AI & SUSTAINABILITY IN VET EDUCATION

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Activity Reference: 3.2 – Project template for AI-SAVES@ProjectHub

Logo:

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AI-SAVES@PROJECTHUB PROJECT SUBMISSION TEMPLATE

This template provides a structured format for submitting projects to the **AI-SAVES@ProjectHub**. Each section should be completed thoroughly to ensure consistency and provide all necessary information for project evaluation and sharing within the hub.

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1. Project Title:

AI Plant Health Monitoring System

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2. Project Category:

AI in IoT

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3. Project Description:

This project presents the development of an automated system for monitoring plant health, integrating computer vision and AI to detect leaf diseases and assess environmental conditions, particularly soil moisture. Designed for urban and precision agriculture, the system supports sustainability by optimizing water usage and enabling early disease detection. It combines convolutional neural networks (CNNs), Raspberry Pi image capture, and ESP32-based soil moisture sensors. The result is a self-contained solution that captures data, classifies plant health, and provides actionable irrigation and treatment recommendations.

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4. Keywords:

AI, Computer Vision, Smart Agriculture, Sustainability, Automation

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5. Target Audience:

Both Educators and Students

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6. Project Objectives:

- Automate detection of plant diseases via leaf image analysis.
- Optimize water usage through intelligent irrigation based on soil moisture.
- Provide actionable insights for treatment recommendations.
- Enable small-scale, urban agricultural producers to monitor crops with minimal technical knowledge.
- Promote sustainable agriculture by reducing water and pesticide waste.

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7. Project Timeline:

Start Date: February 15, 2025
End Date: June 15, 2025

Milestones:

- Problem and Objective Definition – February 15 to February 28
- Data Collection and Preprocessing – March 1 to March 14
- AI Model Development – March 15 to April 18
- Model Testing and Validation – March 29 to Abril 25
- System Integration and Automation – April 26 to May 23
- Sensor and Camera Integration – May 10 to May 30
- Final Testing and Optimization – May 31 to June 13
- Report Documentation – Concurrent

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8. Resources Provided:

- Raspberry Pi 5 with camera module (AI-SAVES Kit)
- ESP32 with capacitive soil moisture sensor (AI-SAVES Kit)
- Python source code for model training and deployment (ZIP)
- Project report (PDF)

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9. Tools and Technologies Used:

- **Hardware:** Raspberry Pi 5, ESP32, capacitive soil sensor
- **Software:** Python, TensorFlow/Keras, OpenCV
- **AI Models:** MobileNet, Xception, InceptionResNetV2
- **Others:** Stratified Split, Data Augmentation, Transfer Learning

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10. Step-by-Step Implementation Plan:

1. Define problem scope and project objectives;
2. Collect and prepare dataset using PlantVillage;
3. Perform exploratory data analysis and apply Data Augmentation;
4. Split dataset using stratified method into training, validation, and test sets;
5. Train and fine-tune CNN models (MobileNet, Xception, InceptionResNetV2);
6. Evaluate model performance using metrics like accuracy, F1-score, ROC curves;
7. Deploy best-performing model on Raspberry Pi;
8. Set up image capture via Raspberry Pi camera and data transmission from ESP32 sensor;
9. Integrate soil moisture readings and automated irrigation logic;
10. Implement real-time diagnosis and PDF report generation;
11. Conduct final tests and collect feedback for improvements.

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11. Evaluation Criteria:

- **Accuracy of Disease Detection:** Model performance above 96% accuracy;
- **System Integration:** Reliable communication between sensors and Raspberry Pi;
- **User Feedback:** Clarity and usability of generated reports and interface;
- **Sustainability Impact:** Reduction in water use and pesticide application.

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12. Languages Available:

Portuguese

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13. Contributors:

- **Sara Catarina Freitas Macedo** (Student, Project Developer) – System design, AI model training, and integration.
- **Prof. Paulo Sérgio dos Santos Matos** (ISEP Supervisor) – Academic guidance and technical oversight.
- **Prof. Maria Goreti Carvalho Marreiros** (ISEP Co-supervisor) – Support in system analysis and integration strategy.
- **Ana Lúcia Soares Machado** (External Supervisor) – Agricultural application and real-world validation input.

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17. Feedback and Continuous Improvement:

- Feedback will be collected via surveys post-testing phase.
- Observations from controlled test environments will be documented.
- Periodic review meetings with supervisors will guide refinements.
- Future iterations aim to add remote interface, security layers, and cloud connectivity.

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