

Workshop III

Finite State Machines

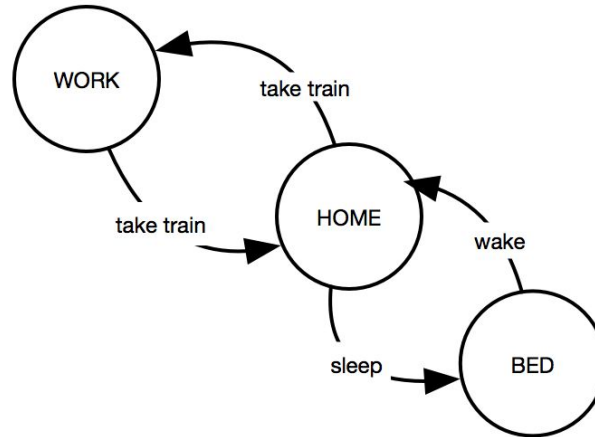
SECTION I

What is a Finite State Machine?

Finite-state machine (FSM)

- A model that is used to design and represent control flow in systems with a finite number of states.
- Also known as a finite-state automaton (FSA)

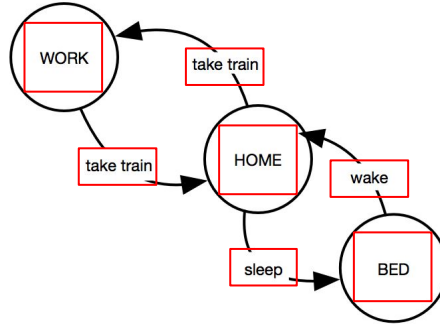
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Structure of an FSM

- FSMs are made up of states and transitions:
 - States represent the information stored by the system
 - Denoted by circles
 - Transitions represent the movement between states, and occur when a certain input or condition is satisfied.
 - Denoted by arrows, and their conditions are often written along the arrow

Ex.



How can an FSM be used in embedded systems?

- FSMs are a great way to implement the control flow of a system into code in an intuitive and efficient manner.
- FSMs can be implemented in numerous programming languages
 - We will implement FSMs using C/C++ through control statements (ex. if statements and switch statements) and enumerated types

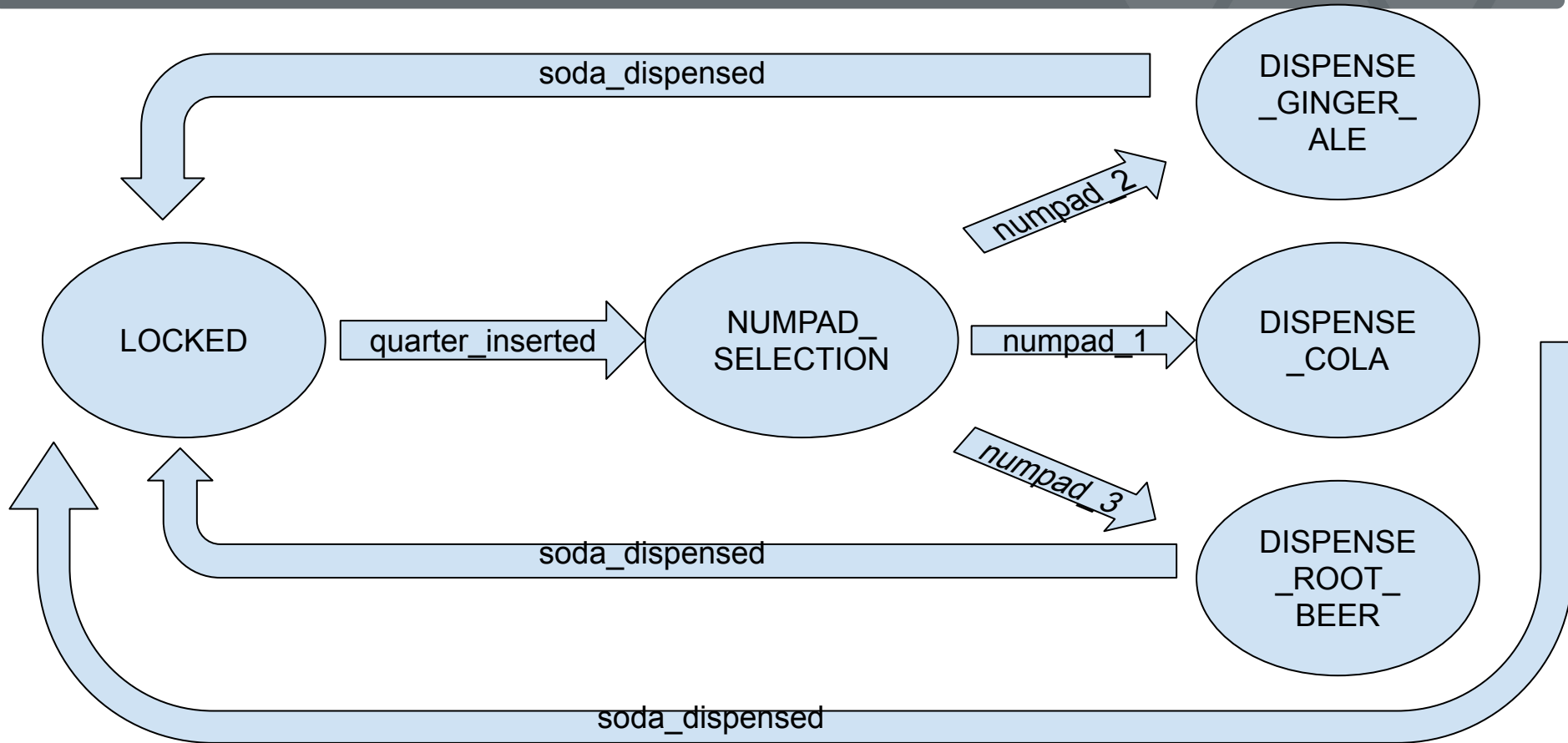
SECTION II

Making a Finite State Machine: Vending Machine Example

Requirements of the Vending Machine

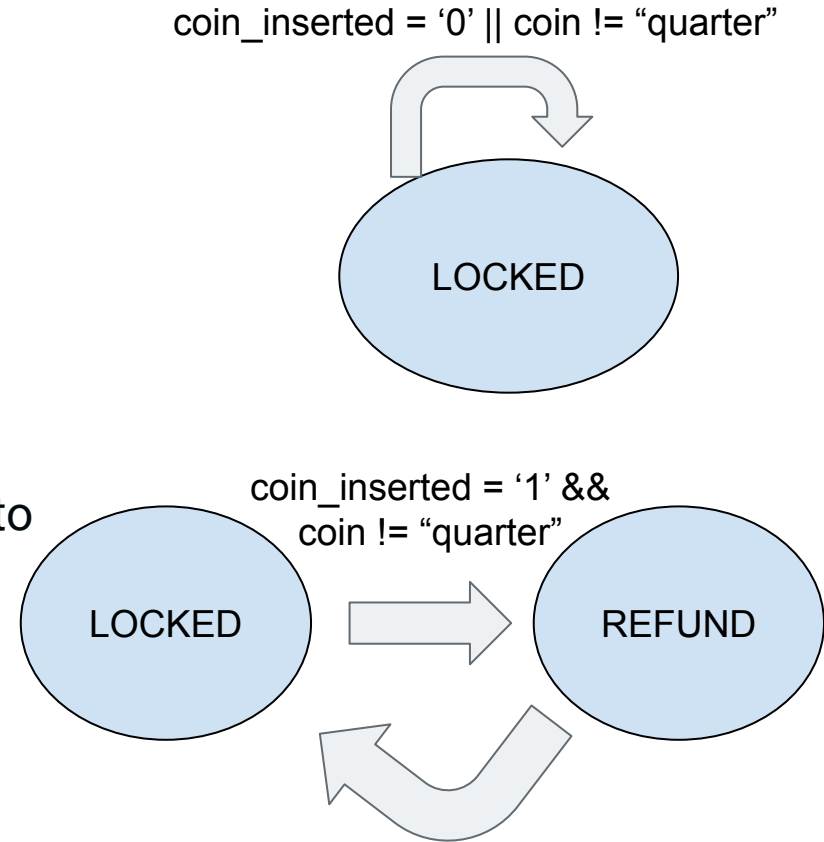
- We want to create a vending machine that accepts only quarters.
- It has a numpad with 3 buttons (1, 2, 3).
- The machine is locked until money is inserted.
- When the user inserts a quarter, they may select an option from the numpad.
- After making their selection, the machine dispenses the selected drink (cola, ginger ale, or root beer).
- Then the machine locks again.

Diagram of the Vending Machine



Bettering the Machine

- The user now enters coins that are not quarters.
 - We want the vending machine to do nothing until they enter a quarter.
 - How do we show this?
- Now, when they enter a coin that is not a quarter.
 - We want to return that coin, then return to the locked state.
 - How would the FSM change now?



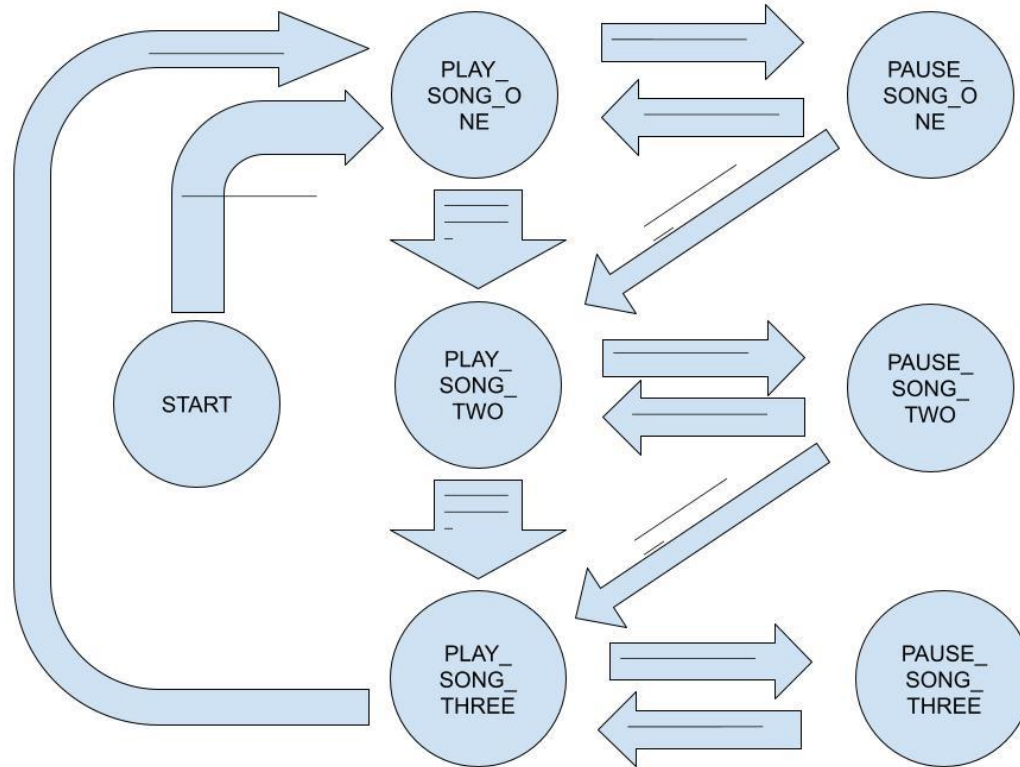
SECTION IV

Building an FSM for iPoduino

iPoduino Requirements

- The player must play 3 songs and have two buttons.
- One of the player's buttons must toggle the music between "Play" mode and "Pause" mode.
 - In "Play" mode, the player must playback a song. It should resume the song that was previously paused if the "Skip/Next Song" button was not pressed.
 - In "Pause" mode, no song should be played.
- The second button should be the "Skip/Next Song" button, which interrupts the current song and plays a new song.
 - Each press of this button must cycle through all songs
 - If the player was in "Pause" mode when the "Skip/Next Song" button is pressed, the player must immediately enter "Play" mode.

Diagram of iPoduino



SECTION V

Coding an FSM for iPoduino

"Life is like a finite state machine — sometimes you're in the 'happy' state, other times you're in the 'confused' state, and occasionally, you find yourself in the 'error' state. Just keep transitioning!"

-Danny Devito

Famous Misquotes

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