Human-centric Advanced Driver Assistance Systems

PhD Candidate:
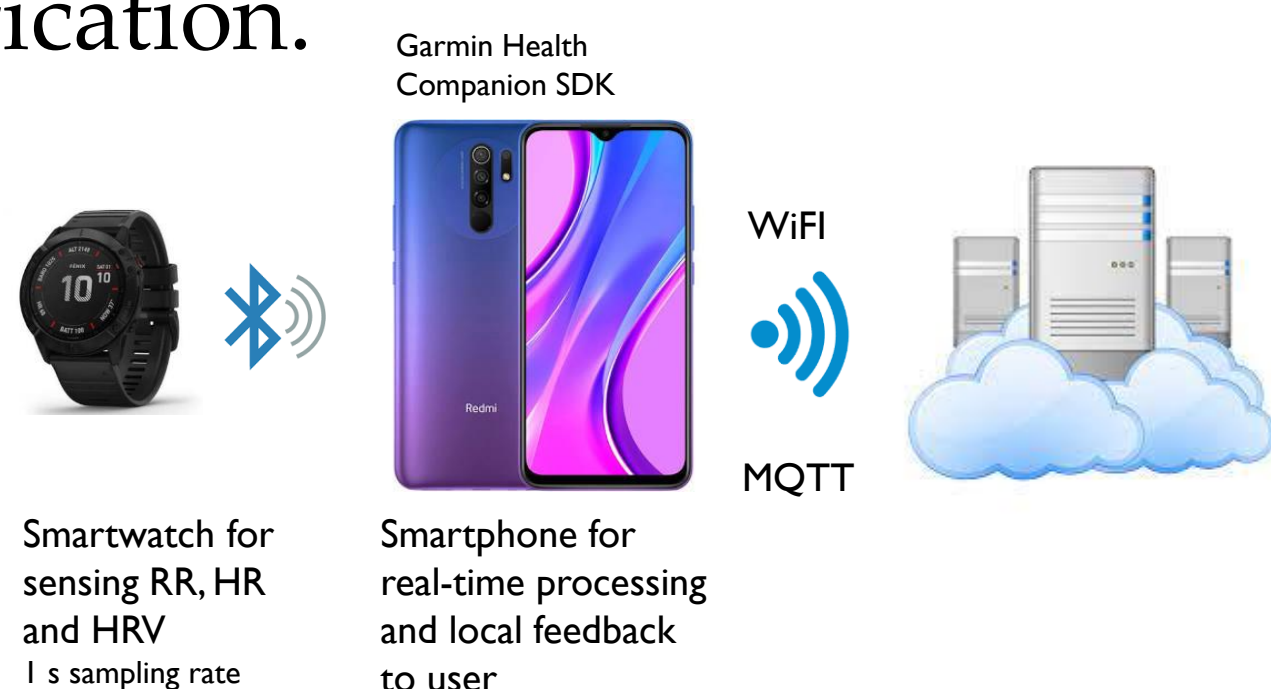
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1. Motivation

The sleep on wheel has a big impact on the world. It is possible to fight this problem working on prevention or protection. It is possible to do prevention on this problem analyzing the sleep behaviour, going to identify some critical condition identifiable as sleep disorders, for example the Obstructive Sleep Apnoea Syndrome (OSAS), the restless leg syndrome, etc. Instead, the protection can be done monitoring the driver status in terms of distraction, drowsiness and emotion.

2. Proposed Methodology

We are developing a set of real-time algorithms able to identify with high accuracy some critical conditions like: Drowsiness Detection: The fundament of our activities is the multidisciplinary approach born thanks to the collaboration with sleep experts' medical doctors from Jmedical and Sleep Advice Technologies (SAT).

The Real-Time Drowsiness Detection algorithm published in IEEE Access [1] aims to predict the sleep onset monitoring the ANS action thought the autonomic arousals identification.

Garmin Health Companion SDK

WiFI

MQTT

Smartwatch for sensing RR, HR and HRV
1 s sampling rate

Smartphone for real-time processing and local feedback to user

An important experimental activity has been carried out in the AVL dynamic car simulator, located Graz (AT), for testing the algorithms on field.

ID	MD Sleep Scoring	Garmin First alarm	Gap From The First Genereted Alarm
JH	15:15:05	15:09:42	00:05:23
SN	17:30:35	17:28:06	00:02:29
BD	11:40:38	11:35:10	00:05:28
EA	None	None	None
SG	14:09:35	13:53:50	00:15:45
LP	13:16:35	13:14:03	00:02:32
OV	None	None	None
MS	None	None	None
OC	None	None	None
MA	14:36:00	14:34:32	00:01:28
JB	16:33:00	16:25:43	00:07:17
GM	None	None	None
JM	None	None	None
BD2	12:43:00	12:18:58	00:24:02
PH	None	None	None

3. Future field of interest

For the future activities we are approaching to develop a set of algorithm with the aim to give a feedback of wellness:

- Watching at the sleep quality the risks for problem coming with the hypertension.
- For the athletes (professional or not), we want to estimate the training status.
- Emotion Detection of the driver [2].
- Automatic Sleep Apnoea identification.

4. References

1. **Pugliese, L.**, et al. (2022). A Novel Algorithm for Detecting the Drowsiness Onset in Real-Time. IEEE Access, 10, 42601-42606.

2. **Pugliese, L.**; et al., A Novel Redundant Validation IoT System for Affective Learning Based on Facial Expressions and Biological Signals. Sensors 2022, 22, 2773. https://doi.org/10.3390/s22072773