User Scenario based on Student's Current Level of Learning

This document outlines a set of **user scenarios** that capture how students and researchers interact with the DGenie platform across different levels of expertise and objectives. It highlights their goals, workflows, and outcomes, demonstrating how AI-assisted circuit design and simulation can be applied in academic and research contexts.

Recommended flow for ease of using this Document - Start with table 1, 2 and 3 in the same order

1. Table 1: **List of circuits preloaded** in DGenie under the GenieLab Project folder.
2. Table 2: Identify your **current Level of Learning** & then move to Table 3
3. Table 3: Contains explanation, especially the **"Main Flow"** section has the steps to execute.

Table :1 List of Circuits Pre-Loaded in GenieLab Project

S.No.	Circuit category	Circuit Name
1	Single stage	Common-Source Stage with Resistive Load
2		CS Stage with Diode-Connected Load
3		CS Stage with Current-Source Load
4		Source Follower
5		Common-Gate Stage
6		Cascode Stage
7	Differential Amplifiers	Basic Differential Pair
8		Common-Mode Response of a differential pair
9		Differential Pair with MOS Loads
10	Current Mirrors	Basic current mirror
11		Cascode Current Mirrors
12	OTA (Operational transconductance amplifier)	Two stage OpAmp (single ended output)
13		Telescopic Op-amp
14		Folded Cascode amp
15	V2I	V2I converter (feedback sensing)
16	Comparators	Two stage comparator
17	Switched Capacitors	Switched capacitor amplifier
18		Switched capacitor integrator
19	BGR and LDOs	Bandgap reference
20		PMOS based LDO

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Table 2: Summary of various Levels of Learning

SI No	User Learning Requirement	People Involved	End-User Benefit
1	**Basic learning to understand subject** I am an ECE student I am new to analog circuit design. I want **basic learning** of the subject as it is part of my curriculum	EC Student	Student gets to have **basic awareness** of the subject through an interactive experience Click here to go to detailed learning
2	**Interested in Analog Design** I am a 3rd year ECE student **interested** in Analog design but have no understanding of that	EC Student	Student uses preloaded Razavi Circuits to learn and just observe/learn the workflow Click here to go to detailed learning
3	**Advanced Learning** I am a 4th year ECE student with some level of understanding and want to understand the circuit deeper	EC Student	I develop a deeper understanding of circuit behavior by analyzing how changes in design parameters affect performance metrics such as gain, bandwidth, and power consumption. I am able to modify circuits, run simulations, and interpret results to build stronger intuition about circuit design and trade-offs. Click here to go to detailed learning
4	**Interested in AI** I am a 4th year student with an ECE background but **interested in understanding AI**.	EC Student	I want to develop a basic AI agent (a CS amplifier). I copy and understand an existing/developed simple AI agent that optimizes a CS amplifier. I may not develop the agent itself. I may transfer the agent from one circuit to another circuit Click here to go to detailed learning

5	**Interdisciplinary** I am a 4th year student with deep interest in ECE (background) but interested in working with a CS student in jointly developing AI agent	EC Student CS Student	I want to co-develop an AI agent (an op-amp). I will end up having an understanding of AI development workflow, what it takes to build AI agents for circuit design without learning AI frameworks in detail (For EX: Pytorch, Connectors) I work with the CS student to exchange what information a circuit needs as an input, what information a circuit simulation gives as an input, what specifications a circuit needs to have. I work with the CS student to co-develop this agent from a circuit / ECS perspective. I provide inputs to the extent that the CS guy will use to develop the AI agent and corresponding Click here to go to detailed learning
6	**Understanding AI agents** I am a 3rd year CS student with no knowledge in ECE but I am interested in understanding AI agents	CS Student	I want to understand APIs, Connectors, Pytorch Framework, Reinforcement Learning agent Click here to go to detailed learning
7	**Developing AI agents** I am 4th year CS student with good AI background and am interested in developing AI agents by collaborating with ECE student Interdisciplinary	CS Student ECE Student	I want to co-develop an AI agent (Ex: an op-amp). I will end up having an understanding of some circuit knowledge but am deeply involved in the AI development workflow, what it takes to build AI agents for circuit design without learning Circuit design frameworks in detail I work with the ECE student to exchange what information an AI agent needs as inputs from the circuit world and what outputs the AI agent has to deliver to the circuit world for achieving the desired targets in circuits. I work with the ECE student to co-develop this agent from an AI Agent perspective.

			I provide inputs to the extent that the ECE student will use to develop his Circuit- AI agent Click here to go to detailed learning
8	**Advanced Learner : Connectors** I am a 4th year CS student with a good background in Coding (specifically Python) and am interested in developing connector frameworks in a multi-disciplinary world.	CS Student	I want to develop APIs, Connectors, for Pytorch Frameworks & Reinforcement Learning agents. Click here to go to detailed learning
9	**Advanced Learner** I am in my 4th year/Masters/Ph.D with good background in Circuits and I want to convert specification sheets into real optimized circuits with AI agents	ECE Student/ Researcher CS Student / Researcher	I want to publish circuits that meet commercial technical specification sheets (Ex: PLL, ADC, RF, Power Mgmt etc). These circuits meet the technical spec sheets through AI agents that are co-developed in the Genie platform. The circuits and agents are made publicly available through Genie. Click here to go to detailed learning
10	**Advanced Learner** I am an Advanced Circuit Researcher, most likely in my Masters/Ph.D. I am interested in publishing papers with AI optimized circuit collateral	ECE Researcher CS Student / Researcher	I want to develop advanced circuits and publish them with open source agents along with my research papers and publications Click here to go to detailed learning
11	**Advanced Learner** I am an Advanced AI Researcher, most likely in my Masters/Ph.D. I am in interested in real world application where AI/RL can be used for system optimization	CS Student / Researcher ECE Researcher	I want to develop AI agents for advanced circuits and publish them as open source agents as part of my research papers and publications. Click here to go to detailed learning

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Table 3: Detailed Explanation of Each of the Levels of Learning

Scenario 1	I am an ECE student. I am new to analog circuit design. I want **basic learning** of the subject as it is part of my curriculum.
Short Description	In this scenario, I am an undergraduate Electronics and Communications Engineering student who is taking an analog electronics course because it is part of the required curriculum. My primary objective is to have basic learning of the subject to pass the subject rather than develop deep expertise in circuit design. I find the subject difficult to understand because the concepts are often taught in a theoretical manner using textbooks and derivations. It is hard for me to connect the mathematical explanations with the actual behavior of circuits. As a result, I struggle to stay engaged with the subject and have difficulty understanding how circuits practically operate. I need a simpler way to visualize and interact with circuits so that I can better understand the basic concepts required to pass the course.
Goal	At the end of 1 month, I should be able to: 1. Understand the basic structure of common analog circuits. 2. Observe how circuits behave through simulations. 3. Understand basic measurements such as voltage levels, gain, and signal response. 4. Relate theoretical concepts from lectures to circuit behavior. By the end of the semester, I should be able to understand enough circuit concepts and workflows to successfully complete assignments, labs, and examinations for the course.
Constraints	1. Limited interest in deep circuit design concepts. 2. Limited time available for studying outside course requirements. 3. Basic understanding of electrical and electronic fundamentals. 4. Internet access required for using simulation tools.
Actors	Student(s) of Electronics & Communications Engineering
Illustration	EC Student - Use Genie - Basic Analog Design Learning - Gain practical knowledge

Prerequisites	1. The student is enrolled in an analog electronics course as part of their curriculum. 2. The student has access to course materials such as lectures and textbooks. 3. The student has access to the Genie platform or similar simulation tools.
Main Flow	1. Select a simple circuit from the available list of circuits. 2. Sign in to Genie. 3. Access the Genie platform. 4. Clone the circuit project. (How to clone a project) and provide a name for the cloned project 5. Select the Test Bench circuit provided 6. Run the simulation without modifying the circuit. (Run Simulation) 7. Observe how the circuit behaves by reviewing the logs and the netlist / schematic. 8. View measurements such as voltages, signals, and output responses. 9. Relate the simulation results to the concepts learned in class. 10. Repeat the process with other simple circuits to reinforce understanding.
Alternate Flow(s)	The student may revisit previously simulated circuits to reinforce understanding before exams. The student may explore additional circuits recommended by the professor.
Post conditions	1. The student gains a basic understanding of circuit behavior. 2. The student is able to connect theoretical concepts with simple circuit simulations. 3. The student gains enough familiarity with the subject to complete coursework and pass the subject.
Information Requirements	1. Project specifications 2. Netlist Specifications 3. Input Stimuli Specifications 4. Design Parameter Specifications 5. Measurement Specifications 6. Basic Simulation Outputs

Scenario 2	Typically, I am a 3rd year student interested in Analog design but have no understanding of that. I do not know what it means to draw circuits and simulate them.
Short Description	In this scenario, I have an analog course as part of my curriculum. I follow B. Razavi's text book. It is tough for me to understand directly from the textbook. I am also limited by knowledge in Simulator/ simulation tools. I have no access to Cadence / Synopsys simulation tools. I want to have a platform that helps me understand better and prepares me in designing circuits and simulation. I need to learn this at my own pace.
Goal	At the end of 1 month, I should be able to understand circuit simulations work: 1. How to import pre-drawn circuits in a schematic capture tool (Xschem) 2. Clone projects in Genie platform 3. Understand Simulation Workflow 4. Simulate the cloned circuits in Genie platform 5. Understand the measurements and Optimization of circuits. 6. Enhance my understanding of 3 basic circuits such as inverter, cs amplifier and operational amplifier. At the end of 3 months I should be able to clone and simulate at least 5 circuits from the above given Project List.
Constraints	Internet access and Basic Understanding of MOSFET transistors, Basic Circuit Analysis
Actors	Student(s) of Electronics & Communications Engineering Student(s) of Electrical Engineering
Illustration	
Prerequisites	The student must have determined that it is in their best interest to learn analog circuit design basics. The college is helping the student with the necessary theoretical knowledge

Main Flow	1. Select a simple circuit from the available list of circuits. 2. Sign in to Genie. 3. Access Genie 4. Clone the project (How to clone a project) 5. Understand each step/stage in the workflow 6. Understand the inputs - the netlist, schematic, process file 7. Understand the Measurements (Measurements) 8. Understand the Simulation (Run Simulation) 9. Understand the Outputs 10. Understand the Genie page (Genie) 11. Have an awareness of what the Agent is trying to do. Not going deep into the agent.
Post conditions	1. Save the project for revisiting/reviewing 2. Save the project for sharing with the concerned lecturer or professor 3. Save the project for creating own test benches or follow-on circuits that can be built on each of the cloned and simulated circuits
Information Requirements	1. Project specifications 2. Netlist Specifications 3. Process Specifications (PDK, Optional) 4. Input Stimuli Specifications 5. Design Parameter Specifications 6. Environment Specifications (Optional) 7. Measurement Specifications 8. Target Specifications 9. Awareness of Agent (Optional)

Scenario 3	I am a 4th year student with some level of understanding and want to understand the circuit deeper.
Short Description	In this scenario, I am a final year student who has already studied analog electronics as part of my curriculum. I have learned about circuits such as amplifiers, current mirrors, and operational amplifiers through lectures and textbooks. While I understand the theory behind these circuits, I want to explore how these circuits behave when design parameters change. Unlike earlier learning stages where I only observe pre-built circuits, I now want to actively modify circuits, simulate them, and analyze how changes affect performance. My access to professional simulation tools such as Cadence or Synopsys may be limited. I want a platform where I can modify design parameters of circuits, run simulations, and observe how performance metrics change. This will allow me to develop deeper intuition about circuit behavior and design trade-offs.
Goal	At the end of 1 month, I should be able to: 1. Understand the simulation workflow used in the Genie platform. 2. Clone existing circuit projects. 3. Identify and modify design parameters of circuits. 4. Run simulations after modifying parameters. 5. Observe how measurements (for Eg. gain, bandwidth and power consumption change). 6. Understand how optimization helps achieve desired specifications. 7. Enhance my understanding of circuits such as inverters, common source amplifiers, and operational amplifiers. By the end of 6 months, I should be able to modify circuits confidently, analyze design trade-offs, and develop deeper insight into circuit design. Get ready/prepare myself to draw my own circuits & should be able to understand the usage
Constraints	Basic understanding of MOSFET transistors and circuit analysis. Limited access to professional IC design tools.
Actors	Student(s) of Electronics & Communications Engineering Student(s) of Electrical Engineering

Illustration	
Prerequisites	1. The student has completed foundational courses in analog electronics. 2. The student understands basic circuit operation and simulation concepts. 3. The student wants to deepen their understanding by experimenting with circuit parameters.
Main Flow	1. Sign up on Genie. 2. Access the Genie platform. 3. Select a circuit from the publicly available project list (Circuit Tutorials) 4. Clone the project (How to clone an existing project) 5. Understand the circuit schematic, netlist, and process file. 6. Identify the design parameters associated with the circuit. (Design Parameters) 7. Modify one or more design parameters. 8. Run simulations with the modified parameters. (Run Simulation) 9. Observe how circuit performance changes. 10. Analyze measurements (Eg. gain, frequency response, and power consumption) (Measurements) 11. Run optimization to improve circuit performance. (Genie) 12. Compare results between the original circuit and the modified circuit. 13. Repeat the process to build a deeper understanding of circuit behavior.
Alternate Flow(s)	1. The student may experiment with multiple circuits to understand different circuit behaviors. 2. The student may explore different combinations of design parameters to analyze trade-offs. 3. The student may revisit previously saved circuits to perform further parameter tuning.
Post conditions	1. Save the modified project for future reference. 2. Save different versions of the circuit for comparison. 3. Share the project with the lecturer or professor for discussion. 4. Develop stronger intuition about circuit behavior and design trade-offs.
Information Requirements	1. Project Specifications 2. Netlist Specifications 3. Process Specifications (PDK) 4. Input Stimuli Specifications 5. Design Parameter Specifications 6. Environment Specifications 7. Measurement Specifications 8. Target Specifications 9. Awareness of Agent

Scenario 4	I am a 4th year student with an ECE background but interested in understanding AI.
Short Description	In this scenario, I am a final year Electronics and Communications Engineering student. My academic background is primarily focused on electronics, circuit analysis, and analog design. However, I am interested in understanding how Artificial Intelligence can be applied to engineering problems such as circuit optimization and automated design. While I understand circuits, I do not have deep experience in AI frameworks such as PyTorch or in developing AI agents. I want to understand how AI agents interact with circuit simulations and how they can optimize circuits such as a common source amplifier. I also want to explore how an existing AI agent can be reused and adapted for other circuits using transfer learning techniques.
Goal	At the end of 1 month, I should be able to: 1. Understand how AI agents interact with circuit simulations. 2. Understand the simulation workflow used in the Genie platform. 3. Clone and simulate a circuit such as a common source amplifier. 4. Understand how measurements and optimization targets are defined. 5. Understand the basics of transfer learning and how an existing agent can be adapted to another circuit. By the end of 6 months, I should be able to create a basic AI agent using transfer learning methodology, based on an existing agent that optimizes a circuit such as a common source amplifier.
Constraints	1. Basic understanding of analog circuits and MOSFET operation. 2. Limited experience with AI frameworks such as PyTorch. 3. Limited access to professional EDA tools.
Actors	Student(s) of Electronics & Communications Engineering
Illustration	
Prerequisites	The student has a background in electronics and circuit theory.

	The student is interested in understanding how AI can be applied to circuit design and optimization.
Main Flow	1. Sign up on Genie. 2. Access the Genie platform. 3. Select a circuit such as a two stage operational amplifier. (Circuit Tutorial) 4. Clone the project. (How to clone an existing project) 5. Understand the circuit schematic and netlist. 6. Understand the simulation workflow. 7. Run simulations and observe circuit outputs. 8. Understand how circuit inputs, measurements, and specifications are provided to the AI agent. 9. Understand the transfer learning methodology used for adapting agents. (Transfer Learning) 10. Create a new AI agent by applying transfer learning on the existing agent. 11. Connect the newly created agent to the circuit simulation workflow. 12. Run simulations and observe how the agent modifies design parameters to optimize performance. 13. Analyze the optimization results produced by the agent.
Alternate Flow(s)	The student may experiment with multiple circuits to understand how transfer learning works across circuits. The student may modify optimization targets and observe how the AI agent adapts.
Post conditions	1. Save the project for revisiting and further experimentation. 2. Save the developed AI agent configuration for reuse. 3. Share the project with collaborators or instructors. 4. Develop a basic understanding of AI agent development and transfer learning for circuit optimization.
Information Requirements	1. Project Specifications 2. Netlist Specifications 3. Process Specifications (PDK) 4. Input Stimuli Specifications 5. Design Parameter Specifications 6. Environment Specifications 7. Measurement Specifications 8. Target Specifications 9. Awareness of Agent

Scenario 5	I am a 4th year student with a deep interest in ECE (background) but interested in working with a CS student in jointly developing AI.
Short Description	In this scenario, I am a final year Electronics and Communications Engineering student with a strong interest in circuit design. I want to explore how Artificial Intelligence can be applied to analog circuit design and optimization. My expertise is primarily in electronics, circuit behavior, and circuit specifications. However, I do not have deep knowledge of AI frameworks or machine learning development workflows. I collaborate with a Computer Science student who has expertise in AI, machine learning frameworks, and programming. Together we want to understand how AI agents can interact with circuit simulation workflows and optimize circuits such as operational amplifiers. My role is to explain the circuit operation, parameters, inputs, outputs, and performance specifications. The CS student uses this information to design and implement the AI agent that interacts with the circuit simulation environment. At the same time, I gain a high-level understanding of how the AI agent is developed and integrated with the simulation workflow.
Goal	At the end of 1 month, we should be able to: 1. Understand the circuit simulation workflow used in the Genie platform. 2. Clone and simulate circuits such as an operational amplifier. 3. Understand circuit inputs such as design parameters, process files, and netlists. 4. Understand measurements and outputs produced by circuit simulations. 5. Define the parameters and specifications that an AI agent should optimize. By the end of 6 months, we should be able to collaboratively develop an AI agent that interacts with the circuit simulation workflow and optimizes a circuit such as an operational amplifier.
Constraints	1. Basic understanding of circuit design from the ECE student. 2. Basic programming and AI knowledge from the CS student. 3. Limited access to professional EDA tools.
Actors	Student(s) of Electronics & Communications Engineering Student(s) of Computer Science / Artificial Intelligence

Illustration	
Prerequisites	1. The ECE student has a background in analog circuits and electronic systems. 2. The CS student has knowledge of AI, machine learning, or software development. 3. Both students are interested in interdisciplinary collaboration between electronics and AI. 4. Both students have access to the Genie platform and circuit projects.
Main Flow	1. Sign up on Genie. 2. Access the Genie platform. 3. Select a circuit such as a two stage operational amplifier. (Circuit Tutorial) 4. Clone the project. (How to clone an existing project) 5. Run simulations and observe circuit outputs. (Run Simulation) 6. The ECE student studies the circuit schematic, parameters, and measurements. 7. The ECE student explains the circuit behavior, inputs, outputs, and performance specifications to the CS student. 8. The ECE student explains what parameters can be modified to improve circuit performance. 9. The CS student studies how the circuit simulation workflow operates. 10. The CS student identifies how an AI agent can interact with the simulation system. 11. The CS student develops an AI agent that can modify circuit parameters and evaluate outputs. 12. The ECE student validates whether the circuit behavior and specifications are correctly represented in the agent workflow. 13. Both students test the AI agent using the circuit simulation environment. 14. Analyze how the agent modifies parameters and improves circuit performance.
Alternate Flow(s)	The students may experiment with multiple circuits to understand different optimization workflows. The students may refine circuit specifications and optimization targets during development.
Post conditions	1. Save the project for further experimentation and development. 2. Share project data and results between collaborators. 3. Develop understanding of how AI agents can be built collaboratively for circuit optimization.
Information Requirements	1. Project specifications 2. Netlist Specifications 3. Process Specifications (PDK) 4. Input Stimuli Specifications

	5. Design Parameter Specifications 6. Environment Specifications 7. Measurement Specifications 8. Target Specifications 9. Deep understanding of Agent and Optimization Workflow

Scenario 6	I am a 3rd year CS student with no knowledge in ECE but am interested in developing AI agents.
Short Description	In this scenario, I am a Computer Science student with a background in programming and basic Artificial Intelligence concepts. I do not have prior knowledge of electronics or circuit design. However, I am interested in understanding how AI agents interact with real-world systems and simulation environments. I want to learn how APIs and connectors allow AI agents to communicate with external systems. To do this, I will observe how an AI agent interacts with a simulation workflow that involves circuit simulations. This will help me understand how reinforcement learning agents work in practice and how frameworks such as PyTorch are used to build and run AI agents.
Goal	At the end of 1 month, I should be able to: 1. Understand how APIs and connectors allow programs to interact with simulation systems. 2. Understand the workflow of a circuit simulation platform. 3. Clone and simulate a simple circuit project. 4. Understand the inputs and outputs of the simulation workflow. 5. Understand how a reinforcement learning agent interacts with the simulation system. By the end of 6 months, I should be able to understand how AI agents built using frameworks such as PyTorch interact with simulation environments and modify system parameters to achieve optimization goals.
Constraints	Basic programming knowledge. Limited or no knowledge of electronics or circuit design.

Actors	Student(s) of Computer Science / Artificial Intelligence
Illustration	
Prerequisites	1. The student has basic programming knowledge. 2. The student has basic system design knowledge. 3. The student has basic familiarity with AI concepts. 4. The student has access to the Genie platform.
Main Flow	1. Sign up on Genie. 2. Access the Genie platform. 3. Select a simple circuit from the available circuit list. project list (Circuit Tutorials) 4. Clone the project. (How to clone a project) 5. Run simulations to observe how the circuit behaves. (Run Simulation) 6. Understand the simulation workflow and outputs. 7. Observe how APIs and connectors allow the AI system to interact with the simulation workflow. 8. Understand the inputs provided to the AI agent such as circuit parameters and measurements. 9. Observe how the reinforcement learning agent evaluates the simulation outputs. 10. Understand how the AI agent modifies parameters to improve circuit performance. 11. Observe how the PyTorch-based agent interacts with the simulation system.
Post conditions	1. Save the project for future reference. 2. Develop a basic understanding of how AI agents interact with simulation environments. 3. Gain familiarity with APIs, connectors, reinforcement learning workflows, and PyTorch-based agents.
Information Requirements	1. Project Specifications 2. https://asterquanta.github.io/documentation/#/adk/getting-started 3. Platform Access 4. Development Environment: Python 3.11 or 3.12 5. ADK Installation 6. Agent Project Structure 7. Model Configuration 8. Agent Execution Entry Point 9. Agent–Environment Interface 10. Model Registration and Deployment

Scenario 7	I am 4th year CS student with good AI background and am interested in developing AI agents
Short Description	In this scenario, I am a final year Computer Science student with strong knowledge of Artificial Intelligence, machine learning frameworks, and programming. I am interested in applying AI techniques to engineering systems such as circuit design and optimization. However, I do not have a deep background in electronics or circuit design. To bridge this gap, I collaborate with an Electronics and Communications Engineering student who has knowledge of circuits, circuit parameters, and performance specifications. The ECE student helps explain how circuits work, what parameters define circuit behavior, and what performance targets need to be achieved. My role is to design and develop the AI agent that interacts with the circuit simulation workflow and modifies parameters to achieve the desired circuit specifications. Through this collaboration, we combine AI expertise with circuit knowledge to develop an AI agent capable of optimizing circuits such as operational amplifiers.
Goal	At the end of 1 month, we should be able to: 1. Define how the AI agent will interact with the circuit simulation environment. 2. Define what parameters the AI agent can modify and what targets it should optimize. 3. Understand the circuit simulation workflow in the Genie platform. 4. Understand the circuit inputs such as design parameters, process files, and netlists. 5. Understand the outputs and measurements produced by circuit simulations. By the end of 6 months, I should be able to co-develop an AI agent that interacts with the circuit simulation workflow and optimizes circuits such as operational amplifiers.
Constraints	1. Strong AI and programming background from the CS student. 2. Limited or No circuit design knowledge from the CS student. 3. Dependence on collaboration with an ECE student for circuit-specific knowledge.
Actors	Student(s) of Computer Science / Artificial Intelligence Student(s) of Electronics & Communications Engineering Student(s) of Electrical Engineering

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Prerequisites	1. The CS student has a strong background in AI, machine learning, and programming. 2. The ECE student has knowledge of circuit design and analog circuit behavior. 3. Both students have access to the Genie platform and circuit simulation workflows. 4. Both students are interested in interdisciplinary collaboration between AI and circuit design.
Main Flow	1. Sign up on Genie. 2. Access the Genie platform. 3. Select a circuit such as a two stage operational amplifier. 4. Clone the project. (How to clone a project) 5. Run simulations to observe circuit outputs. (Run Simulation) 6. The ECE student explains the circuit functionality, parameters, and specifications. 7. The ECE student explains what circuit inputs and outputs are relevant for optimization. 8. The CS student analyzes how the AI agent should interact with the simulation workflow. 9. The CS student identifies what inputs the agent should receive from the circuit simulation. 10. The CS student defines what outputs the agent should produce to modify circuit parameters. 11. The CS student develops the AI agent using the Genie-AI framework and optimization methods. 12. The ECE student validates whether the agent is correctly interacting with the circuit simulation environment. 13. Both students run simulations with the AI agent and observe how circuit parameters are modified to achieve the desired performance targets.
Post conditions	1. Save the project for further experimentation. 2. Share the AI agent and simulation results between collaborators. 3. Develop understanding of how AI agents can be built to interact with circuit simulation systems.
Information Requirements	1. Project specifications 2. ADK Specifications 3. Netlist Specifications 4. Process Specifications (PDK) 5. Input Stimuli Specifications 6. Design Parameter Specifications 7. Environment Specifications 8. Measurement Specifications 9. Target Specifications

	10. RL Specifications 11. Awareness of Agent Interaction Workflow

Scenario 8	I am a 4th year CS student with a good background in coding (specifically Python) and am interested in developing connector frameworks in a multi-disciplinary world.
Short Description	In this scenario, I am a final year Computer Science student with strong programming skills, particularly in Python. I am interested in building software infrastructure that enables different systems to communicate with each other in multi-disciplinary environments. Specifically, I want to understand how AI frameworks such as PyTorch and reinforcement learning agents can interact with external systems such as simulation platforms. My focus is not on circuit design itself but on building the connector frameworks and APIs that allow AI agents to communicate with external engineering workflows. To achieve this, I will study how a simulation platform exposes inputs, outputs, and control interfaces that an AI agent can interact with. I will design and implement APIs and connector layers that allow reinforcement learning agents built using PyTorch to interact with these systems.
Goal	At the end of 1 month, I should be able to: 1. Understand how simulation platforms expose inputs and outputs through APIs. 2. Understand how connectors allow external programs to interact with simulation workflows. 3. Identify the data structures and parameters required for communication between AI agents and simulation systems. 4. Understand how reinforcement learning agents interact with external environments. By the end of 6 months, I should be able to design and implement APIs and connector frameworks that allow PyTorch-based reinforcement learning agents to interact with external simulation systems.
Constraints	1. Strong programming knowledge in Python. 2. Limited knowledge of electronics or circuit design.

	3. Focus primarily on software infrastructure rather than domain-specific circuit behavior.
Actors	Student(s) of Computer Science and Engineering
Illustration	
Prerequisites	1. The student has strong programming skills in Python. 2. The student has familiarity with machine learning frameworks such as PyTorch. 3. The student is interested in developing software infrastructure for AI systems. 4. The student has access to the Genie platform and its simulation workflows.
Main Flow	1. Sign up on Genie. 2. Access the Genie platform. 3. Explore how simulation workflows are structured. 4. Identify the inputs, outputs, and parameters exposed by the simulation system. 5. Study how AI agents interact with the simulation workflow. 6. Analyze how data flows between the simulation environment and the AI agent. 7. Design API interfaces that expose simulation parameters and results. 8. Develop connector modules that allow reinforcement learning agents to communicate with the simulation system. 9. Implement communication between the connector framework and a PyTorch-based AI agent. 10. Test the API and connector framework by running reinforcement learning agents with the simulation system.
Post conditions	1. Save the developed API and connector framework for reuse. 2. Share the developed connectors with collaborators or research groups. 3. Develop an understanding of how multi-disciplinary systems can be integrated through APIs and connectors.
Information Requirements	1. Project specifications 2. Netlist Specifications 3. Process Specifications (PDK) 4. Input Stimuli Specifications 5. Design Parameter Specifications 6. Environment Specifications 7. Measurement Specifications 8. Target Specifications 9. API and Connector Specifications 10. Awareness of Agent Interaction Workflow

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Scenario 9	I am in my 4th year / Masters / Ph.D with a good background in circuits and I want to convert specification sheets into real optimized circuits with AI agents.
Short Description	In this scenario, I am an advanced student or researcher with a strong background in circuit design. My goal is to design circuits that meet real-world technical specifications similar to those found in commercial specification sheets. These specifications may include performance targets such as gain, bandwidth, power consumption, noise, stability, and other system-level constraints. Instead of designing these circuits manually through traditional iterative design methods, I want to leverage AI agents that can automatically explore the design space and optimize circuit parameters. To achieve this, I collaborate with a Computer Science student or researcher who specializes in AI development. The ECE researcher provides the circuit specifications, design constraints, and performance targets derived from the specification sheet. The CS researcher develops AI agents that interact with the circuit simulation environment and optimize circuit parameters to meet those specifications. Through this collaboration, circuits and AI agents are developed and validated within the Genie platform.
Goal	At the end of 1 month, we should be able to: 1. Define circuit specifications based on real-world technical specification sheets. 2. Translate specification sheet requirements into simulation targets and measurements. 3. Select an appropriate circuit architecture (for example PLL, ADC, RF block, or power management circuit). 4. Set up the circuit simulation workflow within the Genie platform. By the end of 6 months, we should be able to develop AI agents that optimize circuit parameters so that the resulting circuits meet the defined technical specifications. The circuits and associated AI agents can then be documented and shared through the Genie platform.
Constraints	1. Strong circuit design knowledge from the ECE researcher. 2. Strong AI and programming expertise from the CS researcher.

	3. Complexity of circuit architectures such as PLLs, ADCs, RF blocks, and power management circuits. 4. Availability of accurate simulation models and process design kits (PDKs).
Actors	Student(s)/Researcher(s) of Electronics & Communications Engineering Student(s)/Researcher(s) of Computer Science & Engineering
Illustration	
Prerequisites	1. The ECE researcher has strong knowledge of circuit design and specification requirements. 2. The CS researcher has expertise in AI frameworks and algorithm development. 3. Both researchers have access to the Genie platform and circuit simulation environment. 4. The specification sheet for the target circuit is available.
Main Flow	1. Create the circuit architecture based on the specification sheet (for example PLL, ADC, RF block, or power management circuit) using an external EDA tool. 2. Design the circuit schematic and generate the corresponding netlist. 3. Define initial design parameters and simulation setup in the EDA environment. 4. Sign up on Genie. 5. Access the Genie platform. 6. Create a new project in Genie. (How to create a project) 7. Upload or import the circuit netlist and associated files into the Genie platform. 8. Configure the simulation environment and input stimuli in Genie. 9. Run baseline simulations to understand circuit behavior. (Run Simulation) 10. Define target specifications derived from the specification sheet. 11. Identify the design parameters that can be modified during optimization. (Design Parameters) 12. Develop an AI agent that can interact with the circuit simulation workflow. (ADK Tutorial) 13. Connect the AI agent to the simulation environment. 14. Run Genie Optimization where the AI agent modifies circuit parameters to meet the specification targets. (Genie) 15. Analyze whether the resulting circuit meets the defined technical specifications. 16. Refine the circuit design and AI agent strategy if necessary. 17. Document the final optimized circuit and associated AI agent. 18. Publish the circuit and AI agent through the Genie platform. (Publish Project)
Post conditions	1. The optimized circuit meets the specified technical performance targets. 2. The AI agent used for optimization is validated and documented.

	3. The circuit design and AI agent are published and made publicly available through the Genie platform.
Information Requirements	1. Specification Sheet Requirements 2. Project Specifications 3. Netlist Specifications 4. Process Specifications (PDK) 5. Input Stimuli Specifications 6. Design Parameter Specifications 7. Environment Specifications 8. Measurement Specifications 9. Target Specifications 10. AI Agent and Optimization Workflow Specifications

Scenario 10	I am an Advanced Circuit Researcher, most likely in my Masters/Ph.D. I am interested in publishing papers with AI optimized circuit collateral
Short Description	In this scenario, I am an advanced circuit researcher working on novel circuit architectures and design methodologies. My research involves developing circuits that meet challenging performance targets and contribute new ideas to the field of analog or mixed-signal circuit design. I want to incorporate AI-assisted optimization into my circuit research so that the design process can explore a larger design space and identify optimized circuit solutions. To achieve this, I collaborate with a Computer Science student or researcher who specializes in Artificial Intelligence and machine learning. The AI agents interact with the circuit simulation workflow and help optimize circuit parameters based on defined performance targets. The final circuit designs, along with the AI agents used to optimize them, are included as part of the research output. This allows the research work to be reproducible and allows others in the research community to study and build upon the published circuits and agents.
Goal	At the end of 1 month, we should be able to: 1. Define the research circuit architecture and performance targets.

	2. Set up the circuit simulation workflow within the Genie platform. 3. Define the parameters that can be optimized using AI agents. 4. Establish the interaction between the AI agent and the circuit simulation environment. By the end of 6 months, we should be able to develop AI agents that optimize the research circuit and produce results that meet the defined performance targets. The optimized circuits and associated AI agents can then be documented and included in research papers and publications.
Constraints	1. Advanced circuit design knowledge from the ECE researcher. 2. AI and programming expertise from the CS student or researcher. 3. Availability of accurate simulation models and process design kits (PDKs). 4. Research timelines and publication deadlines.
Actors	Researcher(s) of Electronics & Communications Engineering Student(s)/Researcher(s) of Computer Science & Engineering
Illustration	
Prerequisites	1. The researcher has a defined circuit architecture or research problem. 2. The ECE researcher has strong knowledge of circuit design and performance specifications. 3. The CS student or researcher has expertise in AI frameworks and optimization techniques. 4. Both participants have access to the Genie platform and simulation environment.
Main Flow	1. Define the circuit architecture that will be used for research. 2. Design the circuit schematic and generate the corresponding netlist using an external EDA tool. 3. Set up the initial simulation environment and input stimuli in the EDA tool. 4. Define the performance targets and specifications for the circuit. 5. Run baseline simulations to understand circuit behavior. (Run Simulation) 6. Identify the design parameters that can be optimized. (Design Parameters) 7. Sign up on Genie. 8. Access the Genie platform. 9. Create a new project in Genie. (How to create a project) 10. Upload or import the circuit netlist and associated files into the Genie platform. 11. Configure the simulation environment and inputs in Genie. 12. Develop or configure AI agents that interact with the circuit simulation workflow. (ADK Tutorial) 13. Run 'Genie Optimization' where the AI agent modifies parameters and evaluates results. (Genie)

	14. Analyze simulation results to determine whether the circuit meets the research performance targets. 15. Refine the circuit design and AI agent strategy as necessary. 16. Document the optimized circuit design and the AI agent workflow. 17. Prepare the research results for publication. (Publish Project) 18. Release the circuit design and AI agents as open-source collateral alongside the research publication.
Post conditions	1. The optimized circuit design meets the research performance targets. 2. The AI agent used for optimization is documented and validated. 3. The circuit design and AI agent are released as open-source collateral along with the research publication.
Information Requirements	1. Research Circuit Specifications 2. Project Specifications 3. Netlist Specifications 4. Process Specifications (PDK) 5. Input Stimuli Specifications 6. Design Parameter Specifications 7. Environment Specifications 8. Measurement Specifications 9. Target Specifications 10. AI Agent and Optimization Workflow Specifications

Scenario 11	I am an Advanced AI Researcher, most likely in my Masters/Ph.D. I am interested in real world application where AI/RL can be used for system optimization
Short Description	In this scenario, I am an advanced AI researcher focusing on developing machine learning and reinforcement learning algorithms that can solve real-world optimization problems. I am interested in applying AI techniques to engineering systems where the optimization space is complex and traditional optimization approaches may be inefficient. Analog and mixed-signal circuit design presents a challenging real-world optimization problem where circuit parameters must be tuned to meet strict performance specifications.

	To work in this domain, I collaborate with an ECE researcher who has expertise in circuit design and understands circuit architectures, specifications, and simulation workflows. The ECE researcher helps define the circuit environment, parameters, and performance targets. My role is to develop AI or reinforcement learning agents that can interact with the circuit simulation workflow and optimize circuit parameters to meet these targets. The AI agents developed through this research can be published as open-source agents along with research papers that demonstrate their effectiveness in optimizing advanced circuits.
Goal	At the end of 1 month, we should be able to: 1. Understand the circuit simulation workflow used in the Genie platform. 2. Define the circuit environment that the AI agent will interact with. 3. Identify the inputs, outputs, and reward signals that will be used by the reinforcement learning agent. 4. Run baseline simulations to understand the behavior of the circuit system. By the end of 6 months, we should be able to develop reinforcement learning agents that interact with the circuit simulation environment and optimize advanced circuits. The developed AI agents can then be documented and released as open-source tools alongside research publications.
Constraints	1. Strong AI and reinforcement learning expertise from the CS researcher. 2. Circuit design expertise from the ECE researcher. 3. Availability of accurate circuit models and simulation environments. 4. Research timelines and publication deadlines.
Actors	Researcher(s) of Electronics & Communications Engineering Student(s)/Researcher(s) of Computer Science & Engineering
Illustration	
Prerequisites	1. The CS researcher has expertise in AI, machine learning, and reinforcement learning frameworks. 2. The ECE researcher has strong knowledge of circuit design and simulation workflows. 3. Both researchers have access to the Genie platform and circuit simulation environment. 4. A circuit optimization problem has been defined for research purposes.

Main Flow	1. Select an advanced circuit architecture to be used as the optimization environment. 2. Design the circuit schematic and generate the corresponding netlist using an external EDA tool. 3. Set up the initial simulation environment and input stimuli in the EDA tool. 4. Run baseline simulations to understand circuit behavior and outputs. (Run Simulation) 5. Identify the circuit parameters that can be modified during optimization. (Design Parameters) 6. Define reward functions and optimization targets for the reinforcement learning agent. 7. Sign up on Genie. 8. Access the Genie platform. 9. Create a new project in Genie. (How to create a project) 10. Upload or import the circuit netlist and associated files into the Genie platform. 11. Understand the simulation workflow and outputs within Genie. 12. Define the interaction interface between the AI agent and the simulation environment. 13. Develop an AI or reinforcement learning agent using machine learning frameworks. (ADK Tutorial) 14. Connect the AI agent to the circuit simulation workflow. 15. Run 'Genie optimization' where the AI agent interacts with the circuit environment and learns to improve circuit performance. (Genie) 16. Analyze the optimization results. 17. Document the AI agent architecture, training process, and optimization results. 18. Publish the developed AI agent as an open-source component along with the research publication. (Publish Project)
Post conditions	1. The AI agent successfully interacts with the circuit simulation environment. 2. The agent demonstrates the ability to optimize circuit parameters. 3. The AI agent is documented and released as open-source software. 4. The research results are published along with the agent implementation.
Information Requirements	1. Circuit Environment Specifications 2. Project Specifications 3. Netlist Specifications 4. Process Specifications (PDK) 5. Input Stimuli Specifications 6. Design Parameter Specifications 7. Environment Specifications 8. Measurement Specifications 9. Optimization Targets and Reward Definitions 10. AI Agent Architecture and Training Specifications

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3. References

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