Sensor Installation

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 958264

OPTIMAI

Contents

OPTIMAI

Installation of a Modular Supporting Device for various types of cameras

1

Introduction

- The utilization of various types of optical sensors such as line cameras, area scan profilometers, or area scan cameras in quality control applications require a device to support them in a certain way. These devices **ensure the operationality of the optical sensors** by capturing consistent scenes and securing the repeatability of the process.

- In this context, a 3D-printed construction was designed and manufactured to mount various types of cameras to increase the efficiency of the quality control inspection procedures. **It does this by controlling the angle and the distance between the optical sensor and the investigated part** as it is exhibited in the next figure (Figure 1).

OPTIMAI

Figure 1

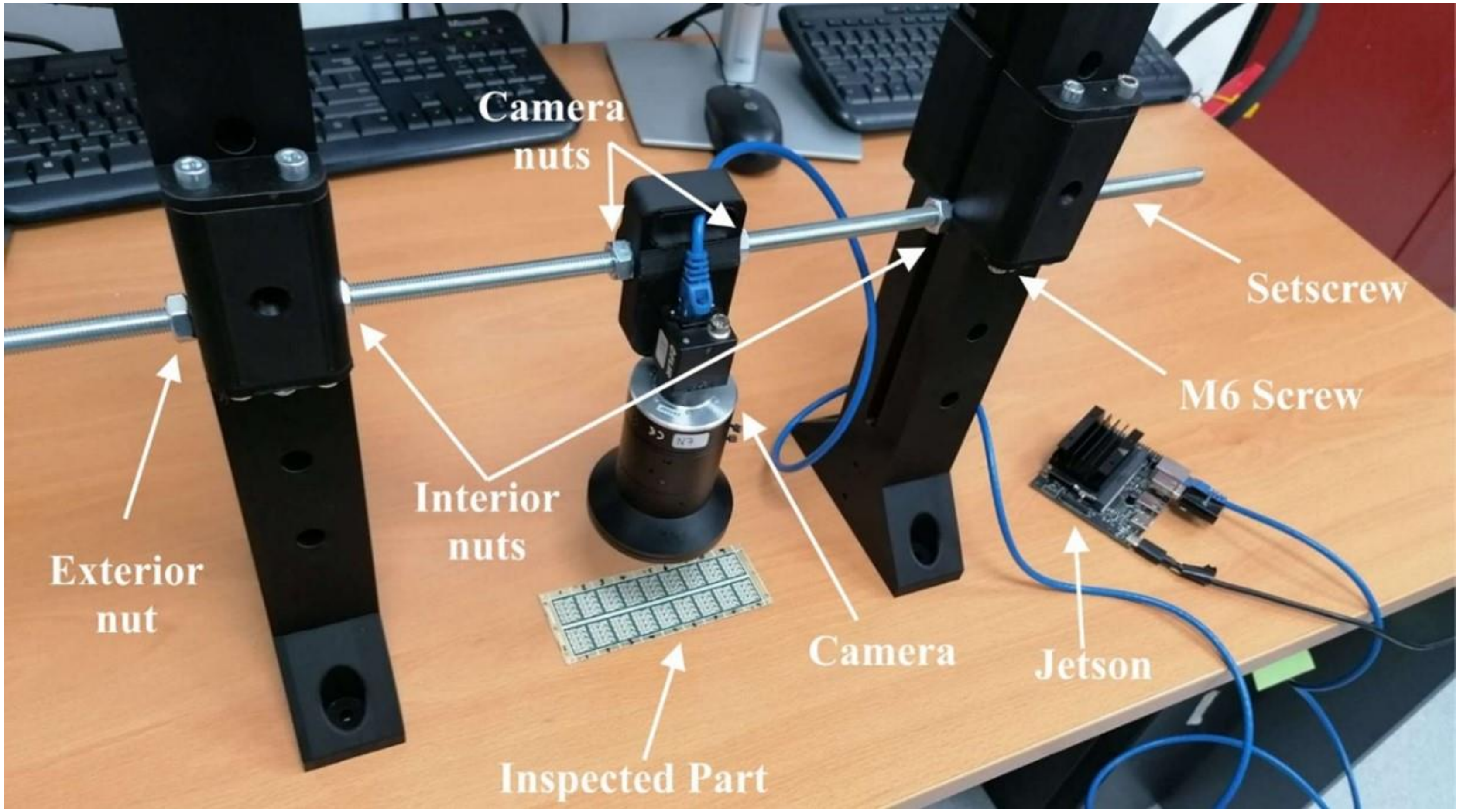


Figure 1: 3D-Printed Device for supporting the optical sensors

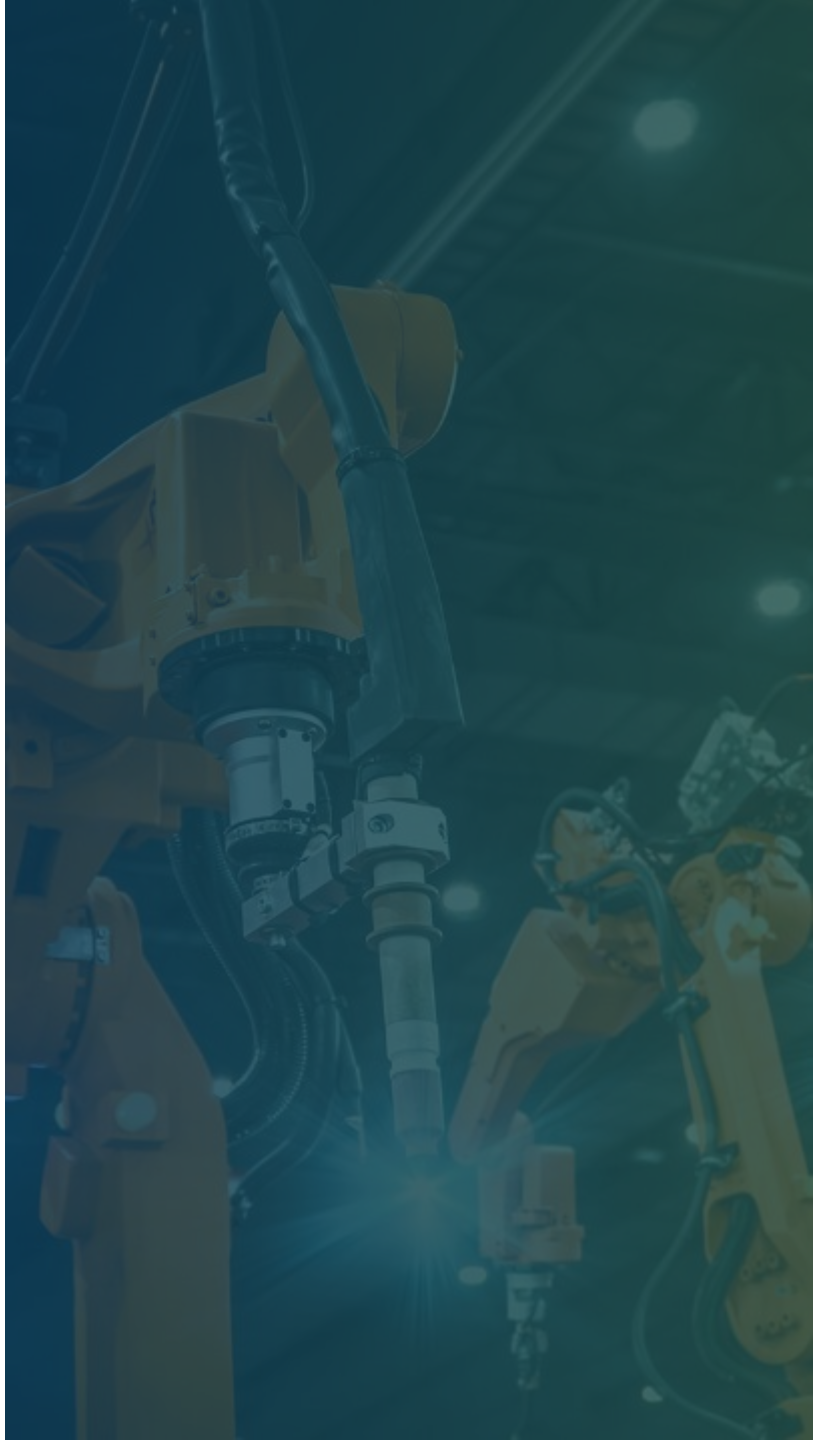
OPTIMAI

Features

The presented device and camera can be utilized by any operator, and there is no need for technical knowledge or experience.

- The experimental set up consists of the utilized camera (line camera or area scan profilometer or area scan camera), two additively manufactured supporting devices, one setscrew, 2 M6 screws and 6 M6 nuts, as illustrated in Figure 1.

- It should be noted that the additively manufactured device is modular and expendable in both vertical and horizontal direction depending on the size of the inspected component.



OPTIMAI

Set-up & control

- The user of the device should:
  - Unscrew the exterior nuts and screw them again in the desired vertical distance of the setscrew (that is supported by a pair of M6 screws) from the examined part. The horizontal distance is regulated by the interior nuts as it presented in the Figure.
- The projected angle of the camera is adjustable by:
  - Rotating the whole camera and screwing the nuts, which are close to the optical unit.
- The camera unit is controlled via a Jetson computer (that could be connected to a monitor with an HDMI cable) where several scenes of the inspected product are acquired.

Set-up & control

- The operator should then place the inspected part under the employed camera and start the measurement through the UI of the Jetson computer.

- By the end of the process, the operator will have obtained information concerning the quality of the inspected part in the form of a message from the Jetson.

- In situations where a defect is detected in the inspected component, a message will be appeared on the monitor informing the operator about the status of the quality control.

Installation of the Hardware Setup for Automatic Calibration of an Elevator Valve Block

2

Introduction

- **Automatic calibration** of an elevator valve block controlling the movement of lift-weights **requires the estimation of its velocity in real-time**.

- In general, an elevator valve block is responsible for the calibration of a hydraulic lift power unit, hence several parameters must be regulated for the lift unit to be fully operational.

- The presented solution that consists of a 3D-printed mount-device, three step motors, three controllers of the motors, one Arduino Megaboard, a power supply and a web camera can be used by any operator, and there is no need for technical knowledge. An outline of the experimental setup can be seen in the next figure (Figure 2).

Figure 2

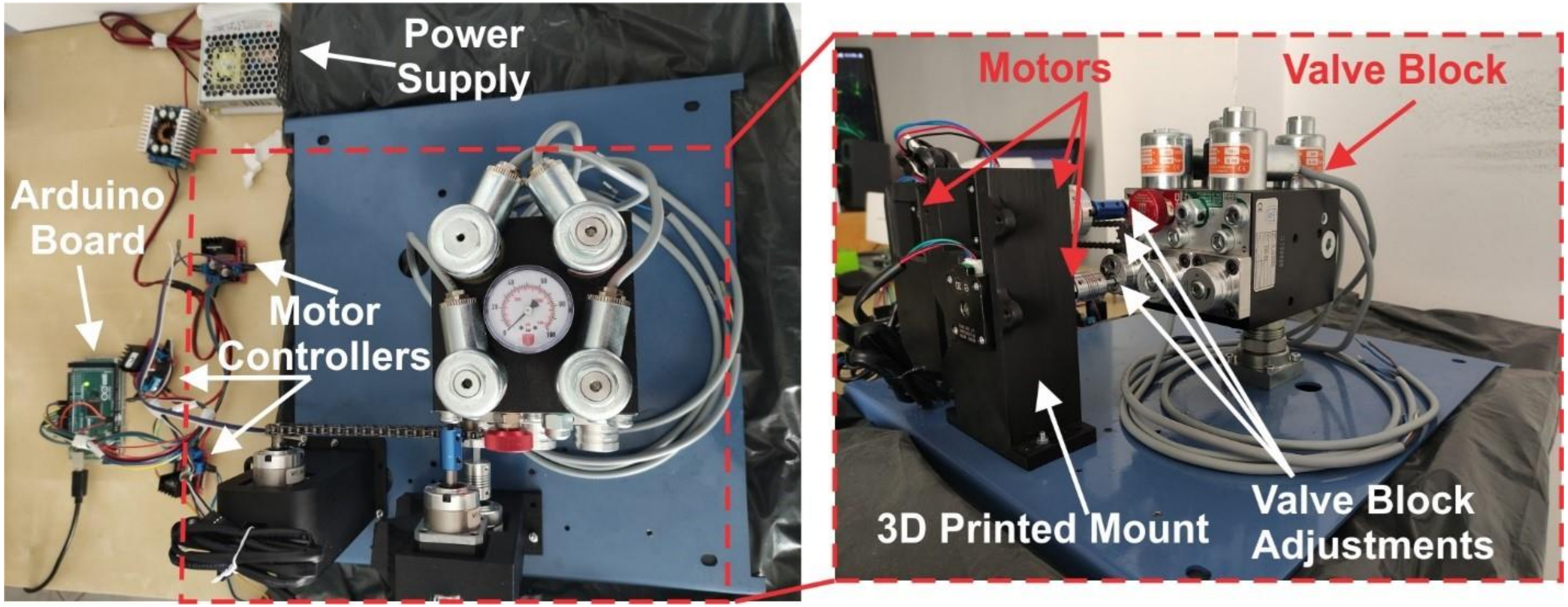


Figure 2: Experimental setup for the automatic valve block calibration

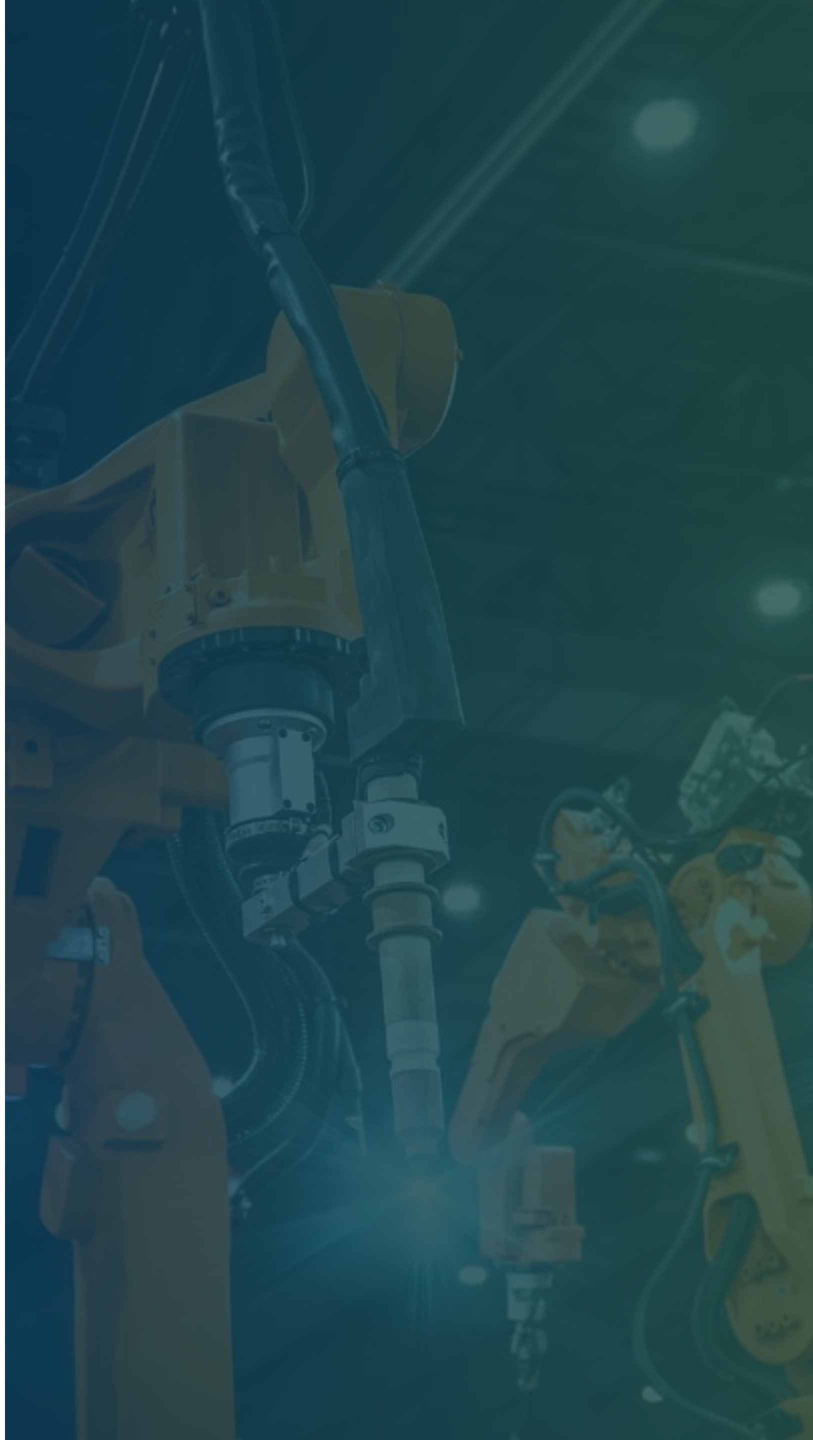
Features

The presented solution can be utilized by any operator, and there is no need for technical knowledge or experience.

- For usability and to avoid extra instrumentation costs incurred using encoders, a simple webcam is employed. Webcam connection with the computational unit (PC, Jetson) is established through a USB cable, thus making the system easy to use and deploy.

- A Soft Sensor model is developed for velocity estimation relying on a robust and efficient tracking algorithm and a real-time denoising process to increase estimation accuracy.

- A critical part of this process is the calibration of the camera to transform pixel coordinates into real-world coordinates.



OPTIMAI

Set-up & calibration

- The user must manually specify at least four points in the image along with their corresponding real-world coordinates to obtain the homography matrix. Camera calibration must be performed each time its field of view changes, e.g., when the camera is moved.

- It must be noted that adjustments on the valve block lead in the regulation of the developed velocities on the lift cabin, so step-motors were employed in order to rotate properly the screws of the block attaining the optimal performance. This could be achieved via the proposed system of actuators and sensors presented in Figure 2.

- These motors are mounted in certain position with the aid of a 3D-pritned construction using the Fused Deposition Modelling technology.

OPTIMAI

Set-up & calibration

- The controllers of the motors are connected to an Arduino board that executes commands from a Jetson computer (that could be connected to a monitor with an HDMI cable). The Jetson receives data from the webcam calculating that way the speed of the lift in order to adjust properly the next rotations of the step motors.

- The suggested solution does not require human intervention, hence the operator has only to attach the step motors on the additively manufactured mount and connect them with the Arduino Mega that communicates with the Jetson computer, as exhibited in Figure 2.

- In the end of the process, the calibration of the elevator lift would be completed, and the measured velocity of the lift will align with the theoretical one.

OPTIMAI

Thank you!

CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 958264