Ananya Ipsita, Ph.D. Student

West Lafayette, IN, US
(Looking for Internships/Co-Ops in Spring/Summer 2024)

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EDUCATION

Aug 2020 - Ongoing	**Purdue University, West Lafayette** *Ph.D. in Mechanical Engineering, GPA: 3.68/4*
May 2022 - May 2024	**Purdue University, West Lafayette** *Degree Certificate in Applied Statistics*
Aug 2018 - May 2020	**Purdue University, West Lafayette** *Master of Science in Mechanical Engineering, GPA: 3.73/4*
Aug 2010 - May 2014	**National Institute of Technology, Rourkela, India** *Bachelor of Engineering in Electronics and Communication Engineering, GPA: 9.27/10*

RESEARCH EXPERIENCE

2.1 Research Summary

I am currently pursuing my Ph.D. in Mechanical Engineering in the Convergence Design lab at Purdue University. My research focuses on the convergence of human factors, human-machine interaction design within the realm of engineering education, and psychology. I see new breakthroughs in computing technology, including Augmented Reality, Virtual Reality, robotics, and Artificial Intelligence, as promising avenues to enhance human capabilities and expertise while enriching their daily lives.

2.2 Primary Research Contributions

1. **StoryMakAR: Bringing Stories to Life with an AR & Physical Prototyping Toolkit for Youth [13, 11]**
   - Design rationale extracted from preliminary studies that show how children engage in maker-based storytelling, what they make, and the issues that arise as a result
   - The StoryMakAR system, which includes plug-and-play electronics, an AR-enabled app that helps users create dynamic storytelling environments, as well as two accompanying environments, DeviceMakAR and EventMakAR, which allow users to program their own customized devices and design the interactions between virtual and physical content
   - The study and evaluation results of our system, which show that it can be used to easily create new and unique storytelling experiences.

2. **VRWeldLearner: Towards Modeling of Virtual Reality Welding Simulators to Promote Accessible and Scalable Training [8]**
   - A design and learning rationale and taxonomy extracted using the backward design approach in learning sciences and through discussion with welding training experts that shows what to consider while designing an effective training system for novice welders;
   - A design framework encompassing structured learning modules to achieve a low-cost and widely scalable virtual Metal Inert Gas (MIG) welding training; and
   - The user study and evaluation results to validate the system's usability using a minimum viable prototype, evaluate the performance of the proposed alternative for visuo-haptic guidance during virtual welding, and understand the impact of visuo-haptic perception in VR towards the development of psycho-motor skills in welding for novices.

3. **VRFromX: From Scanned Reality to Interactive Virtual Experience with Human-in-the-Loop [12, 3]**

- The system workflow design of VRFromX enables creation of interactive VR scenes, from scanning real world scenes into point cloud scans, to transforming point cloud objects into virtual 3D models, and to establishing functionalities and logical connections among virtual contents.
- An embodied user interaction design that supports point cloud segmentation and editing, the AI assistant that guides object retrieval and alignment, and the spatial and visual interface for functionality and logic authoring.
- A detailed system development of a welding use-case scenario, evaluation results obtained from a three-session user study, in addition to two example use-case demonstrations.

4. **Towards Authoring Instructional Flow in immersive Virtual Reality based Learning Units to promote Outcome-oriented Learning [1]**
   - Design of the system workflow that enables collaboration between SMEs and VR developers to facilitate pedagogically driven planning of iVR-based learning units using learning activities framed in alignment with the Backward design approach;
   - Development of a graph-based flow editor that allows flexible composition of learning activities categorized under *Introduction*, *Presentation*, *Practice* and *Application* based on the general instructional framework, to author instruction sequence in iVR-based learning units; and
   - the demonstration of the workflow design using a welding use case along with the evaluation and results from a user study conducted with 12 experienced welders.

5. **Adopting Backward Design into a Constructionist Curriculum Design for IoT Skill Development in High Schoolers [2]**
   - Development of the learning curriculum for an enrichment program to teach high school students about IoT-related concepts by using the Backward design approach from learning sciences;
   - Design of a MAKER-based instruction model as a part of the learning curriculum by using theories of constructionism; and
   - Pilot testing of the curriculum design with 28 high school students during two enrichment programs.

2.3   Research Publications and Patents

2020   13.   Glenn, T., **Ipsita, A.**, Carithers, C., Peppler, K. & Ramani, K. *StoryMakAR: Bringing stories to life with an augmented reality & physical prototyping toolkit for youth* in *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (2020), 1–14.

2021   12.   **Ipsita, A.** *et al. VRFromX: From Scanned Reality to Interactive Virtual Experience with Human-in-the-Loop* in *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (2021), 1–7.

2022   7.   Chidambaram, S. *et al. EditAR: A Digital Twin Authoring Environment for Creation of AR/VR and Video Instructions from a Single Demonstration* in *2022 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)* (2022).

8.   **Ipsita, A.** *et al. Towards Modeling of Virtual Reality Welding Simulators to Promote Accessible and Scalable Training* in *CHI Conference on Human Factors in Computing Systems* (2022), 1–21.

9.   Paredes, L., **Ipsita, A.**, Mesa, J. C., Garrido, R. V. M. & Ramani, K. StretchAR: Exploiting Touch and Stretch as a Method of Interaction for Smart Glasses using Wearable Straps. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies,* 1–26 (2022).

10.   Qian, X. *et al. ScalAR: Authoring Semantically Adaptive Augmented Reality Experiences in Virtual Reality* in *CHI Conference on Human Factors in Computing Systems* (2022), 1–18.

11.   Ramani, K., Glenn, T. K., Carithers, C. & **Ipsita, A.** *System and method for authoring augmented reality storytelling experiences incorporating interactive physical components* Oct. 2022.

2023

1. **Ipsita, A.**, Patel, M., Unmesh, A. & Ramani, K. *Towards Authoring Instructional Flow in immersive Virtual Reality based Learning Units to promote Outcome-oriented Learning* in *Educational technology research and development [Submitted, In Review]* (2023), 1–12.

2. **Ipsita, A.** et al. *Adopting Backward Design into a Constructionist Curriculum Design for IoT Skill Development in High Schoolers* in *SIGCSE Special Interest Group on Computer Science Education [Submitted, In Review]* (2023), 1–7.

3. **Ipsita, A.** et al. *The Design of a Virtual Prototyping System for Authoring Interactive VR Environments from Real World Scans. Journal of Computing and Information Science in Engineering,* 1–18 (2023).

4. Parades, L. et al. *WErgo-VR : Exploration of Virtual On-Body Wearables Design With Real-Time Ergonomics Estimation* in *CHI Conference on Human Factors in Computing Systems [Submitted, In Review]* (2023).

5. Patel, M., **Ipsita, A.**, Erickson, L., Maheshwari, P. & Ramani, K. *PowVRtool: A Handheld Haptic Device for Realistic Power Tool Feedback in VR-Based Manufacturing Training* in *CHI Conference on Human Factors in Computing Systems [Submitted, In Review]* (2023), 1–18.

6. Wu, M.-H., **Ipsita, A.**, Huang, G., Quinn, A. J. & Ramani, K. *ImpersonatAR: Using Embodied Authoring and Evaluation to Prototype Multi-Scenario Use cases for Augmented Reality Applications. Journal of Computing and Information Science in Engineering [Accepted],* 1–17 (2023).

TEACHING EXPERIENCE

3.1 Graduate-undergraduate Education

Fall '19, Spring '20

ME 444 – Computer-Aided Design & Prototyping
Teaching Assistant and Grader
- In charge of lab sessions and provided guidance to over 50 students in enhancing their CAD abilities utilizing PTC Creo.
- Developed innovative guided-project oriented course content to enhance students' hands-on prototyping skills
- Gave selective demonstrations on design for fabrication and wireless mechatronics control.
- Coordinated Toy Fair 2020, where students presented functional prototypes and the commercial viability of their mechanically-engineered toys.

Spring '19

ME 496 - Design & Prototyping of Smart Things
Teaching Assistant and Grader
- Designed the course curriculum utilizing concepts from electronics, 3D fabrication and coding to provide learners with a hands-on engineering experience to design and prototype smart electro-mechanical modules.
- Assisted students during lab sessions and guided projects.
- Organized the IoT Fair where student teams collaboratively demonstrated scaled down mock-up IoT factory.

Spring '23

ME 553 – Product & Process Design
Teaching Assistant and Grader
- Guided 78 students with the design thinking process for their final projects, both individually and in teams, from identifying opportunities and conceptualizing ideas to selecting and realizing concepts, culminating in the creation of final prototypes.
- Coordinated case studies, and project review meetings and final presentations
- Assisted the course instructor with course scheduling, assignment review and grading

3.2 Informal Education and Outreach

Summer '19, Summer '22, Summer '23	**Summer Enrichment Program - Design and Prototyping of Smart Toys and Robots with GER^2I - Gifted Education Research and Resource Institute Program** *Coach, 2019 and Lead Instructor, 2022, 2023* • Responsible for educating middle and high school students through instruction. • Prepared software installation, electrical circuitry courses and components, workshops, and finalized projects with a team of five coaches. • Engaged students in practical assignments that enhanced their fundamental skills in product design methodologies, Arduino programming, and working with electrical circuitry components.

PROFESSIONAL EXPERIENCE

June '14 - June '18	**Demand Signal Management, SAP Labs India Pvt. Ltd.** *Software Developer* • Responsible for supporting and enhancing the product features of DSiM, a system that compiles real-time demand signals including downstream demand data, point-of-sale (POS) data, and market research. • Involved in all stages of project development, from the initial blueprint and specification mapping to the final delivery and ongoing maintenance support.

SKILLS

AI, ML, Optimisation	Tensorflow, OpenCV, PyTorch, Linear Regression, K-Means, Genetic Algorithms, Kalman Filter, LQR
Design & Prototyping	Embedded System, Arduino, 3D Printing, Laser Cutting, PCB Layout, Creo, AutoCAD
AR/VR Development	Unity, ARCore, OpenGL, Hololens1, Oculus
Programming	Java, C/C++, Java, C#, MATLAB, Javascript, HTML/CSS, Python, ABAP, Assmebly
User-Centered Design	Elicitation Study, Qualitative and Quantitative Evaluation, Statistical Analysis
Instruction Design	Backward Design, Experiential Learning, Constructionism, Curriculum Development

COURSEWORK

Linear Algebra and Its Applications (MA 51100), Theory and Design of Control System (ME 57500), Microprocessors In Electromechanical Systems (ME 58600), Fundamental of BioMEMS and Micro-Integrated Systems (ECE 52600), Applied Optimal Control And Estimation (AAE 56800), Product And Process Design (ME 55300), Introduction To Differential Geometry And Topology (MA 52600), Generative Methods in Computer Graphics (CS 59000), Advanced Mathematics For Engineers And Physicists I (MA 52700), Statistical Inference (STAT 51700), Introduction To Probability (STAT 51900), Applied Regression Analysis (STAT 51200), Design Of Experiments (STAT 51400), Artificial Intelligence (ECE 57000), Introduction to Neural Networks (ECE 62900), Reliability Based Design (ME 57100)