MOBILE APP FOR AIR QUALITY FORECASTING IN GUADALAJARA, MEXICO

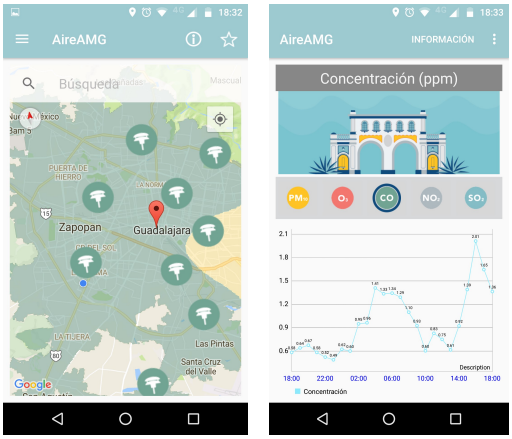
C. González-Figueredo (1), E. A. Egurrola-Hernández (1), H. De Alba-Martínez (1), R. L. Ramírez-Briseño (1), E. Magaña-Villegas (2)

(1) Technological and Industrial Processes Department, Western Institute of Technology and Higher Education (ITESO), Tlaquepaque, Jalisco, 45604, México;
(2) Biological Sciences Division, Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, 86150, México.
Presenting author email: figueredo@iteso.mx

Summary
AireAMG is a mobile app for air quality forecasting in the Guadalajara Metropolitan Area in Mexico. This app uses real-time air quality measurements of five criteria pollutants, along with meteorological data, to forecast air pollution concentration. A novel scheme of Artificial Neural Networks (ARN) coupled to Kalman filters is used to generate air quality predictions for up to 24 hours for each of the monitoring stations locations. We used these predictions to generate ozone and particulate matter dispersion maps, by interpolating with the Inverse Distance Weighted (IDW) method. AireAMG updates these forecasts and dispersion maps every hour, and is available for Android and iOS systems.

Introduction
Air quality is a growing concern in megacities such as Guadalajara, Mexico. Local air quality contingency plans must take into account air quality forecasting, in order to better react and prevent poor air quality episodes. In addition, the general population needs to have accessible information regarding air quality, in order to prevent their exposure to high air pollutants levels. Systems such as Urban Air in China (http://urbanair.msra.cn/En) and USA's National Weather Service (http://airquality.weather.gov/), offer real-time air quality forecasting to the general population. SIMAJ, is the Atmospheric Monitoring System for the Guadalajara Metropolitan Area (http://siga.jalisco.gob.mx/), and offers real time air pollution measurements, but fails to provide specific forecasting of air quality. AireAMG is a mobile app system that offers air quality forecasts, based on SIMAJ's air quality measurements and is available for Android and iOS systems.

Methodology and Results
SIMAJ, the Atmospheric Monitoring System for the Guadalajara Metropolitan Area has ten air quality monitoring stations distributed throughout the city. AireAMG takes from SIMAJ real-time concentrations of five criteria pollutants: ozone, carbon dioxide, nitrogen dioxide, sulphur dioxide and particulate matter PM_{10}; along with four meteorological parameters: temperature, relative humidity and wind speed and direction. These parameters are used as inlets for a novel scheme of Artificial Neural Network (ARN), coupled with Kalman filters (González-Figueredo & Ramírez-Briseño, 2016), to forecast air quality levels in each of the ten locations of the monitoring stations. Then, we use the IDW method to interpolate air quality levels, and generate pollutant dispersion maps. IMECA colour code is used to represent the pollution magnitude (Norma NADF-009-AIRE-2006), as shown in figure 1a. The mobile app can show a dispersion map for ozone and PM_{10}, since these two parameters are those that usually reach values superior to the norm.
AireAMG allows the user to select any location in the city, and a pop-up screen shows the forecasting for the five criteria pollutants, as shown on figure 1b. The user can also save their favorite locations in order to follow the air quality easily.



a) *b)*

Fig. 1 AireAMG mobile app interface: a) pollutant dispersion map, b) air quality forecasting.

Conclusions
AireAMG is the first mobile app in Mexico that offers air quality forecasts, not just real-time information. This app offers useful information for government agencies, and general population, and it can be used for decision-making regarding episodes of environmental contingencies.

Acknowledgement
This work was funded by SICyT and COECyTJAL, through the 2015 grant for developing mobile apps with high social and environmental impact.

References
Ramírez-Briseño, R.L., González-Figueredo C., 2016. "Sistema de Predicción de la Calidad del Aire en la ZMG, Technical Report, Western Institute of Technology and Higher Education (ITESO), México.
Secretaría del Medio Ambiente, 2006. Norma ambiental NADF-009-AIRE-2006 que establece los requisitos para elaborar el índice metropolitano de la calidad del aire.