USB6021, NI cRIO 9045 modules, and AA modules); DirectSoft PLC ; Electrocardiogram Machine; Spirometer

Relevant Courses

Coursework Control System, Discrete Neural Network Control, Introduction to Neural Networks, Mechanics of Machinery, Neuromechanics of Human Movement, Statistical Data Analysis (alphabetical)

Coursera Control of Mobile Robots, Machine Learning, Python (specialization)

References

1. **Dr. Yun Seong Song**
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3. **Dr. Devin Burns**
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   Associate Professor, Department of Psychological Science
   Missouri University of Science and Technology
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