# Supporting Clinical Therapy Using Smartphone and Activity Sensors

Mobile Patient Information System

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> AmiEs-2016 (22-24 Sept) Heraklion, Crete, Greece

# IKMB

- Institute of clinical molecular biology
- Found in 2003 by CAU in UKSH
- Main focus
  - Understanding of chronic inflammatory diseases
    by exploring the human longevity/healthy ageing
- Other Research
  - Genetics & Bioinformatics
  - Longevity Ancient DNA
  - Molecular Cell Biology



#### Overview

- Problem Background
- Problem Statement
- Solution
- Existing Solutions
- Sensor Evaluations
- Product Promo
- Limitations
- Conclusion

#### Problem Background



- Cancer
- Cardiovascular
- Diabetes
- Respiratory



"Death is inevitable but it doesn't have to be slow, painful and most importantly premature.

Unknown

"

## Problem Background



#### **Problem Statement**

- Preventable, Controllable but not curable
- Communication between Physician & Patient
  - consecutive appointments
    - Health condition
    - Effect of medication
    - How active patient was
    - What he was eating
    - Any side effects







# Application

- Questionnaire
  - QoL, Disease index,
- Self Management
  - Prescriptions
  - Medications
  - Reminders
- Activity Data
  - Phone sensors
  - Wearable sensors
- Other Information
  - Diet Info.
  - Pain

#### Short Quality for Inflamm

Name

This questionnaire is designed to find out how yo asked about symptoms you have been having as a have been feeling in general, and how your mood below each question.

- 1. How often has the feeling of fatigue or being tire
  - 1. All of the time
  - 2. Most of the time
  - 3. A good bit of the time
  - 4. Some of the time
  - 5. A little of the time
  - 6. Hardly any of the time
  - 7. None of the time
- How often during the last 2 weeks have you delay problem?
   All of the time







Green: Food may be moving through your large intestine too quickly. Or you could have eaten lots of green leafy veggies, or green food colouring.



Back: It could mean that you're eleeding internally due to ulder or ance: Some vitamins containing iron ir bismuth subsalicylate could cause lack poop too. Pay attention if it's tick, and see a doc if you're worned-

Light-coloured, white, or Bloodclay-coloured: If it's not what Blood in you're normally seeing it could symptor mean a bile duct obstruction. doc right Some meds could cause this too. In your 3

Blood-stained or Red: Blood in your poop could be a symptom of cancer. Always see a doc right away if you find blood in your stool.





Separate hard lumps, like nuts Sau You're lacking fibre and fluids. Opt Drink more water and chomp

Sausage-shaped, smooth and soft Optimal poopl You re doing finel

Watery, no solid pieces, all liquid You're having diarrhoea! This is probably caused by some sort of infection and diarrhoea is your body's way of cleaning



Sousage-shaped but lumpy Soft blobs with clear-cut edges Not too bad. Pretty normal if you're umps, but you need to load up pooping multiple times a day.





Fluffy pieces with ragged edges, a mushy stool You're on the edge of normal. This type of Soft and sticks to the side of the toilet bowl Presence of too much oil, which could mean that your body isn't absorbing the fats properly. Diseases like chronic

Sausage-shaped but with cracks on surface

### **Existing Solutions**

- GiBuddy
  - Self-management
  - No interaction with sensors
- Google Fit
- Apple Kits
  - Research Kit
  - Care Kit





#### Feasible Sensors

- Initial Filtering
  - General info
  - Battery
  - Sensors
  - Features
  - Development perspective
- Empatica, Withings, Fitbit, Jawbone, Polar, Microsoft, Angel, mi
- Results: Empatica E4 and Angel sensor best suited.

#### Sensor Evaluations

- Study
  - Three participants
  - M 34 182, F 32 163, M 26 178
  - Each walked 5000 steps
  - other person marking 200, 500, 1000 steps with tally marker
- Accuracy
  - Deviation from actual value
- Precision
  - Coefficient of variability (%CV)



# Findings

- Accurate (all steps)
  - MSFT Band 2 (99.97 %)
  - Garmin Vivosmart HR (98.25%)
- Accurate (1000 steps)
  - Garmin Vivosmart HR (98.09%, SD=16.20)
  - MSFT Band 2 (97.91%, SD=29.45)
- Precise
  - Garmin Vivosmart HR (%CV=1.59)
  - MSFT Band 2 (%CV = 2.94)
  - Angel Sensor (%CV=35.92)



# Other Findings

- SD for P2
  - Gender, height difference
- HR evaluation
  - Against GE B20 PROCARE
  - Empatica E4, iHealth Oximeter
  - Subject to more testing
- Other
  - Least comfortable MSFT Band 2
  - Mi Band 1S in terms price



# **Our Application**



## **Application Architecture**



### **Application Architecture**



# Status

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	SIGN IN	Tra			O None of the time	
					All of the time	
	CONFIGURE	Notes		Reports	O Some of the time	
		V			O Most of the time	
					Hardly any of the tin	ne
					DACK	NEVT

# Status

Functionality	Complete	■ ♣ ₩ ? 36% ■ 13:55					
Surveys	Questionnaires	C Search					
Diet	Basic input	mushrooms	DBs				
Pain	Basic input with severity	CAMPBELL Soup Company, CAMPBELL'S Red and White, Chicken Barley with Mushrooms Soup,					
Sensors	EmpaticaE4, MSFT2	condensed					
Free text/questions	Done	CAMPBELL Soup Company, CAMPBELL'S CHUNKY Soups, Salisbury Steak with Mushrooms & Onions Soup					
Medication	Prescription/medicati on to take	CAMPBELL Soup Company, CAMPBELL'S CHUNKY Soups, Slow Roasted Beef with Mushrooms Soup					
Notifications	Medication, questionnaire, Sensors	Mushrooms, shiitake, raw					
Next S							
Integrate security module, add oAuth based sensors, back-end							

# Limitation

- Battery limitation
- Raw data size
- File access
- Coupled components

### Conclusion

- Empowered patients
- Bridging communication gap
- Adaptive therapy
- Secure inhouse data
- Research data base
- Healthier society
- First version for IBD patients.

# Thank you



References in notes