

**MICHIGAN STATE**  

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**U N I V E R S I T Y**

# Project Plan

## IMAGINE: IMAGE INTake Experience

### The Capstone Experience

Team Auto-Owners

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*From Students...  
...to Professionals*

# Functional Specifications

- Generating insurance quotes in a timely and highly accurate manner is difficult without an on-location assessment
- On-location assessments are time-consuming and costly
- By using panoramic images of locations in a virtual reality setting, adjusters can make remote assessments as if they were on site
- Object recognition can significantly reduce the time an assessment takes by automatically identifying objects of interest at a location to the adjuster



# Design Specifications

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- Users should be able to upload images showing an environment and have the objects within identified, located, and labeled
- Users should be able to interface with an inventory of identified objects and make edits to their information through a web portal
- An image and its inventory should be viewable and annotated in a Unity VR application
- Image environment type should be classified by the objects within the image



# Screen Mockup: Web Application

The login screen features a dark blue header with the Auto-Owners Insurance logo on the left and 'LIVE SUPPORT' on the right. Below the header, the text 'Welcome' is on the left and 'Register' is on the right. A white login form is centered, containing a 'Login' heading, a horizontal line, and two input fields labeled 'User Name:' and 'Password:'. Below the fields are two blue buttons: 'LOGIN' and 'CANCEL'. At the bottom of the page, there is contact information for Underwriting Support (1-800-238-2934) and Technical Support (1-800-346-0346 x1850), a disclaimer about the use of information, and a footer with links for Live Support, Feedback & Comments, and Terms of Use and Private Policy, alongside the Auto-Owners Insurance logo and tagline 'LIFE • HOME • CAR • BUSINESS'.

The photo categories screen features a dark blue header with the Auto-Owners Insurance logo on the left and 'LIVE SUPPORT' on the right. Below the header, 'Photo Categories' is on the left, and 'My profile' and 'Logout' are on the right. A white content area titled 'Environment' contains a 'Mockup Options' section with a 3x3 grid of buttons: 'HOUSING', 'OFFICE', 'OUTSIDE', 'RESTAURANT', 'STREET', 'CLICKABLE', 'CLICKABLE', 'CLICKABLE', and 'CLICKABLE'. At the bottom of the page, there is contact information for Underwriting Support (1-800-238-2934) and Technical Support (1-800-346-0346 x1850), a disclaimer about the use of information, and a footer with links for Live Support, Feedback & Comments, and Terms of Use and Private Policy, alongside the Auto-Owners Insurance logo and tagline 'LIFE • HOME • CAR • BUSINESS'.



# Screen Mockup: Web Application

LIVE SUPPORT

Photos My profile Logout

## Housing

List of each category

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"The Smith Home" 324 Maple Street  
Edit - Paragraph

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Anyone Home 1  
Read only - Paragraph

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Anyone Home 2  
Read only - Paragraph

[ADD TO LIST](#)

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Underwriting Support: 1-800-238-2934 | Technical Support: 1-800-346-0346 x1850

The information gathered will be used for the sole purpose of providing an insurance rate proposal. Rates are subject to change based on company rate schedules and/or changes to any of the required rating information.

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LIVE SUPPORT

Inventory View Environment Export Download

## "The Smith Home" 324 Maple Street

Object Recognition

Sample Table

IMAGE NUM	OBJECT	ROOM	CHARACTERISTICS	NOTES
1	Sink	Bathroom #1	Pedestal	
1	Toilet	Bathroom #1		
2	Shower/Tub	Bathroom #2		
2	Sink	Bathroom #2	Vanity	
2	Toilet	Bathroom #2		
3	Bed	Bedroom #1	Twin size	
4	Bed	Bedroom #2	Queen size	
5	Bed	Bedroom #3	Full size	Underwriting, Feb. 2018: Bedroom looks unused. May be used as a spare bedroom and not for full-time occupants. That could affect the exposure on the policy. Refer to the agency to confirm.
6	Table		Underwriting, Feb. 2018: looks like the dining room table	
7	Couch	Living Room #1		

[ADD TO LIST](#)

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# Screen Mockup: Web Application

**Auto-Owners**  
INSURANCE

LIVE SUPPORT

Photo Edit Environment My profile Logout

Photo1

Edit



Information

Photo Name:

Upload User Name:

Upload Time:

Category:

Description:

Underwriting Support: 1-800-238-2934 | Technical Support: 1-800-346-0346 x1850

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**Auto-Owners**  
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**Auto-Owners**  
INSURANCE

LIVE SUPPORT

Item Edit Environment My profile Logout

Item1

Edit



Image Number:

Object:

Room:

Characteristics:

Notes:

Link:

Accuracy:

Underwriting Support: 1-800-238-2934 | Technical Support: 1-800-346-0346 x1850

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**Auto-Owners**  
INSURANCE  
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# Screen Mockup: VR Menu

## *Auto-Owners* INSURANCE

HOUSING

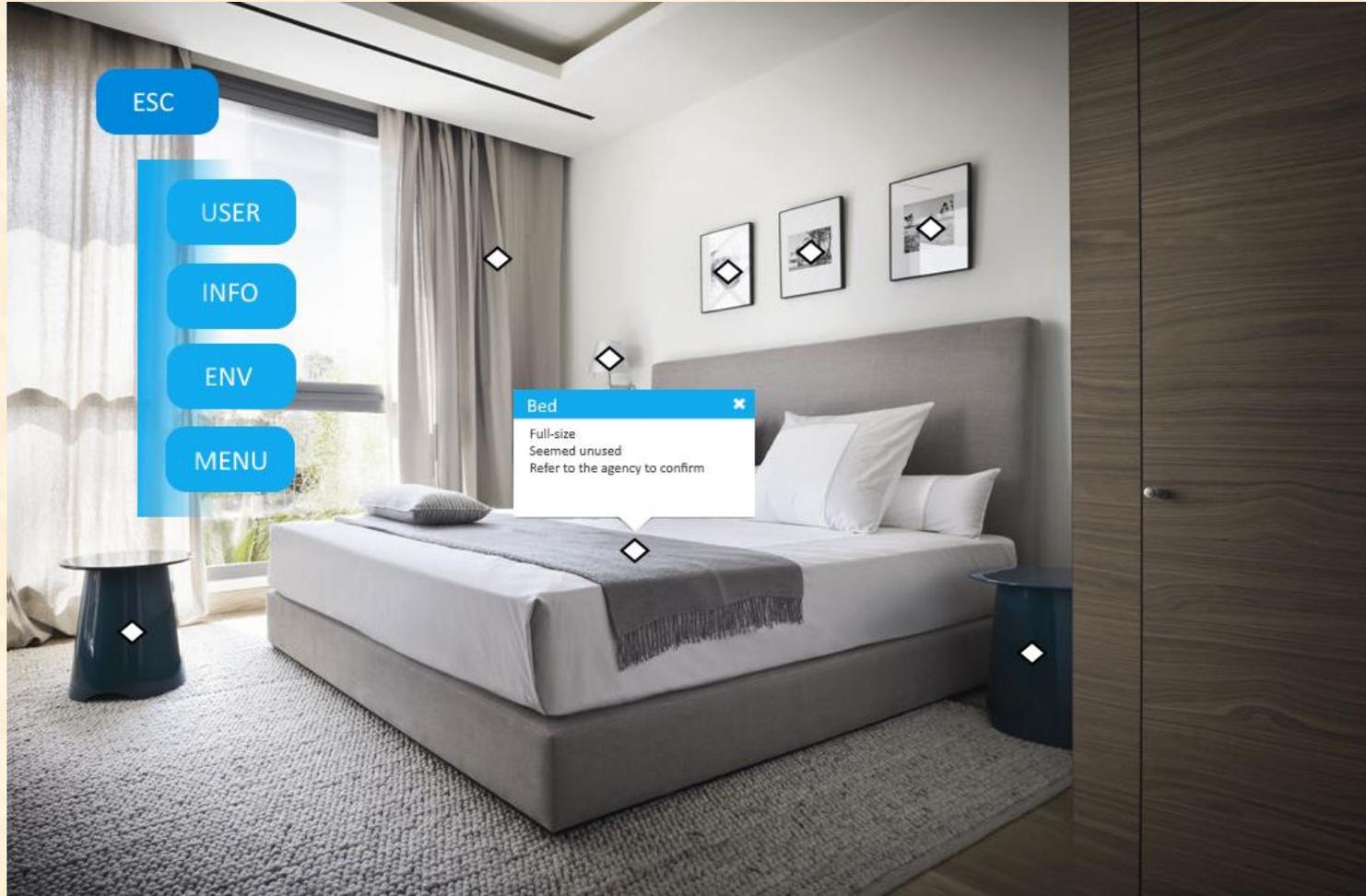
OFFICE

RESTUARANT

OTHERS



# Screen Mockup: VR User Interface

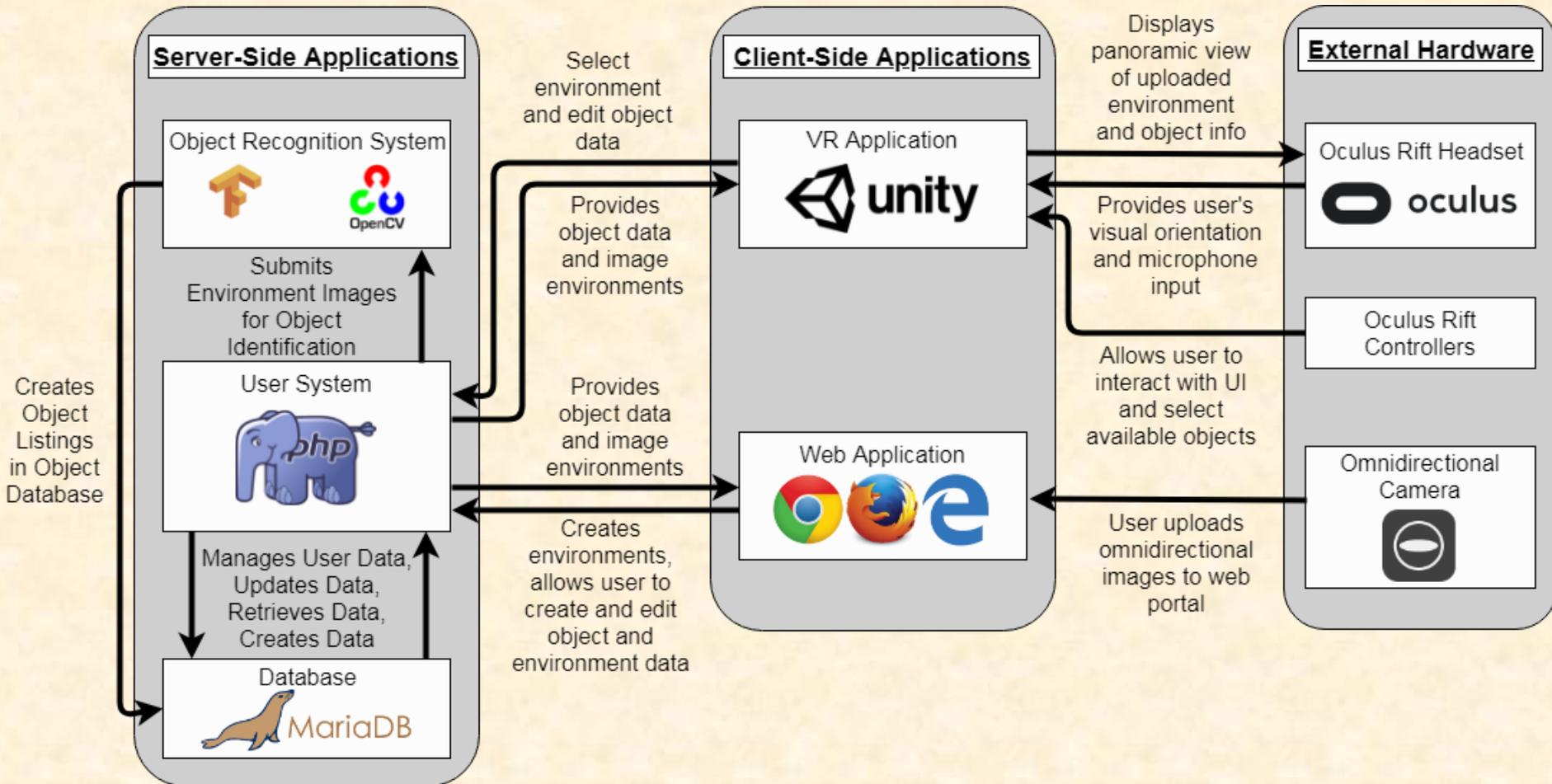


# Technical Specifications

- Panoramic photos are processed by the object recognition system (OpenCV/TensorFlow) to identify objects of interest and store their locations and information in a database (MariaDB)
- A VR Headset (Oculus Rift) can be used to view panoramic photos and annotated versions of the objects in them in an immersive manner
- The web application (PHP) can be used to see a manifest of the objects found in a photo, information about that photo's environment, as well as to edit the information of those objects and information about the photo's environment



# System Architecture



# System Components

- Hardware Platforms
  - Oculus Rift VR Headset
  - Oculus Rift Touch Controllers
  - Dell PowerEdge Server
  - CUDA Graphics Processing Unit
- Software Platforms / Technologies
  - Unity Game Development Studio
  - OpenCV
  - TensorFlow
  - GitLab
  - PHP
  - MariaDB
  - Ubuntu Server



# Risks

- Inability to classify an environment
  - Environments should be classified based on types of objects found (i.e. bedroom, office, etc.)
  - Train negative classifiers to drop incompatible environments
- Multiple concurrent users
  - Multiple separate workflows will need to be able to be accessed by all users
  - Manage interactions with a user system using transactions to enforce ACID
- Object recognition in spherical images
  - 3D images have distorted pixel densities and will make classifying difficult
  - Normalize 3D images to 2D or include warped images when training our classifier
- Server Access Limited by MSU Firewall
  - MSU has firewall rules that prevent some external communications
  - Pipeline traffic through channels that are not restricted



# Questions?

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