

# Control and Monitoring Winemaking Process Online

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POSTER EXTENDED ABSTRACT

**Abstract.** In the process of wine production distributed sensor networks are used for monitoring parameters that enable constant wine quality. This paper presents an ongoing project for monitoring the conditions in the wine cellar and for controlling the wine fermentation process. Temperature and humidity sensors installed in the cellar are used to provide similar conditions for the barrels in the cellar. During the process of fermentation sensors located in the barrels are used to control the level of CO<sub>2</sub>, alcohol and temperature. The microcontroller PIC16F877A processes information obtained from the sensors and sends it to the server via Ethernet controller ENC28J60. At this moment only the on board temperature sensor is tested and is operational. We expect that data collected in the process of the exploitation of the system will be useful for the wine producers and will contribute to better quality of wines.

**Keywords:** Sensor networks, wine production, temperature sensor, humidity sensor, CO<sub>2</sub> sensor, alcohol sensor, microcontroller PIC16F877A.

## 1 Introduction

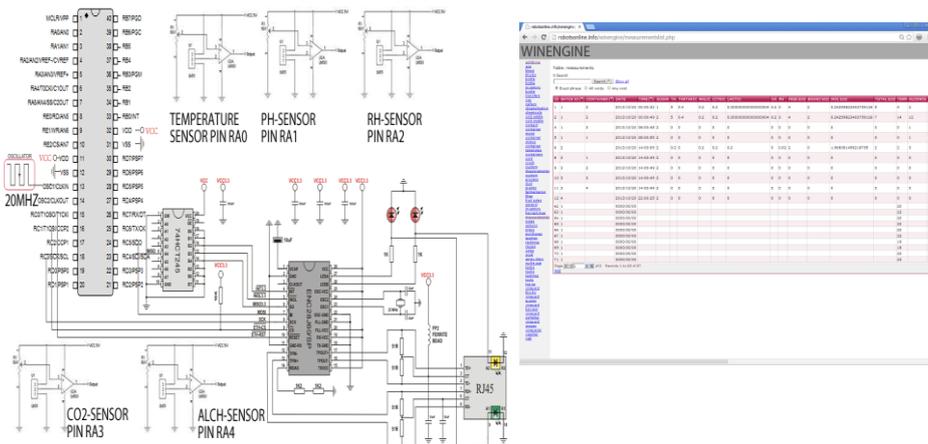
Sensors and sensor networks are used for different purposes [1]. For example, for habitat monitoring, agriculture [2], wine production [3], health care, etc.

Sensor networks located in the vineyard are used to gain knowledge about the relationship between soil and air characteristics and interventions like fertilization, treatment with chemicals and irrigation. Parameters relevant for these systems are: solar irradiation and temperature which affect the sugar level and the ripeness of grapes, and air humidity which stimulates the development of some fungi and could lead to spread of infections. Wind is monitored for planning the irrigation process because of its influence over vaporization.

In this paper we describe a prototype of sensor system for monitoring the parameters important for wine fermentation and production. The temperature in the fermentation process has impact on wine characteristics and quality. During the wine fermentation yeast transforms sugar into alcohol and CO<sub>2</sub>. The proposed low cost sensor network consists of microcontroller PIC16F877A, Ethernet controller ENC28J60, temperature sensor from Seed Depot, relative humidity sensor from SparkFun, alcohol gas sensor and CO<sub>2</sub> sensor from Parallax and pH probe from Vernier. Web application for storing sensor data is created using PHP script that reads XML file generated by the microcontroller and sends data to MySQL database.

## 2 Design of the Prototype and its Components

After analyzing the best suited sensors to the needs and microcontrollers a low cost prototype of the sensor system was developed. The system provides information for several parameters that have to be controlled during winemaking of the must fermentation process: CO<sub>2</sub>, alcohol, temperature and PH value.



**Figure 1:** Schematic design of the sensor network **Figure 2:** Screen-shot of the application

Microcontroller PIC16F877A processes data from sensors, turns information from analog to digital and sends it via Ethernet controller ENC28J60 through the SPI interface to the server (Fig. 1). The microcontroller has internal temperature sensor and an integrated Analog-to-Digital Converter, low price and low power consumption.

Part of the project is a web application that we started to develop (Fig. 2). The application stores the necessary data and covers the basic activities in the winery. PHP script reads sensor measurements from XML file and stores data to MySQL database.

As this sensor system is especially developed for small wineries not able to invest too much in technology, we therefore selected low cost components that were easy to integrate and program.

## References

1. Akyildiz, I. F., Su, W., Sankarasubramaniam, Y., Cayirci, E.: A Survey on Sensor Networks. IEEE Communications Magazine, vol. 40 no.8, pp.102-114. (2002)
2. Ruiz-Garcia, L., Lunadei, L., Barreiro, P., Robla, J. I.: A Review of Wireless Sensor Technologies and Applications in Agriculture and Food Industry: State of the Art and Current Trends, Sensors 2009, vol. 9, pp. 4728-4750. (2009)
3. Anastasi, G., Farruggia, O., Lo Re, G., Ortolani, M.: Monitoring High-Quality Wine Production using Wireless Sensor Networks. Proceedings of 42<sup>st</sup> Hawaii International Conference on Systems Science (HICSS-42 2009): Waikoloa, Big Island, HI, USA. (2009)