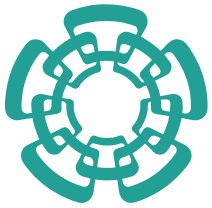

Smart usage of context information for the analysis, design and generation of power-aware polices for mobile sensing apps

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Problem antecedents

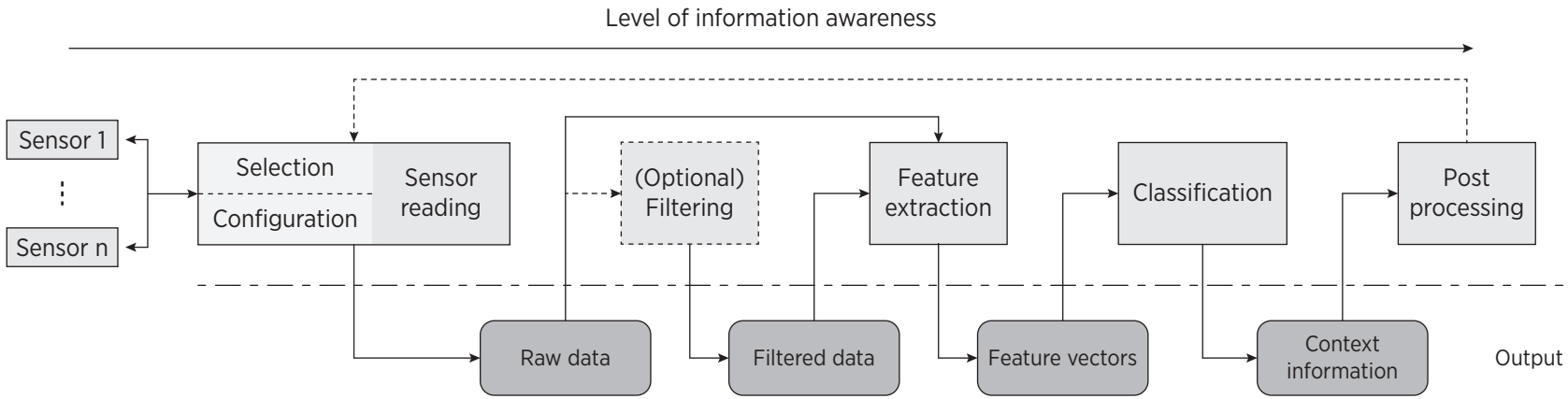

Figure: Stages of mobile sensing applications

Problem statement

Problem statement: Mobility pattern identification

Given a set $V = \{v_1, v_2, \ldots, v_n\}$ of data values read from sensor S in the time interval $T \in [t_1, t_2]$, identify the current mobility pattern p_S that represents the activity of user.

$$\text{PatternIdentifier}(V) \longrightarrow p_S \in \textit{Patterns} \tag{1}$$

Where *Patterns* is a set of patterns that represent an interesting state in user mobility, specifically the set $\{\textit{no\_movement}, \textit{walking}, \textit{running}, \textit{vehicle\_transportation}\}$.

Problem statement

Problem statement: Policy generation

Given the set of detected mobility patterns $\mathcal{P} = \{p_{S_1}, p_{S_2}, \ldots, p_{S_n}\}$ in data from sensors $\mathcal{S} = \{S_1, S_2, \ldots, S_n\}$, parameters for assigning weight to energy e and accuracy a, and physical constraints status c of a mobile device, find a policy that select the proper set of sensors $\mathcal{S}_{new}$ and its associated configuration $\mathcal{S}_{new_{conf}}$ while meeting application requirements.

$$\text{PolicyGeneration}(\mathcal{P}_{\mathcal{S}}, e, a, c) \longrightarrow \mathcal{S}_{new}, \mathcal{S}_{new_{conf}} \tag{2}$$

The $\mathcal{S}_{new_{conf}}$ configuration is referred as the *duty cycle* of associated sensor.

Interaction between problems

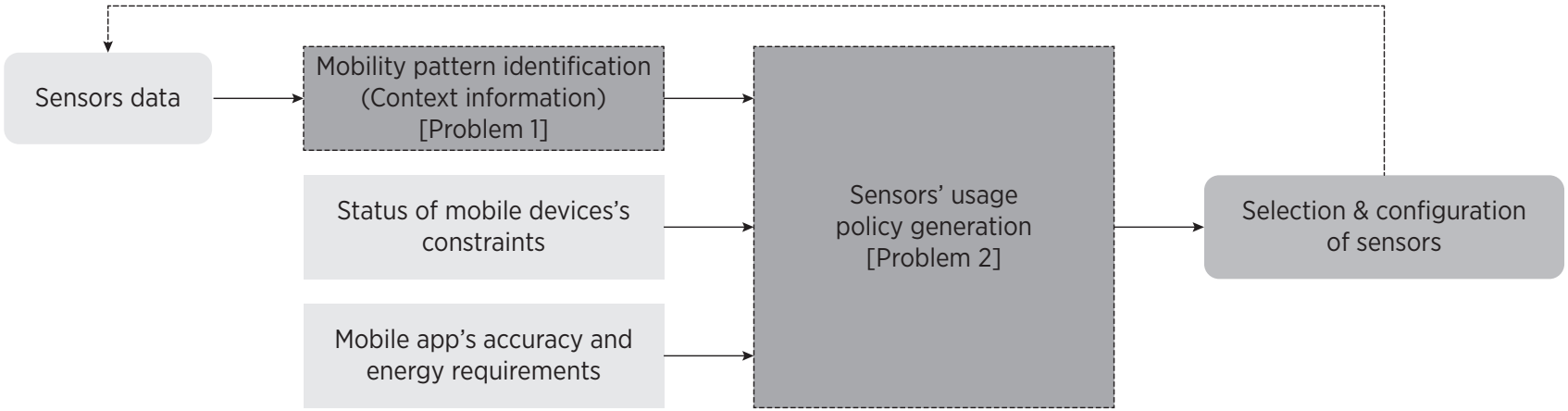

Figure: Interaction between the thesis work's problems

Problem's scenario

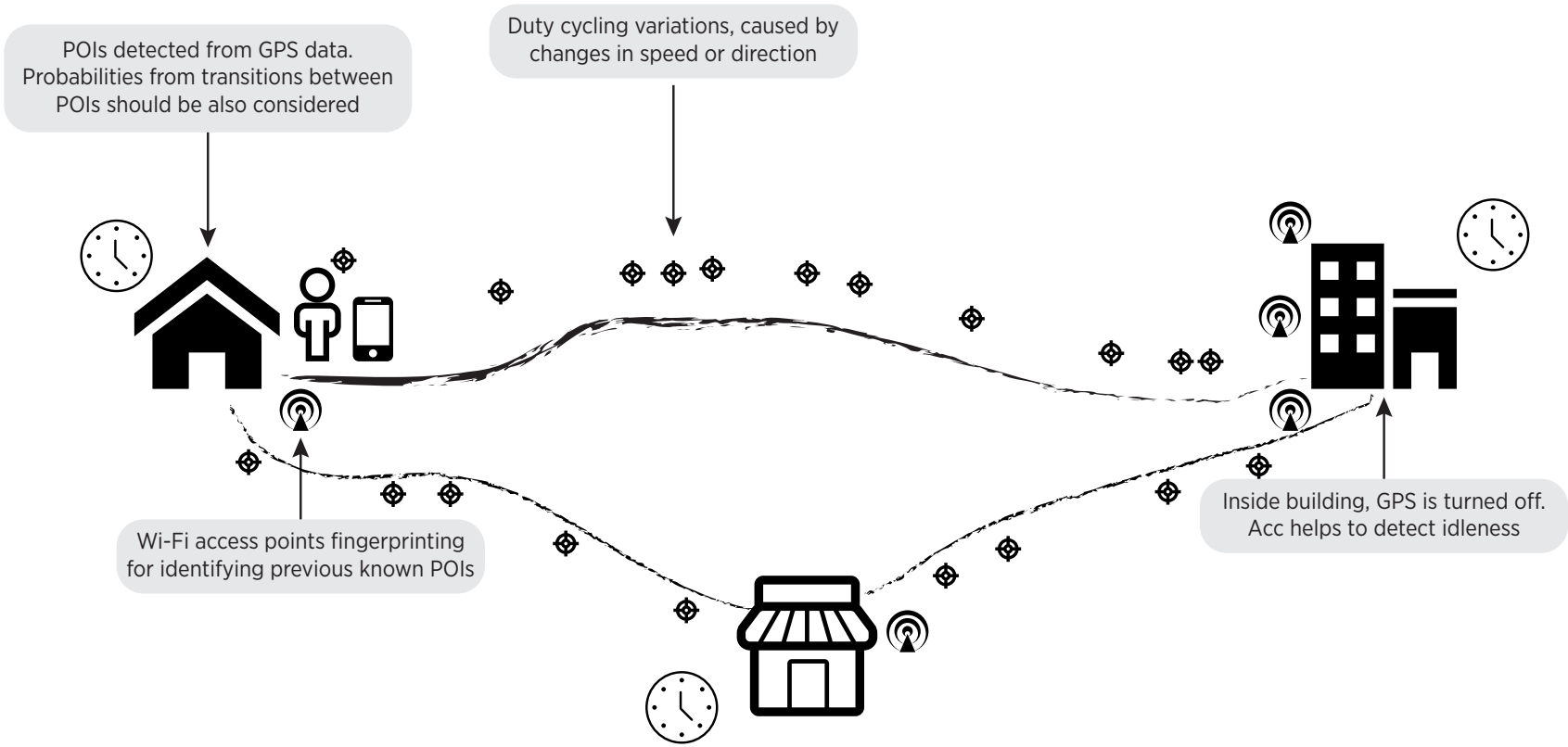

Figure: Basic problem's scenario

Methodology

This is our methodology. We can use the most updated version of the central figure.

State of art related techniques

A small version of the survey can fit here. Here we have to describe the taxonomy of the survey, as well as the way the context information is prepared for adapting sensory operations (the granularity of information of the implicit second taxonomy). We can describe works using these categories, avoiding a literal, cumbersome and too-long description of individual solutions.

Taxonomy of state of art solutions

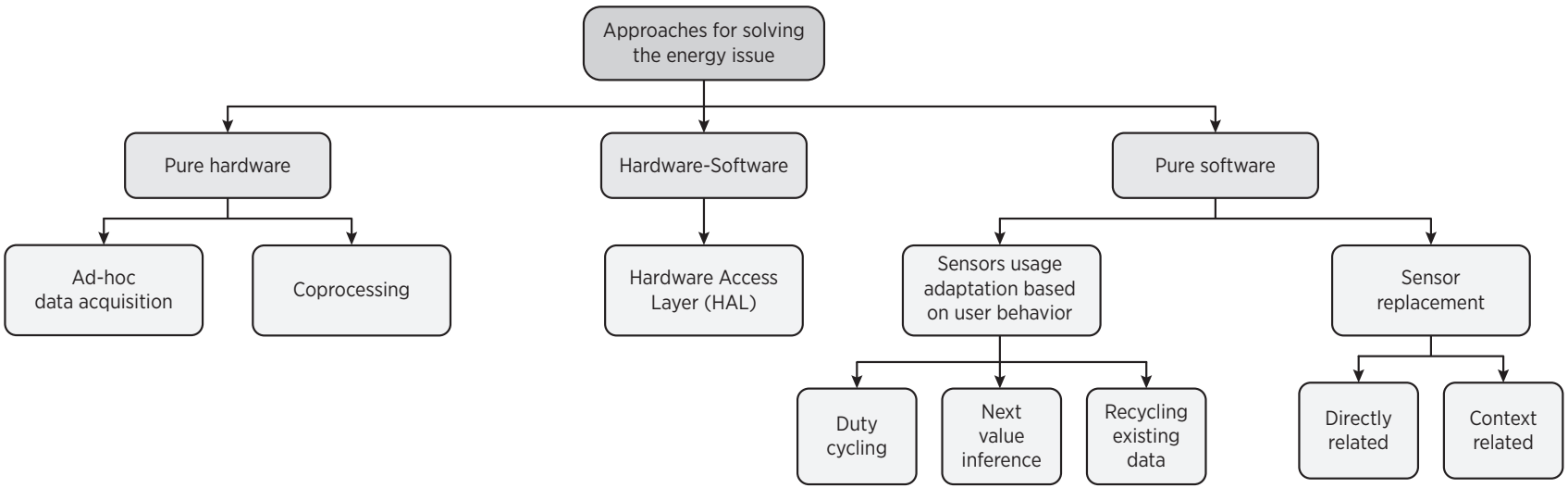

Figure: Taxonomy of solutions

Distribution of approaches

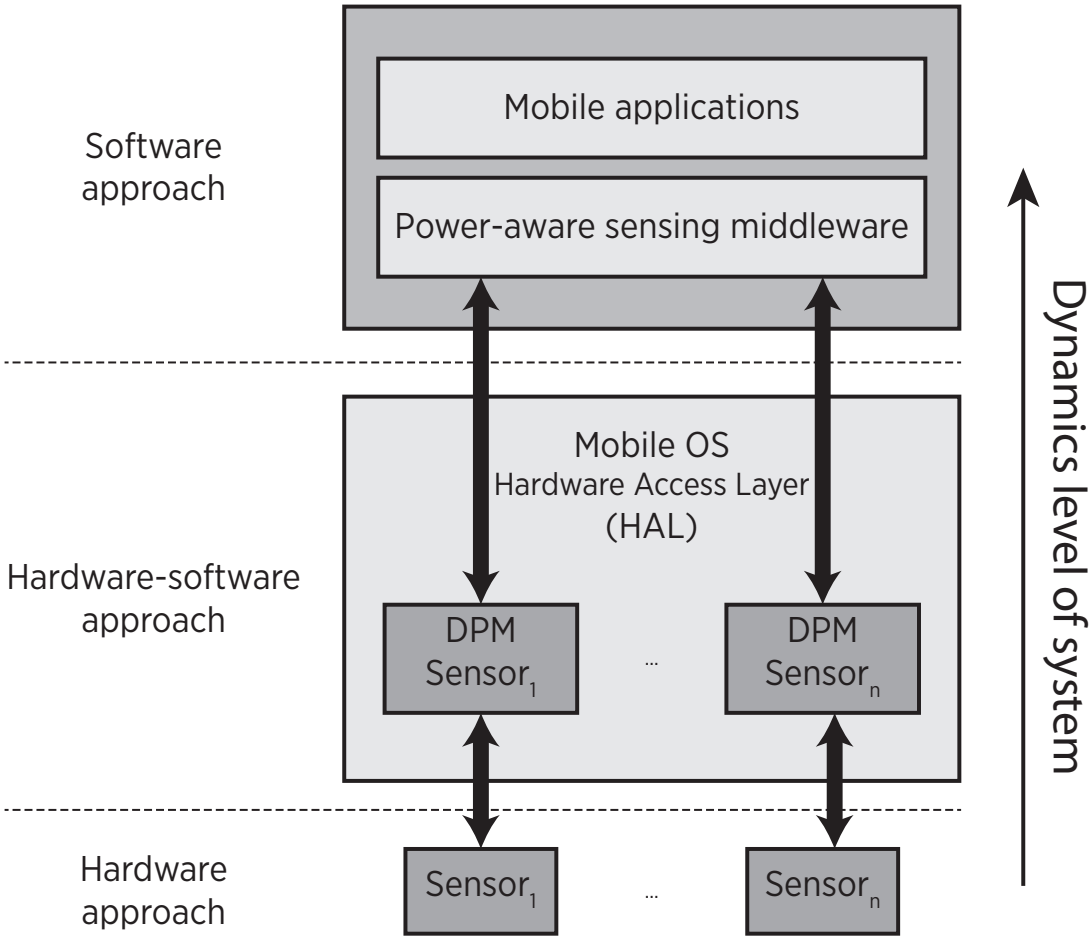

Figure: Distribution of approaches across mobile platform's layers

Proposed solution

Figure of *dual-taxonomy*.

How are we going to be different?. At the end we can describe that:

- In the ML block, we are going to produce an enhanced-expanded spatial-time model by:
  - Classifying accelerometer data in user activity.
  - Obtaining context information from other sources:
    - Fingerprinting, battery status.
  - Obtaining speed from GPS
  - Obtaining location from GPS and WPS
- In the policy block, we will try to adapt the sensing dimension spliting the problem into:
  - Learning and detection of stay points (Already covered)
  - Learning and detection (tracking) of trajectories.
- In the HW adaptation bloc, we will use several variants of the PS approach. For instance, we will do:
  - Sensor replacement, Context related (battery) and Direct related (WPS).
  - Adapt accordingly to what is learned from user through Duty Cycling (DC) and Recycling existing Data (RD). Maybe we will use Next Value Inference (VI) in the policy, when we adapt under uncertainty. For instance, we are 80% sure that user is running, we will proceed with caution adapting duty cycle with fine granularity, this is negotiable.
- At the end, we are trying to maintain sensors within a range that allows to perform the tracking but considering the trade-off

Results

Here, we can mentioned that we have partially prooved the possibility of performing user location tracking and stay points detection using only the smartphone. This empowers us to keep building the blocks that will complement our solution.

Scientific products

I think we can menton the survey. We need to find out whether we can describe the article related to the on-device detection of stay points, highlighting its 'event-oriented' perspective, which represent the most natural way on which smartphone-based systems for LBS should work, being proactive.

Future work

Adequate the calendar-schedule explaining the apparent delay produced by the survey, but remarking its added value as a metric and as a scientific booster for improving the work.

Conclusions

Conclusions should be focused on the presentation