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Smart Home Simulation in the Virtual World

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Smart Home Simulation for Human Workflow Understanding

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Motivation

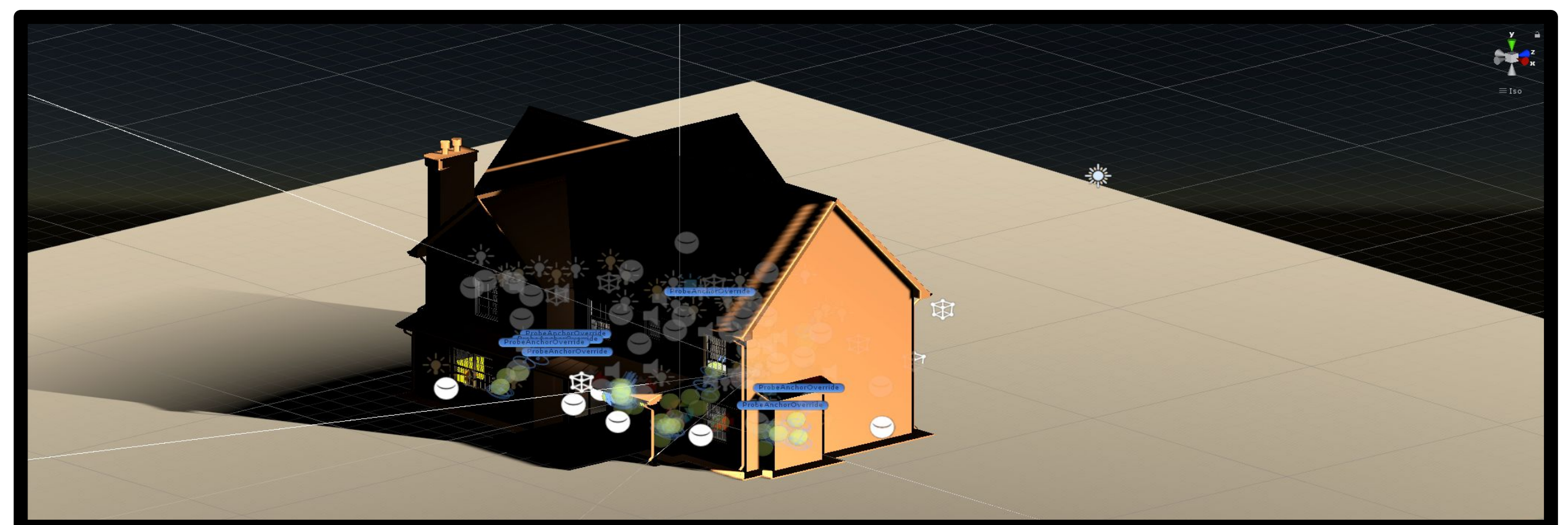
Testing new IoT devices has always been very difficult to implement without it costing a lot of time or money. Using a virtual simulation would drive down both costs of testing a prototype significantly and allow for additional planning/redesign before proceeding to real-world application.

Background

A smart object is an object that takes in information and uses that information to give an appropriate response. Others who have worked on something similar have used multiple smart objects to gather data on human activity and had an interactable smart object respond to that activity. A big problem with the development of smart objects is the cost-risk vs. reward.

Objective

- Simulate a virtual environment and use virtual smart objects to recognize human activity in a household
- Automate smart objects and smart sensors
- Lower price and energy costs for testing and make simulation deployment easier
- Contribute to IoT research and promote the growth of this area of research



Use Case

Title: Smart Kitchen

Actors: Avatar and Smart Home

Trigger: Sensors detect someone in the kitchen

Pre-Condition: Avatar is looking to cook

Post-Condition: Avatar has a meal.

Basic Flow:

1. Avatar decides to cook a certain type of meal.
2. Smart Home displays the ingredients, preparations, etc.
3. Avatar finishes preparing the ingredients.
4. Smart Home turns on the stove top, oven, etc.
5. Avatar begins cooking.
6. Smart Home monitors temperature, advises owner with additional ingredients or spices.
7. Avatar finishes cooking and Smart Home begins to clean up.
8. Smart Home turns down all active appliances.

Alternate Flow - Step 3:

3B. Avatar selects expired food.

4B. Smart Home warns Avatar

Alternate Flow - Step 3:

3C. Avatar does not have sufficient ingredients.

4C. Smart Home lists groceries stores that have missing ingredients with prices.

Design Criteria

- Use Unity to create a virtual environment
- Set up sensors in the virtual environment to track human activity
- Create an interactable as an aid to the avatar
- Create multiple objects that respond automatically to user's movements
- Set up and create an interactable that can listen to user voice commands

Next Steps

- Incorporate natural language processing using audio devices
- Expand overall knowledge and integration of machine learning techniques
- Further employ inverse kinematics to accurately train AI for all out realism in the virtual world
- Implement idea for use in the real world