FONDAZIONE BRUNO KESSLER
MAGAZINE

Sensors to sniff the air

January 21, 2022

Funded by the CARIT Foundation, the TernAria project, led by FBK, involves Arpa Umbria, Airi and ADI. Proposed topic: the cycle of innovation, from research to a product on the market. FBK to continue its partnership with the schools of Terni for another 3 years

With the **TernAria project**, organized by the Research and Innovation Unit for Schools at Fondazione Bruno Kessler, the **intervention model in cooperation with schools**, perfected in recent years that includes research and development activities, is being shared by Trentino with Umbria.

The **Cassa di Risparmio di Terni and Narni Foundation** has funded the initiative that will involve the classes of **6 high schools** with more than **150 students**, the Regional Environmental Protection Agency **(ARPA Umbria)**, the Italian Association for Industrial Research **(AIRI)** and the Industrial Design Association **(ADI)**.

The final result will allow the Terni school community to replicate the exercise in other areas in the future (for example on scientific communication processes or social issues). For its part, FBK has committed for at least three years to providing schools and ARPA Umbria with its research activity on the subject of **environmental monitoring**. In this regard, the project has a complementary role with respect to other professional projects, already active in the area, managed by ARPA Umbria (**Air selfie** and **Air selfie 2**)

The training course is aimed at developing **air quality sensors** that will be **manufactured by students** during the current school year. As part of the project, researchers Andrea Gaiardo, Matteo Valt and Pietro Tosato visited the town of Terni on December 13 and 14, 2021.

The purpose of the visit was twofold. First, the **installation of low cost and low energy control units**, prepared with chemoresistive sensors (*) developed by the FBK MICRO NANO FACILITY group of the Sensor & Devices Center, for the disseminated monitoring of polluting gases. At the same time, the researchers gave the students of the "**Allievi-Sangallo" Technical School of Terni lectures and technical/practical lessons** on the technologies used for the development of the environmental monitoring control units.

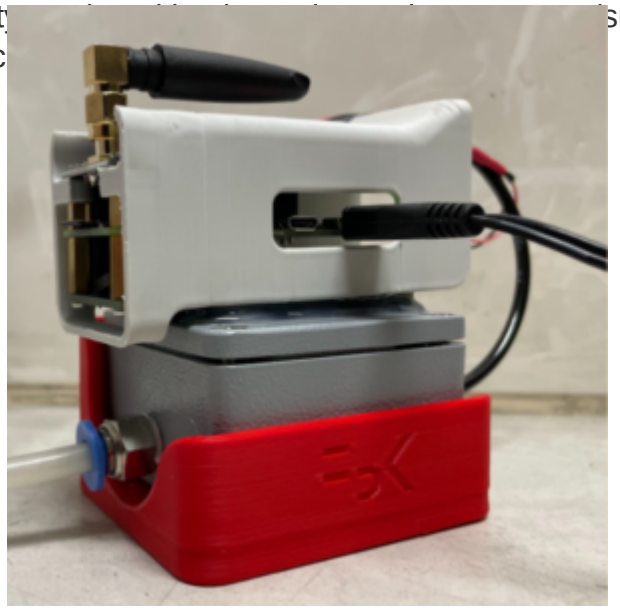
In the weeks preceding the visit, the researchers developed environmental monitoring stations in the Foundation's laboratories. The heart of these systems are the **chemoresistive gas sensors, a compact, low-cost and low-energy technology, which allows the concentration of polluting gases to be detected with high sensitivity, with detection limits of parts per billion.**

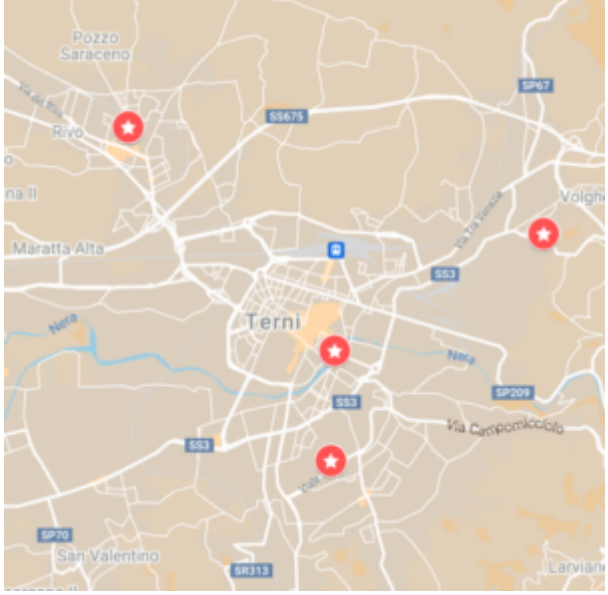
The recent development of innovative sensitive materials at FBK's MNF group has led to the construction of sensor platforms aimed at monitoring the **main environmental pollutants**, in this case **NOx (nitrogen oxides), CO (carbon monoxide) and ozone**.

In addition to the chemoresistive sensors, the **control units consist of dedicated electronics** that read the sensor signal and transmit the data collected to the cloud, **and a pneumatic system that allows external air to be flowed into the chamber containing the chemoresistive sensors.**

INSTALLATION

Monday, December 13, FBK researchers, assisted by **ARPA Umbria** Terni office staff, installed 5 environmental monitoring units in key points of the city with the aim of assessing the impacts on air quality such as heating and traffic) and by industrial sourc





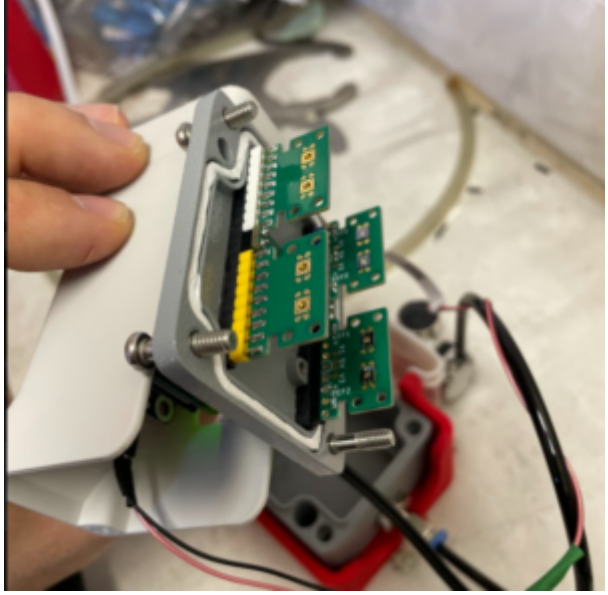
The control units were installed in the ARPA Umbria monitoring stations, with the aim of having, as an analytical reference, the certified systems of the environmental protection body. This step is essential to verify and validate the actual performance of innovative research systems for the qualitative and quantitative monitoring of pollutants, such as those developed at FBK. **The installed control units will collect data until September 2022, the project end date.**

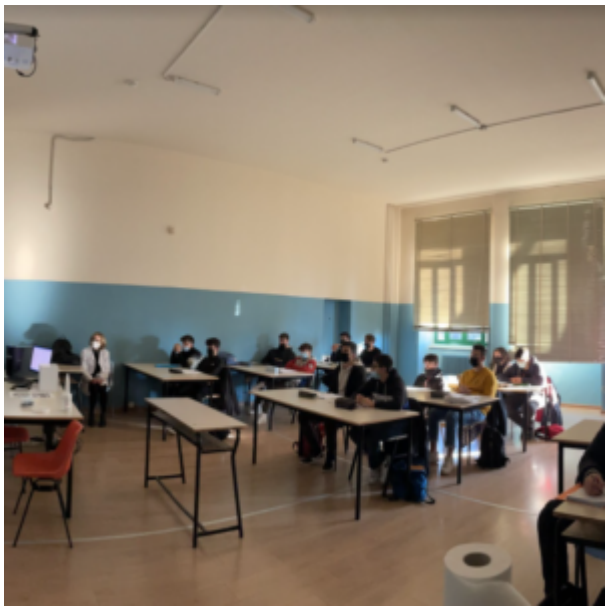
TRAINING

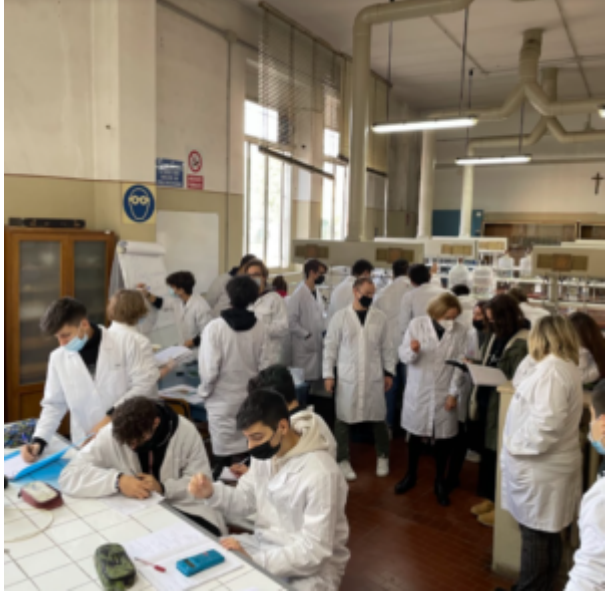
Tuesday, December 14, the FBK researchers met some of the classes involved in the project. In particular, researchers **Andrea Gaiardo and Matteo Valt** gave a technical/practical lesson on the synthesis of **sensitive materials used in chemoresistive gas sensors**, while researcher **Pietro Tosato's** lesson focused on the **development of the electronics used in FBK monitoring control units**. The students, under the supervision of teachers and researchers, will have to implement a solution similar to the one installed, to be used on motor vehicles. These will monitor the quality of air in motion and save the data on the cloud. Additional theoretical/practical lessons will be planned to this end.

As for the "chemical" part, students were trained on the type of sensitive materials that are currently used in chemoresistive gas sensors, the heart of the device itself. After a brief introductory theoretical presentation in the classroom, the meeting moved to one of the ITT chemistry laboratories, where the **students synthesized two nanostructured semiconductors, tin dioxide (SnO2) and zinc oxide (ZnO), two of the materials currently used for monitoring environmental pollutants**. The lab experiment took place under the supervision of FBK researchers, Prof. Claudia Fiorentini and ITT laboratory technicians.

By the end of the project, the students will manufacture and put into operation a control unit.







TernAria involves 6 high schools in Terni: ITT Allievi-Sangallo, Istituto di Istruzione Tecnico Economico Casagrande Cesi, Istituto di Istruzione Superiore Classico e Artistico (IISCA), Liceo Scientifico Donatelli, il Liceo Scientifico Galilei and Istituto Omnicomprensivo IPSIA S. Pertini • CPIA.

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