

# The smart phones of tomorrow

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## Abstract

*The handheld devices are not only becoming smaller and more powerful, but also offer newer functionalities. One cannot even imagine what to expect from smartphones of next generation. In this position paper, our objective is to look into the future and see what challenges and opportunities are offered by smartphones.*

## 1 Overview and Objectives

Handheld devices like PDAs or smartphones have brought dramatic changes to our day to day living. Not only these device are becoming more and more powerful with integrated functions, but their size is getting smaller and smaller also. The smartphones today, are more powerful than the desktops of the 1990s. Even knowing the advancement from the first smartphone, IBM Simon, to today's smartphones, one can not imagine a smartphone of years in future. What functions could we expect from it? IrDA, Wi-Fi, Bluetooth, we have these already. Camera, internet, fax, email, text messages, music, video, GPS, calendar, are available on finger tips. So what else can we expect from the mobile phones of next decade? Can a smartphone replace the PC at office or home? Do we want more computing power in smart phone? Is there anything a desktop can do, but not the smartphone? Is that, email and short messages still be the main communication methods? How do we communicate with others? After the hardware, software and network revolution, what is next? Computers are every where. You can smell one even on your fridge. Big computers are getting even bigger and small computers are getting even smaller. The small, energy efficient, and smart devices are making the cyber-physical systems feasible. Imagine the world Mark Weiser[3] envisioned— *A world in which computing is so pervasive that everyday devices can sense their relationship to us and each other.* They could, thereby, respond so appropriately to our actions that the computing

aspects would fade into the background. Underlying this vision is the assumption that sensing a broad set of physical phenomena, rather than just data input, will become a common aspect of small, embedded computers and that these devices will communicate with each other (as well as to some powerful infrastructure) to organize and coordinate their actions [2]. If you look outside from your window, you will see your stock prices and the weather reports dancing on the backyard fountain [1].

In this position paper, we present a wish list of applications that we believe to be available on handheld devices as the result of advancements in cyber-physical systems in the near future.

## 2 What can your smartphone do?

The physical world presents an incredibly rich set of input modalities, including acoustics, image, motion, vibration, heat, light, moisture, pressure, ultrasound, radio, magnetic, and many more exotic modes [2]. How do we capture, categorize and retrieve this multi-faceted information? New applications of course will have to seamlessly integrate these inputs from physical world.

- Smartphones speech recognition can automatically recognize the telephone conversation content and store it as text document, so that you can edit, include in your blogs. Today's speech recognition used in automatic answering systems have already achieved acceptable accuracy. In near future, speech recognition will become more accurate with big sample databases.
- The GPS on your smartphone, receives the signal of the traffic and weather information, decides the best driving route. According to the collected information about driving habits, including the work, lunch, gas, and recreation habits of people, traffic is estimated for you whenever you are on the road.
- When you are driving around, you do not have to look

for parking any more, your smartphone locates the closest empty parking space for you.

- The GPS on smartphones automatically detects when the devices should be turned off.
- You will receive an instant message from your daughter's school so that you know as soon as she leaves the school.
- You can send an instant message to turn off the water sprinker at your backyard, can change your air-conditioner temperature.
- Your smart phone will prepare the news you are interested most, and record the TV shows for you.
- Smartphones will replace desktop, laptops, since you can process any request on your smartphone.
- A smartphone can handle any amount of data transparently, without your knowing where it is actually stored and processed.
- You check your bank accounts etc. with your smartphone. A smartphone knows its owner, can help authenticate your identity for bank transactions etc.
- A smartphone knows its owner and locks itself when lost it and becomes useless to others. When you buy new one, the new retrieves everything from old.
- Your smartphone will have the collection of any library around the world. You can request any book or any other media from any library right on your smartphone.
- You do not need to remember any passwords, carry any keys, cards or certificates with you. Your smartphone authenticates you to those sensors. It verifies you everywhere.
- You can use the projector on your smartphone, browse internet on any flat surface. If you push a link on the web page, your smartphone camera captures the request and brings you to the new page. You can type on the keyboard image.
- Your smartphone records the meetings, conversations, lectures and presentation and archives them.
- If you are listening to a music in your bedroom and you walked to your kitchen. Your smartphone turns the kitchen sound system on and turns off the music in bedroom.
- If you leave from your home without carrying your umbrella, and if there is rain in forecast, your smartphone will remind you.

- If you are going to a restaurant with your friends, smartphone tell your the estimated waiting time to get a table at this moment.
- In most cases, you may even realize that your smartphone is taking care of everything. With the sensor signals from your environment, everything is ready when you need it.

### 3 Challenges

As described by related literature, the security, energy efficiency etc are the important challenges for the cyber-physical systems. In this position paper we mainly focus on the data management of the small devices like smartphones. Currently on grid computing, the physical data is located at different sites can be accessed by the logical link. User usually do not have to know where the exact physical data is located. There are multiple replicas of the same data and grid data manager selects the data set which is closest to the running tasks.

In cyber physical systems, we have small sensors and computers everywhere. They usually have small storage available to them and they need to store and retrieve data from other larger storage resources. You store your documents at office and open them during your business trip in other country, your smartphone should be able to locate and retrieve them immediately without showing you the sand clock. When you receive the message says your daughter is waiting at school, you need the fastest, shortest route to the school at rush hour. You expect accurate, fast and predictable information from your smartphone. Information storage, query and retrieval are the main research issues here to make the cyber physical systems feasible.

The goal is to store your data securely and retrieve them whenever you need them no matter where you are, which device you are using. This involves data security, data management, network communications, and real-time aspects of cyber-physical systems and spawns even more research challenges.

### References

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