

# KNOWLEDGE EXTRACTION FROM USAGE DATA OF MOBILE DEVICES WITH EDUCATIONAL PURPOSES

Universidade de Vigo  
AtlantTIC

PhD student: Francisco de Arriba Pérez

Advisors: Manuel Caeiro Rodríguez, Juan Manuel Santos Gago

GIST, Dept. of Telematic Engineering , University of Vigo. Vigo, Spain 2016/17, farriba@uvigo.es

## MOTIVATION

- Using Machine Learning techniques to obtaining user patterns and indicators.
- New devices with capabilities to detect sleep and stress: wearables -> **wrist wearables**.
- Relevance of stress and sleep patterns in educational context.
- Using biometric data from wrist wearable devices to detect these patterns.

## THESIS OBJECTIVES

1. Study of wearable devices.
  - Evolution and market share of these devices.
  - Sensors features and availability.
  - Data access mechanisms.
2. Research and proposal of student indicators.
3. Architecture.
  - Data collection.
  - Homogenization.
  - Analysis.
4. Analysis and applicability in a certain e-learning contexts.

## RESULTS & DISCUSSIONS

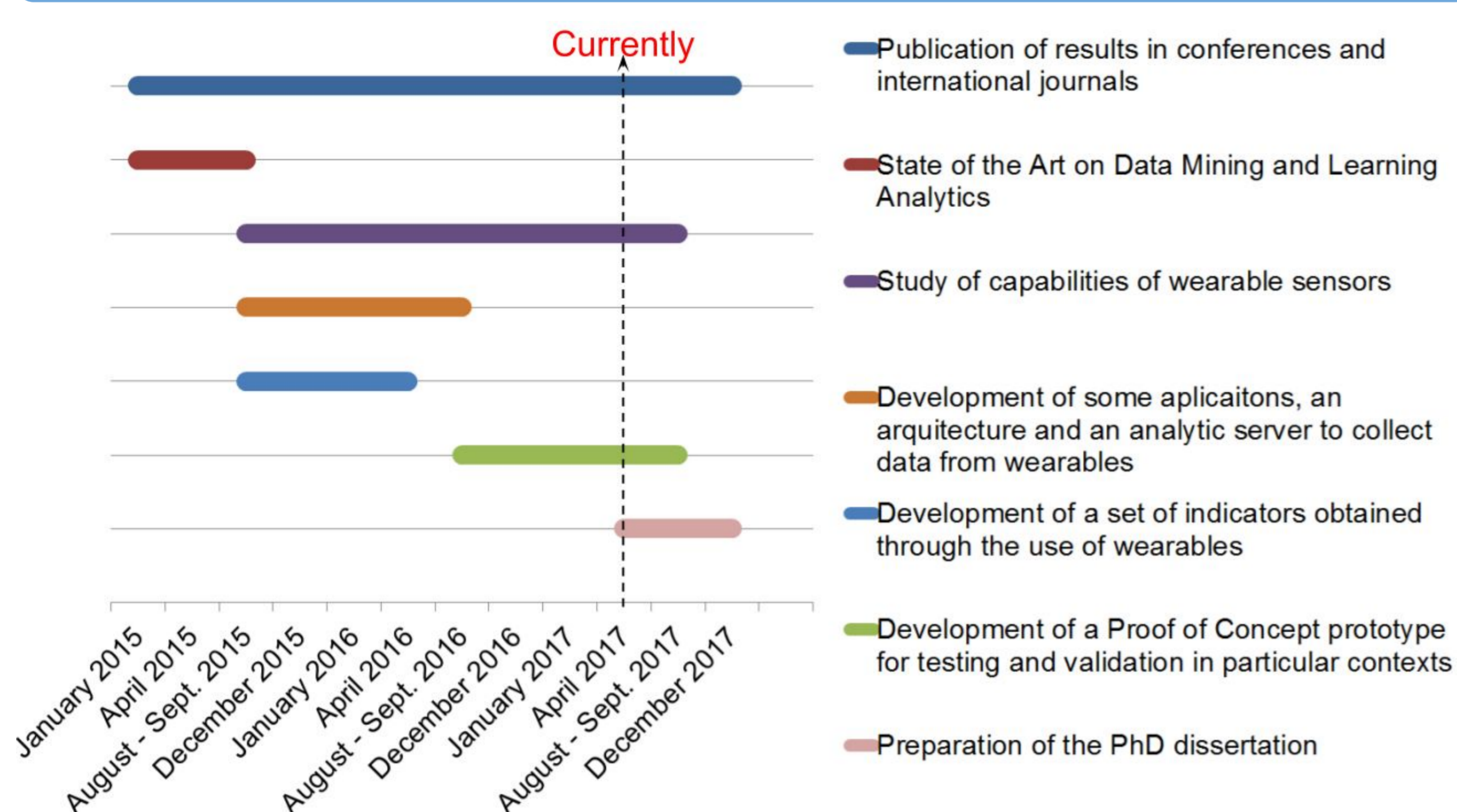
### Publications

- General Journals: accepted [1].
- Journal Citation Reports: [2, 3], under review [4].
- Conferences: [5, 6, 7, 8].

### Research achievements

- Proposal of sleep indicators and algorithms: sleep quality (SQ), sleepiness(S), chronotype(C), sleep regularity(SR), change sensitivity(CS) [1, 3, 6].
- Proposal of stress indicators and algorithms: snapshot stress (SS), aggregated stress(AS), latent stress(LS), stress regularity(SR) [1, 4].
- Development of the architecture [1, 2, 5].
- Development of an Analytics-Server [1, 2].
- Development a prototype dashboard for teachers [1, 2, 3, 4, 8].
- Development Android apps.
  - To capture and present data [2, 3, 4, 8].
  - To develop the sleep experiment [3, 8].
  - To develop the stress experiment [4, 8].
- Applicability in educational contexts [2, 3, 4, 7, 8].

## RESEARCH PLAN

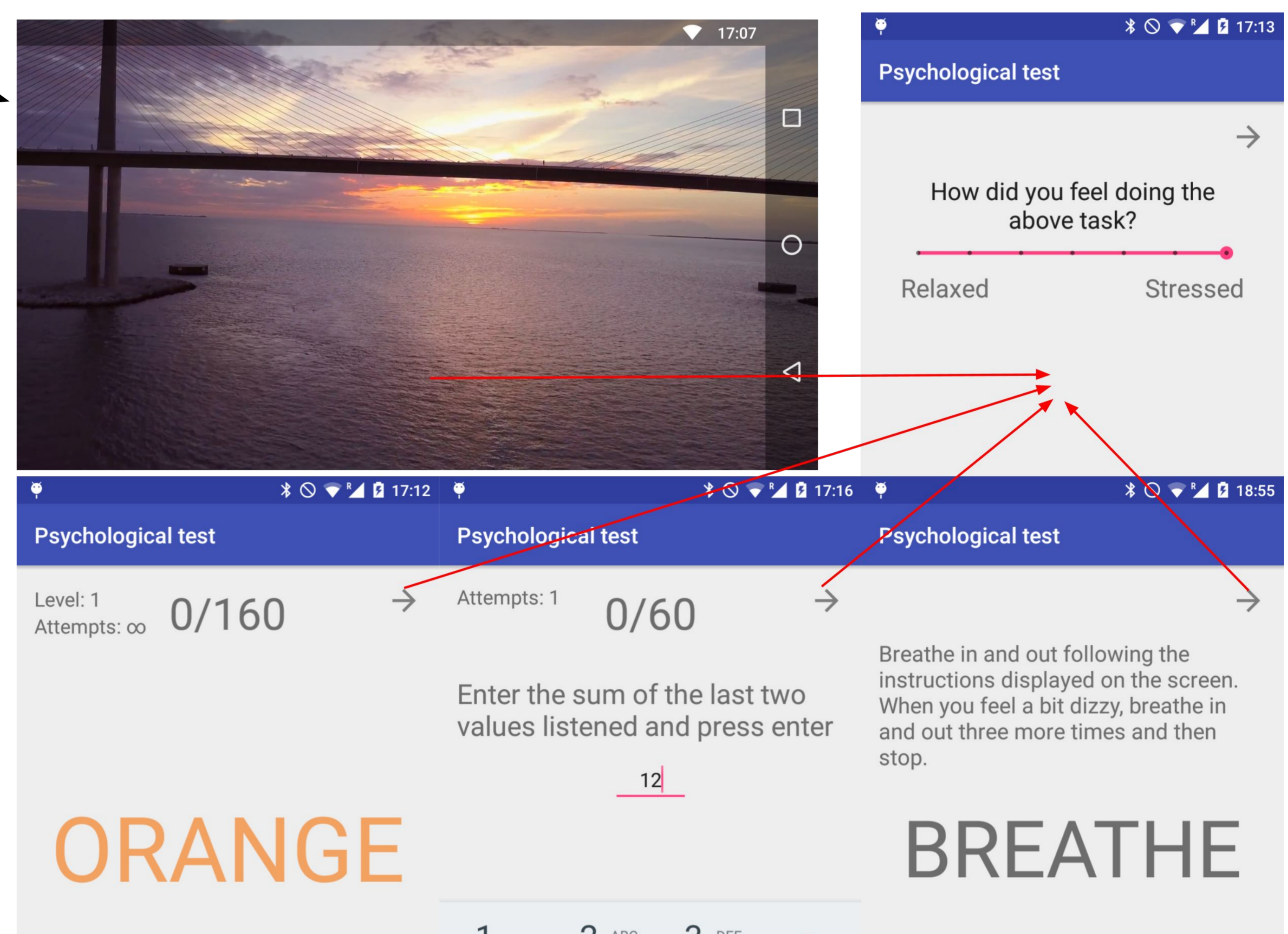


## ANALYTICS RESULTS TABLE

Indicator	Vars.	Algorithm	Evaluation Method	Vendors mean error	Our system mean error
SQ	Sleep duration, fall as sleep, awakes, heart rate min and average skin temperature	K*	Personal quiz	30.55%±16	14.93%±16

Indicator	Vars.	Algorithm	Evaluation Method	Accuracy
S	Heart rate, accelerometer, skin temperature	C4.5	Personal quiz	97.26%
C	Start time in bed, End time in bed	Rank equivalent to chronotype table	Horne and Ostberg questionnaire	100%
SS	Heart rate, accelerometer, skin temperature, Galvanic Skin Response	C4.5	The Stroop Colour-Word Interference, Paced Auditory Serial Addition Test, Hyperventilation task	99.74%

## STRESS EVALUATION APP



## NEXT YEAR PLANNING

Develop another proof of concept in an educational context

Preparation of the PhD dissertation (Completion planned for the end of December-17)

## REFERENCES

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- [3] de Arriba Pérez, F., Caeiro Rodríguez, M., & Santos Gago, J. M. (2017). How do you sleep? Using off the shelf wrist wearables to estimate sleep quality, sleepiness level, chronotype and sleep regularity indicators. *Journal of Ambient Intelligence and Humanized Computing*, 1-21.
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