

## Road Expert System

### Topics:

- Overtaking
- U-Turn
- Stopping on the side

### Idea:

- The Road Expert System is a rule-based system that tackles three driving topics, where it questions the user about the topic and the situation he's facing, in order to determine if the user is driving safely and following the road rules. Finally it provides the user with advices concerning the safety and the rules that are not followed.

### Knowledge base:

- For each of the topics mentioned above exists rules which will determine the result of the system:

#### 1. Overtake:

- a. Direct follow
- b. Give way
- c. Check mirror
- d. Break speed

#### 2. U-Turn:

- a. Check sign
- b. Road one-way
- c. See all directions
- d. Other road users
- e. Enough space

#### 3. Stopping on the side:

- a. Check mirror
- b. Signal
- c. Lights

- After the user has chosen his topic, the system will question him according to these rules, with an answer of YES or NO, which will be set to the variable as a fact.
- After the insertion of the facts, the system will match them with the according rules, which will result in an Advice for safety.

Rules	Facts example
<pre> CLIPS&gt; (rules)   start   one-one   one-two   one-three   one-four   two-one   two-two   two-three   two-four   two-five   three-one   three-two   three-three   one-overtaking-all-good   one-overtaking-follow   one-overtaking-give-way   one-overtaking-check-mirror   one-overtaking-break-speed   two-u-turn-all-good   two-u-turn-sign   two-u-turn-road-one-way   two-u-turn-all-directions   two-u-turn-other-road-users   two-u-turn-enough-space   three-stop-all-good   three-stop-mirror   three-signal   three-lights   print-string   print-safe   print-overtake-one   print-overtake-two   print-overtake-three   print-overtake-four   print-u-turn-one   print-u-turn-two   print-u-turn-three   print-u-turn-four   print-u-turn-five   print-stop-one   print-stop-two   print-stop-three   For a total of 42 defrules. </pre>	<pre> CLIPS&gt; (facts)   f-0      (initial-fact)   f-1      (choice one)   f-2      (direct-follow yes)   f-3      (overtake-one "Never directly follow another overtaking vehicle.")   f-4      (give-way yes)   f-5      (check-mirror yes)   f-6      (break-speed yes)   f-7      (overtake-four "You must not break the speed limit, even when overtaking.")   For a total of 8 facts. </pre>

**Sample dialogue 1:**

**Overtake -> Yes -> Yes -> Yes -> Yes**

CLIPS> (run)

```
*****
*          Choose one situation          *
*****
* 1. Overtaking                         *
* 2. U-Turn                             *
* 3. Stopping on the side               *
* 4. Exit                               *
*****
```

Your choice? 1

Are you directly following another overtaking vehicle (yes/no)? yes

Are you giving way to faster traffic already overtaking from behind (yes/no)? yes

Are you checking your mirrors before overtaking (yes/no)? yes

Are you breaking the speed when overtaking (yes/no)? Yes

Advice:

You must not break the speed limit, even when overtaking.

Never directly follow another overtaking vehicle.

**Sample dialogue 2:**

**U-Turn -> Yes -> No -> Yes -> No -> No**

CLIPS> (run)

\*\*\*\*\*

\* Choose one situation \*

\*\*\*\*\*

\* 1. Overtaking \*

\* 2. U-Turn \*

\* 3. Stopping on the side \*

\* 4. Exit \*

\*\*\*\*\*

Your choice? 2

Is there any sign prohibiting a U-Turn (yes/no)? yes

Is the road one way (yes/no)? no

Are you in a place where you can see all directions (yes/no)? yes

Are you giving way to all other road users (yes/no)? no

Are you sure there's enough room to complete your U-Turn (yes/no)? no

Advice:

Make sure there is sufficient room to complete your manoeuvre safely and smoothly.

Give way to all other road users

Check there are no signs or road markings prohibiting a U-turn, for example a continuous centre white line.

**Sample dialogue 3:**

**Stopping -> No -> Yes -> Yes**

CLIPS> (run)

\*\*\*\*\*

\* Choose one situation \*

\*\*\*\*\*

\* 1. Overtaking \*

\* 2. U-Turn \*

\* 3. Stopping on the side \*

\* 4. Exit \*

\*\*\*\*\*

Your choice? 3

Are you checking your mirrors (yes/no)? no

Are you signaling your intention (yes/no)? yes

Are you leaving your headlights ON (yes/no)? yes

Advice:

You should not leave your headlights on when stopping at the side of the road, including laybys or private property.

Check in your mirror to make sure you can slow down and stop safely.

**Evaluation:**

Evaluation rules	
	one-overtaking-all-good one-overtaking-follow one-overtaking-give-way one-overtaking-check-mirror one-overtaking-break-speed two-u-turn-all-good two-u-turn-sign two-u-turn-road-one-way two-u-turn-all-directions two-u-turn-other-road-users two-u-turn-enough-space three-stop-all-good three-stop-mirror three-signal three-lights

**Example of evaluation:**

```
(defrule two-u-turn-all-directions
  (all-directions no)
```

```
=>
```

```
  (assert (u-turn-three "Look for a safe place, where you can see clearly
in all directions.")))
```

In this example, the system checks if the fact (all-directions no) exists, and then asserts an advice for safety to the attribute "u-turn-three".

At the end, the system checks the attributes which are not null and prints them:

```
(defrule print-overtake-one ""
  (declare (salience -10))
  (overtake-one ?item)
=>
  (printout t crlf)
  (format t " %s%n%n%n" ?item))
```