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S- Health a new challenging field of wireless communication, m-health and smart cities.

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Outline

- Motivation

- Facts and Scenarios

- e-health , m-health, s-health evolution

- S-health and smart cities connections

- S-health architecture and examples

- S-health challenges and opportunities

- Conclusions

- The new era of mobile health ushered in by the wide adoption of ubiquitous computing and mobile communications has brought opportunities for governments and companies to rethink their concept of healthcare.
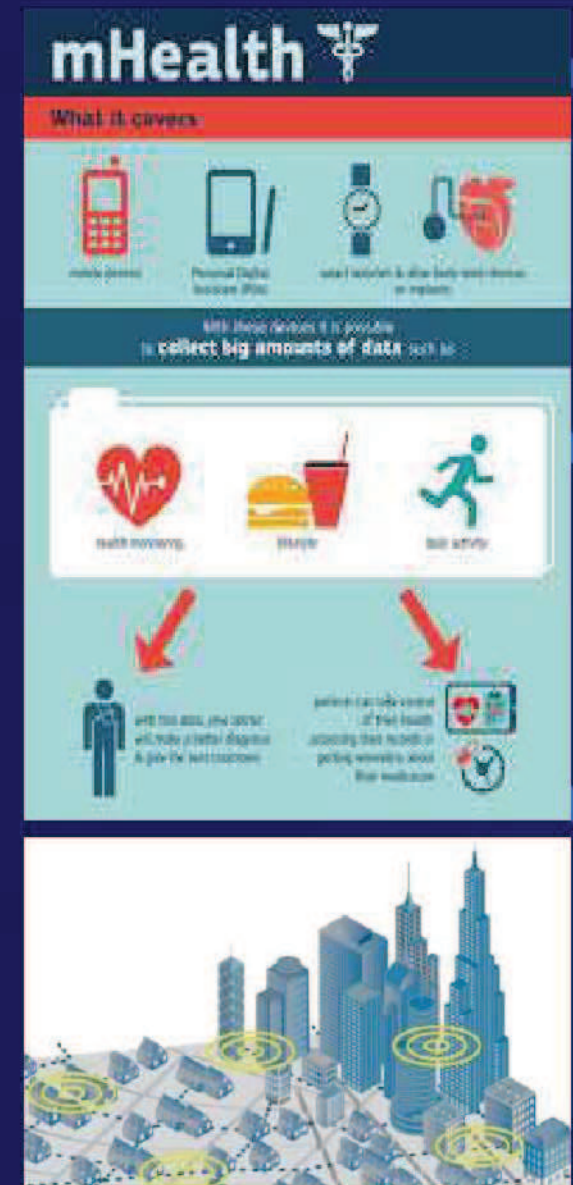
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- The worldwide urbanization process represents a formidable challenge and attracts attention toward cities that are expected to gather higher populations and provide citizens with services in an efficient and human manner.

Facts and Scenarios

- *M-Health + Smart Cities ->S-Health*

- **smart health**: context-aware complement of mobile health within smart cities.

- **What about the challenges and opportunities** that s-Health would imply and provide a common ground for further research in the field of wireless communication in measurements?

Facts and Scenarios

- The adoption of information and communication technologies (ICT) within the healthcare sector led to the concept of electronic health (e-health), which is contributing to reduced costs and increased efficiency.
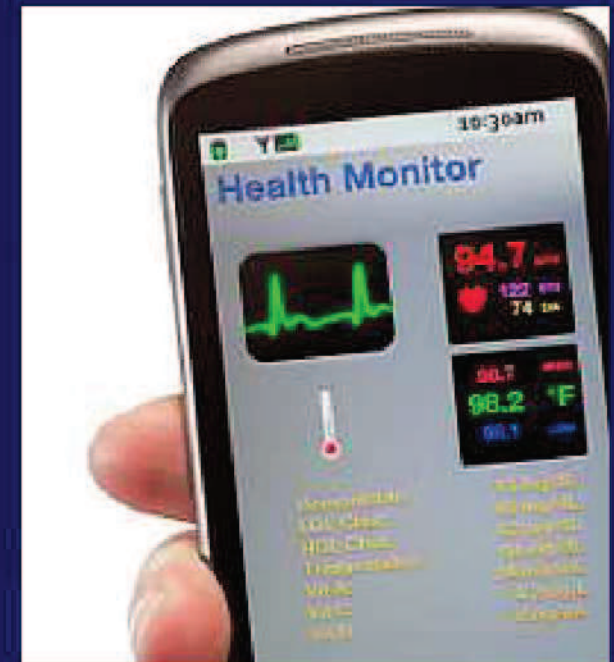
e-health to m-health

- Smartphone with GPS usage → mobile health(m-health),

- mHealth - delivery of healthcare services via mobile communication devices. m-Health has extraordinary

- potential since it adds to the advantages of e-health

- all the benefits related to the ubiquity of

- mobile devices (i.e., global monitoring capabilities,

- wide availability, and immediacy).

m-Health /e-Health extra advantages based on ubiquity of mobile devices:

- global monitoring capabilities,

- wide availability,

- and immediacy.

smart cities: *foundation*

- Fully based on the latest ICT developments

smart cities: *objectives*

- local economy support based on implemented ICT

- Transportation optimization

- Quality of life: air quality water quality, mobility

- e-governance:

Smart City: a System of Systems of Systems...

IBM, Intel, Siemens are looking to smart cities

Why?

- Today 50% percent of the world population lives in cities,

- In 2050 : 70% percent of world population will live in cities

IBM, Intel, Siemens are looking to smart cities

What?

Identified action areas

- public safety,
- Energy optimization
- utilities (e.g. TV cable, optical fibre)
- economic development,
- Education (context awareness on city history),
- social services optimization
- healthcare.

Smart cities behavior and the citizens

- ## Smart cities behaviour monitoring is done using:
  - sensing, processing and communication

- ## Monitoring SCities
  - understand the living environment at any time.
  - Supply the healthcare applications and services with active context awareness

- *applications and services are automatically adapted to discovered context by changing the application's and services' behavior .*

- G. Chen and D. Kotz, "A Survey of Context-Aware Mobile Computing Research," tech. rep. TR2000-381,Dept. of Computer Science, Dartmouth College, 2000.

- Amsterdam as Smart City search for sustainability on:
- living,
- working,
- mobility,
- public space
- *Practical : focus on the reduction of CO_2*

Emissions based on mobility optimization

Widespread adoption of sensors within smart cities provides:

- additional interactions through people-centric, participatory sensing
- opportunistic sensing

- Smart city: *system of systems*,
- Smart city: provide citizens and local authorities processed information and/or personalized information

mHealth candidate for SCity

- ## Why?

- to perform tasks more efficiently.

- to perform remote monitoring of patients

- to perform communication between professionals, relatives, and patients

  –

m-Health and healthcare services

- It allows easy access to an unprecedented number of services and knowledge.

- It can be user-oriented.

- It can be personalized.

- extends the capabilities of indoor monitoring environments,

- continuous assessment of the state of patients,

- early detection of emergency situations,

- detection of changes in health conditions,

m-Health and Smart City interaction for S-Health
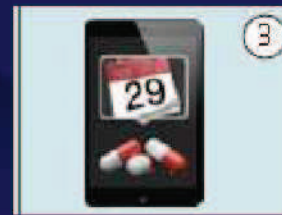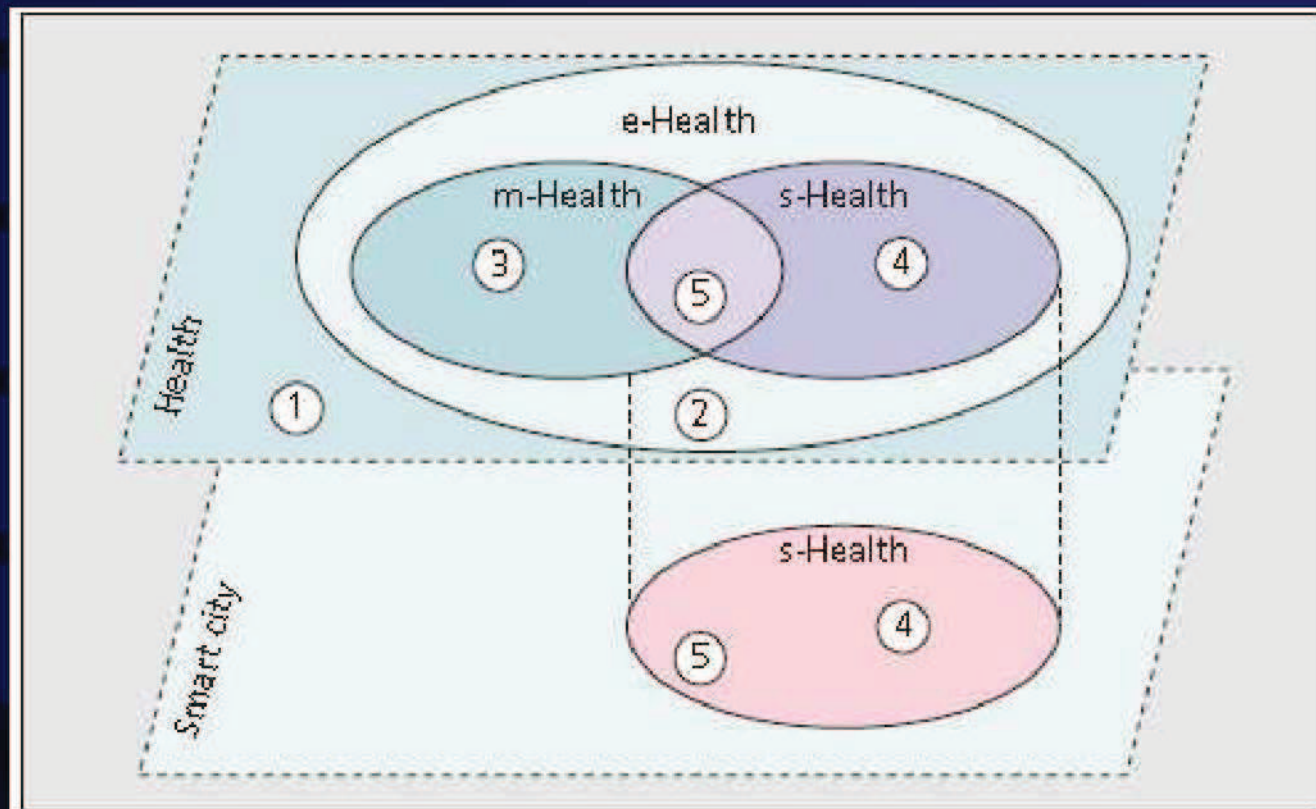
S-Health and related fields

***People move to Cloud Computing and Distributed Systems mobile devices has** made millions of people turn to cloud-basedservices.*

- Infrastructure as a service (IaaS),
- Platform as a service (PaaS),
- software as a service (SaaS)

On the cloud from instance :contacts, calendar events, emails, multimedia, data

From heterogeneous environment: different devices,

operating systems and applications.

S-Health and related fields

Sensor Networks, Body Area Networks, and Their Interoperation

- provide s-health in a personalized way is the possibility of gathering multiple data from patients and the environment.

- Drawbacks and challenges

great variety of network technologies→ difficult to interoperate them;

radio-electric interference → low quality of services

-

-

S-Health and related fields

Privacy Protection and Security

fundamental right that has to be guaranteed.
critical requirements for healthcare applications

Critical scenarios:

the continuous monitoring of patients could be seen as an invasion of privacy

Solutions:

Private information retrieval and anonymization techniques will play a key role in s-health.

S-Health and related fields

Privacy Protection and Security

Security protocols - key cryptography
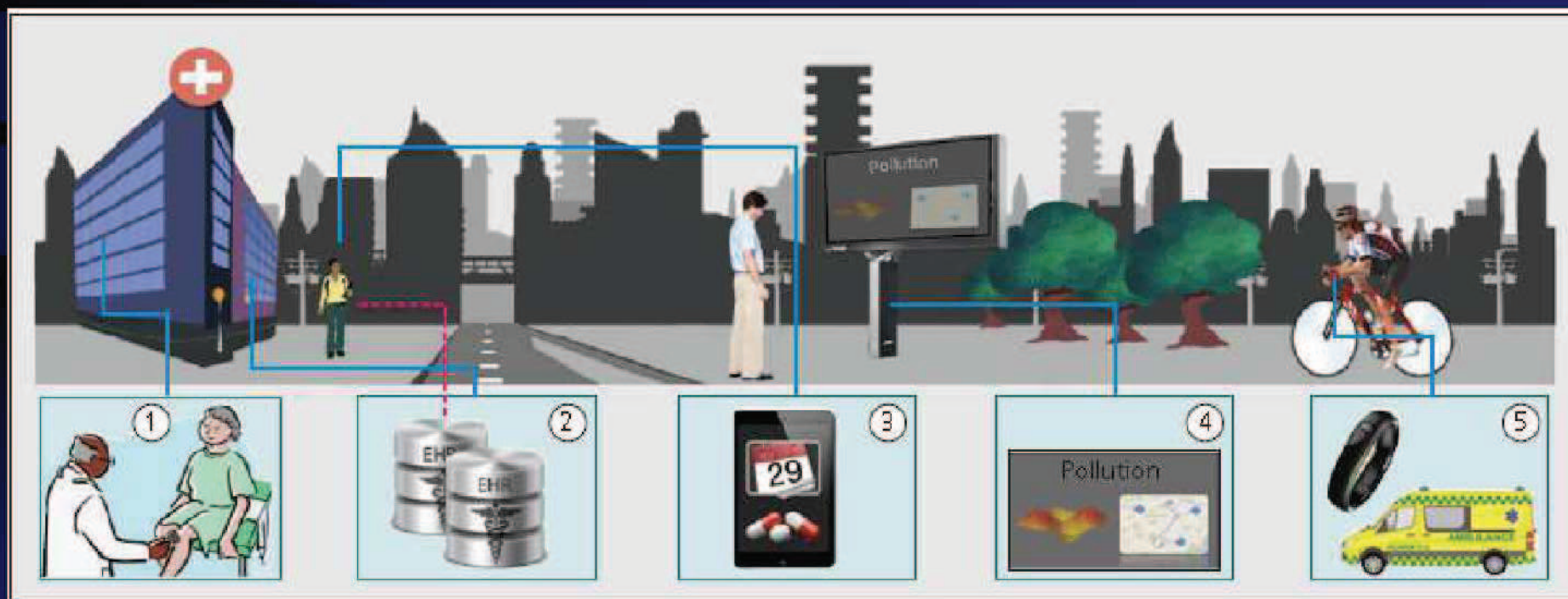
Biometric features :
- iris,
- fingerprints,
- ECG???

radio frequency identification (RFID)
- identification of physical objects
- people.

S-Health definition

"Smart health (s-health) is the provision of health services by using the context-aware network and sensing infrastructure of smart cities."

Health, e-Health, m-Health, S-Health by examples

Classical health. a doctor visiting
a patient with traditional tools (e.g stethoscope)

e-Health a doctor visiting a patient and uses
of electronic health records (EHR). ICT is used.

m-Health. a patient checking her prescriptions from her
mobile phone to guarantee medication adherence.
This is a subset of e-health since it uses
mobile devices to access medical data.

s-Health. A patient gets information from an interactive information pole to check the pollution level as well as the level of pollen and dust for which he has allergies.

→ The areas that could be dangerous for his health condition are avoided if

The information pole informs him about the best route to go, and where the closest pharmacies are to buy antihistamine pills.

Health, e-Health, m-Health, S-Health by examples

m-Health augmented with s-Health.

A cyclist wearing a bracelet with accelerometers and vital signs monitoring capabilities has an accident.

The body sensor network detects the fall and sends an alert to the city infrastructure.
- alert received
- traffic conditions analyzed
- ambulance dispatched through the best possible route.

In addition, the traffic lights of the city are dynamically adjusted in order to reduce the time needed by the ambulanceto reach the cyclist.

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Health Future and Biomedical Instrumentation Opportunity

healthcare provision provided by centralized healthcare services, provided by doctors' to offices and hospitals,

health monitoring based on ubiquitous and pervasive services that implies low cost solutions in ICT and biomedical instrumentation.

Are we already focused in this?

Health Future and Biomedical Instrumentation Opportunity

Why?

1. increasing demand for better, more comprehensive and proactive healthcare, whose key component is the early-stage diagnosis of health issues provided by long-term and unobtrusive monitoring.

2. Second, there is a need to mitigate the increasing healthcare expenses.

mHealth –sHealth comparison

Differences in information sources:

data used in m-health come from the patients.

Data used in s-health are not only from patients but from a completely independent new source → smart city sensing Infrastructure.

Differences in information flows:

m-Health is personalized (user-centric),

s-health is not only user-centric but also city-centric.

• *Appearance s-health justified*

sHealth Challenges

1. **Multidisciplinary Research and Interaction**

2. **Security and Privacy**

3. **Sensor Integration**

4. **Big Data Management and the Cloud**

5. **Usability and Human–Computer Interaction**

sHealth Oportunities

The concept of s-health is founded on the use of the infrastructure of smart cities, which opens a wide range of opportunities for the development of new health-related applications and services.

1. *Data Collection, Presentation, and Analysis*

2. *Prevention and Management of Critical Incidents*

3. *Effectiveness and Environmental Assessment*

4. *Engaging Patients and Families in Managing Their Health*

5. *Epidemic Control*

6. *Cost Saving*

Conclusions

- The widespread adoption of ICT in the context of cities has led to the appearance of smart cities.

- Similarly, the use of ICT and mobile technologies for health-related issues ended up with the provision of patient monitoring and healthcare in a pervasive way through electronic and mobile health.

- Joining smart cities and m-health in a smart health (s-health) concept will open new way of thinking the healthcare and new application of the instrumentation, smart instrumentation in healthcare

CONTEXT-AWARE NETWORKING AND COMMUNICATIONS

Smart Health: A Context-Aware Health Paradigm within Smart Cities

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Thank you!