WeatherUSI: User-Based Weather Crowdsourcing on Public Displays

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Abstract. Contemporary public display systems hold a significant potential to contribute to in situ crowdsourcing. Recently, public display systems have surpassed their traditional role as static content projection hotspots by supporting interactivity and hosting applications that increase overall perceived user utility. As such, we developed WeatherUSI, a web-based interactive public display application that enables passers-by to input subjective information about current and future weather conditions. In this demo paper, we present the functionality of the app, describe the underlying system infrastructure and present how we combine input streams originating from WeatherUSI app on a public display together with its mobile app counterparts for facilitating user based weather crowdsourcing.

1 Introduction

Public display systems are increasingly becoming part of the urban landscape. Most public displays today are simple slide-show systems that broadcast content in the form of static images. However, public displays envisioned in the near future will not only integrate content from a number of different sources, but also serve as data collection stations. Indeed, research has shown that public displays may hold a significant potential in "crowdsourcing", when motivational design and feedback validation mechanisms are employed [2]. Crowdsourcing is a process where a large number of volunteer users contribute information through an online platform. A well-known example of crowd sourcing is Wikipedia.

Crowdsourcing has recently been gaining ground in mobile devices leveraging both their abundance and their increasingly available on-board sensors. Within this context we previously developed Atmos [5], a mobile app that collects both human and sensory weather related input, for providing highly localized weather information via a network of mobile devices. Collected input is clustered by location, processed and instilled back into the network of mobile devices. In order to increase the system's user base, along with the android and iOS counterparts, we recently designed a public display version of Atmos, called WeatherUSI and deployed it at University of Lugano (USI) [3]. With WeatherUSI we plan to explore how the act of weather crowdsourcing on public displays differs from the existing use of Atmos on mobile devices. In fact, we have found that humans can be somewhat accurate when they estimate current weather conditions and even when they perform short-term weather predictions, on a mobile

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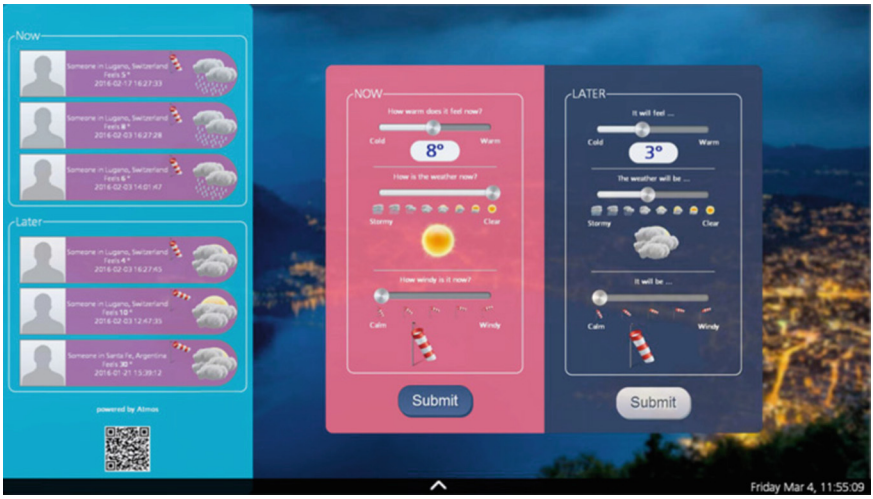

Fig. 1. The WeatherUSI app interface comprised of "NOW" panel for obtaining user input on current weather conditions (i.e. report) and "LATER" for future weather conditions (i.e. prediction), respectively. On the left part, global crowd updates are displayed, as they get collected.

device [4]. Apart from the data collected through the weather reporting interface, we also hope that the public nature of display systems will open up novel ways of studying crowdsourcing activities in situ through direct observations, an opportunity that is much more difficult in a mobile setting. Next, we present the app deployed on the University's public displays and showcase the underlying infrastructure.

2 The WeatherUSI Application

WeatherUSI app (see Fig. 1) encompasses a modern interface for obtaining user input about weather conditions. Passers-by can input how they are currently experiencing the weather and/or how they think it will develop in the short future, using a three bar layout. Similar to Atmos android and iOS mobile apps, the public display interface collects user generated information about current and future temperature (in °C), weather phenomena (e.g. sunny, stormy or cloudy) and wind intensity in a qualitative scale. After the user presses the submit button, all input is collected, processed and merged with data collected via the mobile app counterparts (i.e. Atmos android and iOS apps) and presented both in the WeatherUSI interface as well as, Atmos apps. Moreover, upon submitting a user weather report or prediction, the respective panel flips, displaying weather information downloaded from the Weather Underground API, allowing one to compare one's input with the measurement of a nearby weather station. This feature aims at increasing user participation through gamification, enabling to compare their accuracy in estimating current and future weather conditions with that of a ground meteorological station.

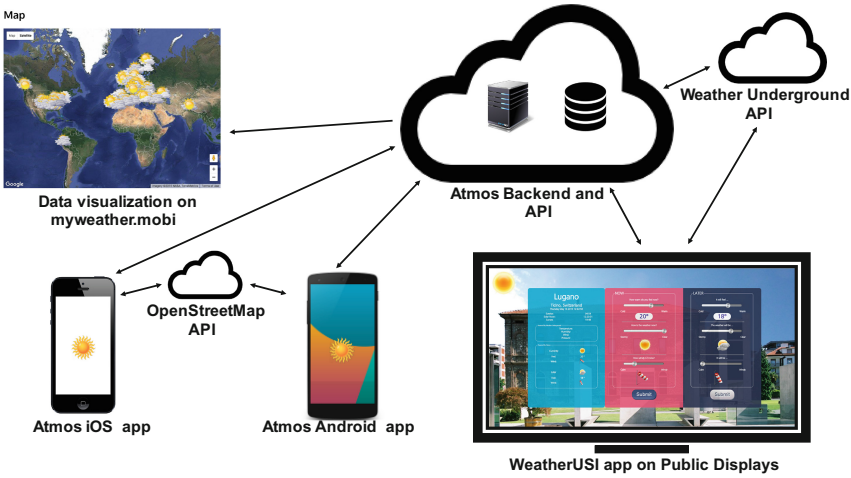

Fig. 2. Atmos Ecosystem comprised of Atmos android and iOS mobile apps and WeatherUSI public display app for aggregating user input. OpenStreetMap API is used for reverse geocoding, whereas Weather Underground API is used for obtaining ground truth for performing comparisons. Data visualization is available at myweather.mobi.

2.1 System Architecture

The WeatherUSI app is part of the broader "Atmos ecosystem" (see Fig. 2) for collecting both human (i.e. manual) and sensor (i.e. automated) generated weather information. Apart from user input, collected across all three versions of the apps, sensor input is also aggregated by the mobile apps, via polling any weather-related sensor (e.g. environmental pressure sensor) found on a mobile device. Ultimately, we envision Atmos ecosystem will offer a particular advantage for weather forecasting in places with microclimates, where current weather models prove insufficient. Atmos is entirely web-based architecture that combines Restful and WebSocket services.

Currently, we are deploying WeatherUSI on a interactive and multi-application public display at our university [1] and employing machine-learning algorithms for efficiently combining both human input and sensor data and generating our own hybrid weather models. WeatherUSI application uses WebSocket technology to communicate with the backend in order to increase the responsiveness of the data exchange to and from the display. Responsiveness of WeatherUSI application is very important as its interface immediately visualizes the reported weather data through the touch interface. Our approach utilizes the power of crowds, individually (mobile devices) and collectively (public displays), combining both explicit (human input) and implicit (automated sensor readings) sampling to significantly improve the accuracy of weather forecasting in areas with challenging climatic conditions.

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Appendix

Since the demo session of the conference will be hosted at the University of Lugano (USI), we plan to use one of our four interactive public displays currently installed at USI. We will demo the WeatherUSI application on a 46" touch-enabled display placed on a mobile stand that can be easily moved to the demo location. The demo will require free space in front of the display for uninterrupted movements and interaction with the application, approximately 2 m by 1.5 m. In addition, the demo will require a standard power plug and Internet connection. The planned setup is shown in Fig. 3.

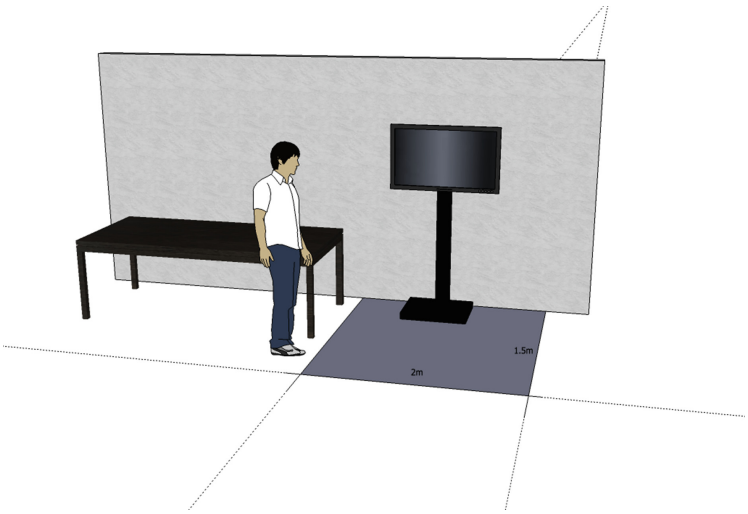

Fig. 3. Demo setup for WeatherUSI application.

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