Inflatable interfaces : a tangible tool as a representation of physical wellbeing

Master thesis proposal

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Anas Alnayef
Supervised by: Florian Echtler, Eva Hornecker, Sujay Shalawadi

Introduction:

- Relying only on screens to monitor self physical activities (e.g. step counts) reduces data perception to a single sensory chanel: vision
- This limits self connection with the data and may discourage users to achieve their personal health goals
- The use of tangible shape-changing objects to represent personal data provides enjoyable experience of data perception through utilizing multiple sensory channels: vision and touch
- Thus, the increased efforts towards healthier lifestyle will be more rewarding upon interaction with the physical interface, which will reflect positively on the general well-being

Main Ideas

- Incorporating more data features: Outdoor activity + indoor inactivity

- Automatic data acquisition

- Design: more compact (single bigger inflatable), redesign texture

- More thorough evaluation: diary studies + interviews

DATA ACQUISITION/FEATURES: Indoor
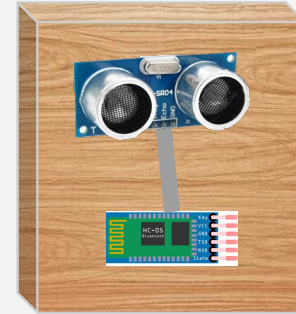
Sitting scenario :
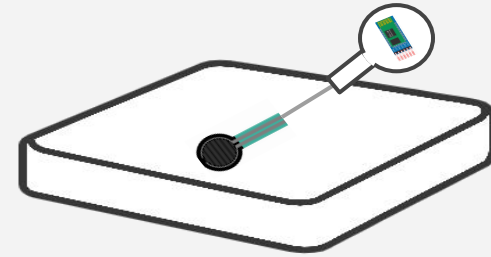
Sensor placed in the middle, BT module in a separate cushion for protection and comfort

Tools	Pressure sensor + Bluetooth module
Data type	Time passed between first pressure detection and no pressure
placement	Inside seat cushions

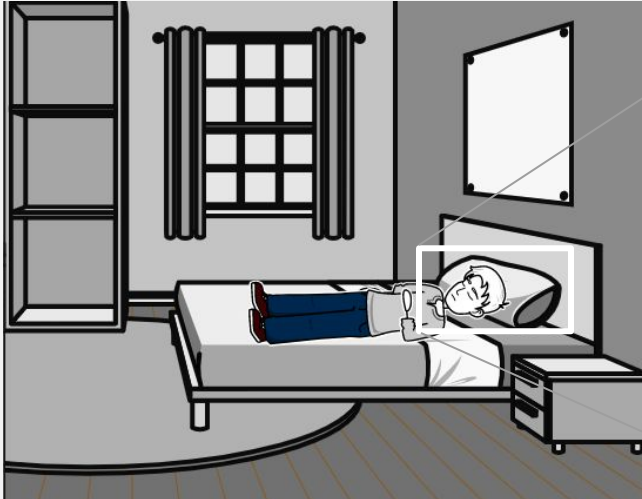# DATA ACQUISITION/FEATURES: Indoor

Moving around scenario :

Sensor and BT module are attached on a board with a suction cup/double sided tape on the back side

Tools	Distance sensor + Bluetooth module
Data type	Time of detection
placement	In hallways

DATA ACQUISITION/FEATURES: Indoor

Sleeping scenario :
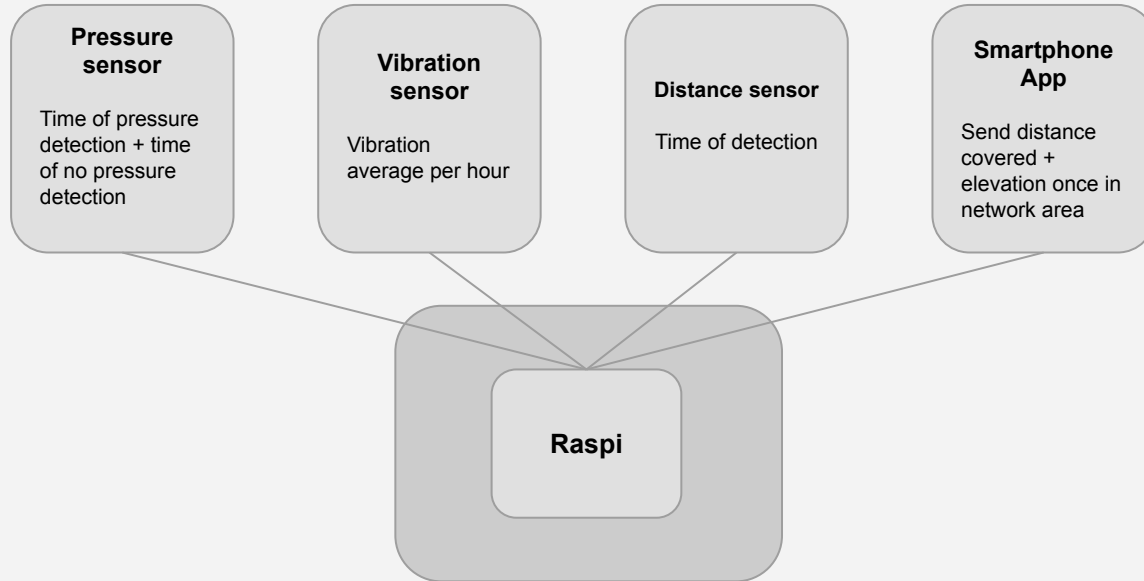

Sensor placed in the side, BT module in a separate cushion for protection and comfort and the whole setup is placed within the pillow cover

Tools	**Vibration sensor + Bluetooth module**
Data type	**Vibration per minute/hour (sleep quality)**
placement	**Inside Pillow cover**

DATA ACQUISITION/FEATURES: Outdoor

Tools	Smartphone app, ACC+GPS sensors
Data type	Distance + Elevation
Additional uses	Set time interval for data representation

DATA ACQUISITION/FEATURES: data syncing

Pressure sensor

Time of pressure detection + time of no pressure detection

Vibration sensor

Vibration average per hour

Distance sensor

Time of detection

Smartphone App

Send distance covered + elevation once in network area

Raspi

The inflatable interface

DESIGN

- A cylinder container, with the main inflatable on top, that holds the air pump, the raspberry pi and valve/PSI sensor
- Inflatable mesh attached to the surface of the main inflatable: mesh thickness correlates with hand pressure; plan A: use valve to allow air to escape from main inflatable to mesh, plan B: use PSI sensor inside main inflatable and extra tube
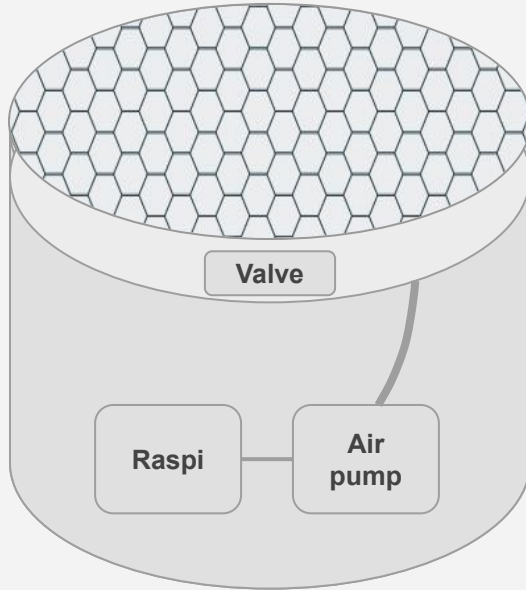
Plan A: Passive inflatable interface (Panic pete toy)
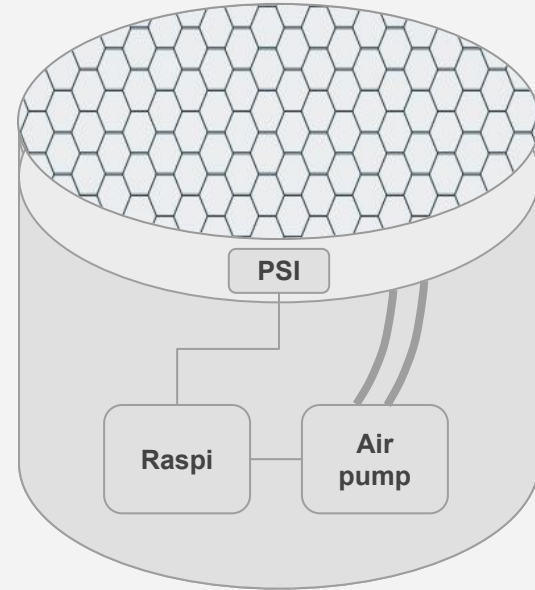
PLan B: Active inflatable interface

EVALUATION

- Pilot Diary study:

  a. Let participants use the system (sensors + smartphone app, without the installation) in their homes for 2-4 days
  b. Automatic daily data logging: to test the validity of the chosen data acquisition methods and to be used for data analysis
  c. At the end, the participants report their experiences daily: eg. how satisfied they are with each of the 4 scenarios mentioned before, by giving a score from 0-10

DATA ANALYSIS AND MAPPING ALGORITHM

- After the pilot study, for each participant, the average satisfaction score of the 4 scenarios is calculated and recorded along with the corresponding data logging output of all sensors
- For each participant, the data acquired for each day will be averaged and regarded as a single example in the regression model
- The averaged satisfaction score will be regarded as the well-being score and will be correlated with the acquired sensor data
- Well-being score correlates with the time the air pump will be activated

Multiple regression model:

	Data feature 01	Data feature 02	Data feature 03	Data feature 04	Well-being: 0-10 score
Example 01	12	15	16	5	7
Example 02	8	11	17	6	8
Example 03	4	12	5	10	5
...	...	...	...	...	...

EVALUATION

- **Main Diary study:** Using the training data from the pilot study

  a. Let another set of users use the system in their homes for 2-4 days
  b. The first day/s show a demo of how different combination of sensor data examples produce a wellbeing score both on smartphone (using sliders) and on the installation to let them comprehend the correlation between the data and the representation
  c. Automatic data logging: for testing the regression model performance

- **Interviews:** users report their experiences and how well the representation reflects their satisfaction with their well-being

Research questions

- **RQ1: can the multiple sensors used to measure indoor and outdoor habits produce measurable wellbeing?**
- **RQ2: How well does the regression model perform?**
- **RQ3: How well can participants relate their wellbeing to the inflatable interface?**
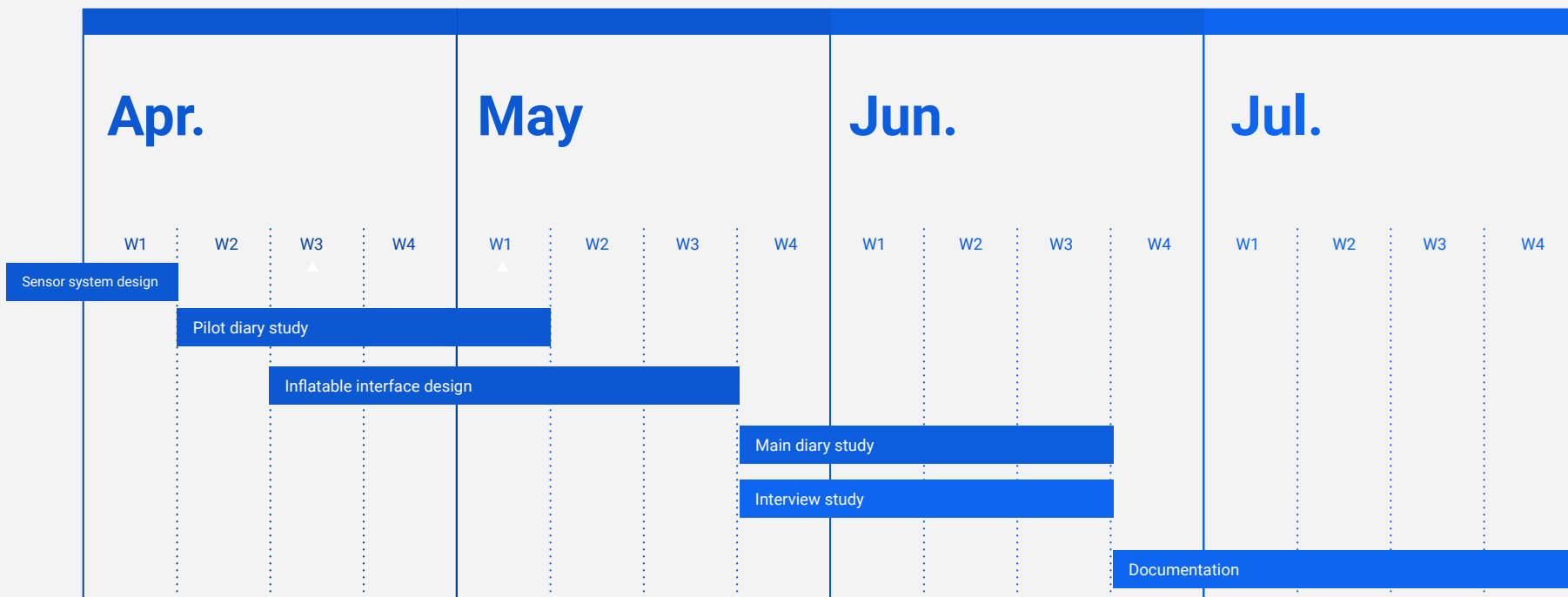
An answer will be derived for RQ1 after correlating the sensors data to the wellbeing satisfaction score that will be given by participants.

RQ2 and RQ3 is expected to be answered after the main pilot study and the interviews

Hypothesised benefits

- Portability, thanks to the compact design, thus easier reachability
- Enough range of data representation since single bigger inflatable, as opposed to 3 smaller ones, is used
- More engaging due to interactivity: texture change with hand pressure
- Non-intrusive data acquisition
- Generalizability to real-life contexts, due to the use of diary study
- Data privacy

Time plan

	Apr.				May				Jun.				Jul.			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4

Sensor system design

Pilot diary study

Inflatable interface design

Main diary study

Interview study

Documentation

THANKS