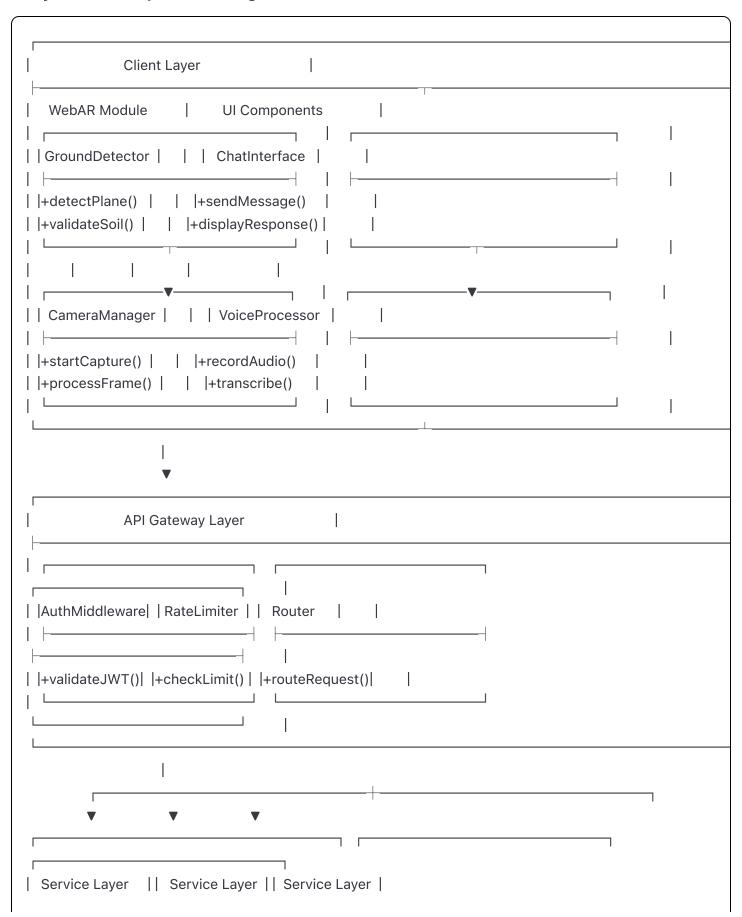
UML Diagrams - Real-World AR ChatGPT for Farmers

1. System Component Diagram



```
| InsightService | | ChatService | | CropCompanion | | | | | | |
      | DataFusionEngine | | RAGPipeline | | | GameEngine | |
| | +fuseData() | | | | +retrieve() | | | | +updateAvatar() | |
| | +interpolate() | | | | +checkAlerts() | |
Data Layer
NASA Adapters Storage Systems
| SMAPAdapter | | RedisCache | |
| |+set() | |
| | MODISAdapter | |
             | | PostgresDB |
| |+fetchNDVI() | | |
             | |+query() |
```

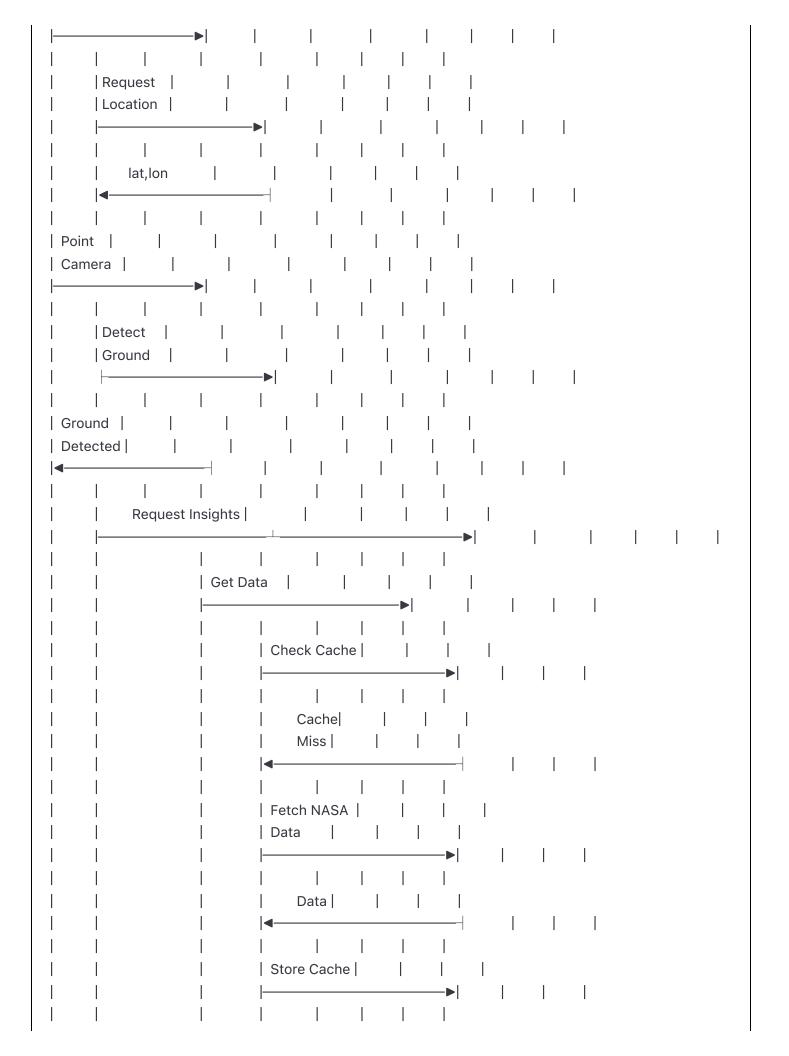
2. Class Diagram - Core Entities

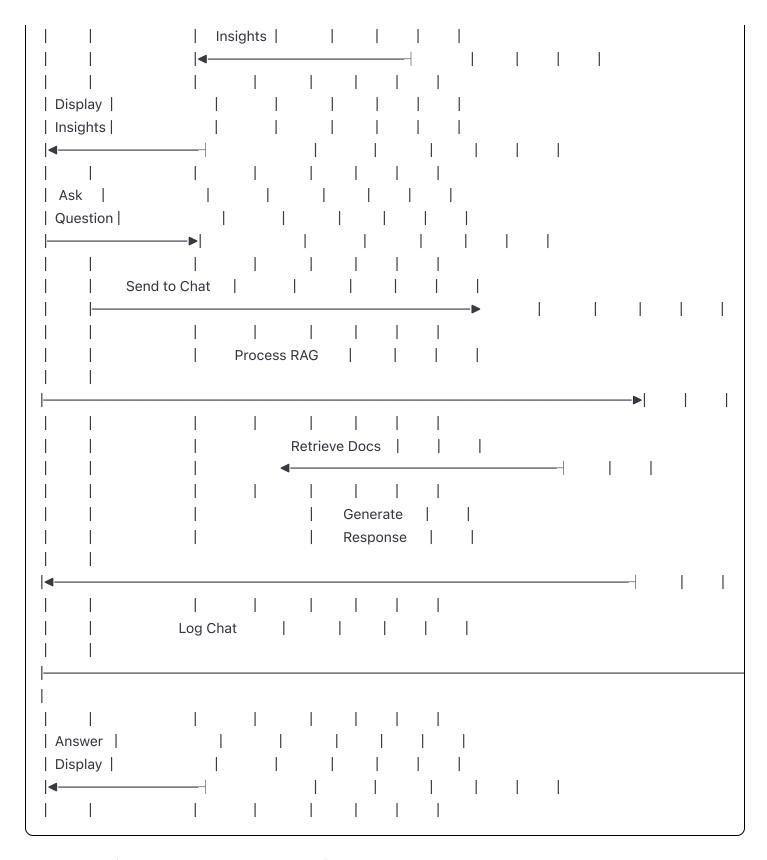
```
|+validate(): boolean |
|+toBucket(): string |
     uses
 SoilInsight
                                  Provenance
|-moistureLevel: float |
                          |-dataSource: string |
|-temperature: float |
                         -granuleId: string
-ndvi: float
                     |-modelVersion: string |
|-evapotrans: float |
                         |-cachedTTL: number |
|-precipitation: float |
                                                      +toJSON(): object
|+analyze(): Analysis |
|+toRecommendation() |
      ▼ generates
| CropRecommendation |---
-crops: Crop[]
                        -name: string
-season: string
                        |-waterNeed: float |
|-constraints: object |
                      -seasonWindow: string
                                                      |-suitabilityScore: float|
|+rank(): Crop[]
|+filter(): Crop[] |
                       |+isViable(): boolean |
  ChatSession
                                        Message
-sessionId: string
                        -content: string
|-userld: string
                       |-role: string
-context: object
                       -timestamp: Date
```

```
|-messages: Message[] |
                            |-citations: Citation[]|
|+addMessage()
                         |+format(): string |
|+getContext(): object |
      ▼ uses
  RAGProcessor
                                        Citation
|-vectorStore: Store | |-type: string
|-retriever: Retriever |
                        |-reference: string |
-generator: LLM
                        l-score: float
|+process(): Response |
                           |+toString(): string |
|+retrieve(): Doc[] |
CropCompanion
                                          Alert
-avatar: Avatar
                       -type: string
|-level: number
                       |-severity: string
-state: string
                      |-message: string
|-alerts: Alert[]
                      -timestamp: Date
                       +dismiss(): void
+evolve(): void
                          +snooze(): void
+checkConditions()
|+sendAlert(): void |
```

3. Sequence Diagram - Main User Flow

User	W	ebAR	GPS	APIGate	eway	Insight	Service	NASAAdapter	Cache	RAG	Chat
								1			
Start					- 1	- 1					





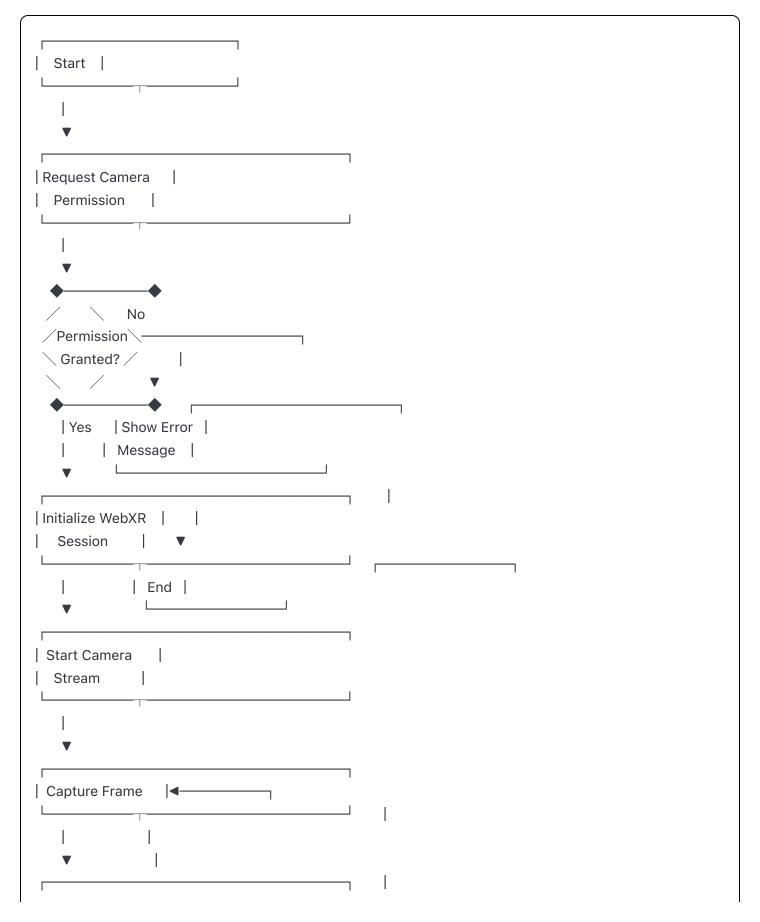
4. State Diagram - Crop Companion

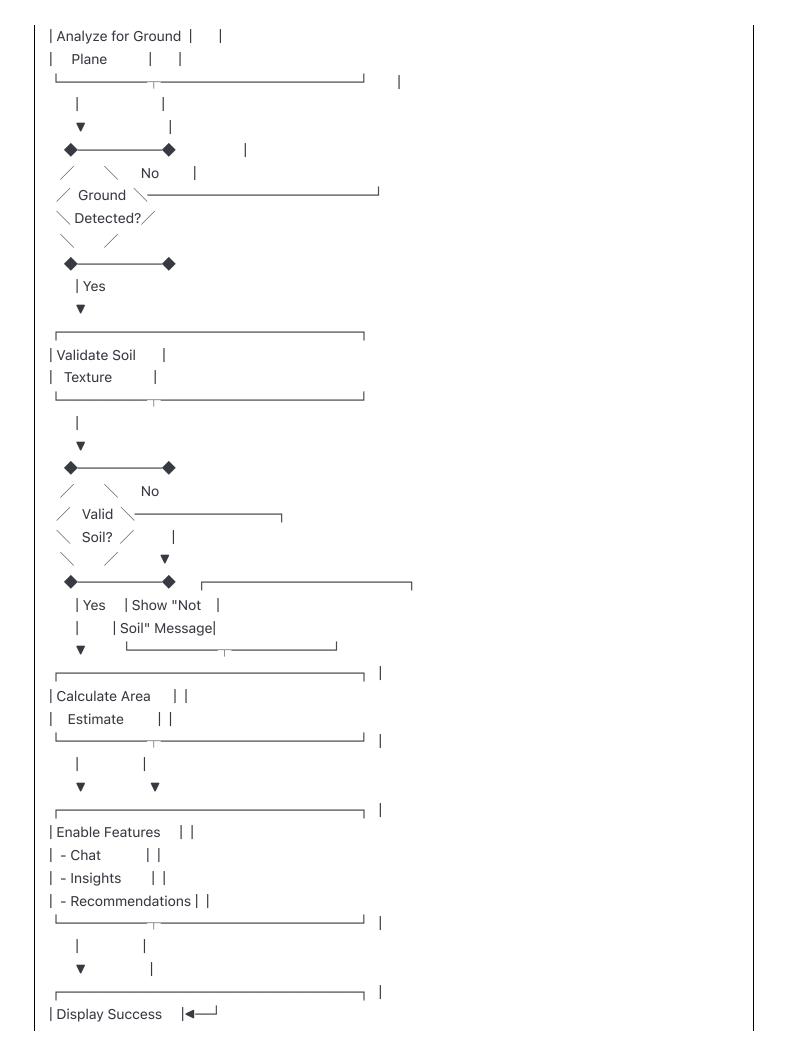
```
| Initial |
| State |
|
```

```
User selects crop
       Seed
       Stage
       7 days pass
      Seedling |
    | Stage | |
      | 14 days | Heat stress
Recovery | | Vegetative | | Stressed |
   | | Stage |----| State |
    1 1
       21 days
     | Flowering |
      Stage
       14 days
                     ——— Disease detected
     | Fruiting |
      Stage | |
             Diseased
             | State |
       | Harvest ready |
        ▼ | Treatment
                applied
     | Harvest |◄
```

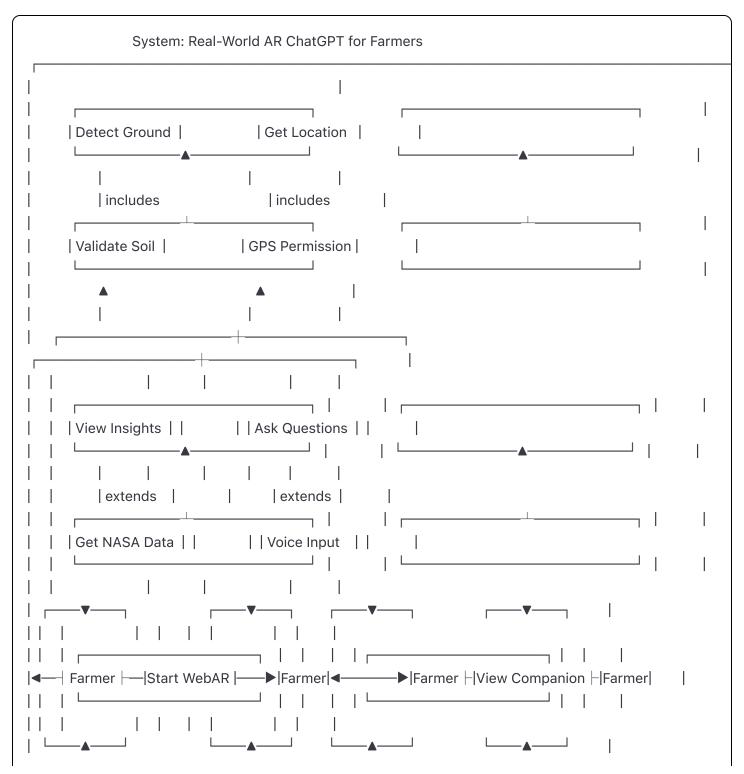
Complete			

5. Activity Diagram - Ground Detection Flow





6. Use Case Diagram



```
extends
      extends
             Game Rewards
   | Irrigation |
   Timing
        External Systems
| NASA APIs | Weather API | LLM | Voice API | Database | |
```

7. Deployment Diagram

```
- Cached Responses
    Load Balancer (ALB)
| Web Server 1 | Web Server 2 |
Node.js Node.js
- Express
               - Express
| - WebSocket | | - WebSocket | | | | |
| Service | | Service | | Service |
| Instance | | Instance | | Instance |
| Python | | Python | | Node.js | | Node.js |
|DataFusion|| RAG || Chat ||Companion|
 Redis
               | PostgreSQL |
                | Primary |
 | Cluster |
 | Cache |
             | PostgreSQL |
             | Read Replica
External Services:
```

```
NASA APIs | Weather API | OpenAI | Google TTS |
| - SMAP | OpenWeather | GPT-4 | |
| - MODIS | | | |
```

8. Data Flow Diagram

```
User
       Input: | Location, Voice, Text
      | WebAR Interface |
      Process 1.0
    Validated | Request
      | API Gateway | → | Auth Store |
      | Process 2.0 | D1 |
     Authorized | Request
| Insight Service | Chat Service |
Process 3.0 Process 4.0
NASA Adapter | RAG Pipeline |
Process 3.1
                Process 4.1
```

