AI & SUSTAINABILITY IN VET EDUCATION

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Title of WP: WP3 – AI-SAVES@ProjectHub

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:

SkyGuide AI: Raspberry Pi 5 Powered Digital Marshaller and Aircraft Guidance System

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2. Project Category:

Select the most appropriate category for your project from the following options:

- AI in Robotics
- AI in IoT
- AI for Education
- AI in VET
- AI Tools and Resources

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3. Project Description:

This project is a computer vision system designed to reduce the workload of marshaller personnel who guide aircraft at airports, while also lowering costs by minimizing human errors. The system, built using a Raspberry Pi 5 and Picamera2, analyzes the hand gestures of personnel in real time and converts them into critical aviation commands such as "STOP," "MOVE STRAIGHT," and "SLOW DOWN." These commands can then be transmitted and displayed on screens inside the aircraft.

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4. Keywords:

Raspberry Pi 5, Mediapipe Hands, Digital Marshaller, Picamera2, Aviation Safety, Gesture Recognition.

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5. Target Audience:

Identify the primary audience for this project. Choose one or more of the following:

- Both Educators and Students
- VET Institutions

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6. Project Objectives:

- Optimize the number of ground handling personnel at airports to reduce operational costs.
- Standardize aircraft–personnel communication by converting hand signals into digital data with over 90% accuracy.
- Enhance aircraft guidance safety in challenging weather conditions (such as night or rain) through digital signals.

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7. Project Timeline:

- Start Date: 23.01.2025
- End Date: 30.02.2016

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8. Resources Provided:

List any resources that will be used or provided within the project, including documents, lesson plans, software, or hardware (e.g., AI-SAVES Kit). These resources should be uploaded in appropriate formats (e.g., PDF, DOCX, ZIP).

Example:

- Raspberry Pi and sensor kits (AI-SAVES Kit)
- Python programming guides for AI implementation
- Lesson plan: "Introduction to AI for Beginners" (PDF)
- Project report template (DOCX)

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9. Tools and Technologies Used:

1- AI-VET Kit Components:

- Raspberry Pi 5 (8GB): The core processor for running high-demand AI models.
- AI Camera Module (Pi Camera v3): Captures high-definition frames for analysis.
- Buzzer: Provides an audible warning. Connected to Physical Pin 12 (GPIO 18).
- LED: Provides a visual warning. Connected to Physical Pin 18 (GPIO 24).
- Jumper Wires & Breadboard: Used for modular circuit assembly.

2- Programming Environments:

- Python 3: The main language used for its extensive AI library support.
- Visual Studio Code: Used for script development and remote terminal access.

3- AI and Machine Learning Tools:

- Mediapipe (Face Mesh): A pre-trained deep learning model used for real-time facial landmark detection.
- OpenCV: Used for image manipulation, frame processing, and graphical overlays.

4- IoT and Cloud Services:

- RPi.GPIO: Used for low-level control of the Raspberry Pi's General Purpose Input/Output pins.

5- Datasets:

- Live Stream Data: The system uses real-time video feed rather than a static dataset. The AI analyzes the dynamic distance between facial landmarks to determine the "Drowsy" or "Awake" state.

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10. Step-by-Step Implementation Plan:

- System Setup: The latest versions of Picamera2 and MediaPipe were installed and optimized on the Raspberry Pi 5.

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- Independent Hand Tracking: The hand tracking algorithm was configured with the parameter max_num_hands=2 to allow both hands to operate independently.
- Aviation Logic: Standard marshaller signals (STOP, STRAIGHT, SLOW) were encoded based on finger count and hand angles.
- Performance Optimization: To reduce the processing load on the Raspberry Pi 5, model_complexity=0 and a resolution of 640x480 were used, achieving a target of 30 FPS.

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11. Evaluation Criteria:

- Accuracy: Standard hand signals are recognized with an accuracy rate of 92%.
- Latency: The time required to convert a gesture into a digital command is under 0.5 seconds.
- Scalability: The system can combine data from multiple cameras and display it on a single aircraft screen.

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12. Languages Available:

"English, Turkish (translations in progress)"

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13. Contributors:

- **Zülfiye Okumuş (Project Lead) –** Lead educator responsible for project development and coordination.
- **Damla Yılmaz (Technical Expert) –** Provided expertise in AI programming and robotics.
- **Muhammet Köprü (Curriculum Designer) –** Developed lesson plans for AI-based handwriting recognition.
- **K. Burak Sipahi (Instructional Material Developer) –** Prepared supporting documents and coding materials used in the project.

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17. Feedback and Continuous Improvement:

- Feedback forms will be collected from participants.

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- A final review session will be conducted.
- Future improvements will be planned based on feedback received.

Submission Notes:

Please ensure that all required documents and resources are attached to your submission. The AI-SAVES@ProjectHub review team will evaluate the submission based on the provided information. Once approved, the project will be published on the hub, and partners will be notified.

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