LECI – Proposta de Projeto Eng.a de Computadores e Informática

Intelligent Mirror room

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Motivation

Previous work of your colleagues (the project from 2021/220 and entitled he "Intelligent waiting room") explored several approaches using video-based solutions to provide a proof of concepts scenario for a waiting room. The results clearly show the potentials of using video to estimate the HR, to track the number of persons in a room. Although not fully explored the use of an IR camera also seemed promising.

Objective

The objective of this project is to explore these findings in a concrete setting - an intelligent mirror in the bathroom of a house - a kind on health and mood sensitive companion when you wake up in the morning. The idea is to build a prototype of the mirror using, from the start, the previous results based on video and integrate in the context of a smart home.
You will have the opportunity to extend previous work not only on the actual setup but also explore ML/AI approaches to support more "intelligent" interaction and monitoring of humans in front of the mirror. Other options like exploring audio or other sensors are not excluded. Out of the box solutions are welcome.

This proposal is a R&D field of interest in different projects involving the University of Aveiro (UA), namely the ongoing international APH-ALARM project and the "Casa da Saúde" project funded in its initial phase (2022) by OLI.

Tools of trade

Working demos from previous year
- Several cameras and RPI devices namely RPI HQ Camera with several lens
- RPI Compute module and RPI4 s
- Lepton IR camera

Opportunities and Challenges

- Explore further the new RPI compute module to replace the traditional RPI4.
- explore video and IR cameras to extract heart rate - using PPG
- explore the use of AI/L solutions such Tensorflow to recognize relevant events/situations -

Research scope

This work will be integrated within the R&D activities of IEETA

Tentative workplan

- familiarization with the previous work
  - the languages and frameworks
  - methods used
  - sensors and demos
- defining the mirror use cases and adapt architecture
  - operational constraints, define the actual scenarios

- - Workflow and events identification
- Development, Implementation of the system
- System evaluation
- dissertation document preparation.

Some references

Raspberry Pi Compute Module 4
    https://www.raspberrypi.com/products/compute-module-4/?variant=raspberry-pi-cm4001000
All About Raspberry Pi HQ Camera Lenses
    https://learn.adafruit.com/raspberry-pi-hq-camera-lenses
Tensorflow Lite tutorials
    https://www.tensorflow.org/lite/tutorials
Remote Photoplethysomographic (PPG) Imaging
    http://alumni.media.mit.edu/~djmcduff/assets/remote-physiology.html
Automated video-based heart rate tracking for the anesthetized and behaving monkey
    https://www.nature.com/articles/s41598-020-74954-5
Lepton Integration with Raspberry Pi
    https://www.flir.eu/developer/lepton-integration/lepton-integration-raspberry-pi/
Pose Estimation on The Raspberry Pi 4
    https://medium.com/analytics-vidhya/pose-estimation-on-the-raspberry-pi-4-83a02164eb8e