##### System States

###### Main structure of FSM

These are the defined states for FSM:

1. **Boot State:** System is powered on, initializing hardware and loading configuration.
2. **Idle State:** System is waiting for user input to start a process.
3. **Heating State:** System is heating the contents to a target temperature.
4. **Holding State:** System maintains temperature for a specified duration
5. **Water Drain State:** System drains water from the vat walls.
6. **Water Refill State:** System refills water in the vat walls.
7. **Cooling State:** System cools milk to a target temperature.
8. **Cheese Drain State:** System drains the processed cheese product.

States definitions

|  |  |  |
| --- | --- | --- |
| **State** | **Entry** | **Exit** |
| Boot | System is powered on | Boot completed |
| Idle | Boot completed / Completion of some process | User selects a mode |
| Heating | Start button is pressed / Cooling completed | Target temperature achieved |
| Holding | Target temperature is achieved | Holding time has elapsed |
| Water Drain | Holding time is complete | Drainage completed |
| Water Refill | Drain complete | Water refilling completed |
| Cooling | Refill complete | Cooling temperature achieved |
| Cheese Drain | Cheese is ready | Cheese drained |

FSM Diagram:

Processes using FSM States

* 1. **Pasteurization:**

Pasteurization uses three FSM states: Idle state, heating state and holding state.

**Process Flow**

**1. Heating State:**

* **Entry**: Process initiated from IDLE
* **Do**:
  + Heating rods activated
  + Agitator runs at speed (X%) in clockwise direction
  + System continuously monitors current temperature
  + Display shows target temperature and current temperature
* **Parameters**:
  + Target Temperature: THT1
* **Exit**: Milk reaches target pasteurization temperature

**3. Holding State:**

* **Entry**: Target temperature reached after Heating
* **Actions**:
  + System maintains temperature at target level (±1°C)
  + Agitator continues at set speed and direction
  + Timer begins countdown of holding time
  + Display shows remaining holding time and current temperature
* **Parameters**:
  + Hold temperature: THT1
  + Hold time: HT1
  + Agitator speed: X%
  + Agitator direction: Clockwise
* **Exit**: Holding time completed
  1. **Water Drainage**

Water drainage process implements the water drainage state only.  
**Process flow  
Water Drain state**

* **Entry:** Holding time is complete
* **Do:**
  + Agitation stopped
  + Pneumatic drain valve is opened
  + Monitor the water level
* **Exit:** Water drainage completed
  1. **Water Refill**

Water refill process implements the water refill state only.

* **Entry:** Water Drainage Completed
* **Actions:**
  + Pneumatic refill valve is opened
  + Monitor the water level
* **Exit:** Water refill completed
  1. **Cooling**

Cooling process implements the cooling state only.

* **Entry:** Water refill completed
* **Actions:**
  + Agitator motor is started at set speed and direction
  + Monitor the temperature
  + System continuously monitors current temperature
  + Display shows target temperature and current temperature
* **Parameters**:
  + Target Temperature: TCT1
* **Exit:** Cooling temperature achieved. Cooling completed
  1. **Cheese making**

Cheese making process uses two FSM states: Heating state and Holding state.

**Process Flow**

**1. Heating State:**

* **Entry**: Cooling completed
* **Actions**:
  + Heating rods activated
  + Agitator runs at speed (Y%) in clockwise direction
  + System continuously monitors current temperature
  + Display shows target temperature and current temperature
* **Parameters**:
  + Target Temperature: THT2
* **Exit**: Milk reaches target pasteurization temperature

**2. Holding State:**

* **Entry**: Target temperature reached after Heating
* **Actions**:
  + System maintains temperature at target level (±1°C)
  + Agitator continues at set speed and direction
  + Timer begins countdown of holding time
  + Display shows remaining holding time and current temperature
* **Parameters**:
  + Hold temperature: THT2
  + Hold time: HT2
  + Agitator speed: Y%
  + Agitator direction: Clockwise
* **Exit**: Holding time completed
  1. **Cheese drainage**

Cheese drainage process implements the cheese drain state.

Process Flow