BURGS Weekly Presentation

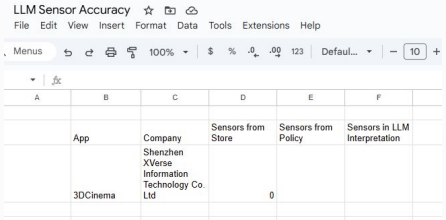
Broadening Undergraduate Research Groups

11/14/2025

Allie, Casie, Gayatri, Kim

GazeXR: LLM Evaluation – Progress Halted Briefly

***Focused on the poster**
Reevaluated what to ROUGE score due to realizations



01

Rouge Scoring

- Rouge score based on sensors
  - Delete other information from original policy to compare
- Rouge score overall summarization

02

Sensor Accuracy

- Manually will do for the 10
  - Plan to finish by next week
- Wrote pseudo code for future work for automating

03

Poster

- Created Poster Plan
  - Looked through examples
- Finish first draft by today
- Present poster to BURGS
- Finalized poster needs to be done 11/17

04

Abstract

- Will complete after poster done
- Due 11/21

Top of poster:

- Title:
- Names (first author to last - last is the PIs)
- Logos (private eye, any sponsors we have)
- School
- Poster QR code

Overview/Introduction

- Eye tracking
  - Risks etc.
- Meta Quest Pro
- Prev. App Auditing Work - CP
- LLM intro - CP

Objectives

- App Auditing Enhanced -> Manifest Evaluations: eye tracking which is a SENSOR - KG
- LLM Investigation on SENSOR information - CP

Implementation/Methodology

- Manifest Files - KG
  - **Eye tracking with consent prompt occuring**
  - **Eye tracking with no consent prompt occuring**
- LLM - CP
  - Prompt Engineering
  - ROUGE
  - Sensor count
  - (talk about previous work)

Results - later issue

- Manifest - KG
  - Google sheet work
- LLM - CP
  - ROUGE Score
- **WE NEED GRAPHS**

Results - later issue

- Manifest - KG
  - Google sheet work
- LLM - CP
  - ROUGE Score
- **WE NEED GRAPHS**

Conclusion

- Manifest - KG
  - Kim you got this
- LLM
  - ?? Need results

Future Work - CP

- Manifest
  - Kim you figure this out
- LLM
  - Explore more LLMs
  - Automate scripting for sensor count
  - Far future Create a special LLM perhaps?

Poster

Understanding Virtual Reality Sensor Permissions, Usage, and Exploitation

Casie Peng (casiepeng@vt.edu), Kim Giordano (kimgiordano27@vt.edu), Dr. Bo Ji (boji@vt.edu), and Dr. Brendan David-John (bmdj@vt.edu)

CP

Overview

The Meta Quest Pro

- The Meta Quest Pro allows for augmented reality (AR) and virtual reality (VR) experiences.
- They are equipped with sensors such as eye-tracking [1].

Eye Tracking

- Estimates gaze direction and movements. [2]
- Eye tracking information can infer personal information about a user. (e.g., gender, preferences, etc.)
- When eye tracking is in use, the user is given a consent prompt

The Risk

- Meta does not control how a third-party app uses, stores, or shares users' gaze data, so users should only allow access to trusted apps [3].
- (Conclusions from app auditing work)

LLM Evaluation

Objectives

Implementation

Extracted Android Manifest(.xml) Files

- APKTool
- Android Debug Bridge
- Android Studio

Investigate App Sensor Use and Permission Declarations

- .xml files
- Tables and Graphs

Sample of Apps Audited

Preliminary Permission Declaration Results

Conclusion

Future Work

Eye Tracking

- Estimates gaze direction and movements. [2]
- Eye tracking information can infer personal information about a user. (e.g., gender, preferences, etc.)
- When eye tracking is in use, the user is given a consent prompt

References

Too similar???

Auditing and Increasing Interpretability of Privacy Policies for Mixed Reality Sensors

Casie Peng (casiepeng@vt.edu), Paul Maynard (pmaynard@vt.edu), Dr. Bo Ji (boji@vt.edu), and Dr. Brendan David-John (bmdj@vt.edu)

Poster

VIRGINIA TECH

COMPUTER SCIENCE

Commonwealth Cyber Initiative

MAOP

Overview

The Meta Quest Pro

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- They are equipped with sensors such as eye-tracking [1].

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The Risk

- Meta does not control how a third-party app uses, stores, or shares users' gaze data, so users should only allow access to trusted apps [3].
- Developers are encouraged to minimize asking for user permission by accessing the information differently or at a reduced quality to minimize this prompting [4].

A Solution

- Generative AI has promise in the privacy domain to improve user understanding
- Challenges include determining accuracy and evaluating these models [5]

Objectives

Risk

Assess whether XR apps notify users about eye-tracking.

Solution

Investigate whether Generative AI can improve users' interpretations of privacy policies related to sensor usage.

Implementation

Obtain App List from Meta Store & Sort

- Web scraping application
  - Python
  - Playwright API
  - Asyncio API
- JSON & CSV app data

Web scraping program video

GitHub to full project code

Risk

Choose Eye-Tracked Apps & Document

- Genre
- Ratings
- User Ratings
- Sensors
- Permissions

Investigate Applications & Document

- Tables & Graph

Solution

Automated Generative AI Prompting

- Python
- Google Gemini API
- TXT file responses

Prompt Engineering

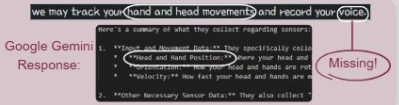
- 3 Prompts
  - Normal prompt
  - Emphasizes visualizations
  - Remove additional information

Go to the link provided below that contains a privacy policy. Summarize details regarding sensors in the privacy policy to make it understandable without getting rid of key information. (insert link)

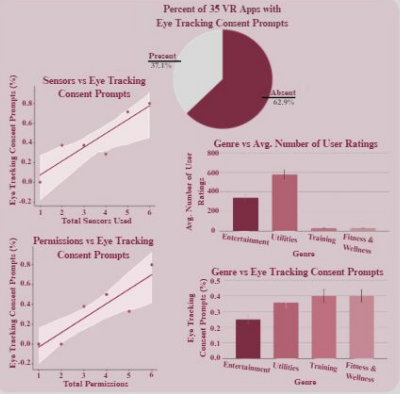
Sample of Apps Audited

Apps	Categorized Genre	Actual Genre	Rating	User Ratings	Sensors	Permissions	Eye Tracking Consent Prompts
Airplane Pilot Training Simulator	Training	Random Training/ Learning	0	0	1	1	Absent
Virtual Desk Rocket	Entertain...	Travel & Exploration	0	0	1	1	Absent
Bowling Alley	Entertain...	Simulation / Sport	2.5	16	1	1	Absent
Endless Climber	Entertain...	Sport	3.5	29	1	1	Absent
SwordVR	Fitness & ...	Fitness & Wellness	5	1	1	1	Absent
Fit Boxing Combat: Free Style Boxing	Fitness & ...	Fitness & Wellness / Sport	4.5	110	1	1	Absent

Solution Preliminary Results



Risk Results



Conclusion

Many free eye-tracking apps lack consent prompts.
We hypothesize this result is because developers...

1. Do not use the eye-tracking permission
2. Access the data differently, leaving users unaware that their gaze data is collected.

Future Work

Risk: Auditing Eye-Tracking Apps

- Audit more XR apps for accuracy
  - Improve the algorithm to sort by other factors.

Solution: Generative AI Sensor Policy Summaries

- Audit more XR/AR app policies for accuracy
- Prompt other generative AI models (e.g., ChatGPT, etc.).
- Use ROUGE/BLEU/GPT Evaluation for proper evaluations.

Far Future

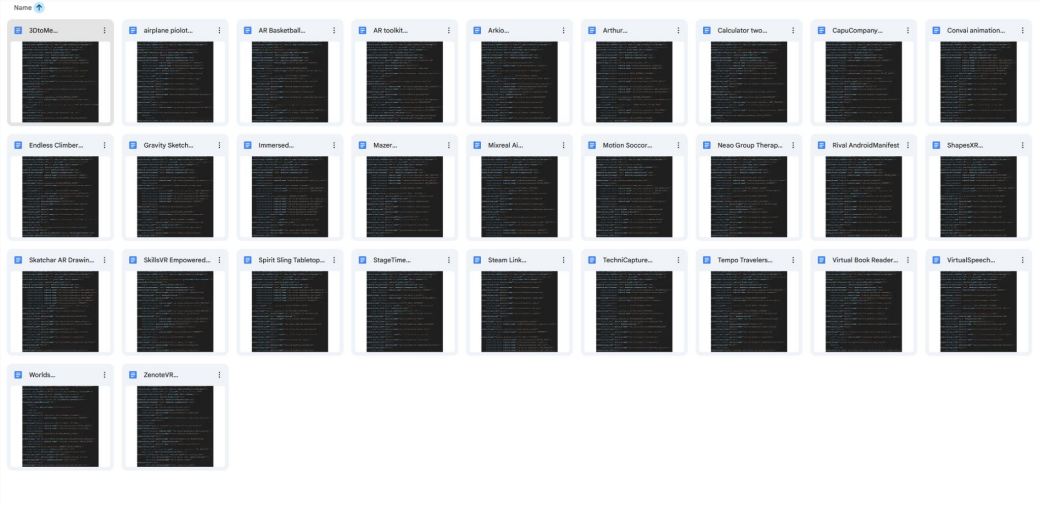
- Make a specialized LLM to analyze XR policies.

References

GazeXR: Manifest Evaluations Progress

Manifest Evaluations Tracking

- All manifests have been extracted and uploaded to the Google Drive
- Working on adding all of the data to my spreadsheet
    - Around 50% Completed
- Found a possible issue - Arthur
    - looking into this more today



Manifest Evaluations

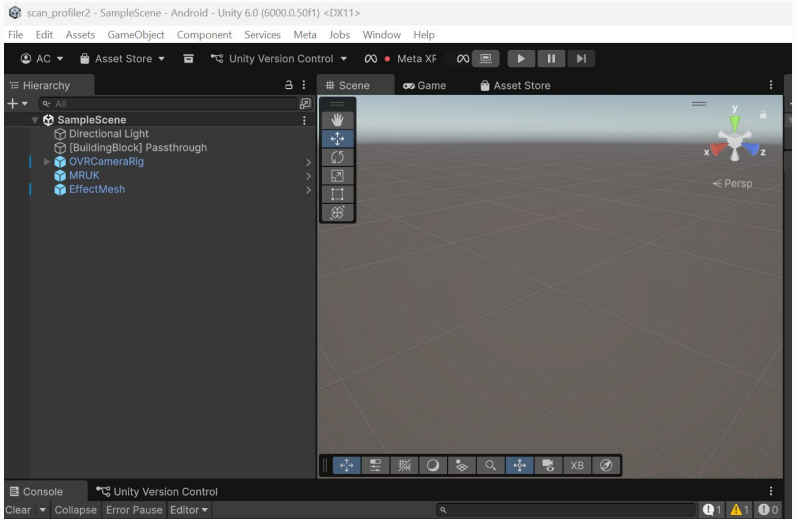
App Name	Meta Store Link	Eye Tracking Declaration Present in Manifest	Eye Tracking Tag Present on Meta Store	Eye Tracking Consent Prompt Present In App
3DtoMe	https://www.meta.com/experiences/	Present	Present	Not Present
Airplane Pilot Training Simula	https://www.meta.com/experiences/	Present	Present	Not Present
AR Basketball	https://www.meta.com/experiences/	Present	Present	Not Present
AR Toolkit	https://www.meta.com/experiences/	Present	Present	Not Present
Arkio	https://www.meta.com/experiences/	Present	Present	Not Present
Calculator Two Memory Cells	https://www.meta.com/experiences/	Present	Present	Not Present
CapuCompany	https://www.meta.com/experiences/	Present	Present	Present
Convai Animation Capture	https://www.meta.com/experiences/	Present	Present	Present
Gravity Sketch	https://www.meta.com/experiences/	Present	Present	Not Present
Immersed	https://www.meta.com/experiences/	Present	Present	Present
Arthur	https://www.meta.com/experiences/	Present	Not Present	Present
Endless Climber	https://www.meta.com/experiences/	Not Present	Not Present	Not Present

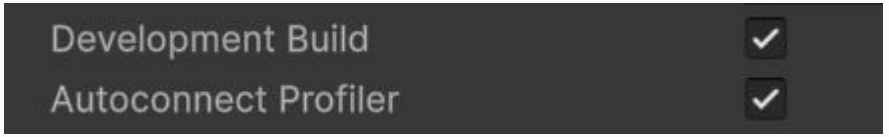
Arthur	https://www.meta.com/experiences/	Present		Not Present

Spatial Seer: Data Collection

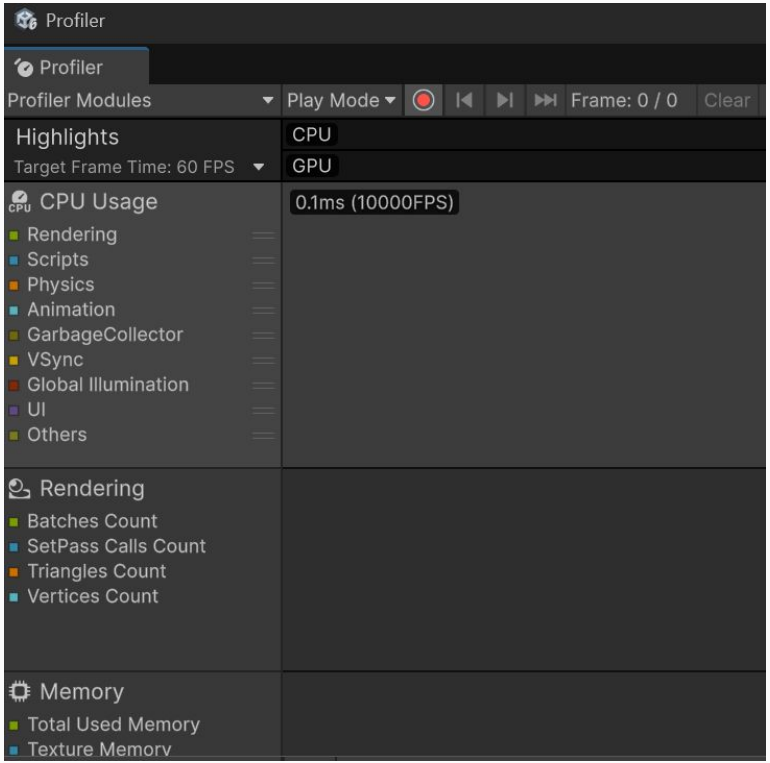
Unity Profiler & Memory Profiler Data

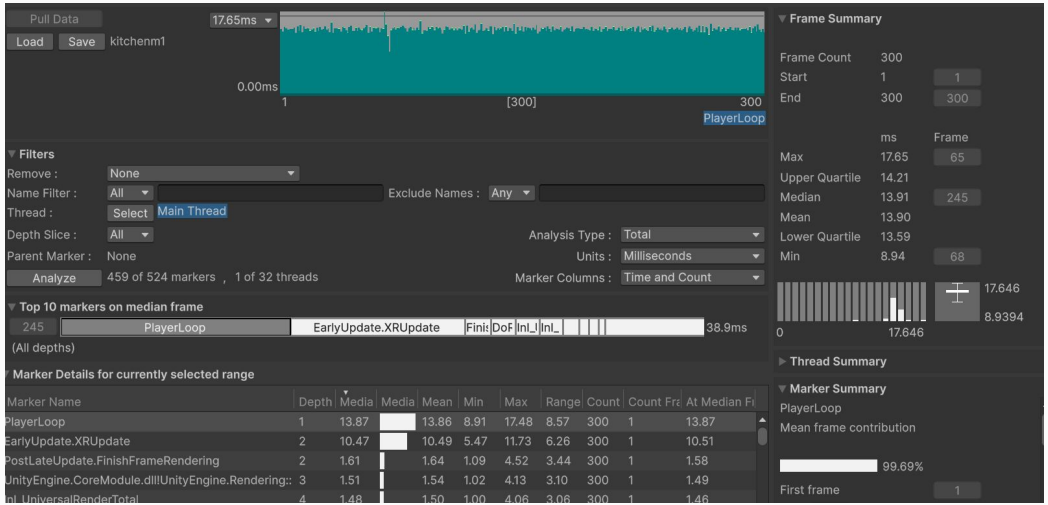
- Finalized our Unity application this week
  - Had some issues with the loading of different room types
  - Building from Android vs. Meta
  - Unity app renders faster when plugged into device?
- Collected 20 trials each for two different room types
- Still aiming to collect 60 trials (30 Unity Profiler, 30 Memory Profiler) next week





Spatial Seer: Unity Profiler





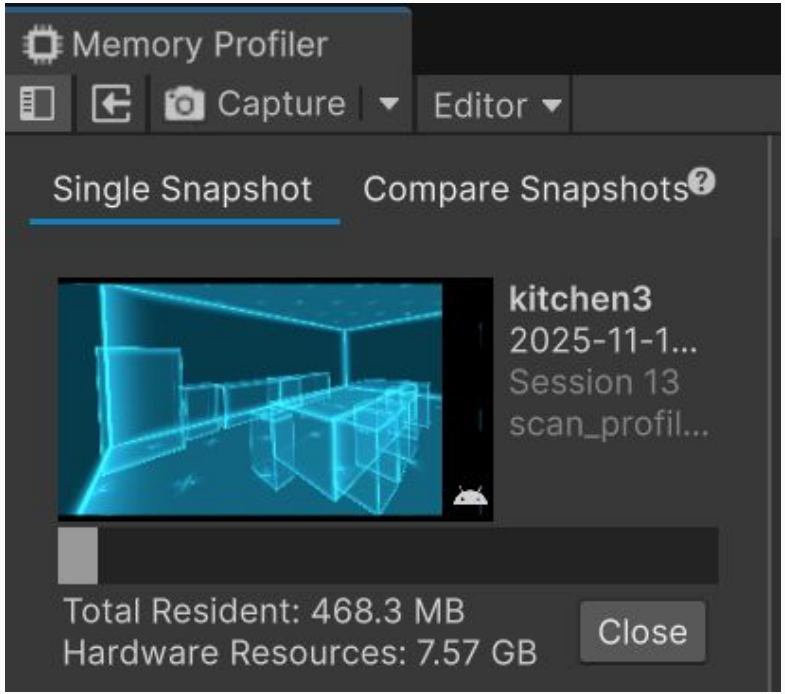
Spatial Seer: Unity Profiler

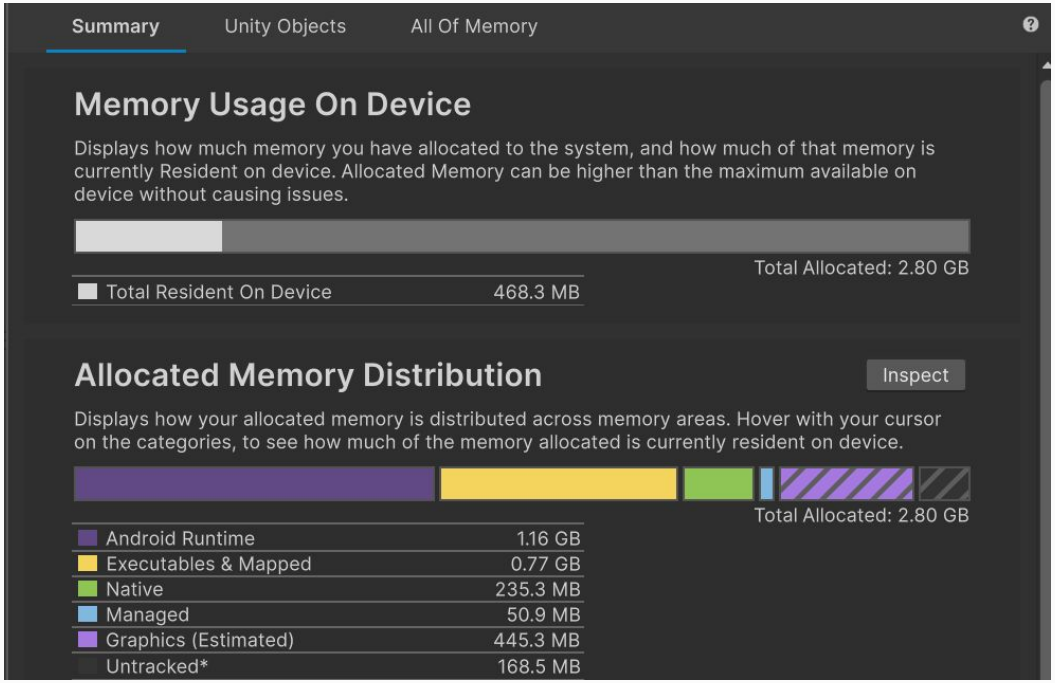
hall1.csv

unity_scans > hallway > cpu > hall1.csv

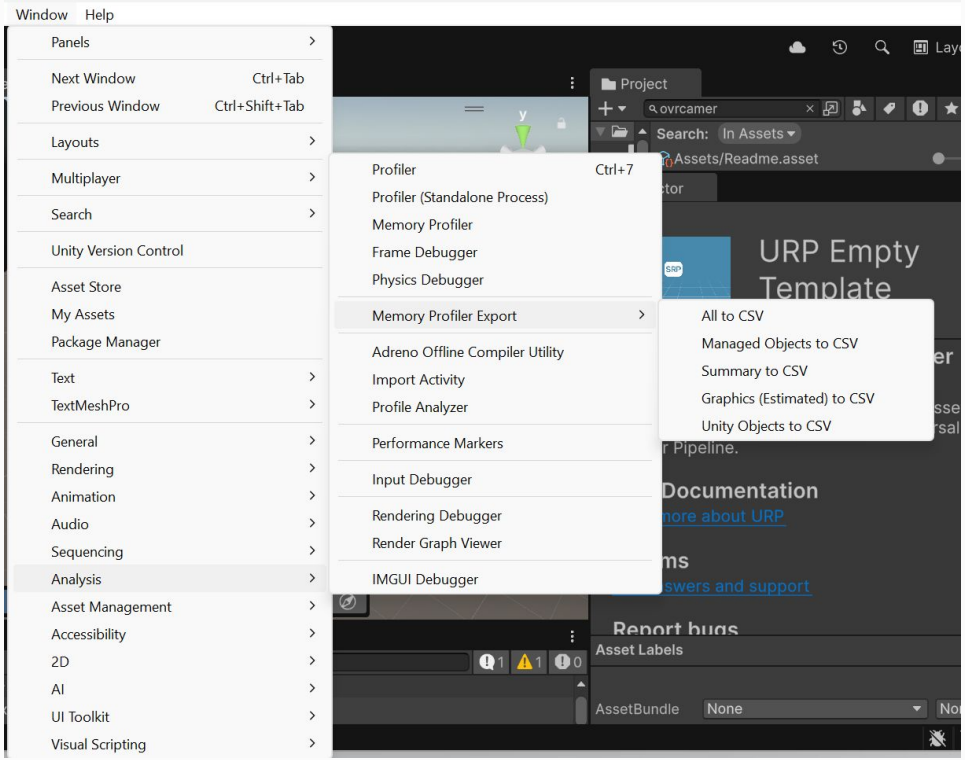
```
Name; Median Time; Min Time; Max Time; Median Frame Index; Min Frame Index; Max Frame Index; Min Depth; Max Depth; Total Time; Mean Time;
"PlayerLoop";13.85292;12.78886;15.4087;282;192;85;1;1;4159.20941829681;13.86403;13.57557;14.1588;300;1;1;1;300;1;12.78886;15.4087;192;85;1
"EarlyUpdate.XRUpdate";10.54646;9.163334;11.61948;267;86;49;2;2;3162.75098419189;10.5425;10.3338;10.73406;300;1;1;1;300;1;9.163334;11.6194
"PostLateUpdate.FinishFrameRendering";1.668646;1.136406;2.332917;212;17;68;2;2;499.857598662376;1.666192;1.578281;1.769844;300;1;1;1;300;1
"UnityEngine.CoreModule.dll!UnityEngine.Rendering::RenderPipelineManager.DoRenderLoop_Internal() [Invoke]";1.574062;1.06599;2.199324;52;17
"Inl_UniversalRenderTotal";1.533229;1.039948;2.159531;172;17;68;4;4;459.776512026787;1.532588;1.448698;1.623906;300;1;1;1;300;1;1.039948;2
"Inl_RenderCameraStack";1.491615;1.007448;2.100782;196;17;68;5;5;446.262332677841;1.487541;1.401198;1.575469;300;1;1;1;300;1;1.007448;2.10
"Inl_UniversalRenderPipeline.RenderSingleCameraInternal: CenterEyeAnchor";1.004687;0.678021;1.513073;277;32;193;6;6;301.330023527145;1.004
"Update.ScriptRunBehaviourUpdate";0.490833;0.329062;1.090469;257;46;85;2;2;151.18106558919;0.5039369;0.453229;0.532813;300;1;1;1;300;1;0.3
"BehaviourUpdate";0.48927;0.327969;1.089427;276;46;85;3;3;150.760383784771;0.5025346;0.450781;0.531042;300;1;1;1;300;1;0.327969;1.089427;4
"PostLateUpdate.PlayerSendFrameStarted";0.360313;0.238802;0.810156;134;29;104;2;2;112.040799811482;0.3734693;0.329583;0.400157;300;1;1;1;3
"Inl_ExecuteRenderGraph";0.318594;0.22651;0.640782;86;32;148;7;7;98.7337706387043;0.3291126;0.293073;0.352865;300;1;1;1;300;1;0.22651;0.64
"FrameEvents.XRBeginFrame";0.302344;0.20276;0.748333;257;7;104;3;3;94.189180791378;0.3139639;0.275677;0.337917;300;1;1;1;300;1;0.20276;0.7
"Inl_RecordRenderGraph";0.260937;0.186355;0.634271;224;17;133;7;7;82.3086015880108;0.274362;0.234219;0.29651;300;1;1;1;300;1;0.186355;0.63
"Inl_On Record Render Graph";0.24573;0.176094;0.617812;224;17;133;8;8;77.447923719883;0.2581598;0.219948;0.277656;300;1;1;1;300;1;0.176094
"Inl_ScriptableRenderContext.Submit";0.225573;0.148646;0.628386;201;253;22;6;6;71.8841269016266;0.2396138;0.207812;0.254791;300;1;1;1;300;
"Oculus.VR.dll!::OVRManager.Update() [Invoke]";0.216719;0.153437;0.659948;132;48;85;4;4;66.78504689037 8;0.2226168;0.20552;0.231511;300;1;1
```

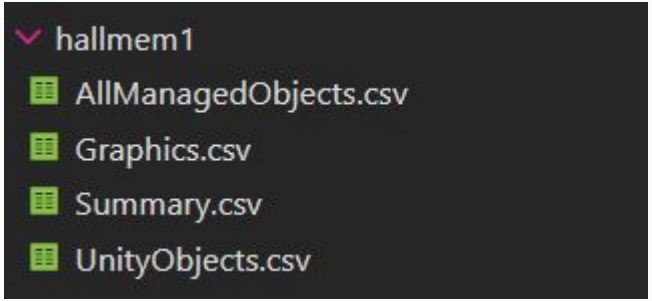
Spatial Seer: Memory Profiler





Spatial Seer: Memory Profiler





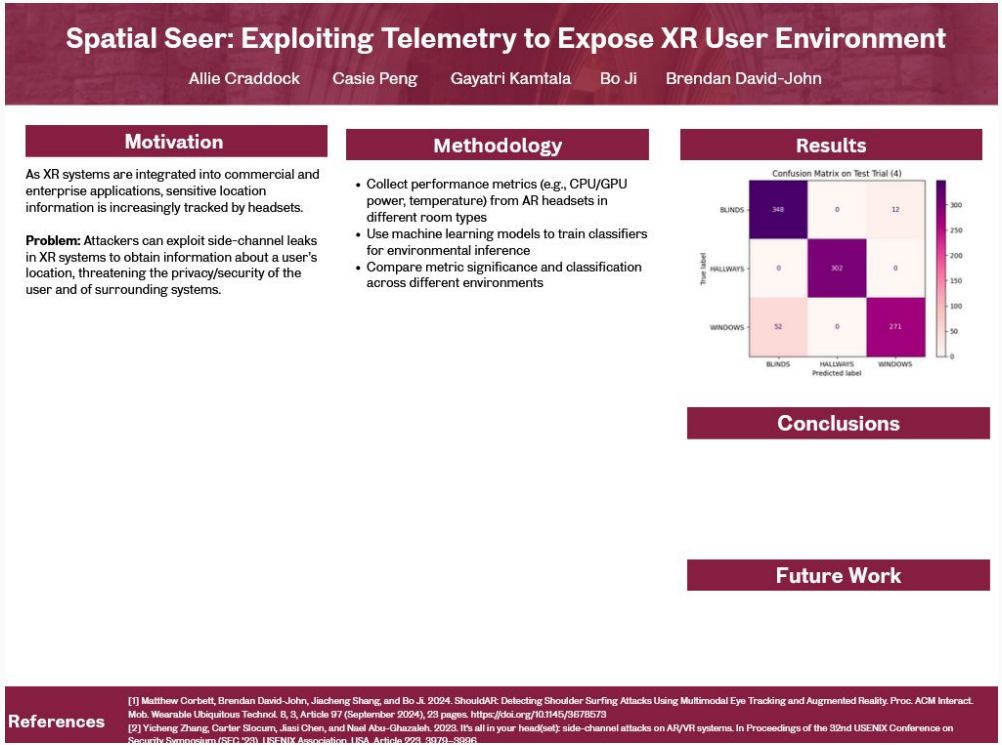
ity_scans > hallway > mem > hallmem1 > AllManagedObjects.csv

```
1  Type,Count,Allocated(MB),Resident(MB)
2  "System.String",4074,0.341,0.341
3  "UnityEngine.InputSystem.Controls.KeyControl",610,0.191,0.191
4  "System.Int32[]",455,0.071,0.071
5  "System.Func<System.Object>",569,0.069,0.069
6  "UnityEngine.Rendering.RenderGraphModule.RenderGraph.Compiled
7  "UnityEngine.InputSystem.Controls.AxisControl",190,0.055,0.05
8  "UnityEngine.Rendering.DebugUI.Value",565,0.052,0.052
9  "UnityEngine.Rendering.RenderGraphModule.RenderGraph.Compiled
10 "UnityEngine.Rendering.ListChangedEventHandler<UnityEngine.Re
11 "System.Func<System.Boolean>",167,0.020,0.020
```

Spatial Seer: VTURCS

Unity Profiler & Memory Profiler Data

- Finalized our poster to present a draft today
- Aim to include our Perfetto model for now until we can replace it with our Unity confusion matrix
- Will mention both progress and methodology from last year's process and this one (MQ3 & ML2)
- Feedback for our abstract



Questions

1.