

Micro-Blog: Map-casting from Mobile Phones to Virtual Sensor Maps

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Abstract

The synergy of phone sensors (microphone, camera, GPS, etc.), wireless capability, and ever-increasing device density can lead to novel people-centric applications. Unlike traditional sensor networks, the next generation networks may be participatory, interactive, and in the scale of human users. Millions of global data points can be organized on a visual platform, queried, and sophisticatedly answered through human participation. Recent years have witnessed the isolated impacts of distributed knowledge sharing (Wikipedia), social networks, sensor networks, and mobile communication. We believe that significant more impact is latent in their convergence, that can to be drawn out through innovations in applications. This demonstration, called *Micro-Blog*, is a first step towards this goal.

Categories and Subject Descriptors

H.4 [Information Systems Applications]: Mobile Phone Networks

Keywords

Mobile phones, sensor networks, human participation

1 Introduction

Micro-Blog merges four distinct components, namely, (i) powerful phone sensors, (ii) mobile wireless networks, (iii) information processing, and (iv) spatial visualization. The main idea is as follows. Taking advantage of micro-phones and cameras in mobile phones, users can record multimedia blogs on the fly. The application running on the mobile phone associates the blog with the time and GPS location of the device, creating what we call the “microblog”. The application then transports the microblog over a peer-to-peer, WiFi, or cellular wireless network, to reach a server that suitably places the blog on a map (such as Google/Microsoft/Yahoo Maps). We call this map-casting. A variety of web services can then be used to mine, group, correlate these blogs based on user interests, themes, social networks, etc. Further, regions where microblogs are not available on a map, Internet users can geo-cast queries to mobile phones that are located around that region. Human

responses to these queries can be map-cast back, enabling a new kind of knowledge-sharing between strangers. Observe that the query and responses can be in human languages, and hence, sophisticated. While surprisingly simple, Micro-Blog is a new paradigm [1, 2, 3, 4, 5] that may change the way we learn, interact, and make decisions.

Example Application in Tourism

Imagine an internet map (e.g., Google Maps) punctuated with numerous icons, each having a “Play” button. An Internet user, Jack, planning a vacation to a beach, navigates to Carolina Beach, NC, and clicks on one of the “Play” buttons. A microblog is instantaneously played that describes an anonymous tourist’s experience at the beach while she was there a few months back. Although exciting, Jack decides to play a few other blogs located around the same geographical region. When one of the blogs seemed negative about the place, Jack groups all the travel blogs from the same blogger, and listens to them. Soon Jack realizes that the blogger does not like secluded places, partially explaining the negative reviews about the Carolina beach. While nearly convinced, Jack is keen on ensuring that parking near the beach is not a problem – unfortunately none of the blogs he played had discussed parking. Therefore, Jack records his query (using either his mobile phone or laptop microphone), and geo-casts the audio-query over the Internet. Jack uses a drawing tool to mark out a region around the beach – the marked region is where he intends to direct his query. Tourists located within the marked region of the beach, those that have Micro-Blog services turned on, find a pop up query on their mobile phones. Only a few people respond by recording their replies into their phones (a new microblog), and (perhaps) adding pictures of the parking spots near the beach. Soon, Jack sees these new blogs on the map with visual details about parking facilities at the Carolina beach. Well convinced of his vacation spot, Jack turns to do the same with hotel reservations.

In general, Micro-Blog can be a distributed socio-physical microscope that enables a high-resolution view of the world. The term “socio-physical” represents the notion of sensing physical data (through cameras, accelerometers, etc.), and processing/distilling this data through human participation. A variety of applications may be enabled, including, micro-education (e.g., blogs and queries on

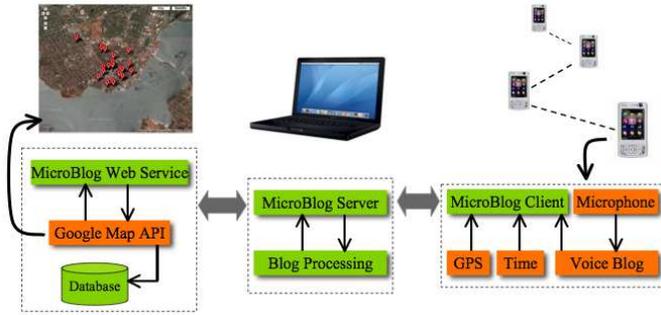


Figure 1. The architecture for Micro-Blog

lifestyles in different countries), micro-news (e.g., human opinions about topics of interest, or blogs on emergency events), micro-health (e.g., timeline of a person's health conditions as blogged at different time instants), etc.

2 Demo and Ongoing Work

Figure 1 shows the simplified architecture for Micro-Blog. We have implemented a light weight Java client on the Mobile phone, a bluetooth/WiFi/cellular based wireless routing protocol, a Micro-Blog web service, and a visualization front end. Our system enables a phone to transport a microblog either over a single hop connection to the server, or over multihop connections as in delay tolerant networks (DTN) [6]. Simple querying is also feasible, as long as the phone has an established session with the Micro-Blog server. Our web service and visualization front end receives the microblog, processes them, and places them on Google maps as shown in Figure 2. A fully functional system entails a wide variety of challenges spanning over a variety of research areas including wireless networking, mobile computing, databases, data mining, and economics.

In this demo, visitors will be given GPS-enabled mobile phones, and asked to blog. The phone will automatically create the microblog using the recorded media contents, GPS, and time, and opportunistically route it (over multi-hop if necessary) to the Micro-Blog server. When the blogger comes back to our demo site, the microblog should be posted at the appropriate location. Querying will also be demonstrated, however, since we have very few GPS enabled phones, the demonstration will only be a proof-of-concept.

Ongoing work is directed towards addressing a number of research problems. (1) An incentive scheme needs to be designed. (2) An opportunistic routing protocol is necessary to route microblogs from phones to the nearest internet gateway (can also be a cell tower). Also, a location-aware broadcast mechanism is necessary for propagating queries. (3) The system needs to be energy-aware in view of the limited battery on the cell phone. (4) The web service will receive streaming blogs and queries, that must be processed/grouped in a variety of user-specified ways. Several database related challenges underlie the scalability of such

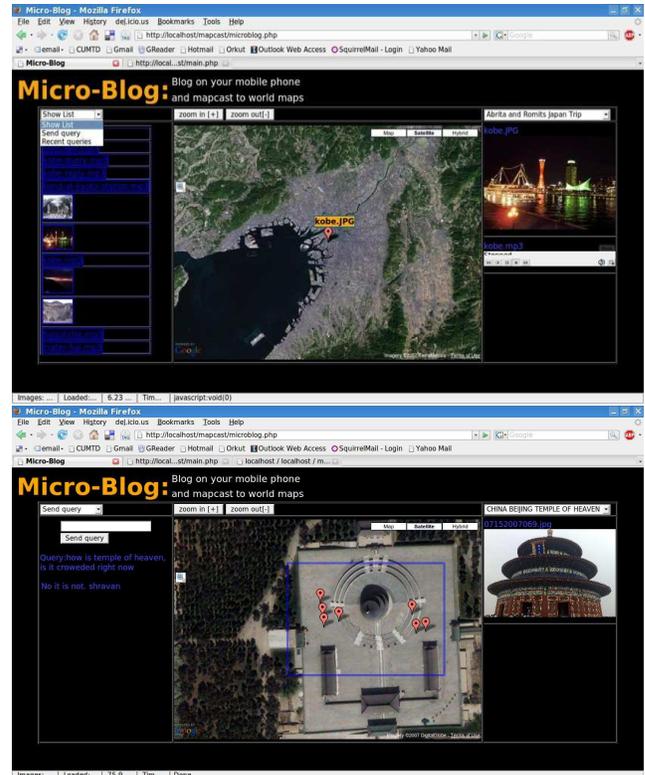


Figure 2. Microblog screenshots (Top) A video microblog from Kobe, Japan. (Bottom) A query directed to the user-drawn box around a Chinese temple. Phones within the box respond as shown in the left panel.

a system [5]. In the future Micro-Blog may converge with passive sensor networks that sense events through medical devices, accelerometers, video cameras, etc. Our ongoing work is systematically addressing these issues with the goal of translating this prototype into a human-usable system.

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