URB 01 Campaignr

URB 01.1 People

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URB 01.2 Overview

Campaignr is a software platform originally developed for the Symbian S60 3rd Ed. Operating System and extended to Windows Mobile this year. It enables mobile handsets to act as general purpose sensing devices. The platform is currently being used at CENS in the context of Urban and Participatory Sensing research. It is the among the primary platforms with which data collection is performed. Due to stability issues in regards to long running data collections, Campaignr had been replaced by other custom single-purpose programs for use in many data collections. However, over this past year, the stability of Campaignr has been drastically improved.

URB 01.3 Approach

Campaignr was designed to be general-purpose so that it would fulfill the sensor needs of a broad range of urban and participatory data collection purposes and be easily configurable by a Campaign designer. It accomplishes this by allowing for a user-configurable campaign xml file to define which sensors, what sampling rate, and what upload destination should be used during data collection.

In order to achieve a high level of customization the design of Campaignr uses many abstract interfaces internally. This, and the complexity of developing native Symbian applications, had led to many unforeseen issues with the software platform. The work focus on Campaignr during this past year has been to make its multi-purpose functionalities very robust (i.e able to run for many days or weeks without requiring a hardware or software reset).

URB 01.4 System(s) Description and/or Experiments

Campaignr plays a key role in the systems developed by the Urban Sensing group. It facilitates the collection and transmission of sensor data to a back-end system for post-processing. Data transmission is supported over the cellular network as well as WiFi, where available. Campaignr for S60 has been refactored over the past year to provide robust fault tolerance. Campaignr is capable of recovering from device failures (e.g. Bluetooth, GPRS radio), as well as data corruption. This allows Campaignr to be run for long periods of time without the need for system reset and has been verified through round-the-clock experimentation with the latest version(s) of Campaignr.

The transmission channels for data now support parallel upload to improve performance. Upload is supported over unsecured and SSL/TLS encrypted channels to send data securely. Secure data transport is especially important for the potentially sensitive nature of the data collected.

Another significant contribution to the Campaignr project is the addition of a Windows Mobile port of the original Campaignr's feature set. The Windows Mobile port of Campaignr will be referred to as CampaignrWM below.

The Windows Mobile port seeks to provide the same features as the S60 version. In addition the port also provides many new experimental modules. Key features include dynamic loading of new sensors, pre-processing on device, processing of incoming SMS and e-mails, and decoupling of upload managers. Hence, it is now possible to quickly write new upload modules for CampaignrWM. As proof of concept of the modular architecture, CampaignrWM has been extended to support both Flickr and Twitter data upload, in addition to the Sensorbase and PEIR formats.

The core components of CampaignrWM was built for Microsoft Compact Framework. The robustness and safety of the framework reduces the complexity of development and makes CampaignrWM a viable alternative for research on the mobile platform. The Compact Framework is a managed environment and has as such certain inherent

resource constraints. So, when necessary CampaignrWM supports the development extensions in native code (C++) - e.g when one needs to interact with the native API or decrease processing overhead. CampaignrWM supports this through COM and an example of this inter-operation can be readily found in the provided camera sensor.

CampaignrWM was developed using the *Footstep* project as a driver application, which measures walking activity by leveraging cell phone, GIS, and sensor technologies. We built the system to provide sedentary adults insight into their daily physical walking patterns. The Footstep project was built in parallel to the on-going development of CampaignrWM and was also used to test the end-to-end functionality and reliability of the latter. The Footstep application makes extensive use of pedometer data. It was therefore necessary to integrate an external pedometer with CampaignrWM. A tailored and self-contained driver library was created for CampaignrWM to support a Nike+ iPod wireless piezoelectric sensor. Due to hardware limitations it was only possible to read low-resolution data from the device. Despite this limitation, the modular sensor integrated and loaded into CampaignrWM with minimal effort. We discovered that external wireless sensors are prone to interference and may therefore become disconnected at any time. To solve this problem CampaignrWM incorporates a sensor watchdog, which will attempt to reconnect if a external device does not respond in a timely manner.

Next, Campaignr for S60 will be the primary collection platform for the new Aging in Place project which is a system being designed for elder care through sensor networks and pattern recognition. It also continues as the primary data collection platform for the PEIR (Personal Environmental Impact Report), including it's public trial with the GoGreen Foundation.

URB 01.5 **Accomplishments**

During the past year, Campaignr has become a highly reliable platform for data collection. Previously, there existed issues with non-uniform sampling periods due to blocking operations occurring (primarily, cellular network connection and extensive logging to the phone's external memory). These issues are no longer present in the current version. All network connection is done in a non-blocking manner, so as not to interfere with data collection. Also, logging is now done on the phone's local memory (which provides a significant performance increase) and moved over to the external memory card during free CPU cycles (this reduces its interference with data collection and upload to almost nothing).

Also, CampaignrWM now offers an additional exciting opportunity for rapid prototyping of mobile and pervasive sensings platform. Future work includes adaptive upload component, device and user authentication,and real-time feedback components.

Public Available Source Code and Binaries. Campaignr also found a new home this past year at campaignr.com. From here anyone can access the free and open-source code base which includes documentation, source, and pre-compiled binaries for both Symbian S60 and Windows Mobile 6.0. CampaignrWM is available as a signed Microsoft Mobile2Market application and can therefore be used on most compatible devices. Campaignr for S60 is available signed for a select number of devices and unsigned for anyone who which to sign and deploy the application. After the launch campaignr.com has had visitors from around the world.

URB 01.6 Future Directions

It is likely that Campaignr development tasks will be largely focus on maintenance for the foreseeable future. The application is at a point where improvements that are needed are sparse and can be accomplished on an as-needed basis. There will be some development with the Aging in Place project in mind. This will consist mainly of better error handling for uploads and multiple-record-uploads to improve performance.

URB 01.7 External Research Partnerships

Nokia

Samsung