

## Project Milestone 04

### Objective:

*The fourth milestone of the project is with the following details:*

<u>Milestone 04</u>	<u>Date</u>	<u>Description</u>
M-04 (6%)	Tuesday, 16 <sup>th</sup> May, 2023	<ol style="list-style-type: none"><li>1. Perform the <b>image processing tasks implemented so far and that will benefit your assigned project</b> (ex. edge detection, corner detection, morphological operations, or others to extract the required features) on the <b>fabricated hardware</b> as a sequence of processes.</li><li>2. Upload codes on the hardware keeping the laptop in the loop as mentioned previously. This should finalize the project closed loop system integrating the image processing approaches performed taking into account the camera as the sensing (feedback element) in the Mechatronic system hardware actuation decision.</li></ol>

*\*The weight of each deliverable is presented between brackets beside the name of each deliverable.*

### Requirements:

*The requirements from this milestone of the project are as follows:*

1. Each team is required to implement the image processing tasks implemented so far **(that will benefit the assigned project's objective)** as edge detection, corner detection, morphological operations, or others to **extract the required features** (shapes, ArUco markers, lanes, obstacles, etc.)
2. The codes should be **uploaded on the hardware fabricated**. It is recommended keeping the laptop in the loop as mentioned previously in case of fixed setup. For, the moving platform, it recommended to use onboard camera communicating with the laptop or the microcontroller wirelessly or to limit the motion of the robot to be in a constrained arena and use a fixed overhead camera connected to the laptop. **TWO** different tasks should be tested (e.g. 1- a conveyor should respond when detecting square or circle applying a sorting process, the conveyor should also decelerate when detecting the object. 2- a mobile robot should detect straight line lanes for lane keeping to move forward and it also should detect a turn to change its direction based on the lane curvature....).

## Project Milestone 04

### Submission:

The submission of this milestone will be in the form of a **Google Drive Link** containing a ZIP file named (MCTR1010-TeamNumber-M04.zip), the file should be submitted through:

[https://docs.google.com/forms/d/e/1FAIpQLScAE5cYZX0Ss5Z4ebeBE1NkZrBWYxdRAXHI8g0VADTciOlfOw/viewform?usp=sf\\_link](https://docs.google.com/forms/d/e/1FAIpQLScAE5cYZX0Ss5Z4ebeBE1NkZrBWYxdRAXHI8g0VADTciOlfOw/viewform?usp=sf_link)

The contents of the zip file:

1. **ZIP file** includes the following items:
  - For teams using **Python** as the coding language, you have to submit the Python scripts **for this milestone only** (if any) saved in (.ipynb).
  - For teams using **MATLAB** as the coding language, you have to submit the MATLAB scripts **for this milestone only** (if any) saved in (.m) and MATLAB workspace saved in (.mat).
  - ALL teams should save the images or videos acquired by the camera, in addition to the processed images that contribute to the decision making of the image.
2. **Word file** that includes the following requirements. Note that the word template to be used is available on the CMS “**MCTR1010 Project: Word Template**”. Feel free to use the latex template provided on the CMS “**MCTR1010 Project: Latex Template**”, **just edit the template to be a single column. Build on the report submitted in MS01, MS02 and MS03.**
  - The report should include all the image processing techniques performed in this milestone, a comparison between the original image and the processed images should be performed. You **MUST NOT** write any codes describing the operation, you should only describe the process in English sentences. You must comment on the results.
  - This report should also include the image features used to actuate the system and the response figures of the system indicating the different closed loop operations done. You should comment on the results obtained relating the image features and system response and output. You should add these parts to the section titled: “**Closed Loop Response**”.

## Project Milestone 04

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3. **PDF file** including a PDF version of the whole report including all the previously mentioned tasks.
4. **Narrated videos** that includes the following:
  - **Video 1:** This video should include all the implemented operations in this milestone acquired by the fixed camera or onboard camera, showing the simple closed loop response done using the defined image features.

The deadline for the submission is **Tuesday 16<sup>th</sup> of May, 2023 at 11:59 PM.**  
Late Submissions will result in deduction from the grade of this deliverable.