AI & SUSTAINABILITY
IN VET EDUCATION

AI-VET MOOC PROJECT SUBMISSION TEMPLATE

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1. Project Title:
Eco-robotics: route optimization according to the amount of waste in a container

2. Project Category:

- ☐ **AI for Sustainable Development**
- ☐ **Connected Systems and Smart Data (AI + IoT)**
- ☐ AI for Industry 4.0
- ☐ Social Impact and Inclusive AI
- ☐ Computer Vision and Image Recognition
- ☐ **Predictive Analytics and Decision Support**
- ☐ **Intelligent Automation and Control Systems**
- ☐ **Smart Environments and Monitoring**
- ☐ Other:_____

3. Project Description:

The project's main goal is creating optimized routes for collection of waste in dumpsters, while also being able to alert of flood and fire in said dumpsters. The collected data is showcased on a website hosted on a Raspberry Pi 5 that has real time tracking of the trucks and their routes, rerouting, observing the current state of any selected dumpster, and viewing past data on a graph for select dumpsters.

4. Keywords:

Ecological, Monitoring, Optimization, Routing, Analytics.

5. Target Audience:

- ☐ Educators
- ☐ Students
- ☐ **Both Educators and Students**
- ☐ **VET Institutions**

6. Project Objectives:

The objective of this project is cleaning the environment from garbage because of overfilled dumpsters, as a side effect of the way I collect data we are able to alert sanitation services about any emergency (fire/flood) if needed. Due to sending garbage trucks only when needed we also contribute to lowering air and traffic pollution. As a direct outcome we arrive to having a cleaner environment and greener scenery that would attract more tourists and encourage people to go outside and stop

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littering so much, and directly help the air quality due to exposing garbage to direct sunlight less often.

7. Project Timeline:

- Start Date: 20.01.2026
- End Date: 23.03.2026

8. Tools and Technologies Used:

1. Hardware parts used: Raspberry Pi 5, ESP32-S3 WROOM Devkit, HC-SR04 Ultrasound sensor, DHT11 Temperature and humidity sensor.
2. Programming environments: Visual Studio Code using the Platformio extension for programming the ESP32, Base VS Code for the code used for the websites and server code (Which is in Node.js)
4. IoT and Cloud Services: The connection between the ESP32 and the server (Rpi 5) is established using the built in Wi-Fi modules which connect to the same network and send data through the same.
5. Datasets: I used the data collected from the temperature and humidity sensor alongside the ultrasound distance to determine the fill level of a given dumpster, it's temperature and humidity to determine if it's on fire or if it's flooded.
6. Additional Tools: I use Traccar to track the current position of dumpsters and trucks. Leaflet to display an interactive map on the website. PostgreSQL to collect and store sensor data. Node.js for turning the Rpi 5 into a server and executing code to optimize the routes and determine if a dumpster is in an emergency.

9. Step-by-Step Implementation Plan:

Concept and Planning
The objective of this project is cleaning the environment from garbage because of overfilled dumpsters, as a side effect of the way I collect data we are able to alert sanitation services about any emergency.

Hardware Setup – Using the AI-VET Kit
I am connecting the DHT11 and HC-SR04 sensors to the ESP32 Devkit and power all of those using a 3.7V Li-Ion battery

Data Collection and Preparation
My project collects temperature, humidity, and distance (for measuring fill level of a dumpster), using this data i can determine of what importance emptying a dumptser is..

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Programming and AI Configuration
The code is written in Visual Studio Code, where i use an extension called Platformio that allows me to program a microcontroller like the ESP32, which helps me collect and send data over to the server (Raspberry Pi), the libraries used can be found in the "platformio.ini" file on my github

Testing and Validation
I tested the prototype using false dumpster info that changes every 5 minutes to see how my routes change, alongside 3d printing a case for the hardware components bit by bit to see if i have gotten the dimensions right.

Final Demonstration and Reflection
The challenges i faced were configuring the ESP32 to send data over internet to the Raspberry Pi, and getting the Raspberry Pi to function as a server, alongside finding tools like traccar and leaflet which assisted me greatly in completing this project. A video of my project in action can be found on my youtube channel, directly accessed via the link in a box below

10- Code

Include the full source code used in the project. If the code is long, provide a link to a GitHub repository or a cloud service where the user can download the code. Annotate key sections of the code to explain its functionality.

https://github.com/OnEjUmPiBoI/Smart-Route-System

11. Evaluation Criteria:

- **Project Success Metrics: Successful completion of robotic tasks using AI applications.**
- **Skills Assessment: Measure students' proficiency in AI programming and robotics assembly.**

12-Credits

Jane Majnovski
Mihail Raicevic

The credits can be found on my GitHub, in the link found above this box

13- Video presentation link (max. 5 minutes)

https://drive.google.com/file/d/1FMj_ofwhfEmiA2x8ONEvXzn-STZZYF3c/view?usp=drive_link

14- Declarations

I declare that I have read and agree with the following statements:

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1- The project is original and developed by the listed team members.
2- All technologies and sources are properly cited.
3- The project was developed using components from the AI-VET kit.
4- We authorize the dissemination of the project for educational and promotional purposes (non-exclusive rights).

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