SENSORSTACK

PUMACY TECHNOLOGIES

CHALLENGES

Assembly workplaces **lack objective, data-driven insight into when and where repetitive, forceful tasks overload workers**. Today's ergonomics assessments lean on subjective observation and fragmented tools, with no integrated wearable sensor analytics to show the real load on hands, arms, and upper body. *In fine*, repetitive assembly, humans remain indispensable because of **high complexity and variabilit**y, yet that same variability drives ergonomic and cognitive strain that is hard to quantify. **Existing wearable assistive systems often don't fit real-world constraints** (gloves, PPE, takt times, hygiene), so adoption is slow.

Without quantitative measures of fingertip forces or detailed posture (wrist, forearm, shoulder), risk "hot spots" stay invisible; **overload is discovered late** as discomfort, errors, or injury. Data lives in silos, lacks synchronization, and rarely aligns to specific micro-tasks on the line, making it impossible to pinpoint when and where a task crosses safe thresholds. The result: generic interventions, slow audits, and pilots that never scale, because teams can't see, with evidence, which subtasks drive risk or how a change reduces load in time.

THE SOLUTION

Sensorstack **combines body-worn IMUs with a smart glove and a focused analytics dashboard** to turn raw motion and contact-force data from manual assembly into step-specific, actionable insight. The **IMUs capture upper-body motion and posture** such as wrist, forearm, elbow, shoulder, while the glove measures fingertip forces and contact events. Both streams are tightly synchronized so the Sensorstack data analytic pipeline can segment a job into defined work steps and quantify what happens in each: force peaks and durations, awkward postures, repetition rates, dwell times, and recovery windows.

Results are computed into **clear risk indicators and trends** that reflect real execution on the assembly workplace. The dashboard on the other hand, gives different stakeholders exactly what they need: operators and line leads see simple flags and step timelines; Process engineers see trends, comparisons across days or stations, and before/after effects of changes. Data and insights are exportable and traceable for evidence-grade reporting and continuous improvement. In short, SensorStack **turns scattered sensor readings into synchronized, step-level ergonomics intelligence** that teams can act on immediately.

EARASHI is an EU project funded by Horizon Europe under GA 101069994.

RESULTS

Across pilot deployments in consumer-goods assembly, SensorStack delivered measurable gains against the project objectives. As such, our system detected and measured process activities with **96% accuracy**, demonstrating reliable step identification in real line conditions. Furthermore, our pipeline recognized and classified a wide spectrum of manual tasks with 92% precision, enabling trustworthy step timelines and trend analysis.

Regarding our solution's usability, we recorded an **average SUS of 71.7** which represents a solid "Good" result with ~64% of operators reporting good satisfaction, thus, confirming usability while signaling **room for improvement toward the ~80% target**. As for the robustness and reliability, our system achieved 96% uptime in field operation, **exceeding the ~95% goal** and supporting continuous monitoring without operator burden.

IMPACT

SensorStack moved **from concept to a validated prototype on a real assembly line**, proving that synchronized IMUs plus a smart glove can deliver step-level ergonomics insight without interrupting production. Thanks to our monitoring partner **FlandersMake**, we extended our solution with clearer activity segmentation, and smoother operator data labeling.

Technically, we were able to **de-risk deployment regarding stable uptime, reliable step detection, and exports** that fit existing health/safety/ergonomic processes. Organizationally, Sensorstack strengthened Pumacy's positioning as a human-centric sensor system provider for assembly workplaces.

We can now **speak with credibility about edge analytics**, **posture and force assessment**, and **evidence-grade reporting**, while backed by field results, not just lab demos. The team also built lasting in-house expertise in wearable ergonomics and sensor-based risk assessment, including data quality assurance, step modeling, and operator-friendly feedback design. The net effect that occurred involved faster path from pilot to scale, clearer value for stakeholders, and a repeatable guideline we can apply to other industrial sectors.

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The SENSORSTACK project has received Financial Support to Third Parties (FSTP) of €199.499,00 from the EARASHI project, which is funded by the European Union's Horizon Europe research and innovation programme under Grant Agreement No.101069994. The support was provided through EARASHI Open Call 2.

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