COMPUTER AND CONTROL ENGINEERING

MUR DM 117/SAT - Non-invasive and low-cost solutions for health monitoring during sleep

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019] Sleep Advice Technologies s.r.l. [P.iva/CF:11954660012]
Supervisor	VIOLANTE MASSIMO - massimo.violante@polito.it
Contact	
Context of the research activity	The PhD program focuses on developing algorithms compatible with commercial off the shelf wearable devices (i.e., smart watches) to identify the Sleep Apnea (SA) pathology. Most of the affected persons are unaware of suffering from SA; hence, they are at risk of more serious diseases and of fatigue-related risks. A non-invasive, low-cost solution that can monitor seamlessly people's sleep and that can detect automatically SA could significantly increase the quality of life of a vast portion of world's population. Progetto finanziato nell'ambito del PNRR - DM 117/2023 - CUP E14D23002020004
	The topic that will be studied is the Sleep Apnea, which is a potentially serious sleep disorder in which breathing repeatedly stops and starts, whose most evident side effects are loud snoring, and tiredness after a full night's sleep. The main types of sleep apnea are: • Obstructive sleep apnea (OSA), which is the more common form that occurs when throat muscles relax and block the flow of air into the lungs; • Central sleep apnea (CSA), which occurs when the brain doesn't send proper signals to the muscles that control breathing; • Treatment-emergent central sleep apnea, also known as complex sleep apnea, which happens when someone has OSA - diagnosed with a sleep study - that converts to CSA when receiving therapy for OSA. Approximately 1 billion of the world's population of 7.3 billion people, between the ages of 30 and 69¿years, are estimated to have the most common type of sleep-disordered breathing, obstructive sleep apnea (OSA). Complications of OSA can include: • Daytime fatigue. The repeated awakenings associated with sleep apnea make typical, restorative sleep impossible, in turn making severe daytime drowsiness, fatigue and irritability likely. People with sleep apnea have an

Objectives	increased risk of motor vehicle and workplace accidents. • High blood pressure or heart problems. Sudden drops in blood oxygen levels that occur during OSA increase blood pressure and strain the cardiovascular system. • Type 2 diabetes. Having sleep apnea increases the risk of developing insulin resistance and type 2 diabetes. • Liver problems. People with sleep apnea are more likely to have irregular results on liver function tests, and their livers are more likely to show signs of scarring, known as nonalcoholic fatty liver disease. Despite the important social aspect of OSA, approximately 80%-90% of OSA syndrome remains undiagnosed. Thanks to the development of novel wearable sensing technologies, such as those found in modern smartwatches, it is now possible to collect an enormous amount of data with a quality comparable to that coming from expensive and invasive medical equipment. In this research we intend to leverage the sensing technology offered by low-cost commercial of the shelf smartwatches to develop a system able to identify OSA. The PhD program will be developed in cooperation with the company Sleep Advice Technologies and is co-sponsored by DM117

Skills and competencies for the development of the activity	MATLAB or Python or C/C++ programming