METEOVIGNA1 –AGROMETEOROLOGICAL STATION FOR VINEYARD MONITORING AND PREVENTION AND MANAGEMENT OF PATHOLOGY AND PHYTOSANITARY TREATMENT (Rev.2 010120)

Meteorological and climatic conditions represent the factor that influence more la viticulture and in particular the onset of pathologies; thanks to new technologies, weather parameters can be acquired automatically by providing the farmer and the industry professionals with a valuable tool to prevent plant diseases and to perform any phyto-sanitary treatments to block infections.

In this respect, Geoves, strong in its multi-year experience in the field of monitoring and construction of professional meteorological sensors, has developed the agronomic stations of the **MeteoVIGNA** series with a **Butterfly** cpu that allows to detect the atmospheric conditions at risk and to forward them in a timely manner to a forecast model on the web (**W-Guard**).

This model allows to reduce the time of intervention in the vineyards and, at the same time, it permits to reduce the number of phyto-sanitary treatments in respecting of environment, end product quality and management costs.

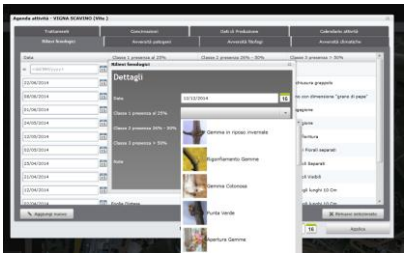
MeteoVIGNA1 station: how is it made and what it includes

Butterfly: It is the central unit, the core of the weather station which measures, displays, storages and transmits data remotely **via GPRS** on a secure internet site (FTP area); this feature combined with the very low consumption allows the station to be powered by a **small solar panel** without any need for connections. Butterfly is programmable and allows you to send **SMS alarms** to the occurrence of sensitive events for the development of vascular diseases such as, for example, rain> 10mm, temperature> 10 ° C, etc.

Weather sensors: Weather sensors for MeteoVigna1 are the temperature and humidity of the air, precipitation and leaves wetting. All sensors are made of robust and stainless materials, in accordance with **WMO** guidelines (World Meteorological Organization - Annex 8) and tested at primary calibration laboratories (Accredia and WMO); this aspect is of paramount importance to get a precise and reliable model.

Pole and accessories: The station support pole is extremely easy to assemble as it is enough to screw the base to the ground and fasten the pole to the base (no civil work is therefore required). All instrumentation is then fixed to the pole by means of clamps and collars supplied.

Meteograph Software & W-Guard Forecasting Model: MeteoVigna1 can be provided with free web software MeteoGraph which allows to display the data from a web page. Optionally, an annual web service is provided (W-Guard) to manage weather and field data (agronomist observations) and to prevent plant diseases and manage plant protection treatments.



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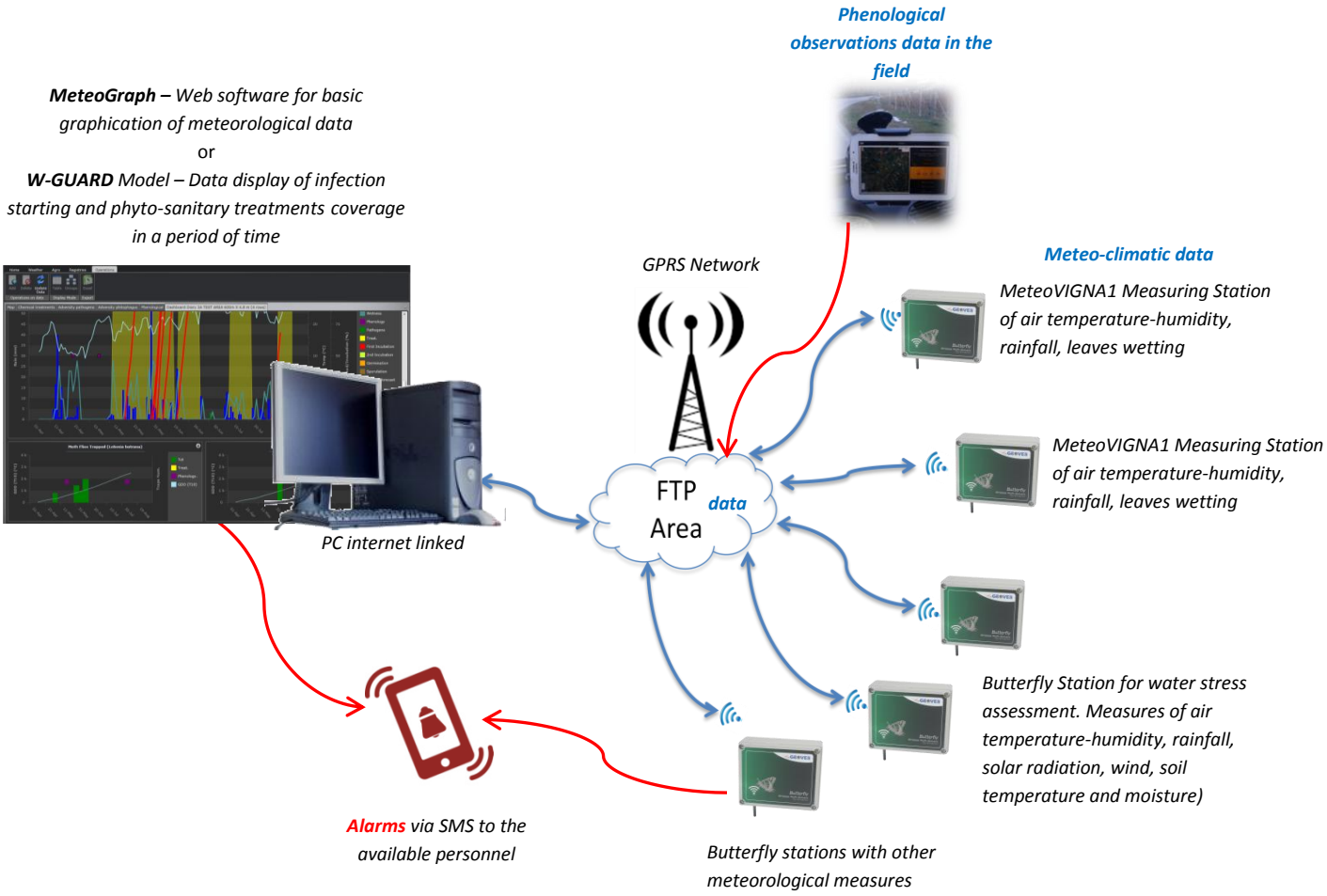
Functional layout and Logic of data and alarms transmission



Advantages

- ✓ Metallic meteorological sensors **WMO** compliant and **Accredia** certifiable
- ✓ High measuring accuracy and resolution
- ✓ Very low power consumption
- ✓ Compact and with low visual impact
- ✓ **Easy to install** in any land or green area **without civil works**
- ✓ No electrical and telephone connection
- ✓ Reliability in time and minimum maintenance required
- ✓ More than 70 types of connectable sensors
- ✓ Fully Italian technology
- ✓ Extreme operating conditions (presence of salinity, sand ice, agents, corrosive, high temperature hikes, etc.)
- ✓ Excel-compliant standard text format (CSV format), with all common commercial databases and software

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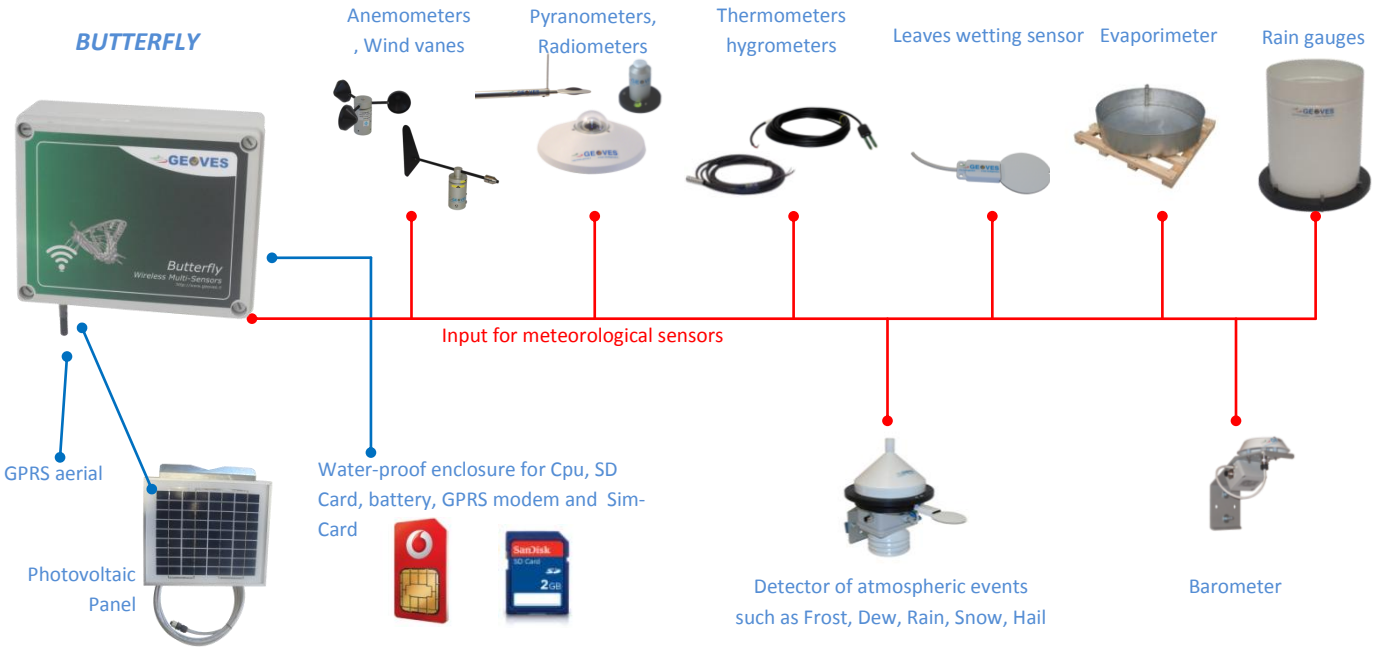
Instruments technical data

Datalogger	**Butterfly – Wireless multi-parametric sensor**
I/O Channels	5 analog inputs (in voltage or current), 1 dedicated input for battery monitoring 2 digital inputs used as pulse counter (eg. rain gauge), frequency-meter (eg. anemometer) or time counter from on/off contact (eg. rain presence, sunshine duration, leaves wetness, etc…)
Power supply	Rechargeable 12Vdc battery with 5W photovoltaic panel, integrated recharger with intelligent battery management (11,5Vdc: battery safe threshold; 12,5Vdc: threshold of power restore to the load)
Data communication	via GPRS on FTP area
Alarms transmission	via SMS or e-mail with change of data transmission rate
Programming	On site: setting of text file in the SD Card memory By remote: by sending of setting file on FTP area
Settable parameters	• Alarm threshold for every measure (settable as rising or falling overflows) • Storage rate (5, 10, 15, 30 or 60') • Transmission rate (5, 10, 15, 30 or 60') • Date and time with NTP synchronization (network time protocol)
Measuring	Elaborated data in the data storage period
Data format	.TXT standard text with CSV format (Comma Separated Value)
Data storage	Backup of 500 days data with circular storage
Conformity	Annex 8 – WMO (World Meteorological Organization)
Working temperature	-30…+70°C
IP56 Enclosure	Plastic material Dim.(LxHxP): 240x190x100mm, screw closure and universal brackets for mounting on the pole. Metallic bands with several diameters on request.

Type of connectable sensors



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INCLUDED METEOROLOGICAL SENSORS

	mSTAUR – Outdoor air temperature-humidity sensor
Temperature - Range	-40…+60 °C
Transducer	Pt100 with anti-radiation shields
Accuracy	±0.2°C
Rel. Humidity - Range	0…100 %
Transducer	Capacitive with anti-radiation shields
Accuracy	±2%
Compliance/test	Accredia

Model	RG200 – Rain gauge (available with anti-icing heater)
Range	infinite
Orifice area	200cm^2 (option: 400 cm^2)
Transducer	Double contact (n.o.) tilting bucket
Accuracy	Class B UNI 11452:2012 (class A connected to the Geoves' datalogger)
Resolution	0.2 mm/commutation (or 0.1mm 400cm^2 version)
Power supply	Without heater: none; With heater (Vers.-R): 12-24Vdc 60W

Model	WLS – Leaf wetness sensor
Measuring range	0…100% of leaf wetness
Transducer	Capacitive
Operative Temperature	-30…+60°C

OPTIONNAL METEOROLOGICAL SENSORS

Model	mWS1 – Wind speed sensor
Range	0…50 m/s (typical) gusts >75m/s
Transducer	Magnetic with sinusoidal AC signal not powered
Accuracy	±0.1m/s
Rotation	High performance bearings

Model	mWD1 – Wind direction sensor
Range	0…359°
Transducer	Linear Potentiometer with continuous 360°
Accuracy	±2°
Rotation	High performance bearings

Model	PIRSC – Silicon cell pyranometer
Measuring range	0…2000 W/m^2
Spectral Range	0.4…1.1µm
Transducer	Silicon cell
Accuracy (typ.)	±4%

Model	RHTT – Soil moisture (temperature and water content)
Range	RH: 0…60% VWC (Soil volumetric water content) T: -40…+60°C
Transducer	Capacitive (RH) and thermo-resistance NTC (T)
Outputs	n.2 0…5Vdc outputs (other on request)
Accuracy	RH: ± 3% VWC between 0 and 50VWC (standard mineral soil, EC <5 mS/cm) T: ±0.5°C (long-term stability: 0.1°C/year)

*Other meteorological sensors are available on request

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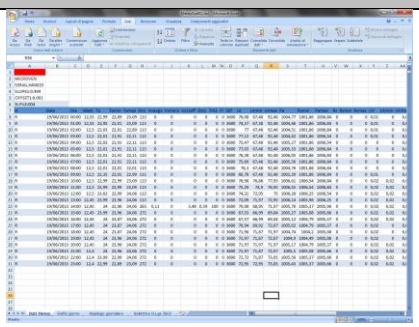
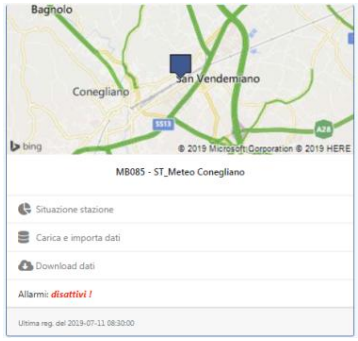
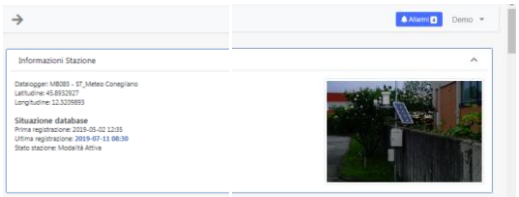
Geodesk&Meteograph – Setup software for Geoves datalogger and web service for data management

SOFTWARE **Model**	**Geodesk & MeteoGraph**
	**Geodesk** is a basic service software, free supplied with all Geoves datalogger, that can import data recorded (on SD card or sent via GPRS or transmitted by cable from the datalogger) and generate a single data file in Excel format. In this way it's possible to create data aggregation of desired period (eg. Monthly) and then derive the tabular and graphical reports. Besides Geodesk creates the setup configuration for the functioning of Butterfly, Micro3 and LPDL Geoves dataloggers
	**MeteoGraph** is a web application for the numerical and graphic display of data transmitted via GPRS on FTP area from environmental monitoring stations with Geoves datalogger. The software relies on an FTP Geoves area where data is sent autonomously by the control units at fixed times and are available in **standard text format** with fields separated by commas (**CSV format**). The data is therefore **always usable** without the need to use proprietary communication protocols or specific programs for data decoding; furthermore, the software **does not require any installation** as Internet access is sufficient and a username and password must be entered to enter the dedicated web page and display the measurements from a PC, tablet or smartphone. The data in text format are processed by MeteoGraph to obtain on the web page both the measurement in numeric format (eg average minimum maximum trend, etc.) and in graphic format that can be downloaded in jpg bitmap format.
	**Station dashboard** The available functions are: • *Station situation*: access to the graphic processing page and to the station's synoptic • *Load and import data*: the data saved on the datalogger SD card are imported, or on a PC folder (or other support) • *Data download*: data are downloaded in text format with fields separated by commas for simple backups or subsequent processing with other applications (eg Excel, Access, external databases or other commercially available software) • *Alarms*: access to the station alarm management menu (optional on request)

	**Station situation - *Station information***
	The parameters displayed are:
	• Station unique identifier (ID)
	• Name of the station
	• Geographic coordinates (Latitude and Longitude)
	• Data base status:
	  ○ Date and time of Start data storage
	  ○ Date and time Last data storage
	  ○ Operation status of the station
	• Photos of the station

	Real-time synoptic of the station The synoptic is a very useful tool for assessing the situation of the latest measurements taken by the monitoring station and assessing the meteorological or environmental situation of the site. For each

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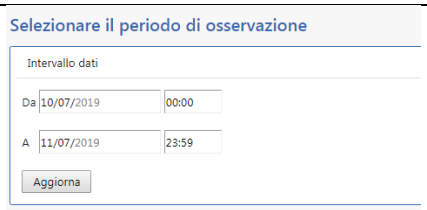
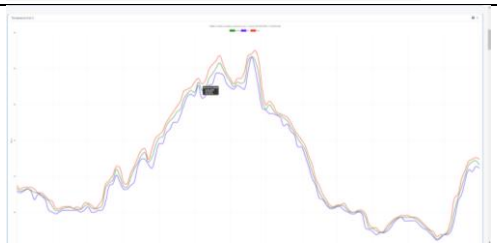
measurement it is possible to associate one or more dedicated processes. For example, for the temperature it is possible to indicate the minimum and maximum value and the time in which it occurred in addition to other calculated measures such as the dew point.
The synoptic also shows:

- calculated measures
- Diagnostic data (eg battery voltage)
- Significant data for the interpretation of the measure (eg barometric tendency, wind chill, monthly precipitation, etc.)

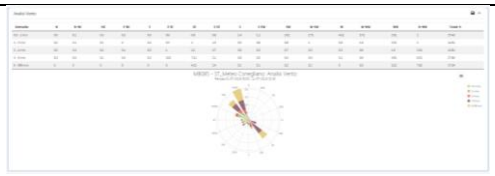


Observation period
It is possible to select the observation period in which to carry out all the elaborations that are displayed by MeteoGraph



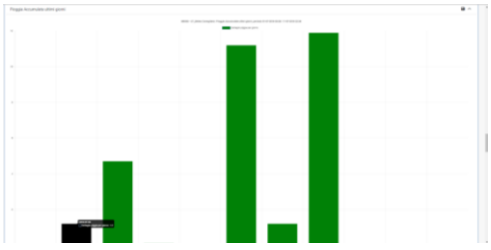
Graphic elaborations

- **Linear multi-line** for measurements where the arithmetic average is applied (eg temperature, humidity, pressure, etc.) with representation of the minimum and maximum value



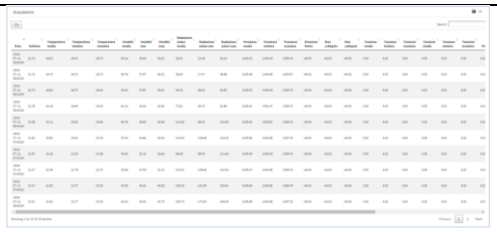
Graphic elaborations

- **Wind-rose** for the anemometer measurements

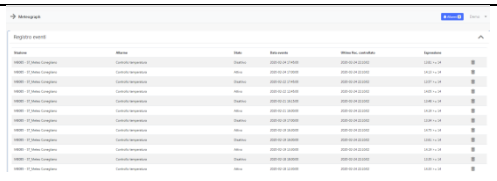


Graphic elaborations for precipitation

- Graph with hourly summation
- Monthly or annual precipitation histogram
- Other graphs are available on request or can be customized with simple filters



Tabular elaborations
Daily data table can be downloaded both in text and in .png image format



Alarm management
To manage alarms, the software allows you to set upward (> value) or downward (<value) intervention thresholds, after which alert emails are sent to the personnel in charge.
The alarms are then represented on the screen with adequate effects and colors to attract the attention of the operator

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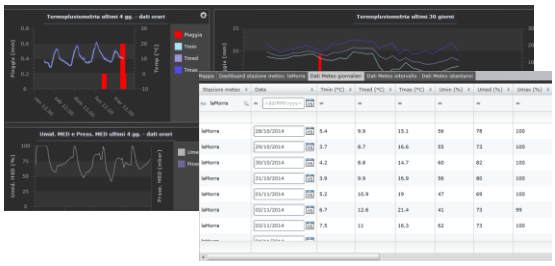
W-Guard - Web service with vineyard models

Model	W-Guard – Agrometeorological platform for vineyards management
 *Web application: geographic map with meteorological stations network*	**W-Guard** is a technological solution for the integrated management of phytosanitary plant protection. It manages and organizes weather measurements from field stations and data from agricultural crop monitoring, plant protection treatments and water supplies. The use of this infrastructure allows farms, technicians, and linked associations to be effectively supported in agronomic choices and in the management of integrated and biological defense. Two different applications can be used to ensure the accessibility and usability of agronomic information: 1. **DESKTOP APPLICATION** (In this web platform large amounts of data are accessed from a PC). 2. **MOBILE APPLICATION** (summary data is organized for quick access from a mobile device, eg tablet or smartphone).
 *Forecasting model for fungal diseases and catch of phytophagous insects*  *Meteo-climatic data elaboration*	**Main functions of the DESKTOP APPLICATION** The platform allows the display of meteorological data, the insertion and display of agronomic information, the publication of preloaded external cartographies and their organization in geolayer, which can be visualized and superimposed through GIS web support. The solution allows access to three functional areas: 1. **Agrometeorological Activities**: View and export data from meteorological stations linked to the platform in tabular and graphical format. 2. **Agronomic activities**: to storage field observations and phytopathological treatments by tracking map locations and managing the following information: *phenological findings, fungal pathologies, presence of harmful insects and catch management, adversity to weather events, treatments and fertilizers performed.* It also allows wine applications to display the result of the Peronospora (Plasmopara viticola) model using time data for temperature and humidity, precipitation and leaves wetting. The result of the model (based on the studies of Universities of Freiburg and Piacenza) is published by the system once a day in the period April-August. The same chart shows the treatments performed and the coverage period of the product used. 3. **Dissemination of data** by managing bulletins for farms and technicians: it allows the writing of texts, the association with an attachment and an agrometeorological bulletin prepared automatically by the system as well as the choice of the sending channel: mail , sms, fax, app

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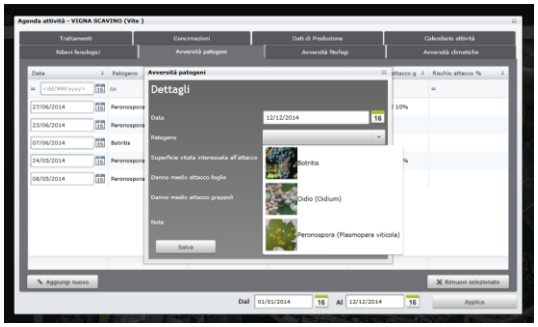
Mobile application: "Navigation" mode



Mobile application: window of field observations data insert

Main functions of the MOBILE APPLICATION (Android APP for Tablet and Smartphone)

This is an application designed for agricultural activities and for the needs of the technician; can operate in "navigator" mode, with continuous updating during car trip (on-line function).

The application allows you to enter and / or consult the following information:

1. **Field Observations:**
   - Phenology
   - Damage to pathogenic fungus
   - Presence of phytophages and insect captures
   - Climate Damage

2. **Management of treatments:**
   - Calendar
   - Product Archive
   - Phytopathological modeling (if included)

3. **Irrigation Monitoring:**
   - Water content control

4. **Meteorological monitoring**
   - Data consultation
   - Historical consultation
   - Graphic development and trends

W-Guard: Summary of the main features

AGRONOMIC FUNCTIONS	DESKTOP	MOBILE App
Drawing of vineyards on aerial photo	✓	✓
Drawing of cultural monitoring points on the map	✓	✓
Storage of phenological surveys	✓	✓
Storage of insect catching	✓	
Storage of phytophage visual surveys	✓	✓
Storage of pathogenic disease surveys	✓	✓
Storage of climatic disease surveys	✓	✓
Storage of treatments	✓	✓
Registration of fertilizers	✓	
Downy mildew (peronospora) prediction model	✓	✓
Oidium prediction model	✓	✓
Email alerts for exceeding alarm thresholds for critical weather events for phytopathic development (eg botrytis)	✓	✓
Photo capture and geo-referencing	✓	✓
Farm bulletin management module and automatic creation of an agrometeorological report for each station	✓	
METEOROLOGICAL FUNCTIONS		
Display of hourly data	✓	✓
Bioclimatic index elaboration and display	✓	
Data Export in Excel format	✓	
SERVICES by OPERATION CENTER		
Daily control of data quality detected by automatic and manual procedures	✓	
Quality control procedures for acquired data	✓	
Interpolation of data in case of anomalous failure or data due to sensor failure or pluviometers clogging	✓	
Reporting of any failure to the supplier of the meteorological stations	✓	
Data storage on cloud platform and SQL database – certified Datacenter ISO 9001:2008 - ISO 27001:2013 - ISO 20000-1:2011	✓	
Daily, Weekly and Monthly backup service	✓	

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