TAILORBOT ROOM DESIGNER

Source: https://depositphotos.com/illustrations/interior-design.html?qvi

Project Proposal
Spring 24 Capstone

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Motivation

- Traditional home design is time-consuming and physically demanding
- TailorBot provides a convenient platform for remote home redesign
- Overcomes time constraints, physical challenges, and enhances accessibility

Source: https://depositphotos.com/illustrations/movers-moving-sofa.html

Use-Cases

- The robot scans the room, creating a digital model that includes representations of existing furniture.
- Users can access a web application to virtually interact with their space and move around furniture models within the environment.
- Solution for interior designers, movers, and individuals with mobility challenges
- Areas: Software + Hardware

Source: https://www.pinterest.com/pin/405183297730594512/

Use-Case Requirements
Room Scanning and Furniture Detection

Motivation:

TailorBot should accurately detect and classify existing furniture within the scanned room, providing users with precise virtual representations.

Requirements:

- Identify object free areas of the room 90% accuracy
- Classify furniture type with 90% accuracy

Use-Case Requirements
Remote Control

Motivation:

The user should have control over the camera's navigation through the room using the remote control.

Requirements:

- The latency in command execution should be below 300 milliseconds
- The device should respond precisely to user inputs

Use-Case Requirements
Response Time

Motivation:

TailorBot should deliver a responsive and time-efficient design experience for users

Requirements:

- Generate model within less than 1 minute per 20 square feet

Technical Challenges

Getting an accurate scan of the floorplan of a room.	Accurately identifying furniture types and their relative position in the room.
Ensuring power efficiency to prolong to device’s operational time on a single charge.	Handling and creation of models and assets is quick and seamless without slowing down the program.

Solution Approach

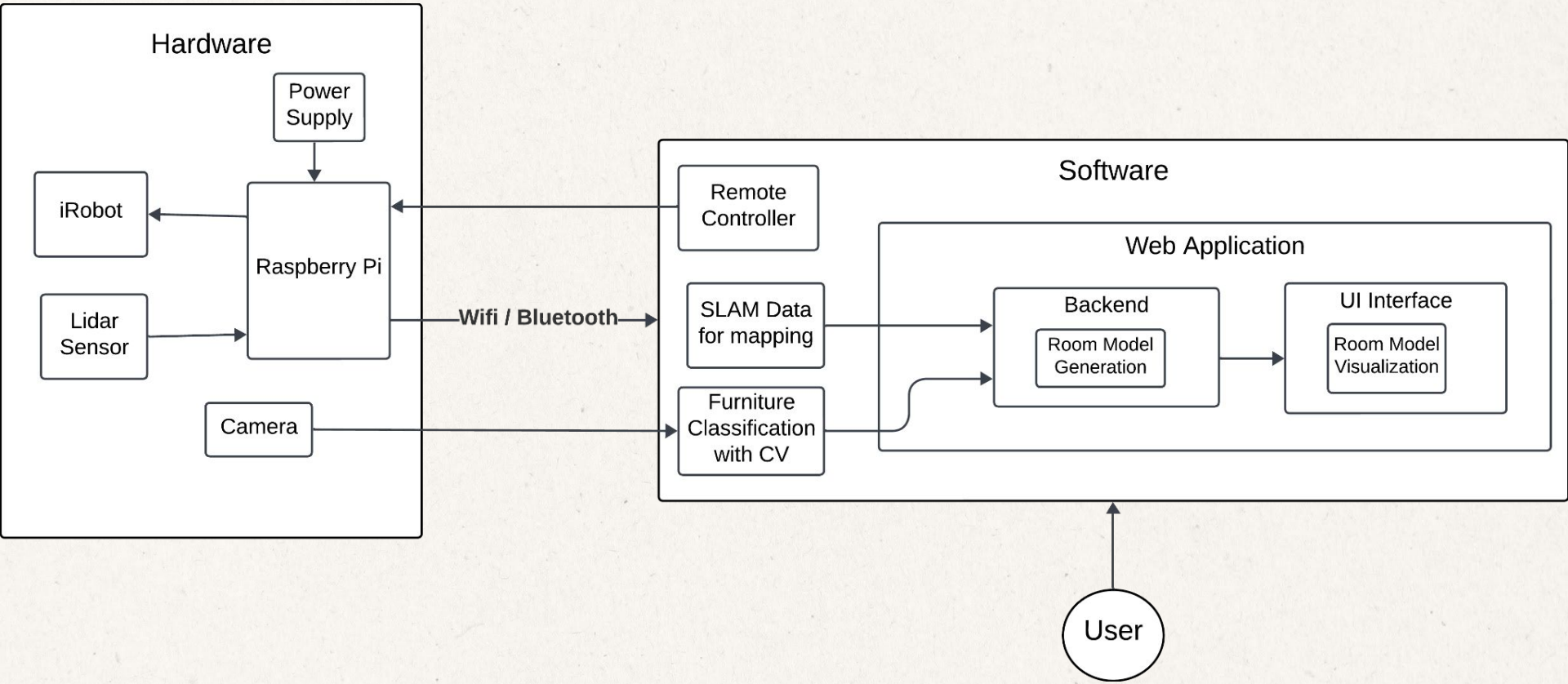
Hardware

- Robot base: iRobot Create for navigating the camera and sensors around the room
- Microcontroller: Raspberry Pi
- Camera for taking photos of objects for classification
- Sensors: LIDAR sensor for scanning the room floorplan

Software

- Web application for users to interact with and manipulate room layouts.
- Classification algorithm for identifying types of furniture
- ROS Libraries for SLAM and remote control movement

Solution Approach – Block Diagram



Testing, Verification, and Metrics

Requirements	Testing	Metrics
Accurately classify types of furniture	Test algorithm of different types of furniture	90% accuracy
Accurately identify object free areas	Test in rectangular and irregular shaped rooms	90% accuracy
Remote control navigation	Navigate through a practice environment and measure latency	Latency below 300 milliseconds
Web application response time	Measure time taken to classify furniture, choose models to display, and generate 2D space	Less than 1 minute per 20 sq ft

Tasks and Division of Labor

- Furniture classification algorithm (Grace)
- Integrating SLAM software packages (Grace)
- Designing remote control system (Zuhieb)
- Robot hardware assembly (Zuhieb)
- Web Application Frontend (Alana)
- Web Application Backend (Alana & Grace)
- 2D Modelling (Alana)
- Software and Hardware Integration (All)
- Subcomponent and full system testing (All)

Schedule

Task Title	Owner	Progress	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Spring Break	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Deliverables			1/22	1/29	2/5	2/12	2/19	2/26	3/4	3/11	3/18	3/25	4/1	4/15	4/22	4/29
Project Abstract	All	Done														
Project Proposal	All	In progress														
Website Setup	All	Done														
Design Review	All	Not started														
Design Document	All	Not started														
Ethics Assignment	All	Not started														
Interim Demo	All	Not started														
Final Presentation	All	Not started														
Final Report	All	Not started														
Software Development																
Furniture Classification Algorithm	Grace	Not started														
Furniture/Room classification testing	All	Not started														
Web Application UI	Alana	Not started														
Web Application Backend	Alana & Grace	Not started														
Web Application testing	All	Not started														
2D Modelling (Room + Furniture)	Alana	Not started														
Hardware Assembly																
Part Ordering	All	Not started														
Movement Automation logic	Grace & Zuhieb	Not started														
Navigation Assistant assembly	Zuhieb	Not started														
Navigation Assistant verification	Zuhieb	Not started														
Integration and Testing																
Full System Integration	All	Not started														
Full System Testing	All	Not started														
Slack																