GESTLINK

Introduction

Industrial workers wear thick, protective gloves made of materials like rubber or leather to guard against extreme temperatures, sharp objects, or chemicals. These gloves make touchscreens nearly unusable, forcing workers to remove them—compromising safety and productivity. This critical limitation in traditional Human-Machine Interfaces (HMIs) creates a safety-productivity gap in specialized environments (e.g., cryogenics, sterile zones). GestLink is an essential technological intervention developed to directly solve this issue. By utilizing non-contact sensers, GestLink accurately classifies gloved hand gestures and provides instant, unambiguous visual confirmation via feedback mechanisms, establishing a reliable, low-latency digital input bridge between the protected worker and the critical machinery they operate, ensuring controls can be executed safely, quickly, and without ever compromising the integrity of the worker's protective gear.

1. Product Overview and Scope

GestLink is a specialized, non-contact edge device designed for industrial environments. Its primary purpose is to reliably detect and classify gloved hand gestures, provide instant local confirmation to the user, and prepare the resulting Gesture ID data for external processing (e.g., company-specific cloud mapping). The module's scope excludes the final industrial action execution.

Attribute	Specification
Product Name	GestLink
Primary Goal	To enable non-contact classification of gloved hand gestures using devices which follow Industry 4.0 standards and provide unambiguous local feedback.

Input Method	Non-Contact Hand Gesture
Control Principle	Edge-Only Classification and Data Staging.

2. Technical Specifications (Hardware & Sensing)

Category	Specification	Details
Microcontroller (MCU)	STM32F207ZG	Selected for industrial-grade performance and ability to perform Edge Classification.
Sensing Technology	IR Gesture Sensor	Infrared camera sensor. Must provide higher spatial resolution to define gloved hand posture independent of material/lighting.
Required Gestures	Minimum of Five (5) distinct, easily differentiable gestures.	Must be robust to heavy gloves (e.g., Open Palm, Fist, Swipe Up/Down, Push).
Feedback Unit		To identify gestures locally
Connectivity	Wired Ethernet	Required for robust staging and transmission of classified Gesture ID data to external systems.
Environmental Rating	IP65 Enclosure (Minimum)	Protection against dust ingress and low-pressure water jets.
Protocol	Industry 4.0 standards alignment	Lightweight, publish/subscribe standard essential for IIoT data staging and cloud mapping.

3. Functional Specifications

ID	Function	Specification

F-01	Gesture Classification	MCU must classify sensor data into a discrete, numbered Gesture ID (1, 2, 3, 4, or 5) locally at the edge.
F-02	Data Staging / Storage	The classified Gesture ID must be immediately stored and prepared for network transmission via the Ethernet interface.
F-03	Visual Feedback	The local unit must display immediate, unambiguous confirmation using dedicated LEDs mapped one-to-one to the recognized Gesture ID.
F-04	Unambiguous Mapping	If Gesture N is recognized, N LEDs must illuminate
F-05	Failure Indication	A clear visual signal (e.g., all LEDs blinking) must indicate an unclassified gesture or data staging failure.

Display Panel Overview

Display Panel using 5 LEDs