SAFE: A Sensor-Actuator-based Early-warning System for Extreme Weather Conditions

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In the past years, damages caused by severe weather conditions have increased dramatically and scientists expect this trend to continue due to climate changes induced by greenhouse gas emissions. The SAFE project, funded by the German Federal Ministry of Education and Research (BMBF), aims at protecting the public against such threats. Its goal is to develop an integrated platform which combines distributed weather sensor networks with improved, location-specific weather prognosis modules and an early warning messaging system. This messaging system is used to provide both the general public and emergency services with personalized, situation-dependent information on upcoming extreme weather conditions. Furthermore, SAFE is able to steer remote-controlled actuators that induce automated countermeasures, such as closing open windows, retracting blinds, or disconnecting sensitive electronic equipment from the power grid.

The core component of the SAFE project is an information logistics platform, which – in accordance with predefined disaster prevention procedures – generates personalized disaster warning messages and distributes these to system subscribers. In a first step, weather data from global forecasting models is combined with localized weather information (e.g., gathered by weather radar) and translated into location-specific weather prognoses. Prognoses can be generated for all relevant natural areas in Germany (roughly 1,000 such areas are considered). For each of these areas, warning levels are defined and constantly updated. Warning messages for subscribers are generated by comparing the subscribers' location and their warning request profiles with actual warnings issued by the meteorological component. Messages are then delivered through the preferred communication media, which are specified by subscribers through an online interface. Messaging alternatives implemented so far allow for distribution via e-Mail, SMS, RSS feed, and through TV set-top boxes. The implemented solution was optimized with respect to high-throughput capabilities and the system has already proven these by distributing 13,107 SMS within

2:28 minutes to warn subscribers of an approaching hailstorm in the Vienna area.

The poster presented at the *GI days* forum shows the layout of the SAFE early warning system. Personalization and situation components, especially personalized message composition and delivery, are described in more detail, as is the integration of remote-controlled actuators into the system. A demonstrator accompanying the poster simulates message delivery and actuator control in a private home environment. Visitors can select a weather hazard situation by clicking on a button and the system then demonstrates its warning capabilities (e.g., by providing information in a running TV screen or by activating warning lights). Additionally, the demonstrator contains a roller blind and a set of sockets that can be remote-controlled if required by the hazard situation (storms, lightning, and so on).

The messaging component and the prognosis kernel of the SAFE system are already operational. The actuator control has been prototypically implemented and full-scale, long-term testing in a real-world environment is planned for late 2008.