

Assegno di Ricerca

Sviluppo dispositivi elettronici per il progetto H2020-WeLASER

L'assegno di Ricerca si configura nell'ambito del progetto "WeLASER – Sustainable Weed Management in Agriculture with Laser-Based Autonomous Tools" di cui sotto si riporta un estratto degli obiettivi ed una sintesi delle attività di UNIBO.

"The research to be implemented is part of the Horizon 2020 project "WeLASER: *Sustainable Weed Management in Agriculture with Laser-Based Autonomous Tools*", funded by the European Union. WeLASER is a 3 year project with 10 partners from 8 European countries including key stakeholders from the multi-actor activities in the project.

A growing global population demands increasing food production, which requires increasing use of pesticides and fertilizers. About 130 million tons of herbicides per year are used in Europe alone that persist in the environment, destroy non-target plants and beneficial insects for the soil and produce health effects in animals and humans –cancer, birth defects and endocrine disruption. Moreover, existing herbicides become more and more ineffective due to the evolution and spread of herbicide-resistant weeds. Substitution of herbicides by mechanical automatic systems is under study, but mechanical solutions contribute to deteriorate the soil properties, harm beneficial soil organisms and provide poor results for in-row weeding. WeLASER solution focuses on non-chemical weed management based on applying lethal doses of energy on the weed meristems using a high-power laser source. An AI-vision system discriminates crops from weeds and detects the position of the weed meristems to point the laser on them using a laser scanner. An autonomous vehicle carries these systems all over the field. A smart controller coordinates these systems and uses IoT and cloud computing techniques to manage agricultural knowledge. This technology will provide a clean solution to the weeding problem and will help to decrease significantly the chemicals on the environment. The required technologies for building this system and the number of actors needed to push it close to market demands the participation of ten experienced groups not easily found at the national level. Moreover, the cost of this high-technological equipment exceeds the funding levels of national organizations and claims the collaboration of large governmental institutions. Thus, with the EC help, WeLASER will put to work a large group of actors and stakeholders to advance in achieving the demanded productivity in agriculture while making the environment more sustainable and enhancing health to animals and humans. The project aims to establish a national community of short food supply chains (Innovation and Collaboration Hub) in Italy and a virtual innovation hub in order to facilitate stakeholder engagement, bringing farmers and consumers together in a trust-enhancing environment enabling them to generate demand driven-innovations. Combination of scientific and practical

knowledge and the use of innovation workshops will enable the development of practical innovative solutions as well as the promotion of a framework for different forms of

collaborative short food supply chains in urban and rural areas. The incumbent will participate in the research and innovation activities planned in the SMARTCHAIN proposal, in close collaboration with the UNIBO staff and the project partners.

Role of UNIBO - UNIBO has in WeLASER different roles in the 8 Workpackages: WP1 - Open-ended multi-actor networking and activities: from initial specifications to exploitation, WP2 - Laser-based weeding system: Development and impact, WP3 - Weed-meristem perception system, WP4 - Autonomous vehicle for laser, WP5 - Industrial integration and evaluation, WP6 - Knowledge spread and innovation, WP7 - Management and coordination, WP8 Ethics requirements.

UNIBO is leader of WP6, and specifically of Task 6.4-Data Management plan. It takes part in every task involving multi-actor activities, and has a main role in the TASK 4.4 – IoT and cloud computing –integration and management. The integration and evaluation of the IoT devices and Cloud Computing will be performed in three sub-tasks:

Subtask 4.4.1 - Development and tests of field IoT devices: the ground devices for environmental monitoring and the independent warning system will be designed, tested in the laboratory and in the field together with the proper networking infrastructure.

Subtask 4.4.2 - Development and tests of the onboard IoT devices: the boarded devices with sensors for the state of rovers/robots will be developed and tested in the laboratory and on the machine, together with the proper interfaces and verifying noise levels.

Subtask 4.4.3 - Development and tests of the cloud system: in parallel to the design of firmware for sub-tasks 4.4.1 and 4.4.2 data structures and protocols will be fitted to the data-management system, which will also respond to the requirements of the DSS (Task 4.3). In this project, an open Object-Relational DataBase (ORDB), based on MongoDB, will be set-up to host persistent historical information collected from fix and on-board IoTs. The software developed and used to carry out this task will be also based on FI-WARE and will consider cybersecurity aspects and measures to stop potential threats (hardware, operating systems and applications).

Piano delle Attività

Il progetto "**Sviluppo dispositivi elettronici per il progetto H2020-WeLASER**" ha due principali obiettivi.

OP - un obiettivo legato alle attività dell progetto WeLASER, inquadrato nella ricerca scientifica applicata. Esso comprenderà un'analisi della letteratura e compilazione dello stato dell'arte sui dispositivi da sviluppare e già studiati e applicati in Agricoltura, riguardanti sia aspetti hardware (alimentazione dispositivi LowPower, connettività,..) che software (programmazione embedded, protocolli di comunicazione, ..); stato dell'arte sui sensori e attuatori ambientali e meteo utilizzati in agricoltura sia a scopo applicativo che di ricerca. Lo studio sarà finalizzato alla fase di sviluppo; selezione di board, sensori, dispositivi accessori e involucro - progettazione e sviluppo di prototipi di dispositivi, test delle componenti e loro assemblati - sviluppo software embedded. Partecipazione al disegno delle prove sperimentali e alle attività in collaborazione con gli altri teams WeLASER.

OF - Obiettivo Formativo, associato ad un approfondimento delle competenze generali e specifiche riguardanti l'argomento della ricerca ma anche soggetti affini, associati ad arricchimento culturale e di linguaggio, ma anche competenze circa la gestione, l'organizzazione e la proposta di progetti di ricerca. L'Assegnista parteciperà a meeting di progetto, alla stesura di documenti di progetto, rendicontazioni, incontri orientati a nuove proposte progettuali e loro compilazione, corredati da corsi in lingua inglese di alto livello.

Gli obiettivi saranno ottenuti inserendo l'Assegnista di ricerca nelle attività scientifiche del gruppo di ricerca del Tutor proponente. L'Assegnista sarà coinvolto nelle attività di ricerca in atto presso il Dipartimento di Scienze e Tecnologie Agro-Alimentari e del Dipartimento di Informatica - Scienze ed Ingegneria (DISI), collaborando all'analisi dei dati ed alla rendicontazione finale.

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