

# Chapter 30

## Combining Location Tracking and RFID Tagging toward an Improved Research Infrastructure

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### ABSTRACT

*The popularity of mobile computing creates new opportunities for information sharing and collaboration through technologies like radio frequency identification (RFID) tags and location awareness technologies. This chapter discusses how these technologies, which provide subtly different information, can be used together toward increased benefit to users. This work introduces technologies for RFID and location awareness, including a survey of projects. We describe advantages of combining these technologies, illustrated through our system, TagIt, that uses these technologies in a traditional research poster environment to provide a rich multimedia experience and encourage ongoing feedback from poster viewers. An overview of TagIt is provided, including user commenting and information sharing capabilities that make use of RFID and location information. User feedback and an expert review highlights how TagIt could benefit authors, information consumers, and the research community, leading to future directions for the research community.*

### INTRODUCTION

Mobile computing provides opportunities for information sharing and collaboration, but also leads to new challenges regarding knowledge of the current location and the surrounding environ-

ment. To fully leverage the flexibility afforded by mobility, developers must design their applications with the knowledge that users will not be seated at a desk to use their computers. Instead, they will be on the move, often in unfamiliar locations with artifacts they have not previously encountered. Users want to rely on their technology to assist

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them in understanding their environment and, even more importantly, to be an active participant in it.

Two related technologies help to address these issues: radio frequency identification (RFID) tags and location awareness technologies. RFID uses low-cost tags with minimal internal memory and sensing capability that are attached to an object for tracking and information storing purposes. RFID has been widely used in workplace and educational setting to provide low-cost tracking and storage. Location awareness refers to real-time location determination that can be accessed by computing technology. Once a user's location can be determined, a system can then share necessary information or allow for collaboration. Current location awareness devices include GPS, Bluetooth, and Wi-Fi.

Individually, these technologies help realize the vision of mobile computing--distinguishing it from traditional desktop computing that is tethered to a fixed location. This chapter takes the next step, demonstrating how they can be used together in moving beyond simple tracking tasks to enhance information sharing and improve communication and collaboration. We envision environments where physical objects are tagged, and the users who scan those tags are mobile. Not only is information related to the tag of interest, but so is information related to the current location and prior locations of the objects. The objects could be technology, physical artifacts, or other people. We explore these possibilities in greater depth in this chapter, and we present TagIt, which combines the RFID tagging of professional posters with location awareness that highlights where they have been displayed.

This chapter explores how simultaneously using RFID and location awareness can augment common research tasks to create a richer, more collaborative environment. The coming sections give a background on location awareness technologies and on the structure and use of RFID. We also discuss specific areas in which RFID can be useful, including industry and education. We

then expound upon our vision for combining RFID tags and location awareness technologies, and we introduce our tool, TagIT that uses RFID and location awareness to augment poster environments by encouraging feedback between poster authors and viewers that would otherwise be impossible with a basic poster presentation.

## **BACKGROUND**

Much research has been done with the common goal of making digital information more mobile and making their interfaces more "user-friendly". Combining digital information with physical artifacts allows users to keep the advantages of physical objects and merge them with the advantages of digital information. This section provides an overview of the two technologies used in our work: location awareness and RFID.

### **Location Awareness Technologies**

Location-based systems provide location awareness information and allow for users to share and retrieve information locally. This document seeks to use the term location awareness to include the human—specifically, the continual location knowledge the human experiences—as the definitive element. Global Positioning Systems (GPS) has become the primary system for supporting outdoor location awareness. This satellite-based mechanism is commonly used in automobiles and other vehicles to provide accurate location information in three dimensions, using triangulation of signal received from four satellites. To determine indoor location, when satellite signal is blocked and does not provide reliable altitude distinction, technologies such as Wi-Fi, Bluetooth, mobile phone towers and infrared signals have emerged as possible solutions. As with GPS, signal strength from one or more of these technologies are triangulated to determine location.

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