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Mobile and Personal Speech Assistant for the Recognition of Disordered Speech

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Outline

- Motivation and problem statement
- Related work and design challenges
- mPASS approach
- System architecture
- Preliminary results
- Conclusion and future work

Motivation and problem statement

- 1.3% of the population has difficulties in speech-based communication:
 - can have problems in daily activities
 - cannot use speech-based interfaces
 - cannot use voice-controlled Assitive Technologies
- Standard automatic speech recognition (ASR) systems perform very poorly for them
- There are many diversified speech disorders

Related work

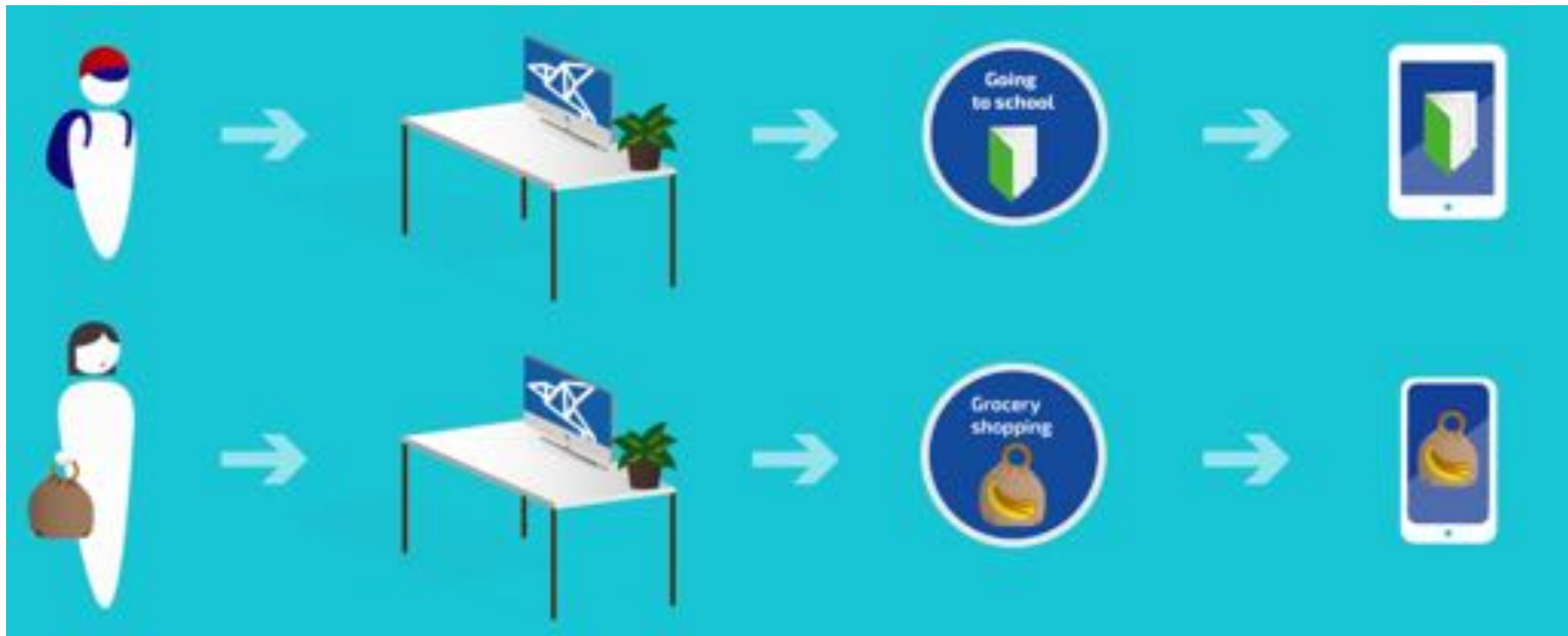
- Speaker-independent ASR systems:
 - Traditional methods fail — they require large-scale databases
 - Adaptation of standard ASR systems — poor performance
- Speaker-dependent dysarthric speech recognition systems:
 - trained mainly in the laboratory environments
 - problems in natural environments — performance not sufficient for practical implementation

Design challenges

- Environmental factors and severity of disease
- User motivation
- Key challenges:
 - core speech recognition technology – new techniques necessary
 - disability-oriented, user-centric system design
- Positive practical verification is a key success measure

Mobile and Personal Speech ASSistant – mPASS

- A web-based platform for building an ASR system that is tailored to user's speech disorder, needs and capabilities



Mobile and Personal Speech ASSistant – mPASS

- Automated and intuitive
- Expert knowledge is not required
- To be used at users' home
- Allows to build systems of diversified complexity
- The trained ASR system can be used with different mobile applications




mPASS
THE PASS TO SPEAKING

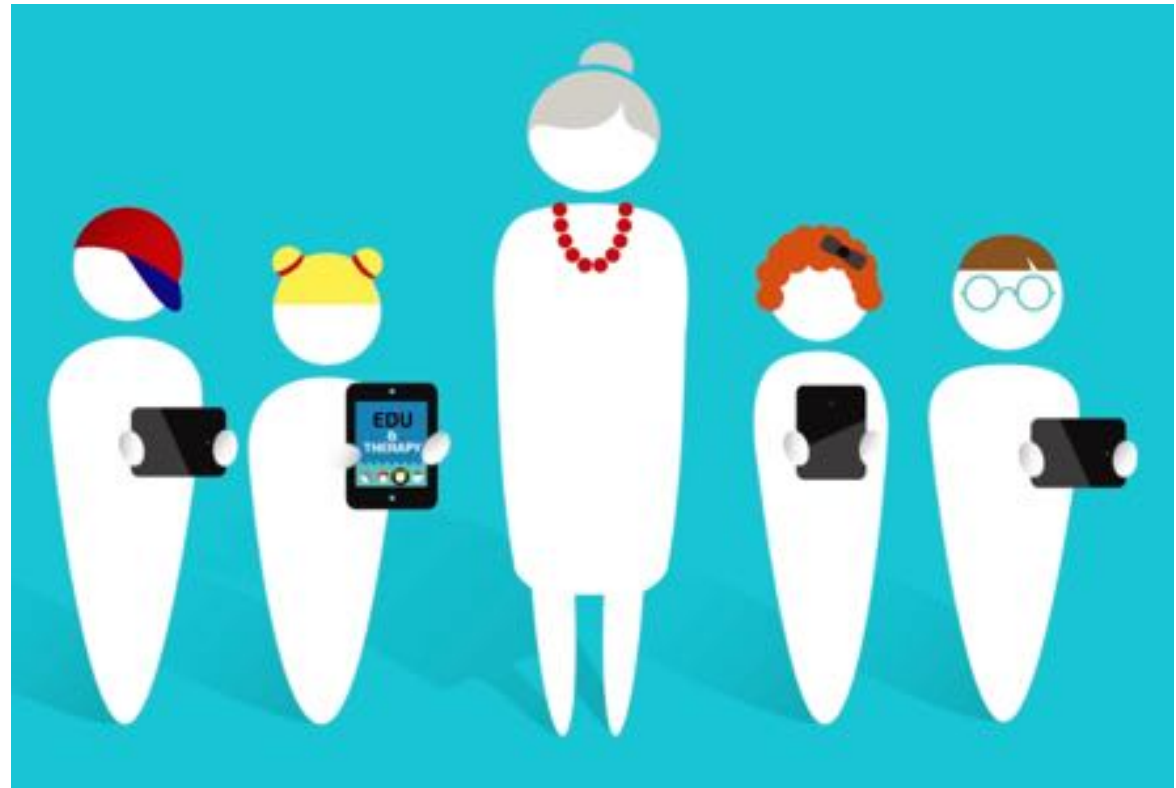
mPASS - examples of applications

- Dictation-based application for “translating” impaired speech



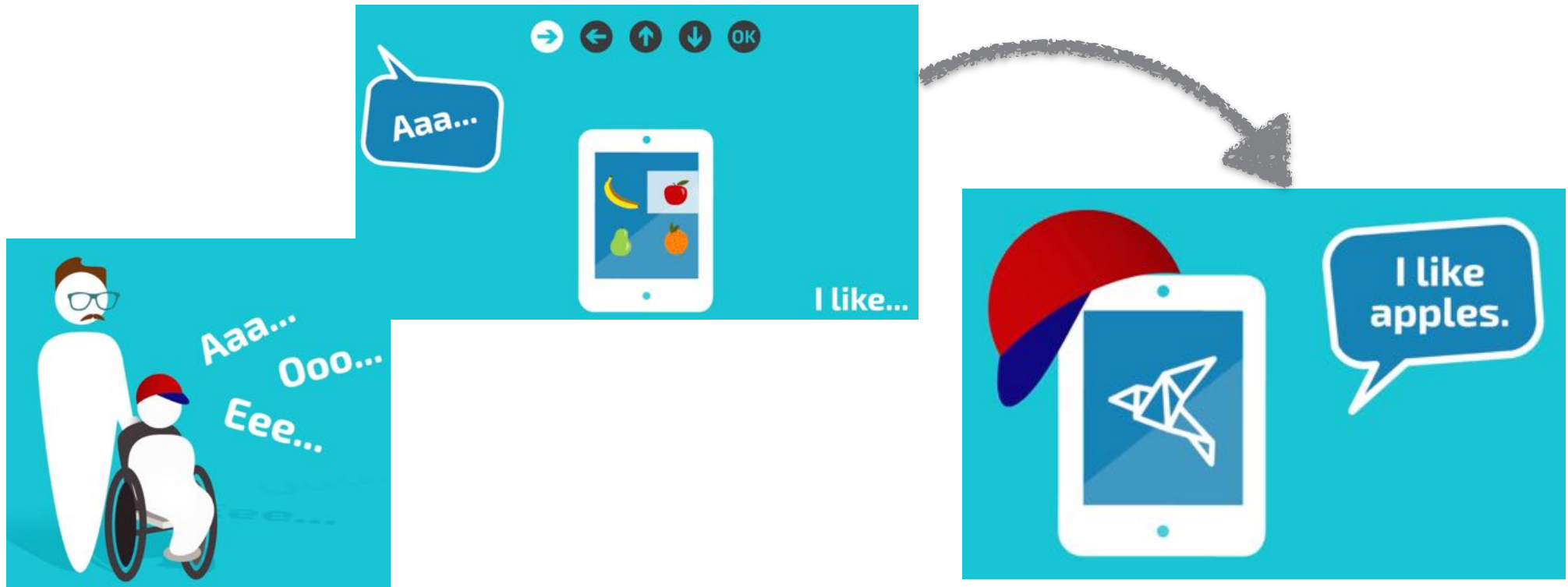
mPASS - examples of applications

- Educational game targeted for autistic users



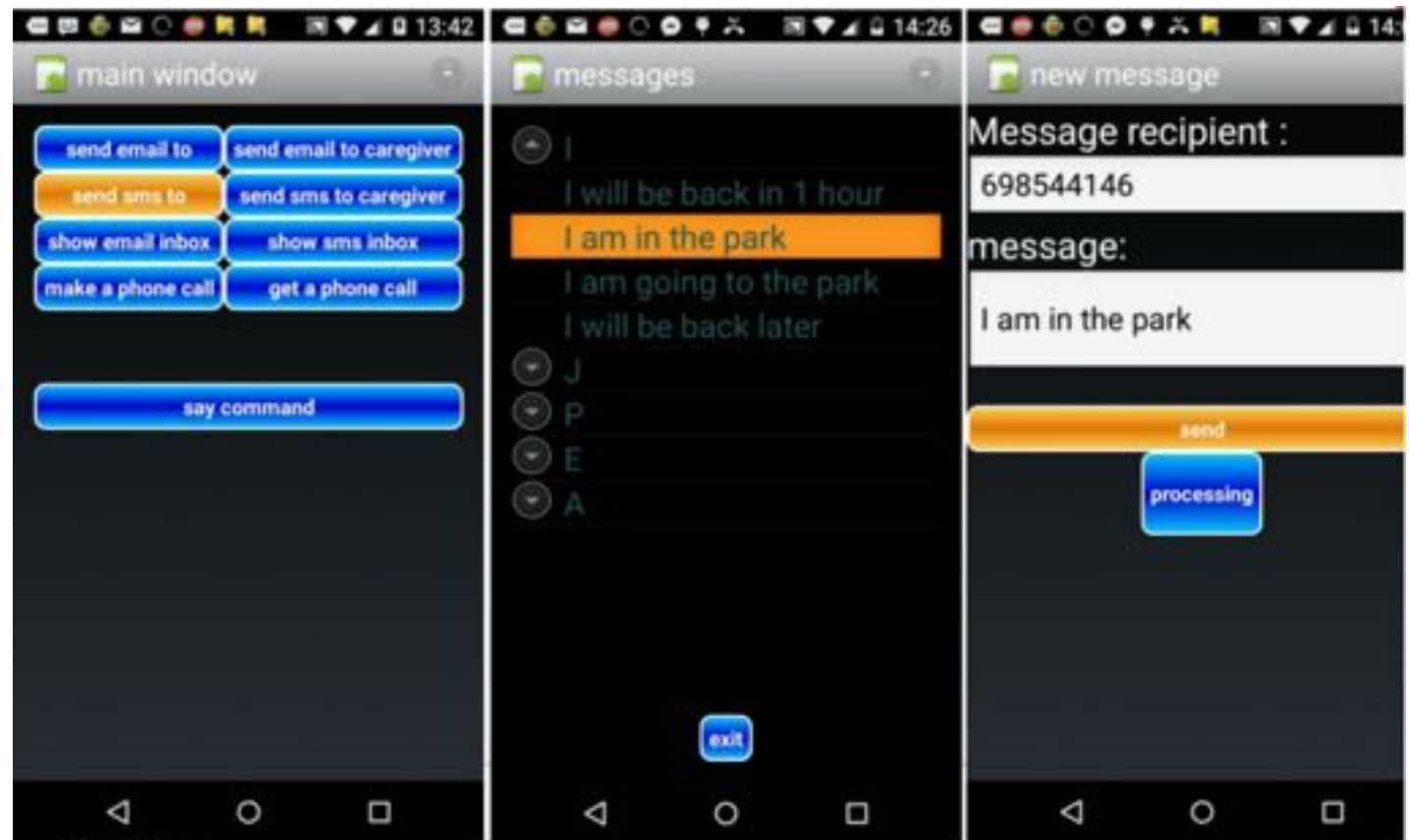
mPASS - examples of applications

- Mobile “communication book”

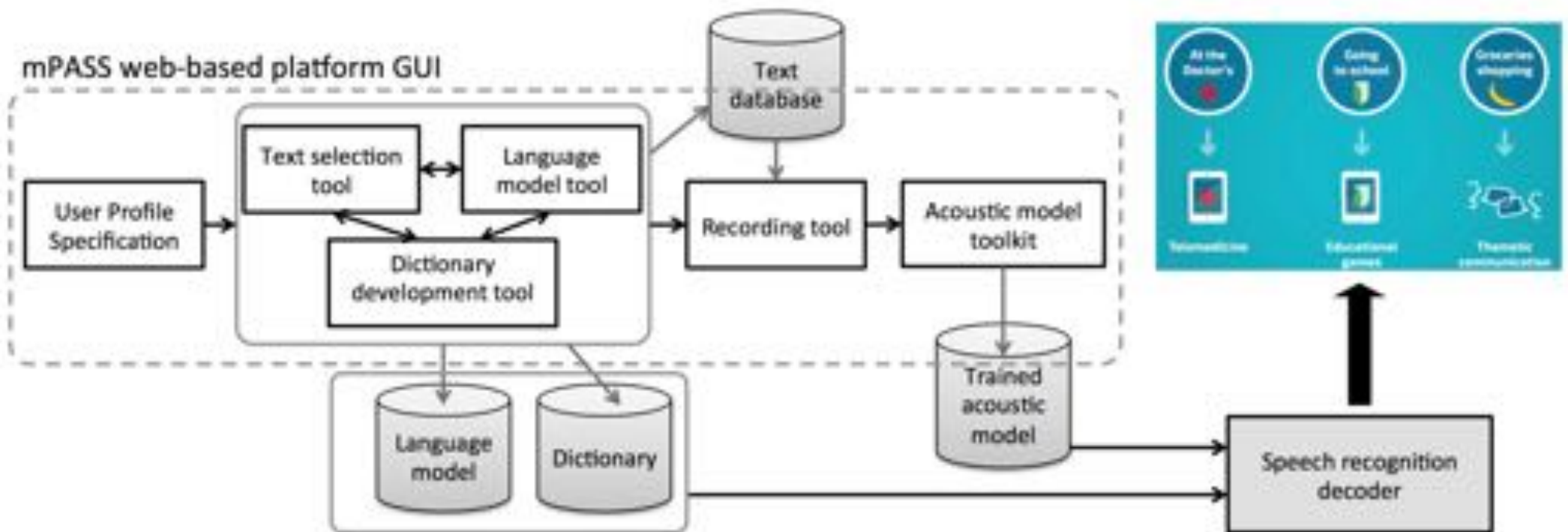


mPASS - examples of applications

- Application allowing to control the mobile device



System architecture



■ Automated process:



Preliminary experiments

- Adult with explosive speech and cerebral palsy
- Voice-controlled mobile app for sending SMS or e-mail
- User-defined voice commands: 8 messages and several action commands:
 - together 21 phrases, recorded 30 times each
- HMM-based acoustic model for ASR

Preliminary results

- Laboratory environment: 99% of recognition accuracy
 - results averaged over 20 trials
- Real environment (home/office): on average 84%
 - over 80 commands tested
- Time necessary to accomplish an action:
 - the voice-controlled version outperformed the manual entry for up to 49%

Action	Voice input	Manual input	Gain
Send SMS to caregiver	31s	56s	45%
Send e-mail to caregiver	33s	65s	49%

Preliminary results

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User assessed a voice-controlled version as the preferred one

Conclusion and future work

- mPASS combines user-centric system design with the top performing ASR tools
- Enables to build at home diversified ASR systems
- Allows for practical usage
- Proof-of-concept evaluation was successful:
 - Very promising outcome for the real usage environments, which was rarely achieved before
- Future work — more detailed performance evaluation



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Thank you for your attention!

Are there any questions?

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