



### 1. THE PROBLEM AND ITS ORGANIZATIONAL VALUE

Professional burnout has reached critical proportions across companies in Portugal, with **61% of workers at severe risk of burnout** and 87% reporting chronic workplace stress, according to 2016 data from the Occupational Health Psychology Association, a figure that has nevertheless shown an upward trend. This phenomenon generates a direct and severe financial impact on organizations, translating into estimated annual losses of **€5.3 billion in the Portuguese market** due to absenteeism, productivity drops, and staff turnover, as reported by the official statements of the *Ordem dos Psicólogos Portugueses (OPP)*.

Early intervention fails due to the **"blind spot" of self-awareness**: the "victim's" inability to recognize the decline in their mental state prior to clinical collapse. Currently, screening within organizations relies on traditional subjective questionnaires and annual evaluations. These tools are slow, costly, and prone to omissions caused by social stigma, preventing effective proactive intervention by Organizational Psychology teams.

### 2. THE MINDSIGHT INTELLIGENT ECOSYSTEM

MindSight is an ecosystem centered on software processing that replaces subjective evaluations with objective data correlations. The system monitors the user's response through a combined architecture: a physical wearable device serving as a biological validation vector and an integrating mobile application. The hardware continuously captures heart rate variability (HRV) and electrodermal activity (EDA) to map **emotional stress**.

To map **cognitive stress**, the mobile application utilizes contextual questionnaires and embedded tests designed as brief games. These games ideally appear via random pop-ups twice a day (during the morning and afternoon), while also allowing voluntary additional sessions. Over weeks, the evolution of scores identifies the periods when the worker exhibits peak mental clarity and productivity. The ecosystem processes these synchronous streams, generating personal reports for the user and predictive decision support for healthcare screening professionals.

#### Strategic Software Differentiation:

MindSight does not aim to compete in the mass manufacturing consumer wearables market. Our differentiator is the analytical data-fusion software. By crossing the user's voluntary indexing (via a physical event-marking button, acts as a 'panic button') with actual biological and cognitive performance, we eliminate the cognitive biases found in traditional human self-reporting.

### 3. DATA ENGINEERING, CALIBRATION, AND AI MODELS

To enable the practical implementation of this architecture, the team overcame three structural development challenges:

- **Real-Time Noise Isolation:** Since the wrist is a zone of high mechanical activity, movement corrupts sensor readings. We developed firmware algorithms that utilize inertial packets to dynamically filter mechanical noise, isolating strictly emotional triggers.
- **Blind-Mode Calibration (Baseline Mapping):** To mitigate the errors of generic predefined metrics, the ecosystem implements a calibration protocol tailored to the user's history. During the first month, the application operates in blind mode (without displaying metrics), processing collected data to calculate a personalized mathematical baseline of physiological levels in both stressed and resting states.
- **Classification Algorithms and Logical Fusion:** The analysis of cognitive tests relies on Ex-Gaussian distribution modeling to capture fluctuations in response times and attention fatigue. These structured indicators are correlated with biometric signals and the 'panic button' timestamps using predictive Artificial Intelligence models based on Random Forest and Support Vector Machines (SVM), previously trained to classify and anticipate acute exhaustion stages.
- **Open Architecture and Prototype Viability:** The functional testing prototype was developed with a focus on local power efficiency (*Edge Computing*), achieving a continuous autonomy of 4 to 5 hours under active Bluetooth (BLE) transmission. The strategic market goal is licensing the software for large-scale correlation with data from real-world environments and wearables, operating under strict *Privacy by Design* (GDPR) principles.