Forget-Me-Not
Group A7
Design Presentation

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Use Case

Problem:
Issue of frequent loss and misplacement of personal items

Application:
Developing a POC for a camera-based object tracking system for indoor environments to locate personal items such as keys, wallets and remotes.

Audience:
Primarily students, working adults, if sufficiently good, Alzheimer's and Dementia patients

Use Case Requirements:

Object Detection
- 80% accuracy (>iPhone, well-lit 10x10ft room)

Camera Setup
- 80% floor visibility to minimize blind spots

Cost Constraints
- Hardware cost <$300.
- Cloud costs <$200 per user/month for continuous usage.

Privacy
- Authorized access on authenticated local devices only

Query Response
- Users receive item location within 20 seconds of querying, based on data at most 30 seconds before time of query

Pic Cred: Google Images

Design Requirements - Driven by Use Case

Hardware Constraints:

Camera Quality	1080p
Image Capture Period	5s
Camera FOV	40°

Latency Constraints:

“Monitor” Workflow:	
Camera Preprocessing Latency	1s
Web Server “Ping” Latency	1s
Object Detection (ML) Latency	5s
Database Write Latency	5s
Total Cross-Component Latency	13s

“Query” Workflow:	
Speech-to-Text Latency:	2s
Web Server “Ping” Latency	1s
Database Read Latency:	7s
ML Latency: 10s	2s
Total Cross-Component Latency	20s

Price Constraints:

Hardware Costs / Room	$300
Cloud Compute Costs / Person / Month	$100
Cloud Storage Costs / Person / Month	$100

Accuracy Constraints:

80% accuracy (>iPhone, well-lit 10x10ft room)

Pic Cred: Google Images

Solution Approach

Monitoring - Object Detection ML:

- No manual tagging (AirTag, Bluetooth), adaptable (software)

Querying - Two Frontends:

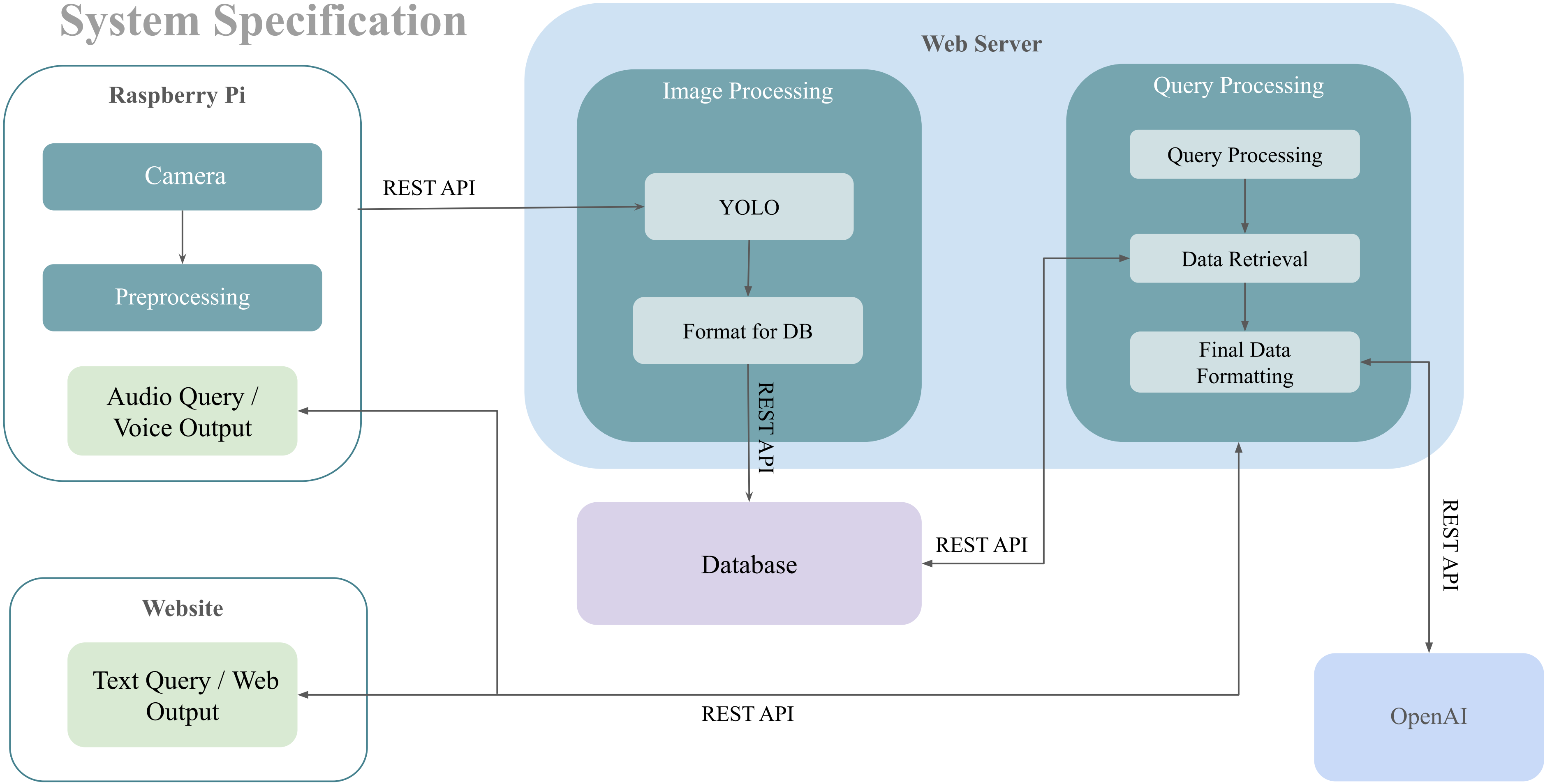
- Microphone
  - Convenient, independent, but possibly less reliable
- Website
  - Comprehensive data control

Two Backends:

- Cloud
  - Reliable, convenient, use-what-you-need (economy of scale)
- Local
  - Secure, fixed-price

Pic Cred: Google Images

System Specification



Implementation Plan (Web Server)

Mission:

Orchestrate requests, run workloads

Design Rationale

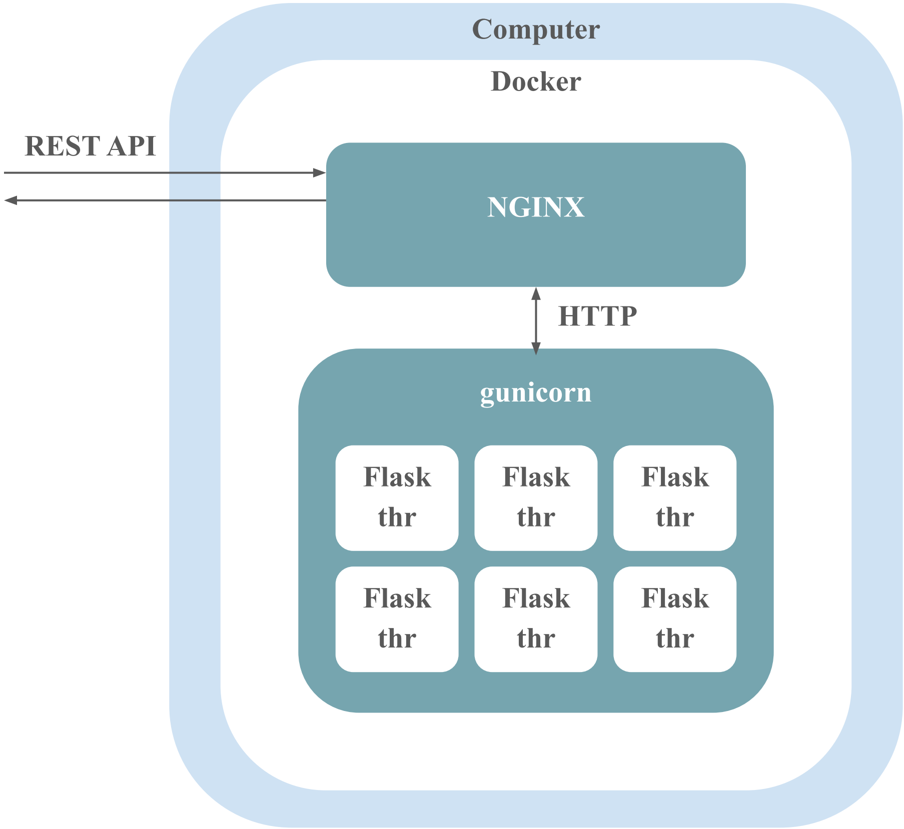
Scalability, platform agnostic, performance

Component Origin

Download/Assemble

Implementation Progress

Prototype



Implementation Plan (Database)

Mission:

Store and serve data with reasonable latency bounds

Design Rationale

Database - Availability, security

Relational - Workload

2 Backends! - Interchangeability, simplicity

Component Origin

Download and Configure

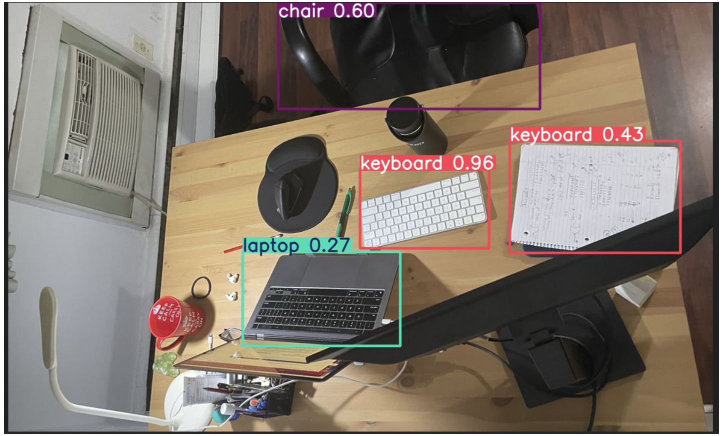
Implementation Progress

Prototype

amazon RDS

SQLite

Implementation Plan (CV)



Mission:

Accurately detect objects of interest

Design Rationale

SOTA, open-source, relatively extensible

Inclusive!

Component Origin

High development investment

Implementation Progress

Research

ultralytics
YOLOv8

Implementation Plan (Hardware)

Mission:

1. Monitor Room
2. Microphone Query/Response

Design Rationale

Flexibility for prototyping (power, capability)

Reasonable form factor

Scalability

Component Origin

Hardware: Bought

Software: All ours

Implementation Progress

Prototype

Verification - By Design Constraints

Accuracy Constraints (Object Detection):

- Training tests
- Home-made dataset
- Risk avoidance - Two interfaces

Latency Constraints

- Code instrumentation
- Risk avoidance - Modular design, replace slow components

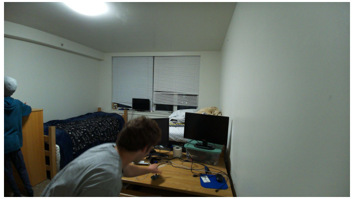
Hardware Constraints:

- Buy to spec, no risk mitigation necessary

Price Constraints

- Mock out components, simulate “Production scale workload” on cloud
- Risk avoidance - Room for optimization





Project Management

Task Allocation:

- Specialty-aware
- Priority-aware

Ethan	Machine Learning - Optimizing accuracy, performance, generality
Swati	Database setup, hardware setup, preprocessing optimization
Giancarlo	Web Server structure, setup, instrumentation,

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	PCT OF TASK COMPLETE
1	Project Conception and Initiation				
1.1	Team Composition Form	Giancarlo	9/11/24	9/12/24	100%
1.1.1	Abstract	Swati	9/12/24	9/13/24	100%
1.2	Website Initialization	Giancarlo	9/13/24	9/14/24	100%
1.3	Proposal Presentation Slides	Swati	9/13/24	9/15/24	100%
1.4	Proposal Presentation	Swati	9/20/24	9/22/24	100%
1.5	Peer Review	All	9/16/24	9/17/24	0%
1.6	Project Initiation	Ethan	9/17/24	9/18/24	50%
2	Project Definition and Planning				
2.1	Design Presentation Slide	Giancarlo	9/17/24	9/18/24	100%
2.2	Design Presentation	Giancarlo	9/18/24	9/19/24	100%
2.3	Peer Review	All	9/19/24	9/20/24	100%
2.4	Design Review	All	9/20/24	9/21/24	0%
3	Project Launch & Execution				
3.1	Initial Equipment Procurement	All	Week 4	Week 5	90%
3.2	ML model training	Ethan	Week 4	Week 10	10%
3.2	RPi configuration with camera	Swati	Week 5	Week 5	100%
3.3	SQL database prototype	Giancarlo	Week 5	Week 6	50%
3.4	Camera Synchronisation	Ethan	Week 8	Week 10	0%
3.5	Pre-processing	Swati	Week 8	Week 10	0%
3.6	Webserver Prototype	Giancarlo	Week 5	Week 5	100%
3.7	Define Interfaces	All	Week 6	Week 6	20%
3.8	Assemble MVP	Giancarlo	Week 6	Week 7	10%
3.9	Inprove Hardware - RasPi Case	Swati	Week 8	Week 8	0%
3. 10	Order Additional Hardware	Swati	Week 6	Week 7	0%
4	Project Performance/Monitoring				
4.1	Construct Testing Dataset	All	Week 4	Week 7	0%
4.2	Instrument Code for Testing	Giancarlo	Week 8	Week 8	0%
4.3	Run Model Tests	Malik M	Week 5	Week 10	0%

PHASE ONE										PHASE TWO										PHASE THREE										PHASE FOUR									
WEEK 1					WEEK 2					WEEK 3					WEEK 4					WEEK 5					WEEK 6					WEEK 7					WEEK 8				
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