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# Analysis of Built-in Mobile Phone Sensors for Supporting Interactions with the Real World

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- Mobile phones are ubiquitous in our everyday life.

- Current mobile phones often support

  - a camera

  - a microphone

  - several network interfaces

- Are these built-in sensors currently useable for real world interactions?

- Main issues:

  - Access to sensor data

  - Performance of the mobile phones and used programming platform

  - Quality of the sensor data

  - Problems using these sensor data

 - Kinds of useful and realisable applications

- Schmidt et al.
  - **Sensors:** light sensor, microphones, temperature etc.
  - **Goal:** prediction of user's context
- Hinckley et al.
  - **Sensors:** touch sensitive sensor, tilt sensor
  - **Goal:** recognizing user actions
- Kindberg et al.
  - **Sensor:** infrared beacons
  - **Goal:** discover the services that are related to objects in the physical world
- Rohs and Gfeller
  - **Sensor:** the camera of a standard mobile phone
  - **Goal:** interpretation of a two dimensional visual code that represents an ID

Used programming platform
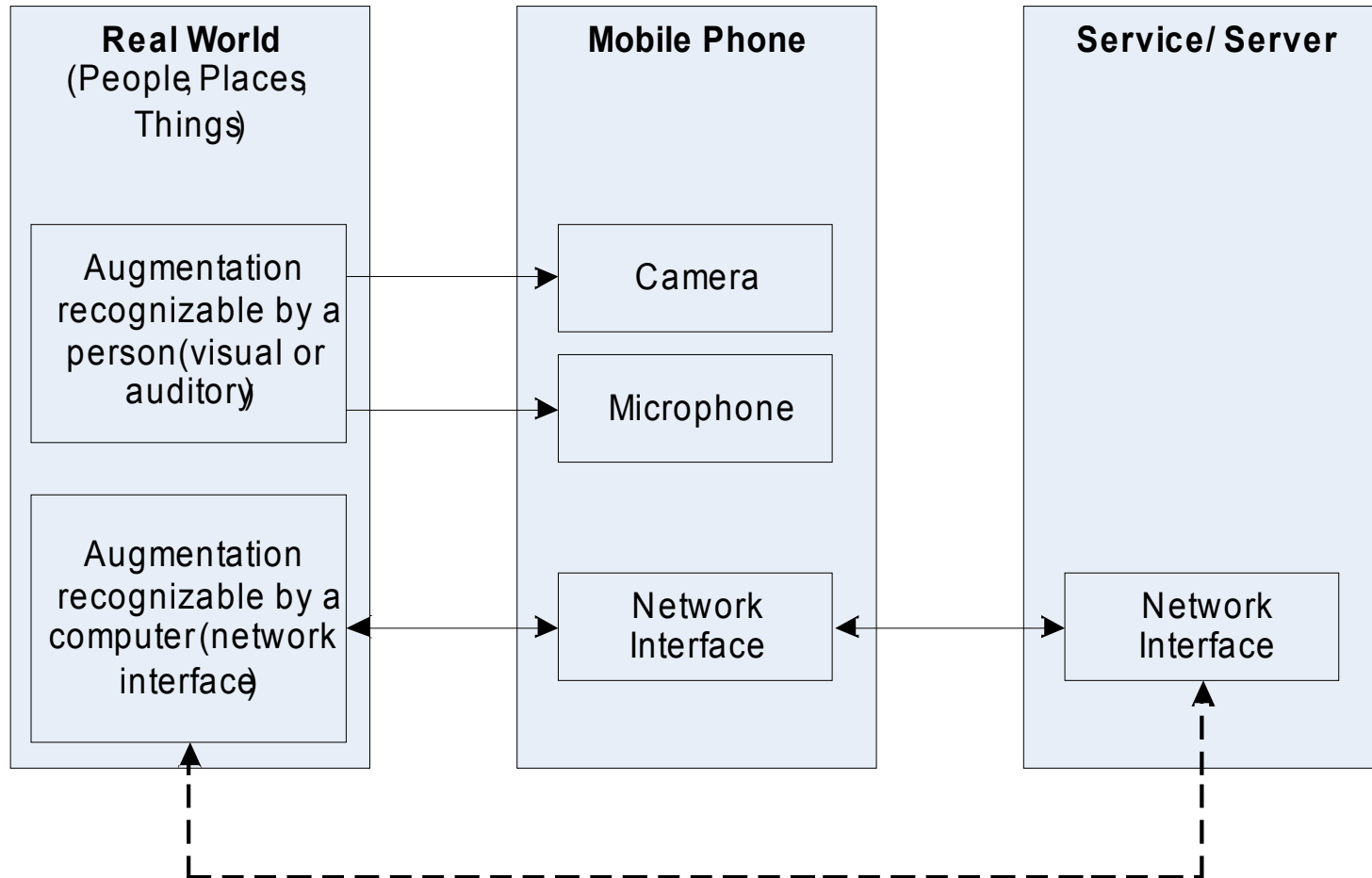
- Java 2 Mirco Edition (J2ME)

  - Platform independent

  - Most mobile phones support J2ME applications

- Used J2ME platform:

  - CLDC 1.0 / 1.1 (Connected Limited Device Configuration)

  - MIDP 2.0 (Mobile Information Device Profile)

  - MMAPI (Mobile Media API)

- MMAPI supports basic access to address the camera or microphone for playing and recording audio or video data

- Used mobile phones: Nokia 6600 and Siemens S65

  – General results for current mobile phones

- Camera tests for the format JPEG

  – Supported by most mobile phones

  – Real life pictures with good quality and memory size

- Microphone test mainly for the format PCM

  – Used for human speech coding

- Evaluation goals:

  – What is the memory size and the quality of the taken pictures?

  – How many pictures can be taken in a given time?

 – What is the memory size and the quality of the recorded audio data?

- Goal was to evaluate the memory size and quality of taken pictures by a J2ME program

- The result shows a moderate memory size and a good picture quality

- Taken pictures usable for various applications (e.g. different kinds of image processing)

- Depending on resolution a lot of pictures can be stored on the memory card or transmitted to a server for a complex analysis
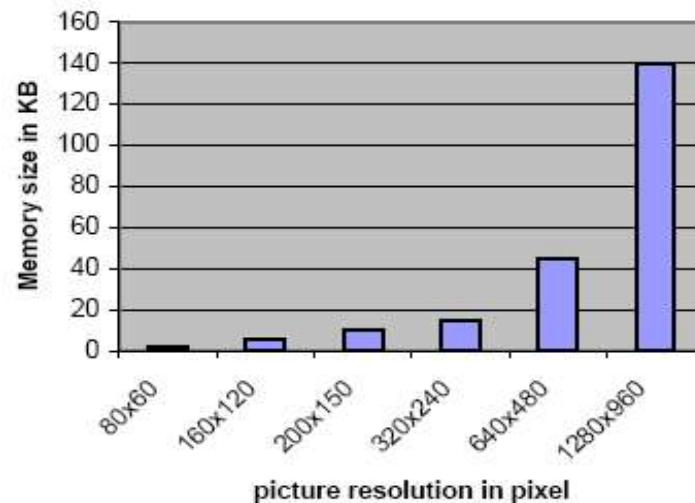
- Goal was to evaluate the number of taken pictures in a given time

- Overall performance is not sufficient for real time applications.

- Real time application written in J2ME such as movement detection are currently impossible.

  – Movement detection needs 10 to 15 frames per second

- The processing power of mobile phones and the J2ME platform are currently to slow.

Resolution	Pictures per second
80x60 pixel	App. 1.7 pictures
160x120 pixel	App. 1.2 pictures
200x150 pixel	App. 0.8 pictures

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- Goal was to evaluate the memory size and the quality of recorded audio data

- The result shows a moderate memory size and an appropriate quality

- Not all parameters are supported (AMR)

- .... analysing users context (meeting), speech recognition
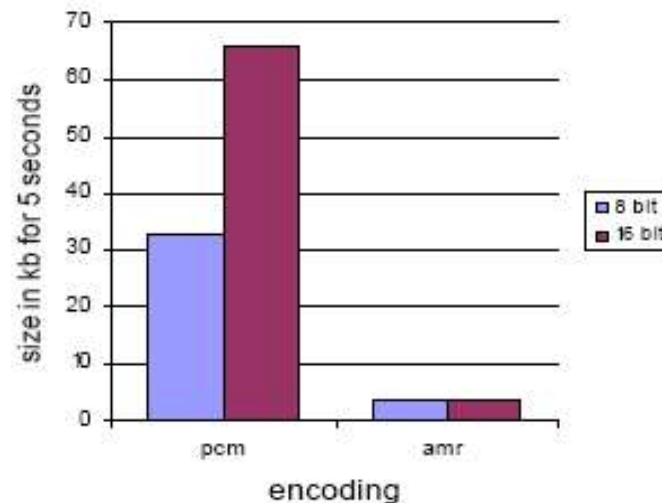
- In general a good quality of recorded data

- There are still a lot of problems :

  - Speed performance evaluation shows real time application are impossible

  - No knowledge about recorded quality

  - Test environment does not run on different mobile phones in the same way

  - Different mobile phones support different formats and different format settings (e.g. resolutions)

  - Often ignorance of parameters e.g. for images size, format etc.

  - Difficult to develop general applications for different mobile phones

- – Because of a lack of matured APIs for mobile phones (e.g. Java2D for image processing) analysis of audio and video on mobile phone is currently often impossible

- – Transmitting data to a server (e.g. J2SE) generates costs and a delay

- – Not enough memory space and processing power

- Interactions with the real world is already possible when using modern mobile devices whose capabilities are tested intensively before.

- In a few years matured corresponding J2ME APIs for mobile phones are expected as well as more processing and working power.

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