

Info@ITU

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INTRODUCTION

Our Info@ITU system is build up of three main components, a monitor, a cloud based proxy, and a Android app. The monitor tracks the user while inside ITU and displays information to the user when the user is close to a display, the app keeps track of when the user leaves or enters ITU, and the proxy enables the app to communicate with the monitor. The deployment diagram in figure 1 illustrates our design.

Context-Aware Applications

The Info@ITU system only really relies on location as context, but it is easy to imaging a few extensions that would increase the value and usability of the system.

Location could be enhanced with accelerometer and a compass sensor to the Android app, that would allow the Android app to determine if the user has been sitting still for a while, e.g. at a session. A combination of an accelerometer and a compass could help determine if a user is standing still and actually facing a display to see his information, or is just moving past it or not looking at it.

Another enhancement would be to also consider if other users is standing in front of a display, which may be able to solve privacy concerns, i.e. by filtering away private information from the display if the user is not alone in front of it.

Considering the fact that the main scenario is ITU hosting a Ubicomp conference, adding time and date to the context is a given. It could, for example, help automatically show upcoming sessions.

MONITOR

To be able to track our users at ITU, we are using a combination of JCAF and the BLIP system where JCAF has all the information about the user and displays the relevant information to the designated monitor, and BLIP is used to keep watch of where the users is at ITU. The first thing that we designed for our JCAF system was a jar called dk.itu.info.jar, which contains all the objects that is going to be used in our

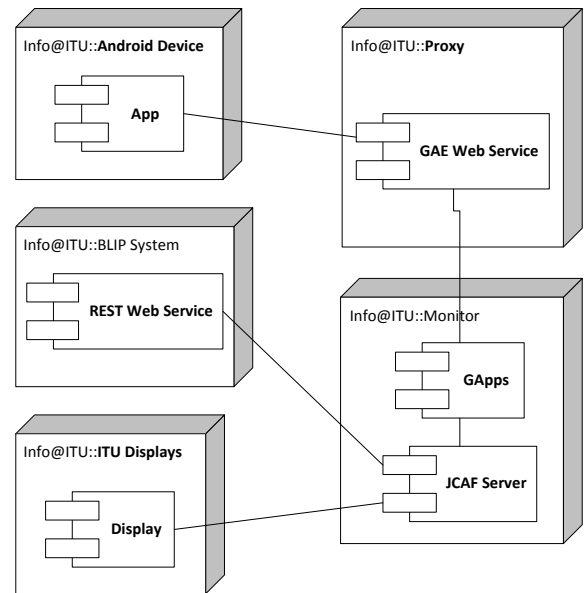


Figure 1. Deployment diagram for our Info@ITU system.

system. As JCAF is a RMI system we need to have the same type of objects both at the server and in the different components as monitors and listeners.

We have two entities, a Visitor and a Room. These contains information about the id and name of the person, and id, floor, sector and room of the room. For our person the id is going to be the mac address of the bluetooth device we are tracking, which could be something like E4B0219CE1AD, and for the room it is the string that represents a Blip node like itu.zone2.zone2c. We have used three different types of actuators to represent the different states that a user can be in, these are Left, Arrived and Located. Arrived is used when a user is arriving at a location, Located is used when we know that a user is Arrived and is still at the same location, and last Left is when a user has left ITU or is sign out and a display needs to be empty.

In order to know the active users at ITU, we have created a service where we receive information about the clients nearby ITU. This is done by using a webservice that returns a JSON array with all the different users and their Bluetooth mac address. These users are then added to the context service, and at the same time we register if any of the users has left ITU and they are then removed from the context service

We then have another application on our context server that is using the Blip webservice provided by the pit-lab. This service uses the mac address as a parameter and returns the location of the bluetooth device, if it is detected by the blip system. So every 15 second we are traversing the list of users to check where they are at ITU. When a user is found the context service is changed to correspond saying that users is arrived at a location. If the user is still at the same position after 15 secondes then he/she is located and then the display should show some information. The reason for this is that there shouldnt be displayed anything if the user is just passing by.

As the users are only updated every 15 seconds, this means that there can be around 30 seconds between updates of the location of a user. Instead of doing it in two process, we could have started a search for user right we have received the list from our webservice.

PROXY

The proxy is available at <http://info-at-itu-proxy.appspot.com> and provides the following service methods for the monitor and mobile devices:

- `entering?<BT MAC address>&<Username>`
This method is used by the phone to tell the system that the phone is moving into ITU and to start tracking the it.
- `leaving?<BT MAC address>`
This method is used by the phone to tell the system that the phone has left ITU and to stop tracking it.
- `ping?<BT MAC address>`
This method should be used every XX minutes, after the phone has entered into ITU, to indicate to the system that the phone is still turned on and inside ITU.
- `getallclients`
This method returns a JSON formatted array of all clients that have been 'checked in with the proxy.

The reason why we added the `ping` method is to handle the common scenario where the phone is out of range of ITU's BLIP sensors for a long time, i.e. when the owner is in a meeting room or lecture hall, or if the owner has turned of his phone or the phone has simply run out of power. If the proxy stops receiving pings from the phone, we assume that the phone should no longer be tracked and can save resources on the monitor.

Future Work

A related feature to the `ping` method, which is not yet implemented, is a scheduled clean-up job, that searches through the list of 'checked in' phones on the proxy and removes those who have not 'pinged in' for 20 minutes.

Push notificaitons from the proxy to the monitor would also be natural extension, since it would lower the resources required and allow the monitor to be notified almost instantly when a new phone 'checks in'. In the current solution, the monitor pulls from the server every 15 seconds to see if there are any new phones or phones that have left.

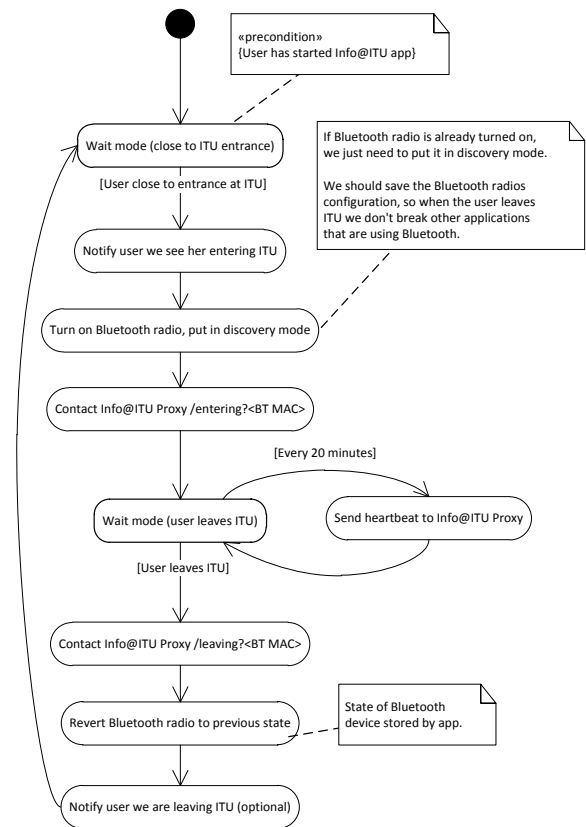


Figure 2. Activity diagram for the Info@ITU App.

APP

For our Info@ITU App we considered the problems with identification (who is actually using the Android device), battery life, and volatile state.

Identification

This is an issue even if mobile phones are often very personal, since they could be shared between people, or more likely, a person could have a private profile and a public profile. So to identify the user of the phone, we ask the user to select one of his Google accounts when signing in to Info@ITU from his device. This also enable the scenario where a user switches between devices or is signed in with multiple devices, since we identify him and his devices by his Google ID, not by an MAC address.

Battery life

This can quickly become an issue when both WiFi, GPS and Bluetooth radios are turned on. So we try to be as effective as possible, only turning on Bluetooth when the device is actually inside ITU.

Volatile state

The volatile state of mobile devices must also be considered – the user can choose to turn it of, the device can run out of battery, the user can turn of Bluetooth or GPS, other applications can turn of Bluetooth or GPS, all things we need to consider when building an app like this that relies on these.

The workflow of our App is illustrated in figure 2. Before we enter into the initial waiting state in the figure, the user is asked to sign in to our application with a Google ID of his choice.

CONCLUSION

During this assignment we have tried to make a context aware application, and started on having some of the considerations regarding making a context aware system. This has given thought of both the limitations systems but also the future possibilities of combining different parts of technology.