***Module name**: Environment detection*

- ***Main functionalities**:*

This module consists of three sub-modules, each performing different sensory tasks.

Optical character recognition (OCR): the main functionality of this sub-module is to recognize human readable characters from images.

Object detection by chromatic discrimination: the main functionality of this sub-module is to detect objects on an image based on their color.

Optical line following: the main functionality of this sub-module is to implement movement algorithms along optically detectable tracks on the ground.

- ***Technical specifications:***

This module is created entirely with LabVIEW™ software.

OCR is the process where the machine vision software recognizes text or characters in an image.

This sub-module is based on the OCR template created with LabVIEW™ software and modified to be able to only recognize text appropriate for the task at hand. The sub-module uses a so-called Character Set File, in which the character templates are stored.

The Object detection by chromatic discrimination sub-module doesn't require any hardware.

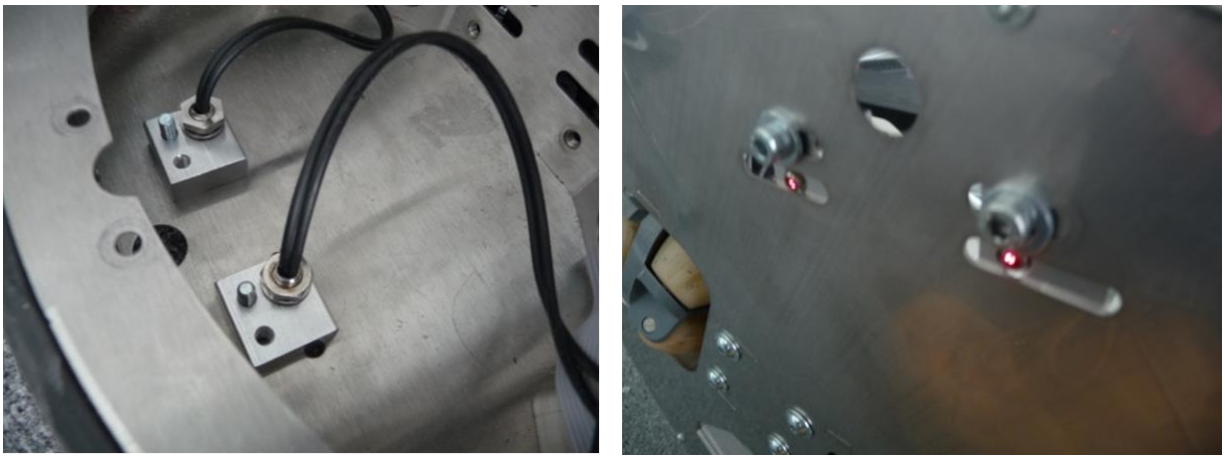
This sub-module uses the HSL color space and calculates the position (X and Y coordinates) of the center of mass of the group of pixels represented with the desired color on a camera image.

The Optical line following sub-module requires the Festo Robotino® v2 mobile robot hardware equipped with 2 optical proximity switches. (See 1. Figure)

1. Figure Factory standard accessory optical proximity switches for the Robotino®[1].

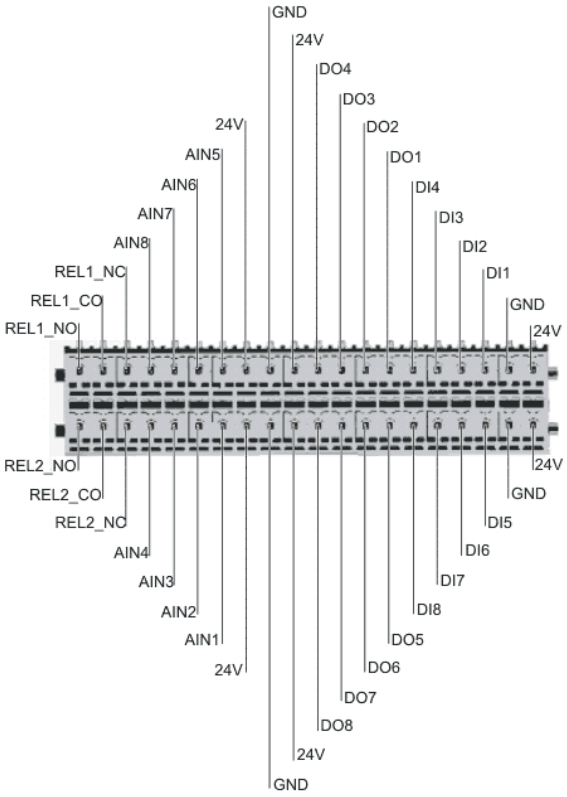
The optical proximity switches should be mounted on the base plate of the Robotino®, facing downwards with relative distance between them matching the width of the track. (See 2. Figure)

[1] *Source: https://wiki.openrobotino.org*



2. Figure Mounting the optical proximity switches on the Robotino®.

The sensors should be connected to the DI0 and DI1 inputs of the Input and output port of the Robotino®. The sub-module is capable to operate on bright floor with dark track and on dark floor with bright track also. (See 3. Figure)



3. Figure Input and output port of the Robotino®[2].

[2] *Source: https://wiki.openrobotino.org*

- ***Inputs and outputs:***

OCR

  - *Inputs: grayscale image in JPG format, Character Set File, text to be recognized.*
  - *Outputs: Recognized text in ASCII string format.*

Object detection by chromatic discrimination

  - *Inputs: image, HSL parameters of the desired color, minimum number of pixels.*
  - *Outputs: desired color is found, position of the center of mass, segmented image highlighting the group of pixels represented with the desired color.*

Optical line following

  - *Inputs: State of the optical proximity switches.*
  - *Output: movement speeds for the Robotino®.*

- ***Interface specification:***

In case the software is used i.e. the sub-modules are operated by the end user, then the end user cannot perform any action with these sub-modules, since these sub-modules are parts of the software.

In case these sub-modules are incorporated in another software then a software developer can perform automated text recognition tasks, detect objects on an image based on their color and implement movement algorithms along optically detectable tracks on the ground respectively.

- ***Formats and standards used****:*

JPG image format, ASCII string format, HSL color space.

- ***Availability:***

The module is already available in source code and as a part of a standalone desktop application by contacting the authors of this description.

- ***Application scenarios:***

Automated text recognition, object detection, optical line following.

Intralogistics.

- ***Offered for internal / external use***

The module as a source code is available both for internal and external use.

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