



# Using Finite State Machines in Introductory Robotics

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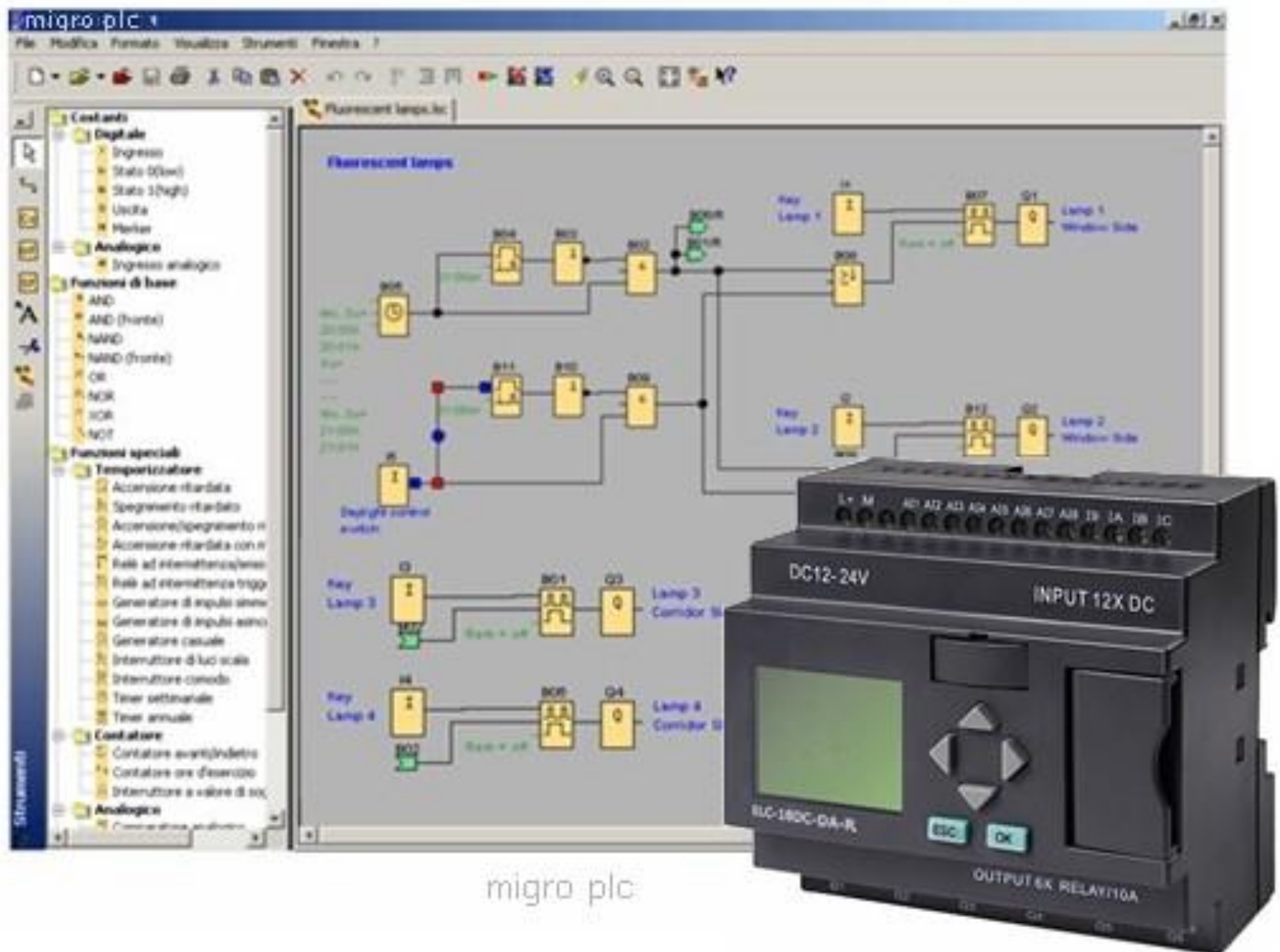
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# Industrial Approach

- IEC TC65, SC65B, WG 7 Programmable Control Systems
- IEC 61131 Standard for Programmable Controllers
  1. General information, definitions of terms, main functional properties and characteristics of PLCs.
  2. Equipment requirements and tests for programmable controllers and their peripherals
  3. Programming languages
    1. Ladder diagram (LD), graphical
    2. Function block diagram (FBD), graphical
    3. Structured text (ST), textual
    4. Instruction list (IL), textual
    5. Sequential function chart (SFC), has elements to organize programs for sequential and parallel control processing.
  4. User guidelines
  5. Communications
  6. Functional safety
  7. Fuzzy control programming
  8. Guidelines for the application and implementation of programming languages
  9. Single-drop digital communication interface for small sensors and actuators (SDCI, marketed as IO-Link)

# Industrial Approach



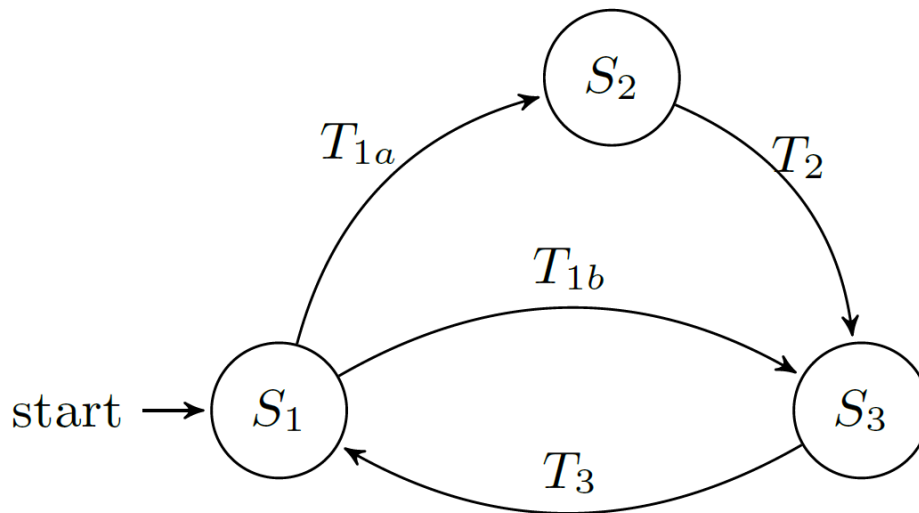
# Academic Approach

Definition:

$$\mathcal{A} = (S, \Sigma, \delta, s_0, F)$$

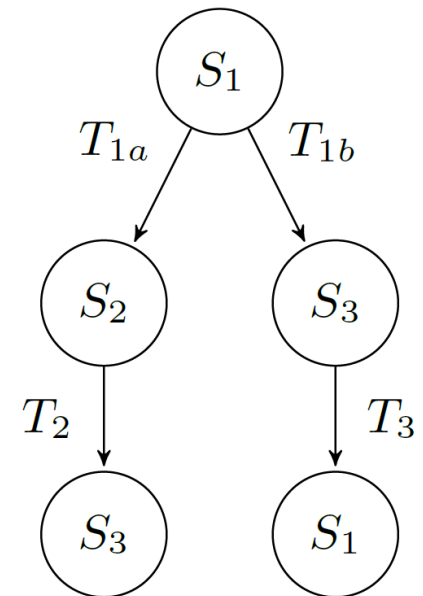
- $S$  ... finite, non-empty set of states
- $\Sigma$  ... input alphabet  
(a finite, non-empty set of symbols)
- $\delta$  ... state-transition function,  $\delta: S \times \Sigma \rightarrow S$
- $s_0$  ... initial state,  $s_0 \in S$
- $F$  ... set of final states,  $F \subseteq S$

# Academic Approach



→

	$T_{1a}$	$T_{1b}$	$T_3$	$T_4$
$S_1$	$S_2$	$S_3$		
$S_2$			$S_3$	
$S_3$				$S_1$



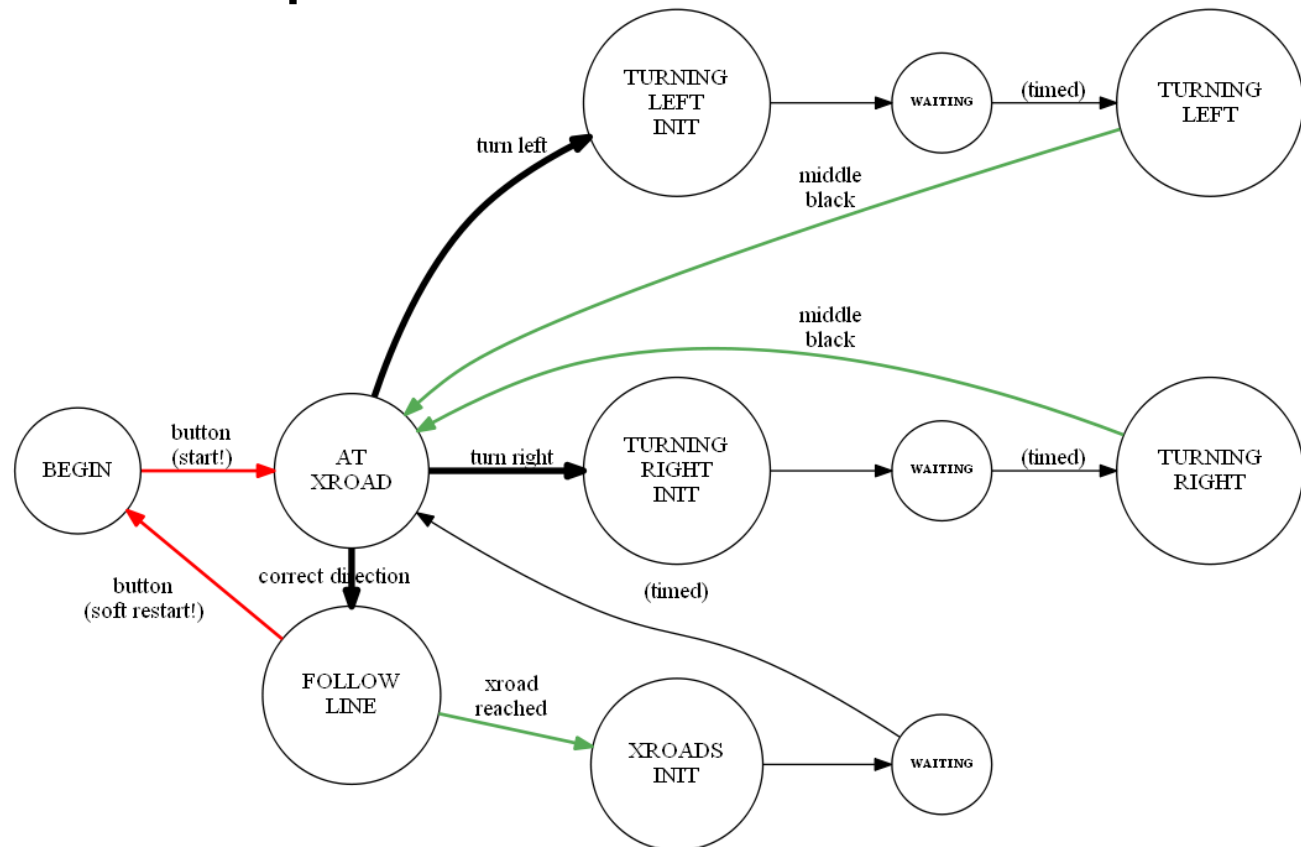
# Practical experience

1. Tutorial for “Introduction to Robotics”  
“I have daubed everything somehow for the first exercise and it somehow more or less worked. Then I learned about FSMs and implemented the last exercise using it.  
**Had I known it earlier**, I would have used it straight on, it was so easy!”

# Practical Experience

## 2. MART Friday Bot

### Ketchup House contest @ Istrobot



# Practical experience

## 2. MART Friday Bot

Prepared in one day for a competition

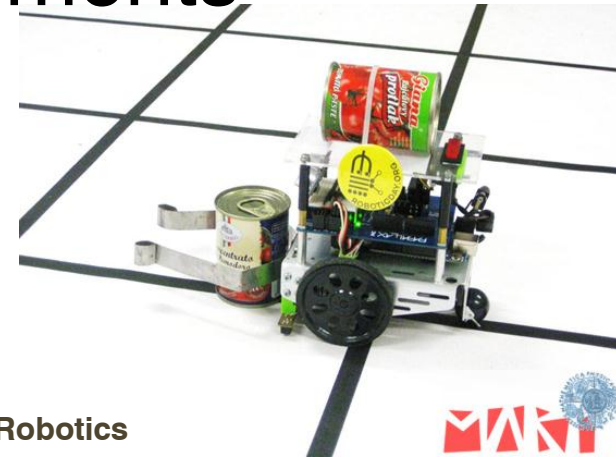
⇒ 3<sup>rd</sup> place

one more day of improvements

⇒ 2<sup>nd</sup> place

one more day of improvements

⇒ 1<sup>st</sup> place





# Thank you for your attention

- Questions?
- Details and more info:  
<http://robotics.sk/go/FSM>  
and see us at the poster

