Smart Detection System

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1. Main concept

Research has shown that householding electricity consumption can take up to 64% on billing utilities [1]. A proper use of electricity is then a step forward to save up valuable resources. The question is then which devices to optimize and why to do it in the first place. A naive answer could be the unplugging of electric domestics such as ovens or TV appliances. The problem with those is that some are imperative necessary i.e for food conservation as in the case of a refrigerator, and therefore should not be turn them off. A better choice would be electric devices that can be switched on and off throughout the day without causing disturbance. Elaborating this further, it is concluded that light bulbs could pose significant reductions on power consumption as they tend to be distributed in all rooms and used at different times of the day.

Considering the background explained above, my idea is to create a smart light detection system that is capable to recognize when bulb lights should be turned off and on. Examples are: turning the lights off when the user leaves the house/room, switching them on when the user arrives to home, setting a warmer/colder tonality according to different situations i.e. for dinner, when studying or even when walking up in the morning. Additionally, the system could predict when a person has woken up in the middle of the night to drink water or go to the bathroom and therefore, turn the lights on so that the user does not stumble reaching the switcher.

2. Smart spaces Themes

Theme 1:

- Anomality detection: when a person is sleeping and wakes up in the middle of night.
- Outdoor localization: GPS of the smartphone to detect when the user enters/leaves the house.

Theme 2:

- Indoor localization: PIR sensor to calculate the relative position of the person in the room.

Theme 3:

- Analyze human activities such as a person when is sleeping by using Machine Learning

Theme 4:

- Light bulb implementation interface on an android application + use of phone as wearable sensor

3. State of the art

Localization system

Experience gained from the first challenge will be applied to calculate one's position using the GPS of a smartphones.

Real-time Sleeping recognition

Challenge 4 will come on handy when working with the ultrasonic sensor to track a person movement while sleeping. This will be done on real-time and will allow the lights to turn on and off interchangeable

PIR recognition

Position of a person in specific rooms will be calculated using a battery and an Arduino uno and deployed in the roof of different rooms of a home

Smart bulb interface

Yellight bulbs will be mainly used as they work with WIFI connection and are programmable via YEELIGHT Toolbox open code

4. Architecture and system components

Hardware components

Localization system

- GPS of a smartphone

Real-time Sleeping recognition

- Ultrasonic sensor
- Accelerometer of smartphone

PIR recognition

- PIR sensor
- Arduino uno
- Batteries 12v.

Smart bulb interface

- Yeelight bulbs

Software components

- Firebase for real-time transfer data and support of live view apps
- Android Studio to develop the app for the phone

5. Time planning, resource, and task allocation

Week 6:

In this week we will gather information from different papers, sketch ideas on the design of the application and collect the materials and hardware to be able to use the sensors for the coming weeks.

Week 7:

During this week we will start working on the different tasks that we will discussed below in this report. Namely the different tasks would be: Localization system, Real-time Sleeping recognition, PIR recognition and Smart bulb interface

Week 8:

In this week we will try to finish the task that were given for each member so that we can test and join our system during the next weeks

Week 9:

At this point in time, we should make the last arrangements to our system, make sure everything is running and we will start working on the report. Additionally, a planning for the demo will be planned and practices beforehand

Week 10:

To our best of our knowledge we will have everything done so that in case we need to try the system again we will fix unforeseen circumstances. The demo and report will be finished by then.

Reference:

[1] Rosin A. 2017. Analysis of Household Electricity Consumption Patterns.