UMBRELLA.net : exploring coincidence ad-hoc networks

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ABSTRACT

UMBRELLA.net is an experimental platform for developing ad-hoc networks based around coincidence or chance occurrences. The project utilizes the haphazard and unpredictable patterns of weather and crowd formation as a catalyst for network formation. This approach is meant to challenge traditional conceptions of how networks form and function by correlating their existence to circumstances beyond people's direct control. The system consists of a set of umbrellas as nodes that can spontaneously form based on weather conditions. UMBRELLA.net establishes a visual footprint of a network in public space and creates a framework for sharing localized information among connected nodes.

Keywords

Ad-hoc networks, connectivity, urban space, wireless communication

INTRODUCTION

In a Mobile Ad-Hoc Network (MANET), communication occurs by forwarding packets from the source to the destination via intermediary nodes [1]. Therefore the source and destination do not need to be in radio range, provided a valid path exists between them. MANETs are conventionally formed for specific purposes such as emergency service communications or impromptu business meetings. UMBRELLA.net examines the creation and dissipation of MANETs based on coincidental occurrences. We believe that coincidence, as an impetus for the creation of networks, is an alternative and beneficial approach for forming new models of interaction. Coincidence links the formation of the MANET to another event beyond our immediate control such as weather. Our aim is twofold: 1.) To deconstruct accepted notions of how networks function in public space by making them visible and only operable based on certain circumstances and 2.) To integrate a network into the common accessory of the umbrella, thus breaking down barriers to entry and increasing the proliferation of these networks in public spaces. Since ad-hoc networks spontaneously form and dissipate according to the amount of nodes present, they provide an ideal context for examining relationships based on proximity and chance conditions. In UMBRELLA.net's case, a coincidence initiates with the act of opening an umbrella when rain begins to fall. This is an example of an individual action spurned by an environmental effect that is part of a collective social behaviour. [Fig 1.] UMBRELLA.net attempts to discover how these coincidences provide a context for examining co-location of individuals and how this might lead to new types of connections amongst strangers or friends in public space.

RELATED WORK

UMBRELLA.net's focus on using networks to unexpectedly connect people in public spaces draws upon considerable past research. Among works of interest include the *Hummingbird* [2], which creates a sense of local awareness of others by "chirping" in its carrier's pocket when another device is within range. Specifically aimed at public spaces, the *Familiar Stranger* [3] project consists of a Bluetooth device that visualizes a collective map of people occupying similar spaces over time such as bus stops or sidewalks. Similarly, *GroupWear* [4] is a nametag system that highlights the commonalities between people wearing them.

Figure 1. Visualisation of the prototype of illuminated Umbrellas.

SYSTEM

The UMBRELLA.net system consists of a hardware and software component integrated into the design of a typical umbrella. We chose an umbrella because it is a familiar everyday object whose use correlates to fluctuating weather conditions. The prototype includes a personal digital assistant (PDA) that interfaces both to the umbrella hardware and the other umbrellas within range utilizing the

Dublin Ad-Hoc Wireless Network (DAWN) [5] infrastructure (DAWN is a Trinity College wireless network test-bed). The PDA software only communicates with others when specific conditions are met i.e., when the umbrellas are open and other nodes exist in close proximity. Below is a diagram of the individual system for each umbrella in the network [Fig.2]. Sensors in the umbrella detect its state (open or closed) and transmit this via Bluetooth to the PDA. If open, the software can engage with the network. Once engaged, the state of the current connection is made visible on the umbrella by illuminating it with LEDs based on three criteria: 1.) If searching for a node it pulses red, 2.) If a node(s) is found it turns solid blue, 3.) If data is sent between umbrellas, it pulses blue. This illumination creates a visual footprint of the network in physical space and allows for a clear visualization of its activity.
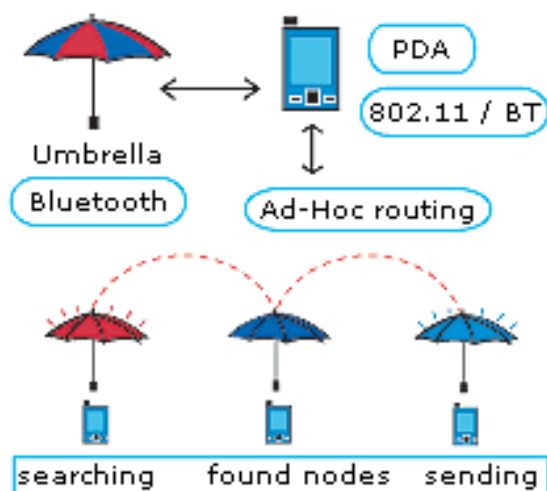

Figure 2. UMBRELLA.net system diagram.

BENEFITS

Below are two examples of how the UMBRELLA.net system attempts to challenge existing network perceptions.

1. **Networks of Coincidence:** UMBRELLA.net proposes a framework for networks that only exist when certain needs or circumstances arise. This allows for temporal communities to form based on proximity and transience of arrangement in physical spaces. This directly counters the slogans of network providers that promise an "always-on" connection for mobile devices in an attempt to provide security of service. We believe these transitory networks can add surprise and beauty to our currently fixed communication channels.

2. **Visual Footprints:** As ubiquitous computing devices proliferate, new ways of exploring people's understanding of their presence and use gains importance. Our approach is to increase awareness of the movement and dissemination of data among people in public spaces by exposing the system itself. By manipulating the visual properties of the umbrellas to reflect their connectivity states and data exchange, UMBRELLA.net allows for a highly evident visual footprint of network activity. This could raise awareness and contribute to people's understanding of how networks function in public environments.

FUTURE WORK

The next iteration of UMBRELLA.net will explore the potential uses and propagation of the network. One example would be to allow for data sharing between nodes when the umbrellas are open. We plan on integrating a message client that allows for multi-hop communications. Other examples might include sharing semi-personal information such as route maps of each individual's journey, personality traits, or music sharing. These starter applications along with user studies will enable us to determine future uses for the platform. We are also interested in expanding the system beyond the singular accessory of the umbrella by porting the hardware and embedded networking capabilities into other ubiquitous everyday objects.

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