Internet of Things

A personal assistant at your side

Imec researchers develop new technology for proximity services.

Introduction

Imagine someone opening the doors for you, taking you to the right floor, configuring your room with your preferred lighting and temperature conditions, knowing your fitness scheme, ... No, this story is not about a well-trained butler, but about a new technology that imec researchers are developing. Valerio Panzica La Manna is one of them. He explains how proximity services will assist us, in 5 years from now.

What are proximity services?

'The right service for the right user in the right place', that's what proximity services are all about. Panzica La Manna further explains: "In the future we will be surrounded by smart appliances which we can operate via our smartphone. Just think of a washing machine, the lighting in a room etc. But the amount of smart things will drastically increase. And you won't be able to have a dedicated smartphone app for each service and appliance."

"Proximity services are the solution to this problem. You will install one generic proximity app on your smartphone and, depending on your location, you will receive messages on your smartphone, earphones or a screen nearby to assist you in what you are doing. The smart things around you will have proximity technology embedded and can communicate with you. And, besides helping you interact with your environment, proximity services are the perfect way to increase the security of online services and devices."

Some examples?

There are numerous examples of potential proximity services. Just think for a minute which daily activity you would want to have some help with. Panzica La Manna gives his favorite examples: checking in in a hotel and visiting the gym. Let's travel to the future:

Imagine you're going on a business trip. In the train station your smartphone tells you which train to take to the airport. You are automatically charged when you enter the train and receive a message when to get out. In the airport you are guided to the right gate: you hear the guiding instructions through your earphone (only wearing it in one ear so you can still have a nice conversation with a colleague joining you on this trip). When arriving at your hotel, your presence is automatically detected. A staff member welcomes you and asks if you need any help, but the check-in occurs automatically. This way, you can focus on the fun stuff and do some social talk if you like, but all the burden of practicalities is taken away. In the elevator, the floor to your room is already indicated (but if you want to go to the bar, just press '2' in the old-fashioned way). When approaching your room's door, it opens automatically. The temperature and lighting intensity is set just like home. When going to the hotel gym and stepping on the treadmill, the right speed and program are set automatically because your app knows this from your visits to the gym back home. The next day, after your business meeting, you still have some time to visit the city. In the tourist office (yes, you still like to have face-to-face contact and get some sightseeing recommendations) the officer indicates her favorite places in town on your digital map. While exploring the neighborhood, you get detailed info on the monuments and places you are passing, through your headphones. This way, you can fully enjoy your surroundings!

Which technologies are needed?

Proximity services can be delivered in several ways. And some use cases are already being tested in real applications. There is the beacon technology, for instance, that was tested in U.S. retail stores to send customers location-specific advertisement messages (e.g. when you pass the fruit market you get a message on your smartphone about a new kind of fruit that is available in the shop). Beacons are small sticker-like devices that send out a Bluetooth low-energy (BLE) signal. When the customer has installed a specific app (of the retail store in this case), he or she gets push messages when passing specific beacons. On the downside of things, beacons use signal-strength based technology, which suffers from limited accuracy and can only be used to identify an approximate category of distance (near, intermediate, far), not a precise measurement.
Alternatively, smart LED lights can be used to enable an indoor GPS system. Also this technology has already been tested, e.g. in French retail stores. Using light, the customer can be located, and specific messages can be sent via an app (the app from the specific retail shop in this case). LED-based solutions, though, require users to always have their smartphones in their hands to receive the light-based signals.

Moreover, from a user perspective, the interaction provided by current solutions is mainly limited to receiving information (e.g. push notifications, coupons) without the capability of controlling the IoT devices in proximity. Therefore, researchers from imec - Holst Centre, together with a number of partner companies, are developing another technology for proximity services: RF-based ranging & localization techniques in combination with innovative software for proximity services. This solution targets high-precision ranging with traditional narrowband radio, so it remains compliant with standardized communication protocols for low cost, low power objects. It determines the distance between the user (= the smartphone) and the object (= a rack in a shop, a hotel lobby) based on phase measurement of the reflected RF signal. This way, a 5x better accuracy is achieved than with existing methods.

Next to this, imec - Holst Centre and its partners are developing special software, based on a new mechanism to automatically install proximity services on a smartphone. As such, one generic app can be installed which will behave differently according to the user's location, based on dynamic software updates. And it will allow users to intuitively control all kinds of objects.

And then there is the security opportunity (which researchers from imec – COSIC – KU Leuven are looking into). Having secure proximity information can add an extra layer of security to one's physical and digital life. Secure and precise proximity ranging and localization can be used to authenticate users that are physically present in a certain place, and this physical presence can be added as a condition for access to authorized services. Such mechanism will provide a secure and intuitive interaction between the user and the IoT. Applications include access control for cars and smart buildings, and secure IoT device commissioning and maintenance.

Biography Valerio Panzica La Manna

Valerio Panzica La Manna is a researcher at imec, the Netherlands. His research focuses on innovative solutions for an easy-to-deploy, easy-to-maintain, easy-to-use, Intuitive Internet of Things. Before joining imec, he worked at the MIT Media Lab, USA, Politecnico di Milano, Italy, and IBM R&D Labs, Israel. He holds a Ph.D. in Software Engineering and a MSc in Computer Science and Engineering from Politecnico di Milano, Italy, and a MSc in Computer Science from the University of Illinois, Chicago, USA.