Service ID S00106

Location   Italy, Remote

Design of test environments for physical testing

Provider service

Politecnico di Milano (POLIMI), Università degli Studi di Milano (UMIL)

Link to content

https://agrifoodtef.eu/catalogue-of-services/design-test-environments-physical-testing

Type of Sector

Arable farming, Greenhouse, Horticulture, Tree Crops, Viticulture

Accepted type of products

Design / Documentation, Physical system

Type of service

Test design

Description

Any physical test activity involves three main components: environment (where the tests take place), protocol (defining what tests are executed and how) and evaluation metrics (used to assess the results of the tests). This service concerns the first element, i.e., the design of a physical testing environment for use cases such as (for instance) weeding, plant phenotyping, and precision spraying solutions. The protocol and the evaluation metrics can -if required- be designed via services S00107 and S00108. Depending on your requirements and reference system/solution to be tested, our team will design an ad hoc setup equipped with all the required features for testing. Environmental features include, for example: the crop and weed species to be prepared and their growth stage, the plant layout and intra-row configuration, seasonal weather and climate-related conditions (e.g., lighting conditions, wind, rain), the type of soil, moisture level, and terrain conditions (e.g., uneven terrain, presence of any slopes, and so forth), the technical infrastructure supporting the tests (e.g., electrical layout, network infrastructure, environmental sensors, data acquisition systems…). In order to consider all aspects of the environment, this service involves a team comprising both engineers and agronomists.

How can the service help you

Building a system (e.g., a machine) that solves a problem and designing the optimal experimental environment to evaluate the performance of the machine are two very different activities and involve very different competencies. The test environment heavily influences the significance of the results and the possibility to use them to identify ways to improve the system.

This service supports customers who developed a solution in designing the environment necessary to validate its efficacy and to demonstrate its performance to potential users. At the end of the service, customers are provided with a complete environment design tailored to their own systems and necessities, which they can immediately use to set up experimental activity.If required, AgrifoodTEF can support the customer in designing also the testing protocol and evaluation metrics (via services S00107 and S00108), in the setup of the experimental activities (via services S00110 and S00111), and in the execution of the tests (service S00112) and associated data collection (service S00113).

If needed, AgrifoodTEF can also provide support with performance evaluation (service S00114), thus offering the full set of activities composing an experimental testing pipeline.

How the service will be delivered

This service description is intentionally generic. Every instance of this service is, in fact, customised to adapt it to the needs and requirements of the specific customer. The following is an example of a service instance.Example service: the customer asks for the design of the environment needed to test the performance of a weeding robot.

On the agronomical side, the designed environment comprises 2 groups of 3 10-metre-long cultivated rows; one group receiving full sunlight and the other receiving shaded sunlight through trees. The rows are part of fields located in the northern part of Italy. Each group of 3 rows includes bean plants and Matricaria weeds, with the density of Matricaria chamomilla increasing from one row to the next (3 levels). The presence of weeds different from Matricaria in the test environment is kept at a negligible level via manual weeding immediately before the tests.

The technical aspects of the designed test environment include a weatherproof 230 V AC network for powering test equipment, an RTK GPS base station to provide the robot with a localisation signal, a wireless network for interconnection between the robot and local infrastructure and software interfaces enabling data acquisition from the robot to a local server and check/preprocessing activities by the server.

Service customisation

The duration of this service is on average 3-6 weeks.The first phase involves one or more interviews, in person or remote, where the customer provides information about the features of the system(s) to be tested and the performance elements of interest. Additional documentation (e.g., machine dimensions and subsystem specifications) may be asked for (under NDA if confidential) in order to precisely match the designed environment to the necessities of the customer.Subsequently we design and plan specific environment features.

These include agronomical aspects (such as planning the procurement and planting of specific crop and weed types, applying specialised treatments, etc.) as well as technical aspects (such as the type and configuration of hardware and software supporting test execution and data collection).At the end of the service, the customer receives a design that can be immediately employed to set up and perform the tests.