

Electronic Nose with Modulated Temperature Sensor Array for Classification of Tomato Paste



Víctor González, Alejandro Bernal, Félix Meléndez, José Ignacio Suárez, Jesús Lozano
Industrial Engineering School. University of Extremadura. Badajoz, SPAIN

INTRODUCTION & AIMS

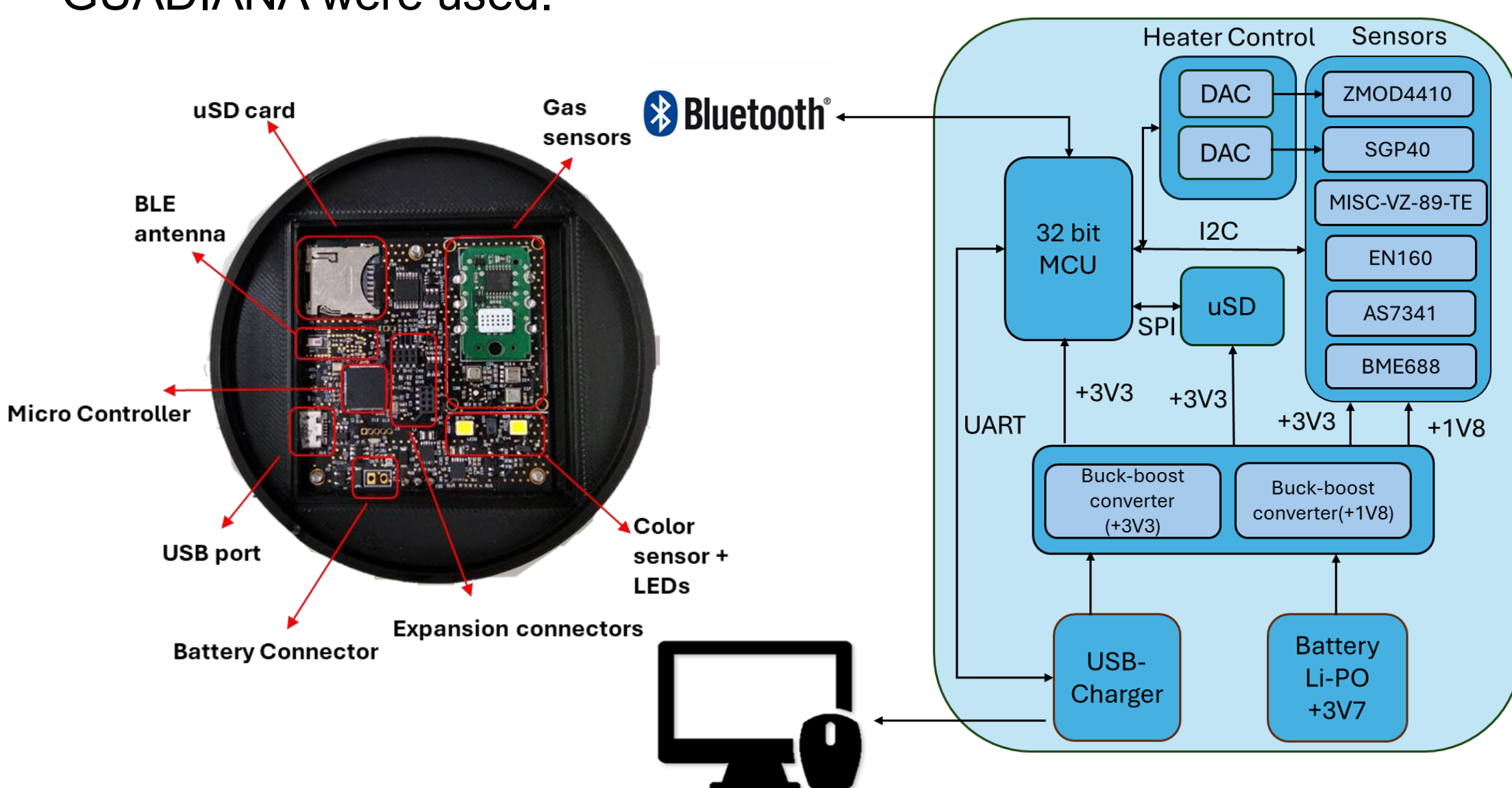
Tomato paste, widely used in foods like sauces and soups, is highly prone to microbial contamination and fermentation due to its sugar, acid, and moisture content. Undesired fermentation causes odor, gas, and color changes, leading to product rejection. Traditional quality checks are slow or destructive, while electronic noses with temperature-modulated sensors offer a fast, non-invasive method to detect spoilage through changes in volatile compounds. This work aims to use a temperature modulated electronic nose to measure fermented and non fermented tomato paste samples.

METHOD

The main features of the electronic nose are the following:

- Five digital MOX sensors (BME688, ENS160, SGP40, ZMOD4410 and MISC-VZ-89-TE) BME688 and ENS160 hotplate temperature are controlled via software, while SGP40 and ZMOD4410 were modulated by adjusting the heater voltage.
- One colour/spectrometer sensor (AS7341) with 12 different colour channels.
- Communication via Bluetooth Low Energy and USB also a SD card can be inserted for data storage.

Sensors were exposed to four triangular temperature/voltage cycles from 200 °C to 400 °C and 3.3 V to 0.5 V, respectively. Fermented tomato paste and control bags provided by TOMATES DEL GUADIANA were used.



Electronic Nose Designed

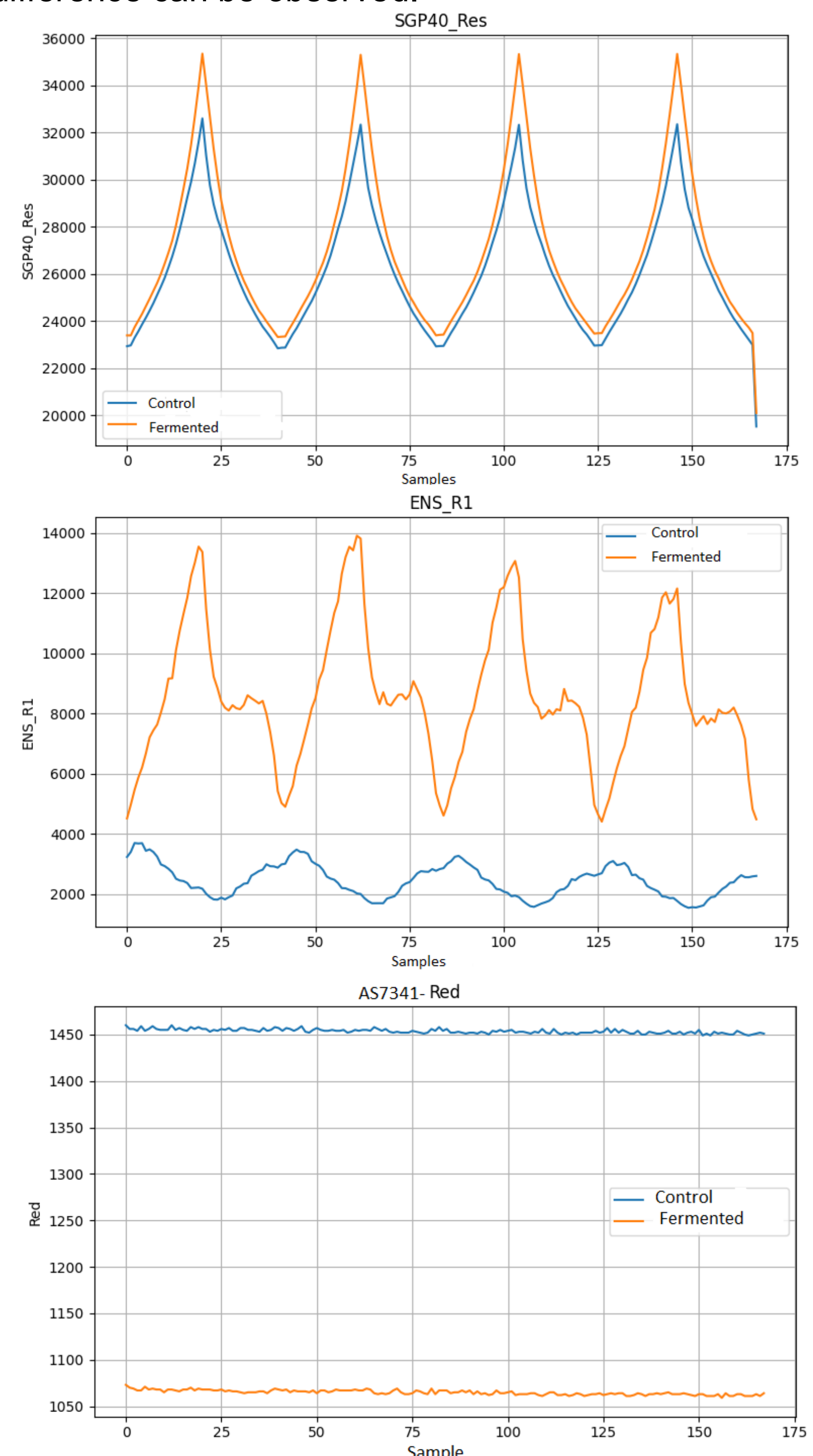
Electronic Nose Block Diagram

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RESULTS & DISCUSSION

The electronic nose showed distinct response curves when sweeping the sensor temperature. Fermented samples produced different VOC profiles compared to non-fermented ones. Also, colour difference can be observed.



CONCLUSION

This study confirms that an electronic nose with temperature-modulated MOX sensors can effectively distinguish between fresh and fermented tomato paste. The thermal response curves provide a unique fingerprint for each condition.

FUTURE WORK / REFERENCES

Huabin Liu, Ruijie Wu, Qianyu Guo, Zhongqiu Hua, and Yi Wu. 2021. "Electronic Nose Based on Temperature Modulation of MOS Sensors for Recognition of Excessive Methanol in Liquors" *ACS Omega*, 6 (45), 30598-30606 DOI: 10.1021/acsomega.1c04350.

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