MoSHCA
My Smart Mobile Healthcare Assistant

Hendrik R. Schwietert, Evalan
Henk.Schwietert@Evalan.com
MoSHCA
Mobility

610,000 Hip Fractures per Year
MoSHCA
COPD

3% of Population
MoSHCA Methodology

**Monitor**
- Wireless sensors
  - Bluetooth
  - Wi-fi
- Smartphone
- User feedback

**Reason**
- Artificial Intelligence & Decision Support Systems
  - Bayesian Networks
  - Case-based Reasoning
  - Rule-based Systems
  - Neural Networks

**Act**
- Detect possible issues
- Warn patients
- Advise medical staff
- Give reminders
- Warn caregivers
MoSHCA Objectives

- Provide a better **patient-centred care** of chronic and acute diseases.

- Develop **intelligent** healthcare solutions for **smartphones** and other systems.

- Increase **patient wellbeing** and reduce the number of visits to hospitals.

- Facilitate **care-givers** task by providing smart tools.
Innovative Aspects

- User-friendliness
  - Mobile phones
  - Sensor usage

- Increased Intelligence
  - Objective data (Sensor inputs)
  - Subjective data (Patients’ perception)

- Context-awareness
  - Environmental, sensor-related, etc.

- Interoperability - Standards
  - SNOMED CT
  - HL7
MoSHCA Use cases

- Mobility Rehabilitation
- Pregnancy
- General Health
- Epilepsy
- Premature Babies
- Hypertension
- Chronic Obstructive Pulmonary Disease
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Epilepsy use case

Tim Riegman, CLB
triegman@clb.nl
MoSHCA Epilepsy App

✓ Improve quality of care
✓ Reduce invasion of privacy

Current situation:

- **Undetected** epileptic seizures result in **unnecessary health damage**
- Epilepsy patients are **unable** to call for help whilst having a seizure
- **Permanent monitoring** required (also during the night)
  - **Massive invasion** of patient’s **privacy** and/or mobility
  - Immense **burden** on care giver
MoSHCA Epilepsy App

- **What:** An android app that is able to detect epilepsy via sound
- **How:** It continuously monitors a sleeping patient via the smartphone’s embedded microphone and uses algorithms to detect sounds affiliated with epileptic seizures. Upon detection, it automatically sends out an alert to care providers
- **Why:**
  - To enable swift assistance
  - To remove the permanent burden of care providers
  - To reduce invasion of privacy
  - To eliminate restriction of mobility.
MoSHCA Epilepsy App

- **Innovative aspects**
  - First (mobile) product that can detect sounds affiliated with epileptic seizures
  - Able to alert care providers of on-going seizures without using physical sensors attached to the patient’s body

- **Key benefits:**
  - **Comfort:** No sensors attached to patient
  - **Use case:** Specifically for sleeping patients
  - **Monitoring time:** External power supply
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Mobility use case

Marleen Germs, Evalan
Marleen.germs@evalan.com
Mobility Use Case

- 800,000 new stroke patients per year in Europe

- Current treatment of balance problems
  - Adhering to the desired loading pattern is key factor
    - difficult to notice and correct (for both patient and physiotherapist)
  - Not supported by mobile medical devices
    - Mainly by visual and verbal feedback of physiotherapist
The MoSHCA Mobility product will ...

- … give **insight in the balance**
- … predict the **optimal state** of the patient
- … predict the **period of time** in which this will be realized
MoSHCA Mobility Solution

- For patients it ...
  - … will **take away uncertainty**
  - … can **speed up rehabilitation**
  - … will **help regaining independency**

- For physiotherapists it gives insight in …
  - … the patients’ actual **loading and balance**
  - … the patients’ **progress** over time
  - … the expected **recovery date** based on the loading data
MoSHCA Mobility Solution

Prototype
Balance test healthy person
MoSHCA Mobility Solution

- Innovative aspects:
  - Multiple innovative sensors and multiple sensor types combined in one system
  - Predicting patient rehabilitation duration (CBR and BN)
    - Guides healthcare professionals in their treatment plan

- Key benefits (against competitors):
  - Ambulant
  - Easyness of use
  - Re-usable sensors
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Premature babies use case

Albert Pla, University of Girona
albert.pla@udg.edu
Premature babies

- 500,000 kids/year prematurely born in Europe (10% of births)
- Very long hospitalization for the baby (1-8 weeks)

- Uncomfortable & Resource Consuming
  - Families suffer high stress
  - Hospital beds occupied for long periods

- Early discharge programs (low risk stage)
  - Nurse periodically visiting patients
    - Limited number of patients
    - Bad cost-effectiveness ratio
    - Not daily information
    - Distance limitation
MoSHCA Solution

- Home monitoring using **Android App & wireless sensors**

**Low Risk Stage**

**Home**
- Information gathering
- Feedback for parents
- Less stress
- Caregivers interaction

**Hospital**
- Remote monitoring
- Decision support
- Parents interaction
- Less resource consumption

**Monitoring**

**Reasoning**

**Acting**

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MoSHCA Procedure

- **X times per day:**
  - Baby’s evaluation
  - Feedback for parents
  - Information sent to hospital
  - Warnings for doctors

**Questions to parents**
MoSHCA Reasoning

- Smartphone reasoning: Knowledge-based System (KBS) → Warns Parents
  - Based on doctors knowledge
- Hospital reasoning: KBS + Case-based Reasoning → Warns & Advises Caregivers
  - Based on doctors knowledge + Hospital health records
MoSHCA Innovations

- Main Innovations
  - Inclusion of reasoning tools that can help parents & Care-givers
    - Warn parents about baby’s status
    - Aid caregivers when assessing the baby
  - Direct interaction with medical team & Hospital facilities
    - The information is sent to the hospital where a caregiver can revise it
    - Caregivers can directly send messages to parents
  - IEEE 1073 Standard Compliance
    - Allows the use of new wireless devices supporting this standard
Other use cases

- General Health
- Hypertension
- Pregnancy
- Chronic Obstructive Pulmonary Disease
Thank you for your attention
We value your opinion and questions
Interested in other use cases?
Hypertension use-case

- Hypertension issues
  - Major risk factor for stroke, heart failure and chronic kidney disease.
  - Half of patients with hypertension are not properly controlling their blood pressure.
  - Controlling hypertension for senior is a big challenge

- Positive antecedents
  - Telephone-based & telemedicine systems have improved patients health.
  - Sensors & mobile apps reduce patient intervention

- Develop a solution to facilitate hypertension management.
Hypertension: MoSHCA App

- MoSHCA Smartphone app:
  - Intelligent decision making for hypertension
  - Decision making: rule-based system
  - Flexible rules set by doctors

- Easy to use:
  - Wireless sensors
  - Reminders
  - Management
COPD use case

- COPD: Chronic obstructive pulmonary disease
  
- High impact
  - Patient quality of life
  - Disease progression
  - Healthcare costs

- The COPD Aerial App aims to predict the worsening of symptoms at an early stage.
  - Prevent worsening of COPD
  - Prevent hospitalization
  - Improve quality of life
COPD: Aerial App

- Early prediction of exacerbations:
  - New methods for learning from historic data
  - Adapts to patient along time

- Data from sensors & patient’s impressions
  - Spirometer for measuring lung function
  - Pulse-oximeter (measuring blood oxygen)
Pregnancy use case

- Pre-eclampsia: serious complication during pregnancy:
  - high blood pressure
  - large amounts of proteins in urine

- Is one of the most common causes of death during pregnancy.

- It can be treated effectively at an early stage

- eMomCare: self-monitoring by pregnant women for *early detection of pre-eclampsia*
Pregnancy: eMomCare App

- Early prediction of pre-eclampsia
  - Probabilistic inference methods
  - Integration of reasoning techniques in smartphones
- Data from sensors
  - Blood pressure monitoring
  - Measurement of proteins in the urine using the smartphone’s camera
General health use case

- Increasing number of people suffering from overweight & obesity

- Chronic patients are treated by:
  - Workout & Exercise Planning.
  - Diet Self-Monitoring.

- Develop a smart monitoring app for general health
General health: MoSHCA App

- Complete monitoring application
  - Diet & Workout
  - Calorie counting
- Personalized tips
- Plans & tips from caregivers
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