**1. Project Title: "EcoAware UA: AI-Powered Climate Education Chatbot with Gamified Carbon Tracking"**

**Research Focus:** Digital solutions for enhancing environmental literacy among Gen Z

**Technical Specifications**

| **Component** | **Technology** | **Justification** |
| --- | --- | --- |
| **Frontend** | Flutter (Dart) | Cross-platform for UA students' varied devices |
| **Backend** | Firebase (Node.js) | UA-approved for quick deployment |
| **AI** | Dialogflow (Python) | Pre-trained NLP for Kapampangan/English |
| **Database** | Firestore | Real-time sync with UA student IDs |
| **APIs** | Google Carbon Footprint API | Accurate activity tracking |

**System Flow**

Diagram

Code

Download

Climate FAQ

Log Activity

Student Opens App

Query Type?

AI Chatbot

Carbon Calculator

Personalized Tips

UA EcoLeaderboard

Rewards System

**Implementation Steps**

1. **Data Collection** (Weeks 1-4):
   * Survey 200 UA students on environmental knowledge gaps
   * Build Kapampangan-language NLP dataset
2. **Development** (Weeks 5-12):
   * Train chatbot with DENR climate materials
   * Integrate with UA's student portal API
3. **Testing** (Weeks 13-16):
   * Beta test with 3 UA student organizations
   * A/B test engagement strategies

**2. Project Title: "WasteWise UA: Computer Vision-Based Waste Classification for Campus Recycling"**

**Research Focus:** Optimizing UA's zero-waste initiative through AI

**Technical Specifications**

| **Component** | **Technology** | **Justification** |
| --- | --- | --- |
| **Frontend** | React.js | Fast PWA for UA janitorial staff |
| **AI Model** | TensorFlow.js (MobileNet) | Browser-based to avoid app installs |
| **Database** | MongoDB | Geospatial queries for bin locations |
| **APIs** | UA Facilities Map | Real-time bin status updates |

**System Flow**

Diagram

Code

Download

Recyclable

Contaminated

Staff Snap Photo

AI Classification

Update Bin Status

Alert Supervisor

Route Optimization

UA Dashboard

**Implementation Steps**

1. **Dataset Creation** (Weeks 1-3):
   * Photograph 5,000 waste items across UA campus
   * Label with UA Environmental Science students
2. **Model Training** (Weeks 4-8):
   * Transfer learning on pre-trained MobileNet
   * Achieve >90% validation accuracy
3. **Deployment** (Weeks 9-12):
   * Web portal for UA maintenance team
   * Integration with existing UA waste logs

**3. Project Title: "GreenLedger UA: Blockchain-Based Sustainability Credential System"**

**Research Focus:** Incentivizing eco-friendly behavior through verifiable credentials

**Technical Specifications**

| **Component** | **Technology** | **Justification** |
| --- | --- | --- |
| **Smart Contracts** | Solidity | Compatibility with UA's Ethereum node |
| **Frontend** | Svelte | Lightweight for UA's aging lab PCs |
| **Identity** | Polygon ID | Privacy-preserving for students |
| **Database** | IPFS | Immutable record of green actions |

**System Flow**

Diagram

Code

Download

Student Recycles

Mint Soulbound NFT

UA GreenScore++

Unlock Benefits

Scholarship Priority

Event Discounts

**Implementation Steps**

1. **Blockchain Setup** (Weeks 1-4):
   * Deploy private Ethereum node on UA servers
   * Create ERC-1155 contract for badges
2. **UA Integration** (Weeks 5-8):
   * Connect with student ID system
   * Train 10 "Green Ambassadors"
3. **Pilot Program** (Weeks 9-16):
   * 500-student test group
   * Measure behavior change vs. control

**Comparative Analysis**

| **Project** | **Language Focus** | **UA Department Alignment** |
| --- | --- | --- |
| EcoAware | Dart/Python | CS/Education |
| WasteWise | JavaScript/Python | IT/Environmental Sci |
| GreenLedger | Solidity/JS | IS/Business Admin |

**Next Steps Suggested:**

1. **Ethics Approval** - Submit to UA research committee
2. **Stakeholder Buy-in** - Present to UA Facilities + Student Affairs
3. **Grant Writing** - DOST-SETUP funding opportunities

**Need any of these customized further?** For example:

* Detailed UML diagrams for specific modules
* Sample datasets for AI training
* Budget breakdown per project phase