

# BISEM

## Biodegradable Sensors for High Resolution Monitoring in Precision Agriculture

### Consortium

- SUPERELECTRIC S.r.l., Italy
- CNR-IMM, Italy
- AGROPECUARIA MORATILLA, Spain

### Sector

AGRICULTURE

### Duration

14  
MONTHS

### Challenge

In the past, farmers were walking through their crop fields randomly to monitor the crops when they felt it is needed in order to prevent diseases and increase the yield. This is fine in case of the small sized fields, but in case of the big ones, it's not the easy way of doing. Nowadays, it is still very important for modern farmers to continuously monitor in detail the health of their cultivations, especially in case of highly added value products such as grapes.

A detailed overview of the crop field can be obtained by a dense placement of sensors so that parameters like terrain moisture and temperature can be precisely measured. However, a lot of sensors means a lot of pollution.

### DIATOMIC Support

The DIATOMIC project management model helped BISEM Consortium to both reach the goals and prepare and deliver the reports: no energy has been dissipated thanks to a very close contact with Coaches that continuously controlled and monitored the evolution of the experiment in the Design, Development and Market phase. The Bootcamp in Athens and the Coimbra Sustainability Summit's sessions have enriched and consolidated the solid support that Coaches provided to the BISEM experiment. The pandemic effects have been perfectly managed by the Project that promptly has put in actions all the monitoring and corrective initiatives necessary and useful to complete the Experiment with a success.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 761809.



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### Solution

BISEM Consortium developed a new generation of biodegradable sensors that could be safely used by agronomists and farmers in order to get a clear and detailed view of the crop health on the fields. With the goal to offer our future clients a turn-key solution, we also developed a sensor placement robotic procedure with the use of drones. The BISEM Experiment drones are used for both sensor placement and sensor reading tasks. BISEM Sensors usually asleep and do not carry onboard any energy source that could imply even the smaller level of pollution for the environment: they are awoken and charged by an “electromagnetic whisper” produced by a dedicated reader Drone and answer to this whisper by transmitting the locally measured parameters. A fully automated Web based infrastructure (AGRIMAP.EU) processes data and provide the farmers with the results.

### Lessons Learned

- Good management in the most cases brings a desired success.
- One challenge were some technological aspects related to biodegradable material processes.
- To overcome this, the support of a very skilled Team from CNR-IMM helped us with very innovative solutions.

### TRL & Adopters

TRL level at the beginning of the experiment: **3**

TRL level at the end of the experiment: **9**

Number of early/first adopters raised during the experiment: **2**

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### Timeline

DIATOMIC's "Three Phases Approach" was a perfect fit for us. The Design Phase has been well balanced with respect to the Development Phase, whose tasks started as soon as the single subsystems requirements were consolidated and agreed by the DIATOMIC Team in the Design Review. Marketing activities started since the beginning of the experiment, as each partner was conscious of the need to promote and sell the BISEM Experiment results, even before they were physically obtained.

### Stakeholders

The BISEM Experiment has been carried out by SUPERELECTRIC personnel from the Rome premise with the continuous collaboration with CNR-IMM microelectronic people from the Rome Tor Vergata Labs for the development of the Biodegradable Technologies implemented in BISEM Sensors. Test fields in Spain were managed by AGROPECUARIA MORATILLA people both in terms of crop field preparation and sensor measurement control.

### End Users

Besides the Moratilla's wheat field in Spain, BISEM Biodegradable sensors and the Precision Agriculture Workflow managed by the AGRIMAP.EU marketplace, have also been adopted at the kiwi fields in the area of Aprilia (Italy) and Tenuta Pepe Vineyard in the area of Avellino (Italy) for the Taurasi wine. High added value fruit cultivation like strawberry and their producers are also considered as potential end users.

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### Key Results

Based on the characteristics of the sensors that are capable to perform complex data acquisition, local pre-processing and data transmission tasks by using very low energy levels generated by remote radio frequency illumination, BISEM Biodegradable sensors represent a real innovation in the field of IoT not only for the market of Precision Agriculture, but also in areas of Utilities, Food, Logistics and Health.

The BISEM Sensors can be used in all situations where the sensor can be positioned, without the need of any maintenance and at the same time, can be read by non-contact/proximal portable devices.

The complete integration with a Cloud based infrastructure allows the immediate use of the acquired data into GIS or 3D engines for the creation of innovative services.

### Impact

DIATOMIC project brought a strong increase on multiple competences for the BISEM Consortium.

SUPERELECTRIC personnel involved in the project improved its skills in the field of non-contact/proximal sensor activation.

CNR-IMM researchers tested innovative technologies for the development of mass production biodegradable sensors.

AGROPECUARIA MORATILLA personnel learned the importance of a correct placement of sensors in the crop field to get parameter measurements that are truly representative of the ongoing phenomena.

All the participants have observed strong evidence of how it is possible to get tangible results in a short time thanks to the application of good management procedures that drive passion and enthusiasm.

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## Testimonials

“ *Biodegradable sensors are really the only way to have a reliable positioning of fixed sensors network.*

– Antonella Pepe, End User

“ *The use of wood as a structure in BISEM biodegradable sensors make such devices really “Green”!*

– Nacho Moratilla, End User

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