

State Transition Diagrams & Flow Charts

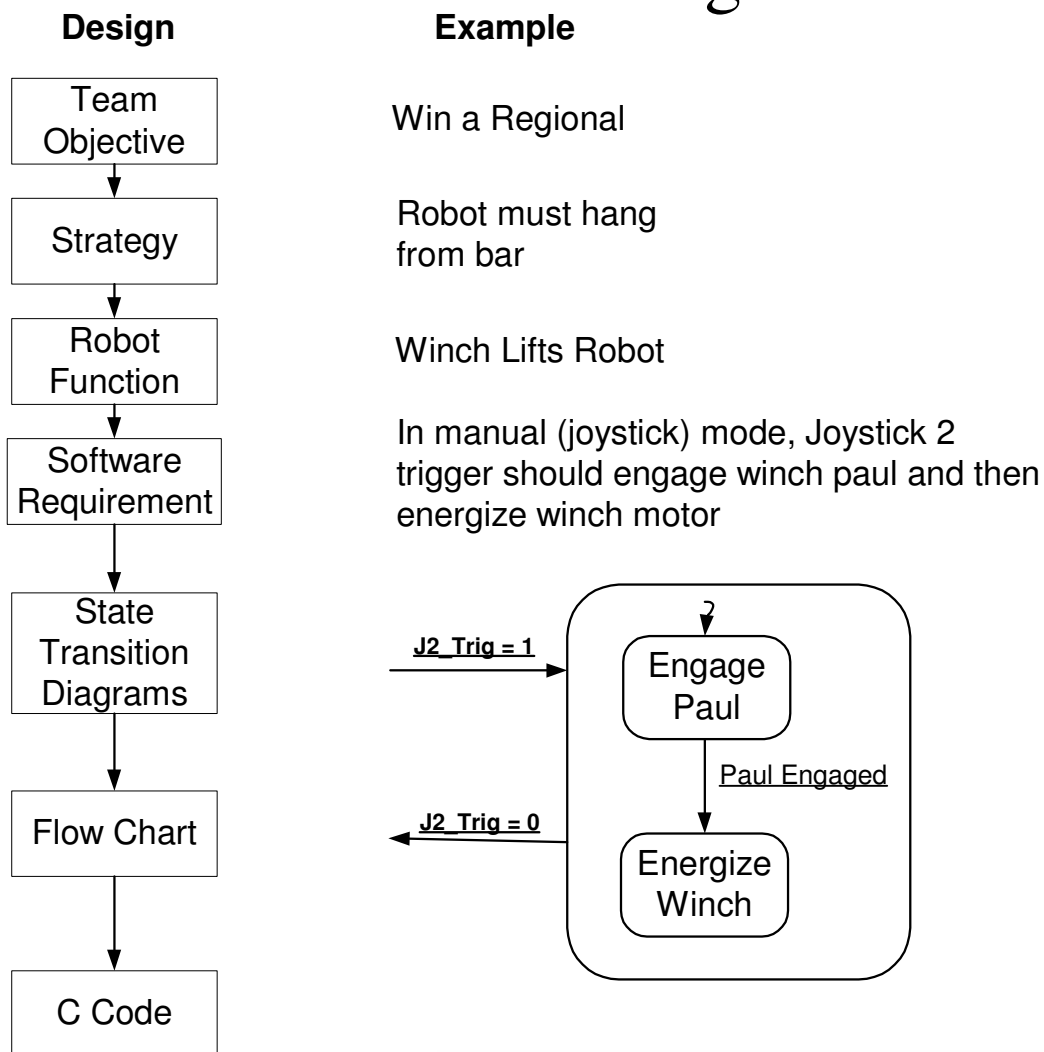
Doug Rhode

November 13, 2004

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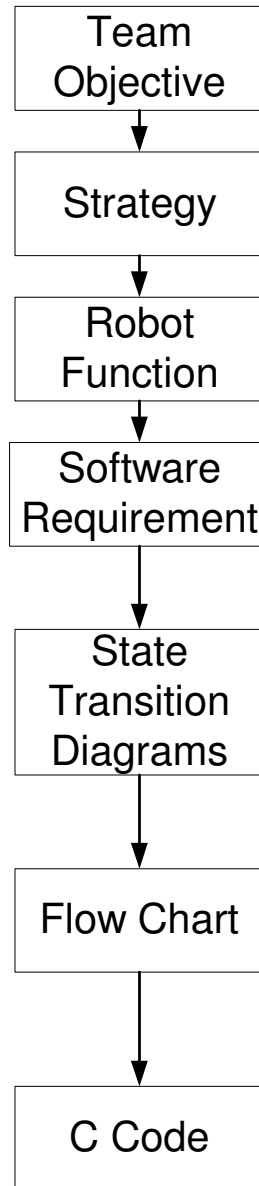
Where do flow charts and state transition diagrams “fit” into the design?



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Design



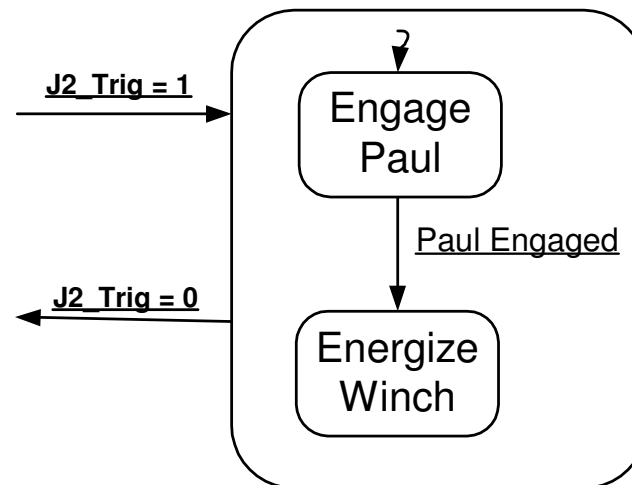
Example

Win a Regional

Robot must hang from bar

Winch Lifts Robot

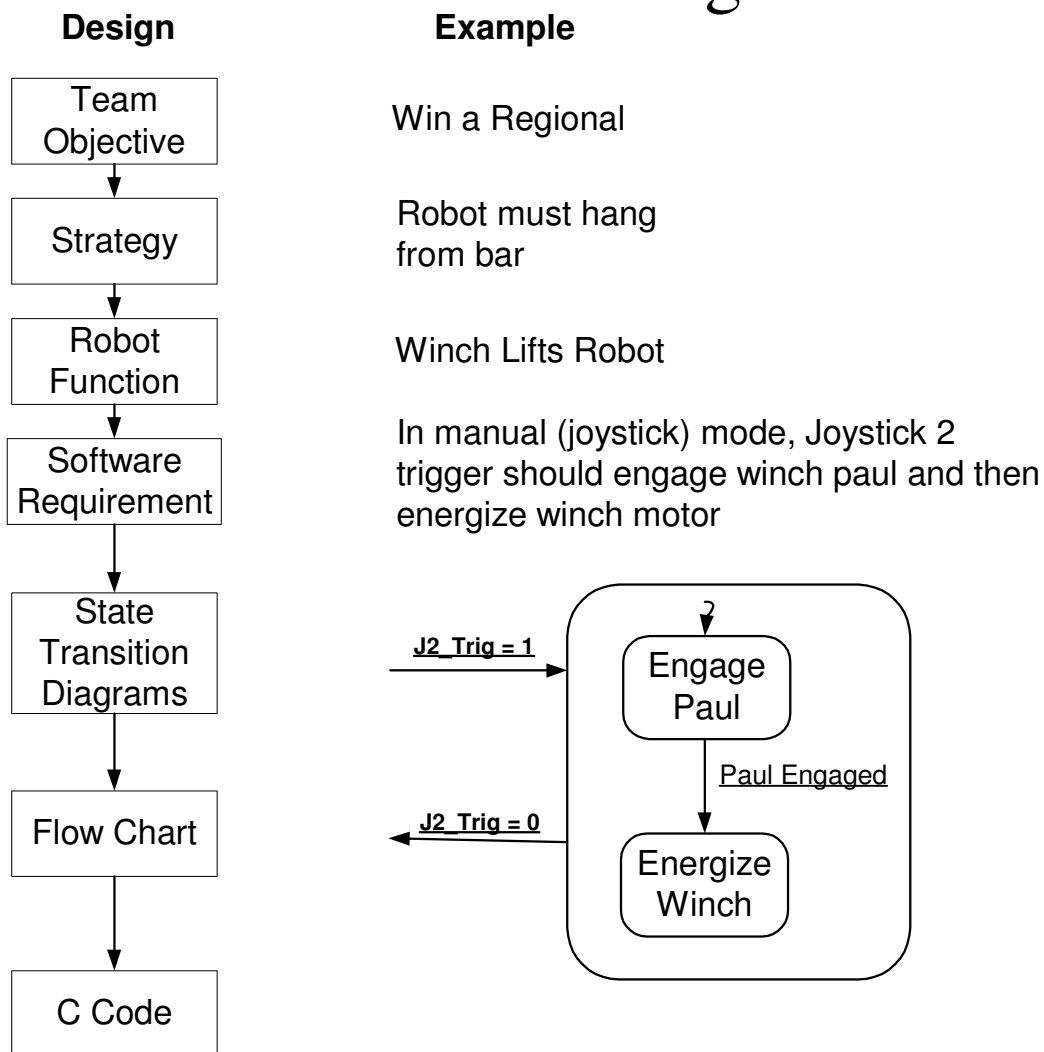
In manual (joystick) mode, Joystick 2 trigger should engage winch paul and then energize winch motor



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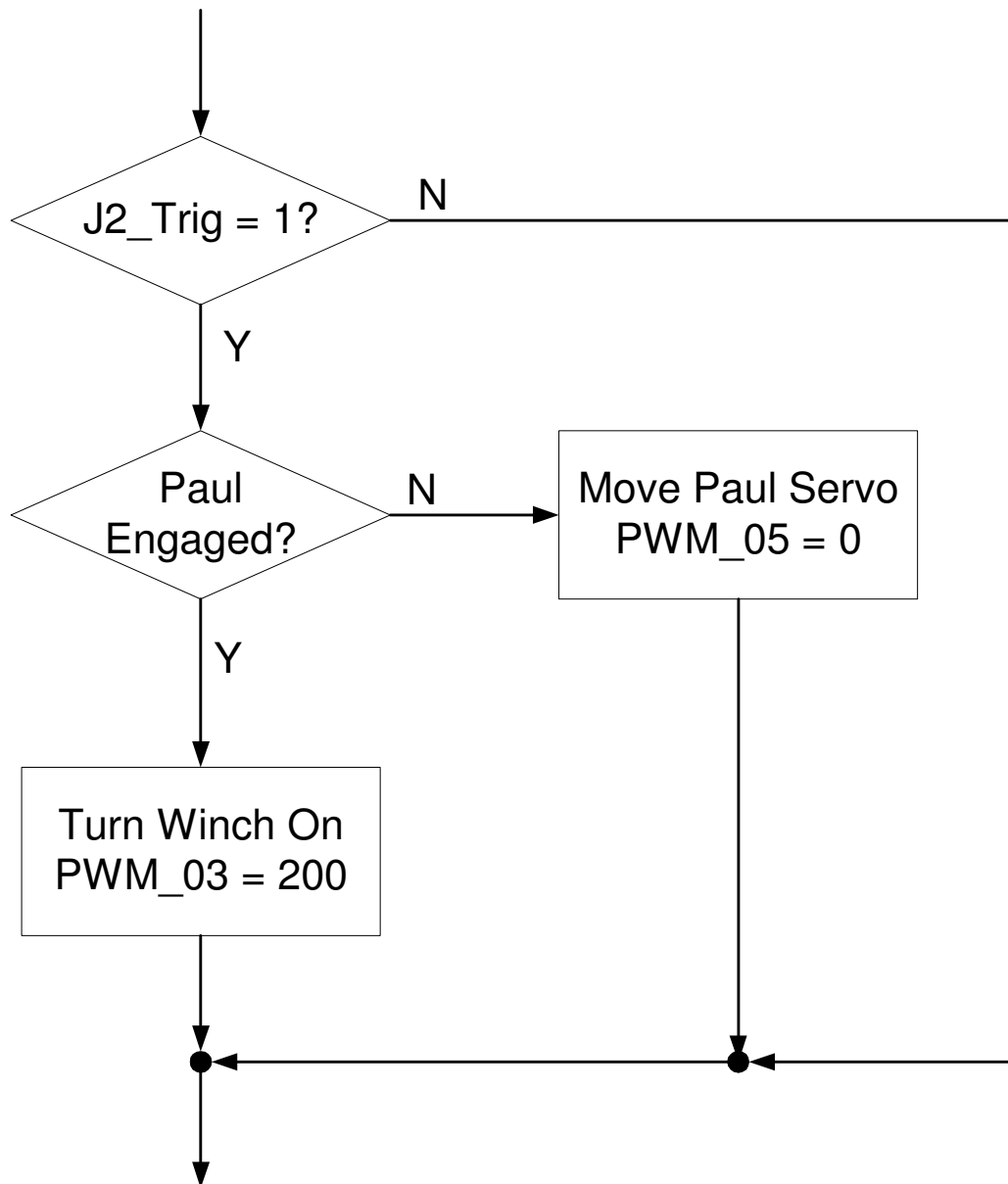


Where do flow charts and state transition diagrams “fit” into the design?



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Why?

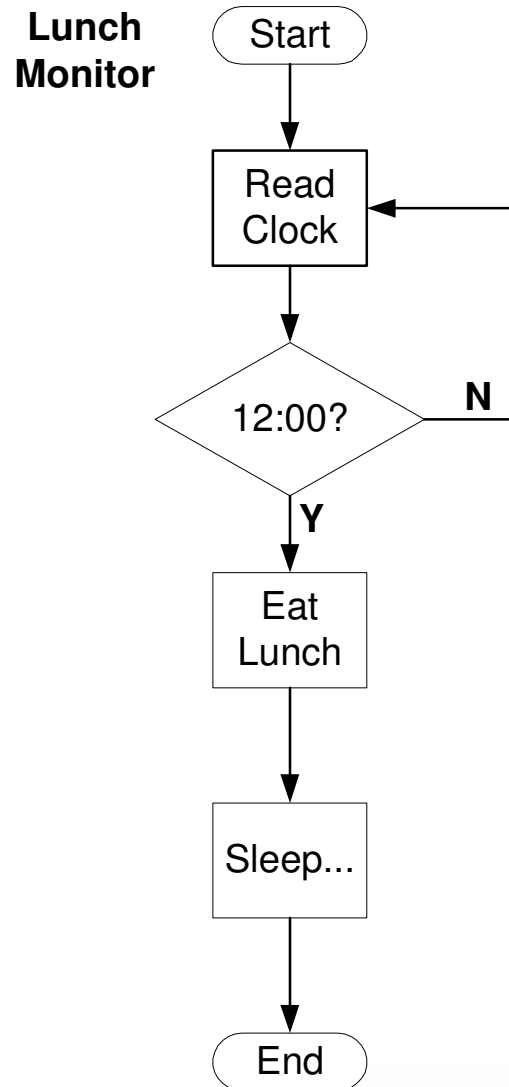
Welcome to a **TEAM!**

- Communication
 - Important if there is more than one programmer
 - Everyone understands how the bot functions (points during competition)
 - Superior Strategy thru Software
- Flexibility
 - Makes it easier to modify program.
 - Saves time explaining what the software does.....
 - Documentation

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Flow Chart Example



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Flow Charts

- Are a graphical representation of an instruction sequence
- Can be high level or pseudo-code
- Many different “right” ways to do them.

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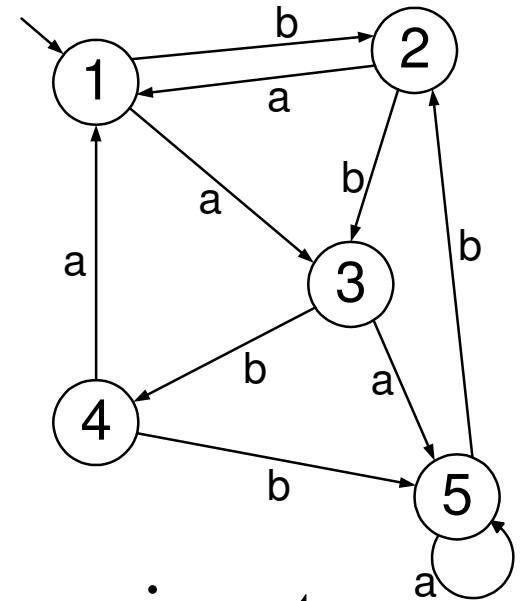


What is a “State”

- The state of a system is the smallest set of variables such that the knowledge of these variables together with the knowledge of the inputs completely determines the behavior of the system in the future.
- The states and the description of the transitions are a model of reality.
- The “right” choice for states really depends upon the use of the model.
- Example – Light Switch
 - (On, Off)
 - (On, Transition, Off)
 - (Position of switch lever)

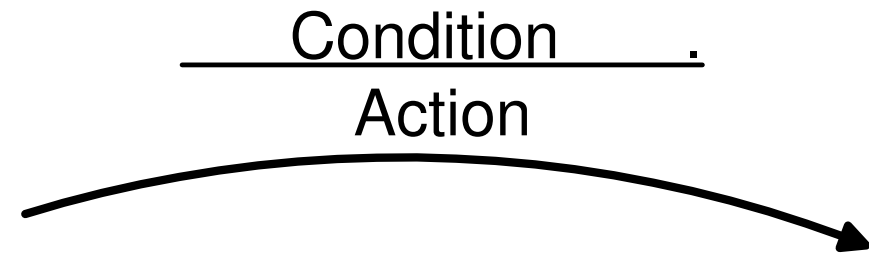


State Machines



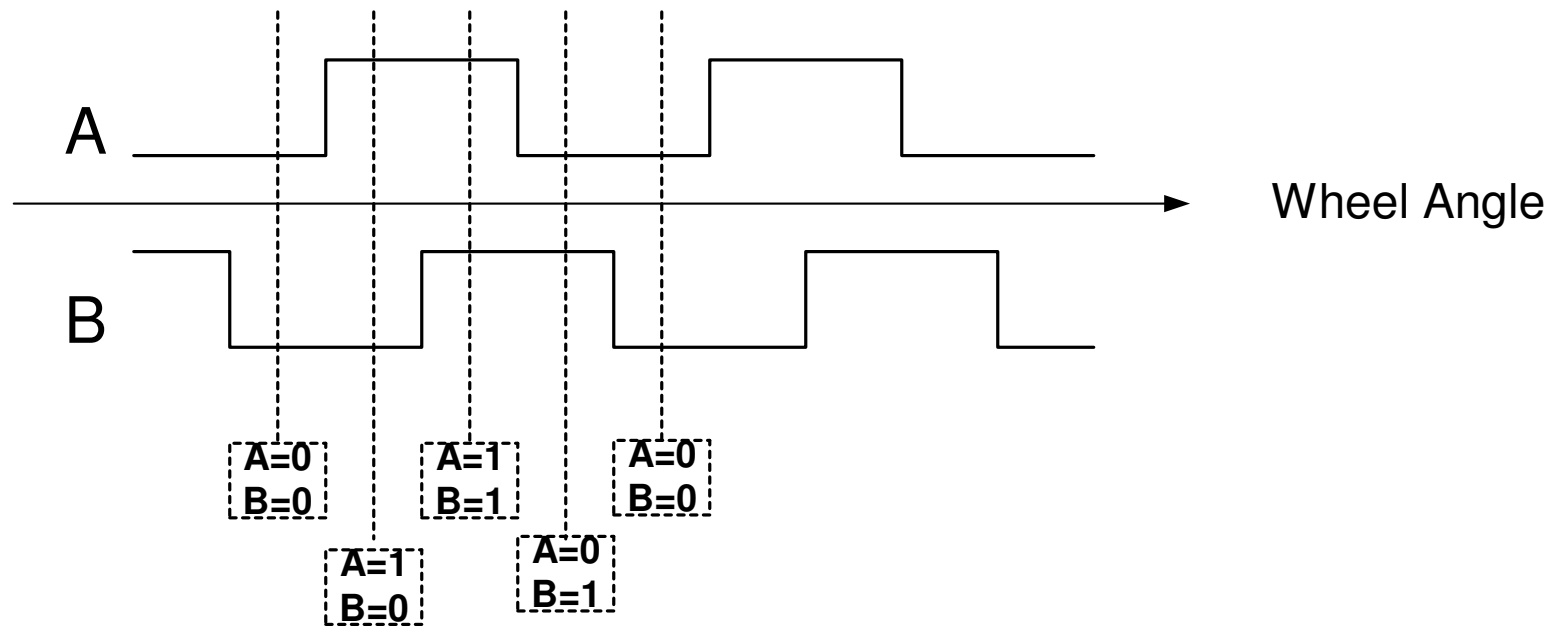
- Finite number of states
- Start somewhere
- Can change states in response to an input or event. These are called “transitions”.
- Finite state machines can be described by state transition diagrams.
- Examples (light switch, traffic lights, elevator, computer,)

Transitions

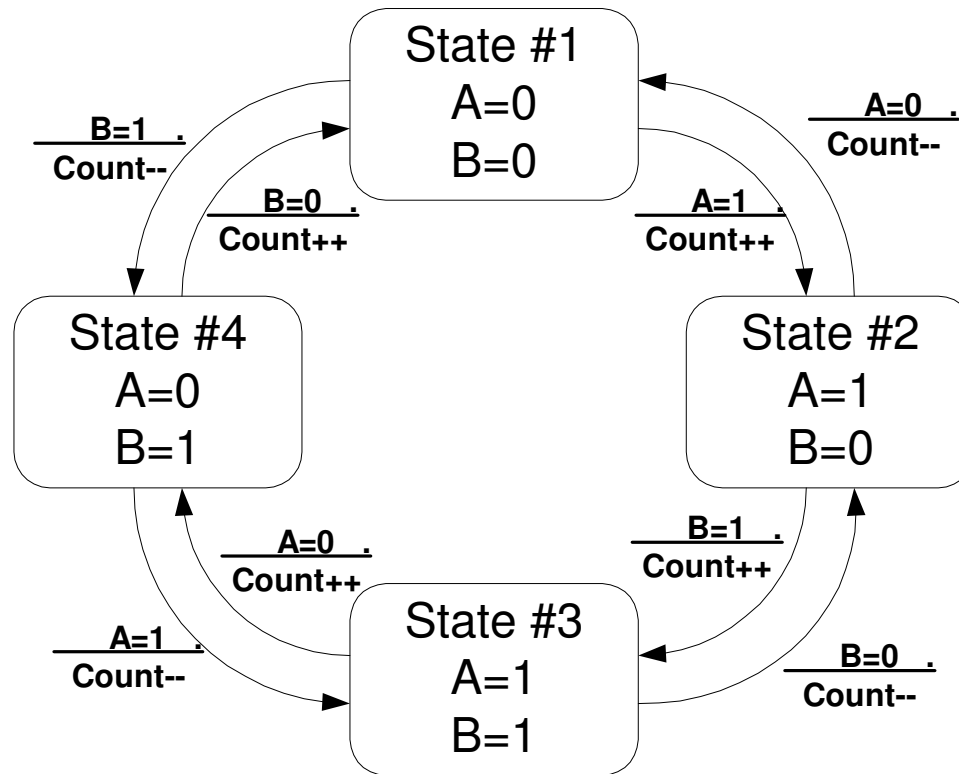


- Describe how the states of the system change in response to inputs (and time).
- Conditions are evaluated every controller period.
- Condition Examples:
 - Enable Switch == on
 - Mode Switch == Joystick
- Action Examples:
 - Disable Bot
 - Execute Joystick User Routines

2 Channel Encoder Example



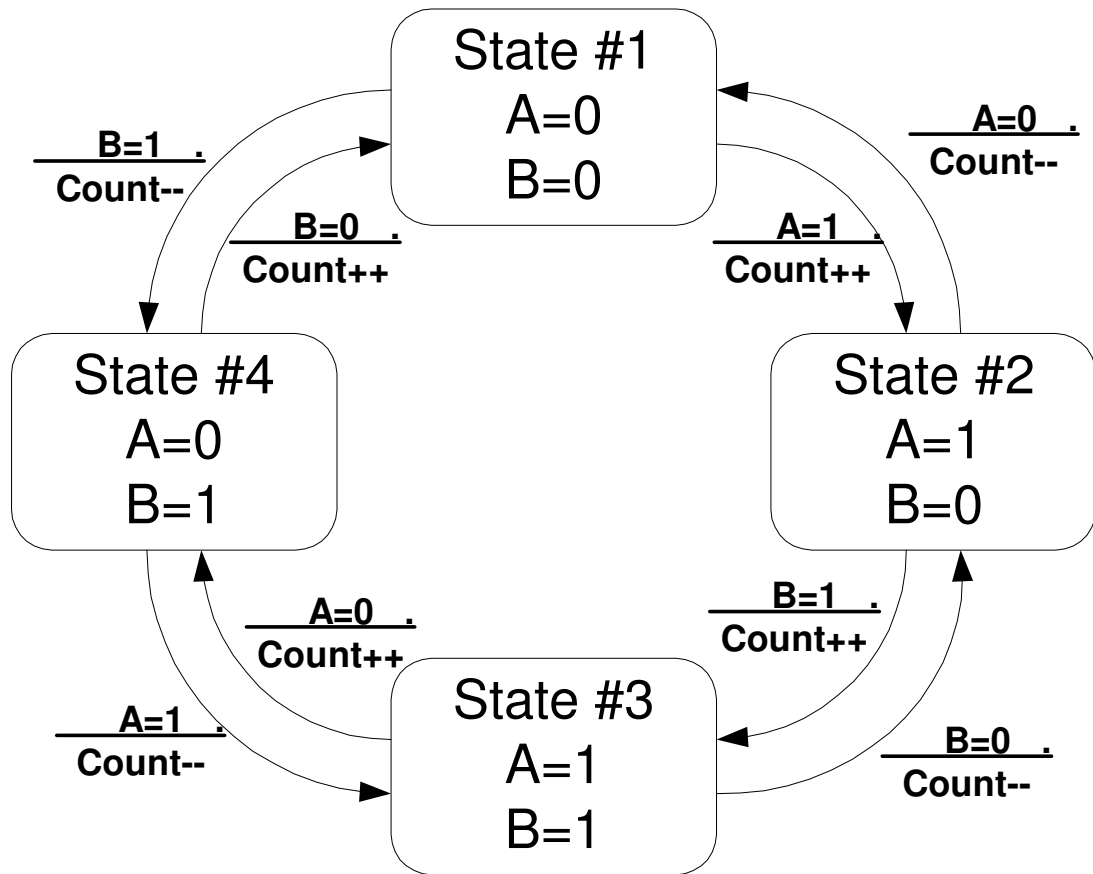
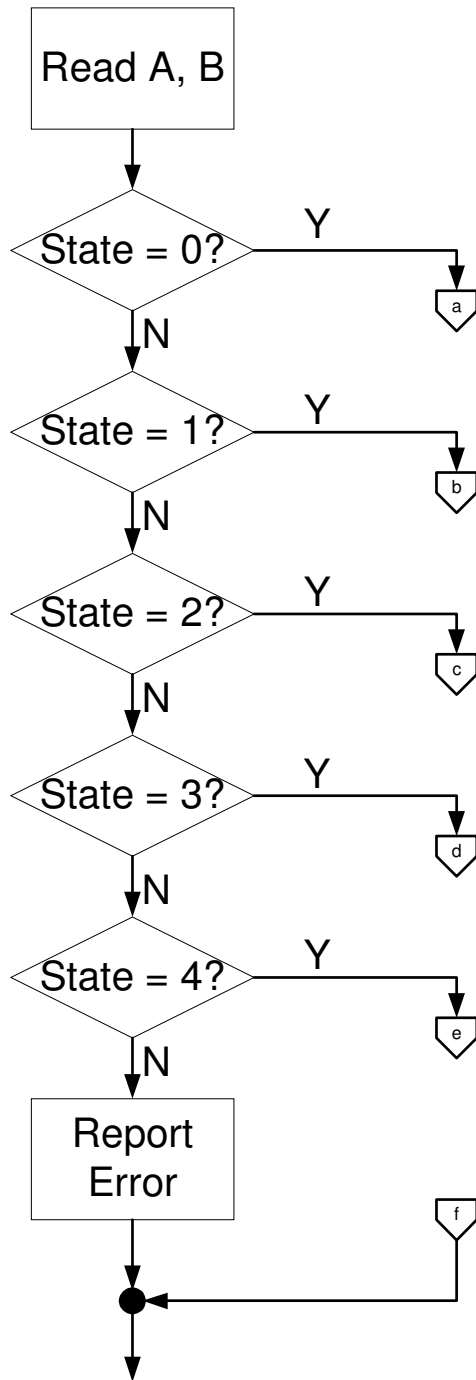
Encoder State Transition Diagram



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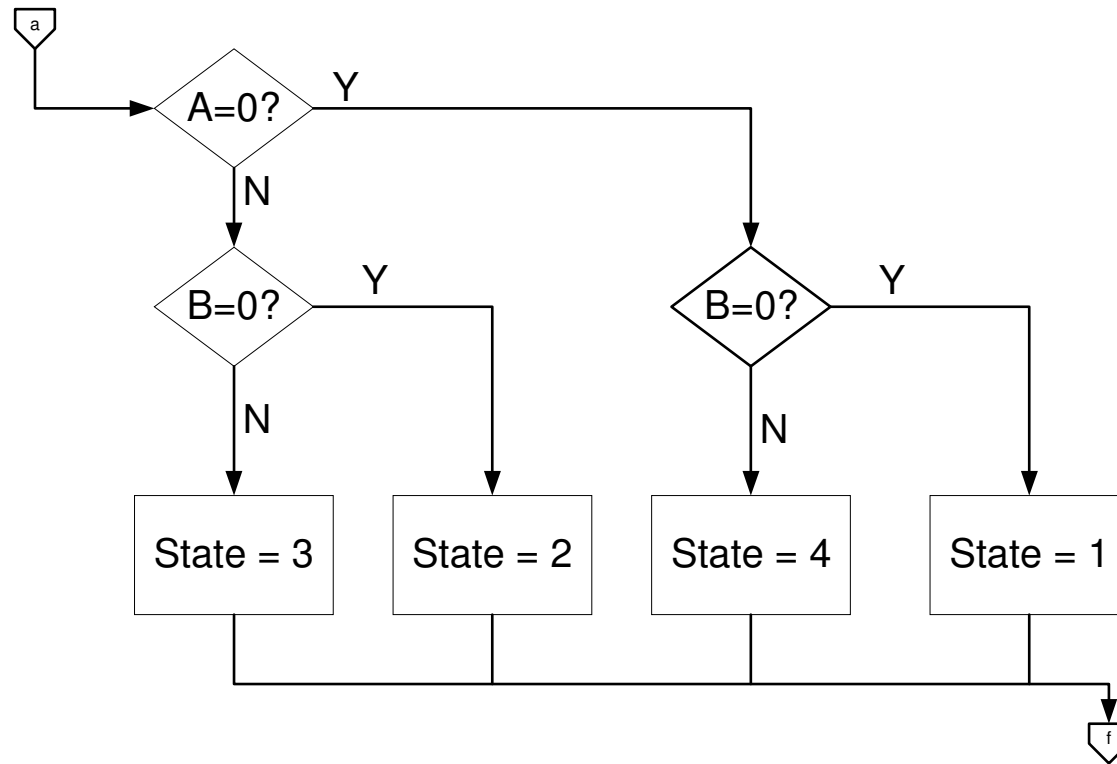
Encoder Flow Chart



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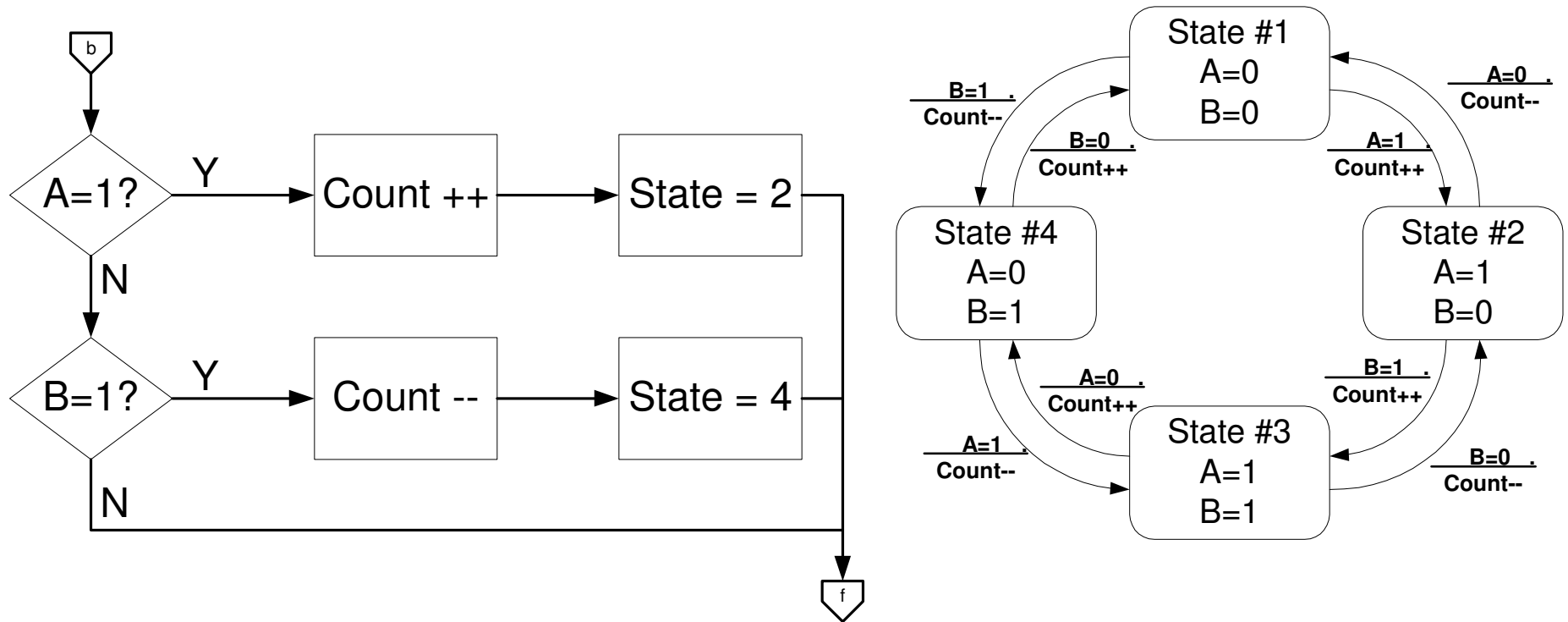
Encoder Flow Chart (State 0)



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Encoder Flow Chart (State 1)



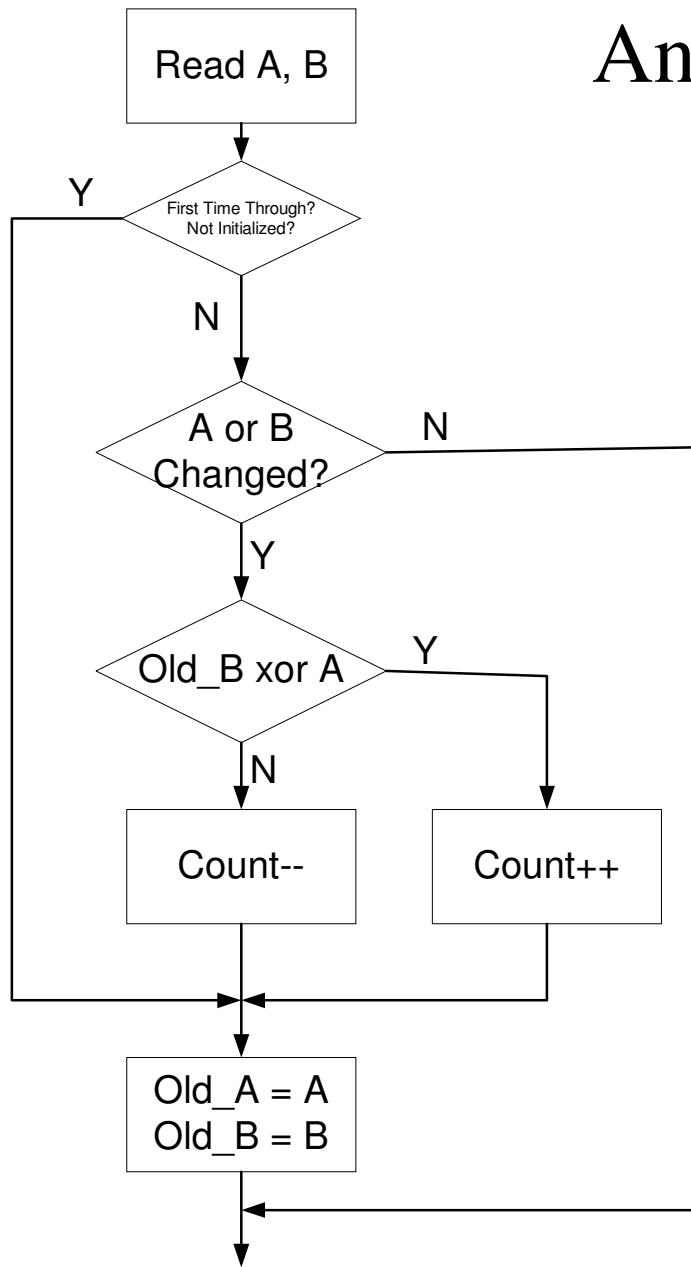
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Another Encoder Algorithm

- This is another way to process a 2 channel incremental encoder.
- In some cases this is more efficient, but is not as easy to explain.
- If either channel has changed since last time
 - If (old B xor new A) then count up
 - Else count down
- Flow chart on next page

Another Encoder Algorithm (Flow Chart)

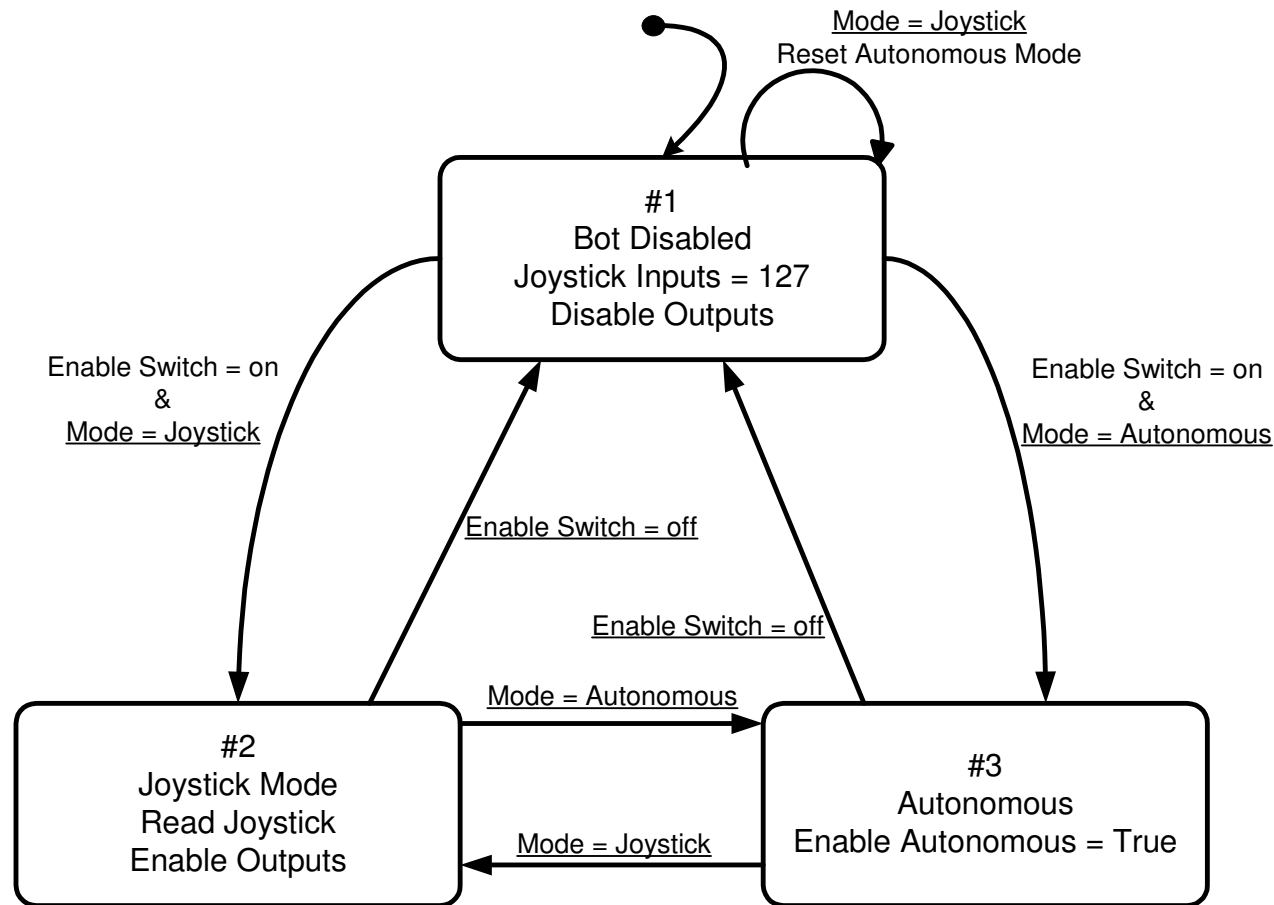


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State Transition Diagram Example

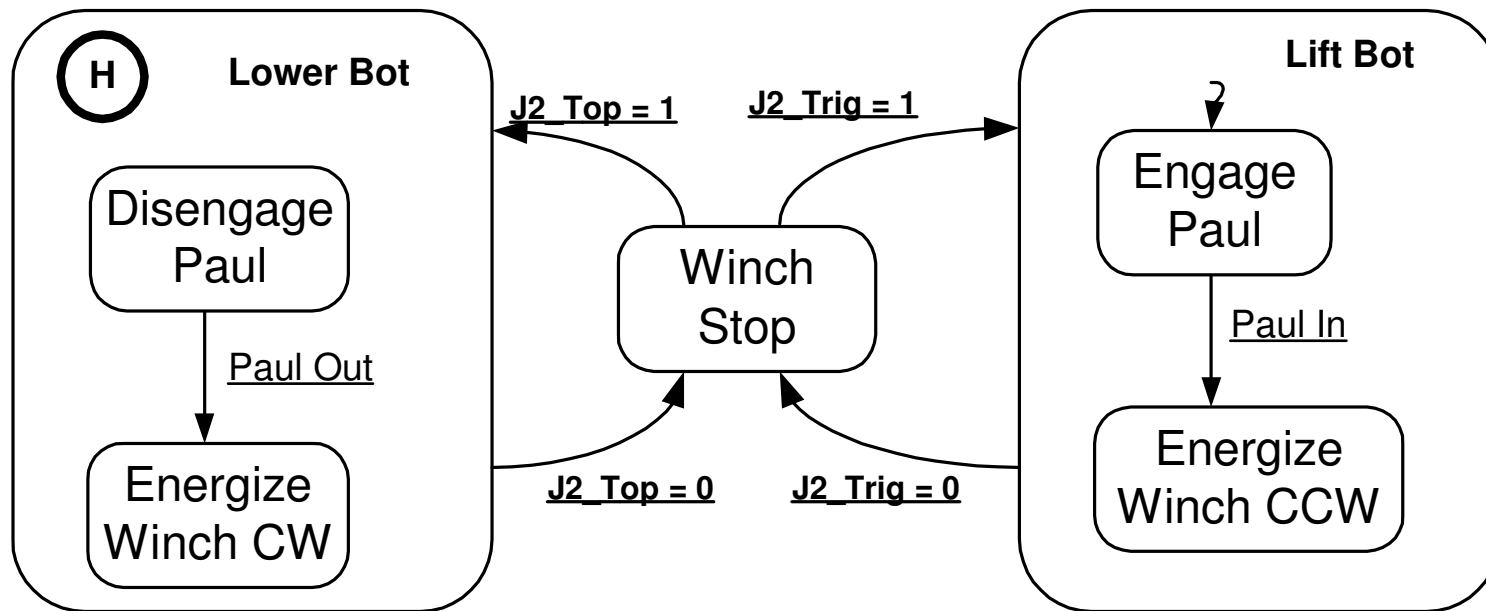
Competition Box Function



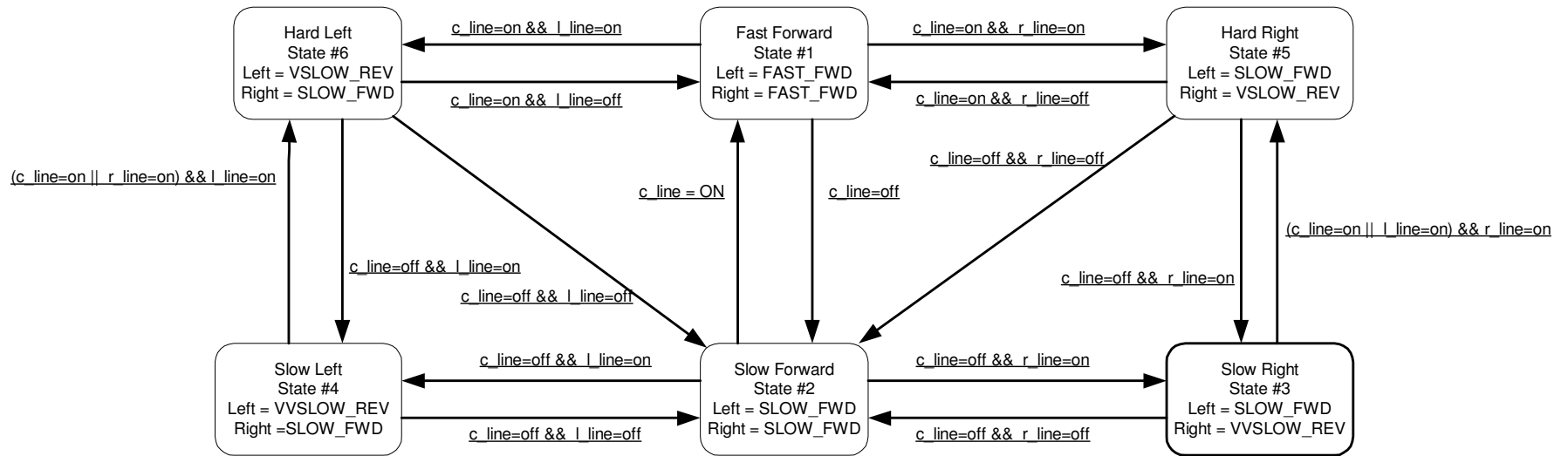
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Nested State Transition Diagrams



State Transition Diagram of Line Tracking Bot



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