The duckietown system

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PART A
Overview

This part describes the Duckietown algorithms and system architecture. We do not go in the software details. The implementation details have been already talked about at length in - Duckietown Software development guide. We do give links to the ROS packages implementing the functionality.
UNIT A-1
Teleoperation

1.1. Implementation

Drivers:

\[(\text{unknown ref code_docs/adafruit_drivers})\]

\[\text{warning} \quad \text{next (1 of 23) index}\]

\[\begin{align*}
\text{I will ignore this because it is an external link.} \\
\text{> I do not know what is indicated by the link 'code_docs/adafruit_drivers'.}
\end{align*}\]

Location not known more precisely.
Created by function `check_if_any_href_is_invalid` in module `mcdp_docs.check_missing_links`.

\[(\text{unknown ref code_docs/pi_camera})\]

\[\text{previous warning next (2 of 23) index}\]

\[\begin{align*}
\text{I will ignore this because it is an external link.} \\
\text{> I do not know what is indicated by the link 'code_docs/pi_camera'.}
\end{align*}\]

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Operator interface:

\[(\text{unknown ref code_docs/joy_mapper})\]

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\text{> I do not know what is indicated by the link 'code_docs/joy_mapper'.}
\end{align*}\]

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Created by function `check_if_any_href_is_invalid` in module `mcdp_docs.check_missing_links`.

1.2. Camera
1.3. Actuators

1.4. IMU
Unit A-2
Parallel autonomy
UNIT A-3
Lane control

3.1. Implementation

Perception:

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> I do not know what is indicated by the link '#code_docs/anti_instagram'.

Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.

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> I do not know what is indicated by the link '#code_docs/ground_projection'.

Location not known more precisely.
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> I do not know what is indicated by the link '#code_docs/line_detector'.

Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.
I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/line_detector2'.

Location not known more precisely.
Created by function `check_if_any_href_is_invalid` in module `mcdp-docs.check_missing_links`.

(unknown ref code_docs/lane_filter)

Control:

(unknown ref code_docs/lane_control)

(unknown ref code_docs/dagu_car)
UNIT A-4
Indefinite navigation

4.1. Implementation

The packages involved in this functionality are:

(unknown ref code_docs/apriltags_ros)

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> I do not know what is indicated by the link '#code_docs/apriltags_ros'.
Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.

(unknown ref code_docs/fsm)

I will ignore this because it is an external link.
> I do not know what is indicated by the link '#code_docs/fsm'.
Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.

(unknown ref code_docs/indefinite_navigation)

I will ignore this because it is an external link.
> I do not know what is indicated by the link '#code_docs/indefinite_navigation'.
Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.

(unknown ref code_docs/intersection_control)
I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/intersection_control'.

Location not known more precisely.
Created by function `check_if_any_href_is_invalid` in module `mcdp_docs.check_missing_links`.

(unknown ref code_docs/navigation)

**Note:** we don’t discuss the details of the packages here; we just give pointers to them.
5.1. Implementation

The packages involved in this functionality are:

> I do not know what is indicated by the link '#code_docs/localization'.

Note: we don’t discuss the details of the packages here; we just give pointers to them.
UNIT A-6
Coordination

6.1. Implementation

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> I do not know what is indicated by the link '#code_docs/led_detection'.

Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.

I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/led_emitter'.

Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.

I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/led_interpreter'.

Location not known more precisely.
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I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/led_joy_mapper'.

Location not known more precisely.
Created by function check_if_any_href_is_invalid in module mcdp_docs.check_missing_links.
I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/led_joy_mapper'.

Location not known more precisely.
Created by function `check_if_any_href_is_invalid` in module `mcdp_docs.check_missing_links`.

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I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/traffic_light'.

Location not known more precisely.
Created by function `check_if_any_href_is_invalid` in module `mcdp_docs.check_missing_links`.

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I will ignore this because it is an external link.

> I do not know what is indicated by the link '#code_docs/rgb_led'.

Location not known more precisely.
Created by function `check_if_any_href_is_invalid` in module `mcdp_docs.check_missing_links`. 
UNIT A-7
Duckietown ROS Guidelines

7.1. Node and Topics
In the source code, a node must only publish/subscribe to private topics.
In roisy, this means that the topic argument of roisy.Publisher and roisy.Sub-
scriber should always have a leading ~. ex: ~wheels_cmd, ~mode.
In roscpp, this means that the node handle should always be initialized as a private
node handle by supplying with a "~" agrument at initialization. Note that the lead-
ing "~" must then be obmitted in the topic names of. ex:

```cpp
ros::NodeHandle nh_("~");
sub_lineseglist_ = nh_.subscribe("lineseglist_in", 1, &GroundProjec-
tion::lineseglist_cb, this);
pub_lineseglist_ = nh_.advertise<duckietown_msgs::SegmentList> ("line-
seglist_out", 1);
```

7.2. Parameters
All the parameters of a node must be private parameters to that node.
All the nodes must write the value of the parameters being used to the parameter
server at initialization. This ensures transparence of the parameters. Note that the
get_param(name,default_value) does not write the default value to the parameter
server automatically.
The default parameter of pkg_name/node_name should be put in ~/duckietown/
catkin_ws/src/duckietown/config/baseline/pkg_name/node_name/default.yaml.
The elemental launch file of this node should load the parameter using <rosparm).

| Note: | The above is deprecated. The configuration is handled differently. |

7.3. Launch file
Each node must have a launch file with the same name in the launch folder of the
package. ex: joy_mapper.py must have a joy_mapper.launch. These are referred to
as the elemental launch files.
Each elemental launch file must only launch one node.
The elemental launch file should put the node under the correct namespace through
the veh arg, load the correct configuration and parameter file throught config and
param_file_name args respectively. veh must not have a default value. This to en-
sure the user to always provide the veh arg. config must be default to baseline and
param_file_name must be default to default.
When a node can be run on the vehicle or on a laptop, the elemental launch file
should provide a local arg. When set to true, the node must be launch on the
launching machine, when set to false, the node must be launch on a vehicle through
the machine attribute.
A node should always be launched by calling its corresponding launch file instead of using `rosrul`. This ensures that the node is put under the correct namespace and all the necessary parameters are provided.

Do not use `<remap>` in the elemental launch files.

Do not use `<param>` in the elemental launch files.