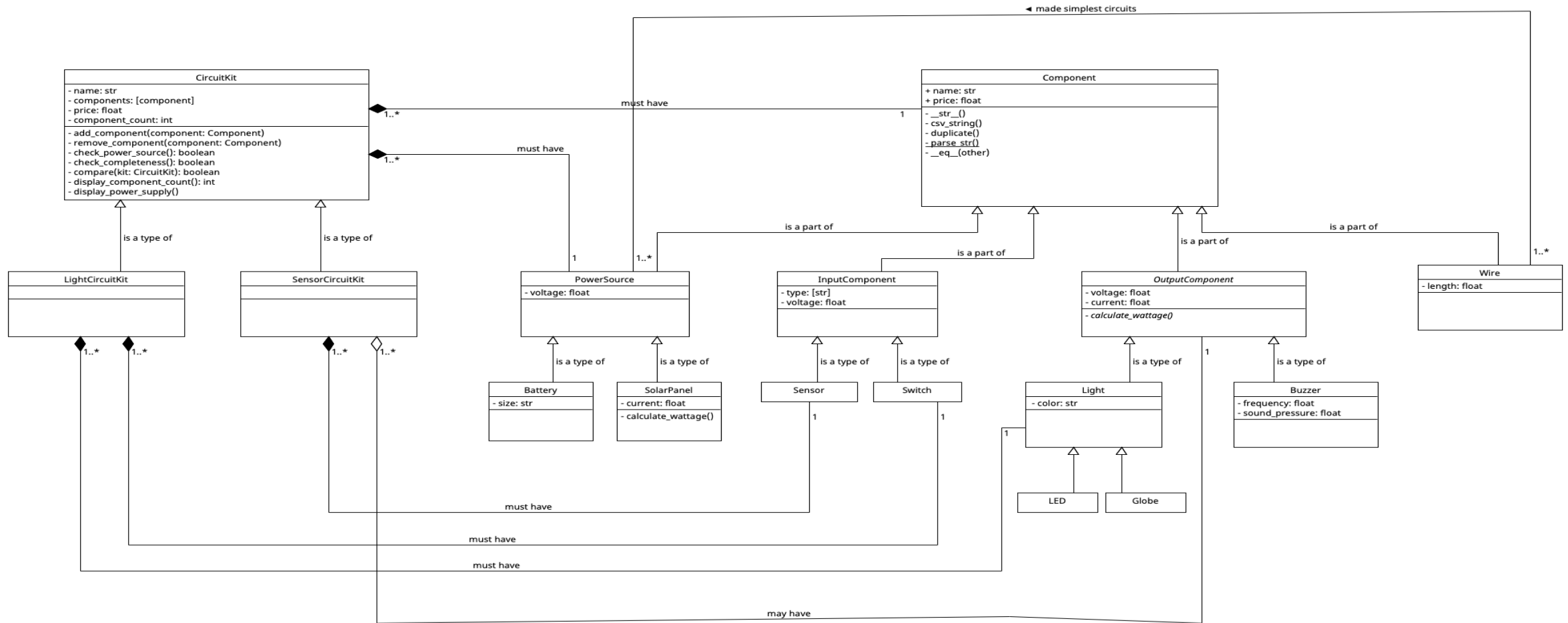# UML Diagram & Design Explanation

COMP1046: Object Orientated Programming

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Team member: Yiyao Lai & Heng Teng

Completeness Diagram

Heng Teng, Yiyao Lai

Component

Base Class of Wire, InputComponent, OutputComponent, PowerSource

```
Component
+ name: str
+ price: float
- __str__()
- csv_string()
- duplicate()
- parse_str()
- __eq__(other)
```

Attribute

- name: The name of the component (String).
- price: The price of the wire (Float, dollars and cents)

Method

- __str__(): Displays the component details in a user-friendly format (String).
- csv_string(): Converts component details to a CSV string format (String).
- duplicate(): Creates a duplicate copy of the component (Component).
- parse_str(data: String): Parses a string to recreate the component object (Component).
- compare(component: Component): Compares the component to another component to check if they are equal (Boolean).

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Wire

Wire
- length: float

Attribute

- Inherited from Component (name, price)
- `length`: The length of the wire (Float, measured in mm).

Method

- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)

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OutputComponent(abstract class)
Inherited from Component

OutputComponent
- voltage: float - current: float
- calculate_wattage()

Attribute
- Inherited from Component (name, price)
- voltage: The voltage of the component (Float, measured in volts).
- current: The current of the component (Float, measured in milliamps).

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)
- calculate_wattage(): Calculates the wattage of the component (Float, in watts).

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Light
Inherited from Component & OutputComponent

Light
- color: str

Attribute
- Inherited from Component (name, price)
- Inherited from Component (voltage, current)
- `color`: The color of the light (String).

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)
- Inherited from OutputComponent(calculate_wattage)

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Buzzer
Inherited from Component & OutputComponent

Buzzer
- frequency: float
- sound_pressure: float

Attribute
- Inherited from Component (name, price)
- Inherited from Component (voltage, current)
- frequency: The frequency of the buzzer (Float, in Hertz).
- sound_pressure: The sound pressure of the buzzer (Float, in decibels).

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)
- Inherited from OutputComponent(calculate_wattage)

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InputComponent
Inherited from Component

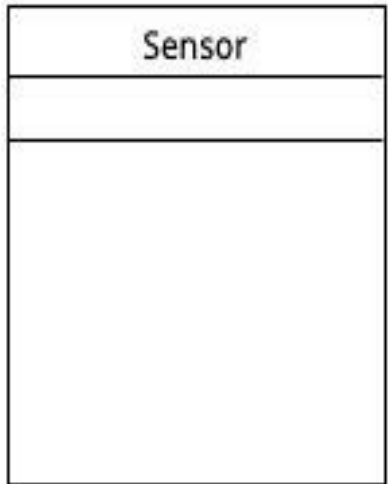| InputComponent |
| --- |
| - type: [str] |
| - voltage: float |
| |
| |

Attribute
- Inherited from Component (name, price)
- type: The type of component (String)
- voltage: The voltage of the component (Float, in volts).

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)

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Sensor & Switch

Inherited from Component & InputComponent

Sensor

Switch

Attribute
- Inherited from Component (name, price)
- Inherited from InputComponent (type, voltage)

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)

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PowerSource

Inherited from Component

PowerSource
- voltage: float

Attribute
- Inherited from Component (name, price)
- voltage: The voltage of the component(PowerSource),(Float, in volts).

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)

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Battery

Inherited from Component & PowerSource

Battery
- size: str

Attribute
- Inherited from Component (name, price)
- Inherited from PowerSource (voltage)
- size: The size of the battery (String, e.g., AA, AAA, etc.).

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)

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SolarPanel

Inherited from Component & PowerSource

SolarPanel
- current: float
- calculate_wattage()

Attribute
- Inherited from Component (name, price)
- Inherited from PowerSource (voltage)
- current: The current of the solar panel (Float, in milliamps)

Method
- Inherited from Component (__str__, csv_str, duplicate, parse_str, __eq__)
- calculate_wattage(): Calculates the wattage of the solar panel (Float, in watts).

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CircuitKit
Base Class of LightCircuitKit & SensorCircuitKit

CircuitKit
- name: str - components: [component] - price: float - component_count: int
- add_component(component: Component) - remove_component(component: Component) - check_power_source(): boolean - check_completeness(): boolean - compare(kit: CircuitKit): boolean - display_component_count(): int - display_power_supply()

Attribute

•name: The name of the circuit kit (String).

•components: A list of components in the kit (List of Component Objects).

•price: The price of the circuit kit (Float, calculated from the sum of component prices).

•component_count: The total number of components in the kit (Integer)

Method

•add_component(component: Component): Adds a component to the circuit kit.

•remove_component(component: Component): Removes a component from the circuit kit.

•check_power_source(): Checks that only one type of power source is used (Boolean).

•check_completeness(): Checks if the circuit kit is complete and functional (Boolean).

•compare(kit: CircuitKit): Compares the circuit kit to another kit to check if they are equal (Boolean).

•display_component_count(): Displays the number of components in the kit (Integer).

•display_power_supply(): Displays the power supply information, including number of power supplies and voltage

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LightCircuitKit & SensorCircuitKit

Inherited from CircuitKit

LightCircuitKit

SensorCircuitKit
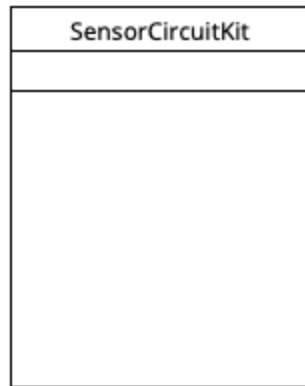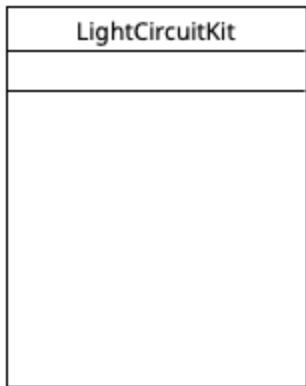
Attribute
- Inherited from CircuitKit(name, components, price, component_count)

Method
- Inherited from CircuitKit (add_component, remove_component, check_power_source, check_completeness, compare, display_component_count, display_power_supply)

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Association

Wire & PowerSource

Wire
- length: float

PowerSource
- voltage: float

Explanation:

Association relationship:

Wire connects to PowerSource to enable the flow of electricity in a circuit.Wires act as the fundamental medium to connect components in a circuit, facilitating power flow.

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Aggregation

Between SensorCircuitKit & OutputComponent(Light, Buzzer)
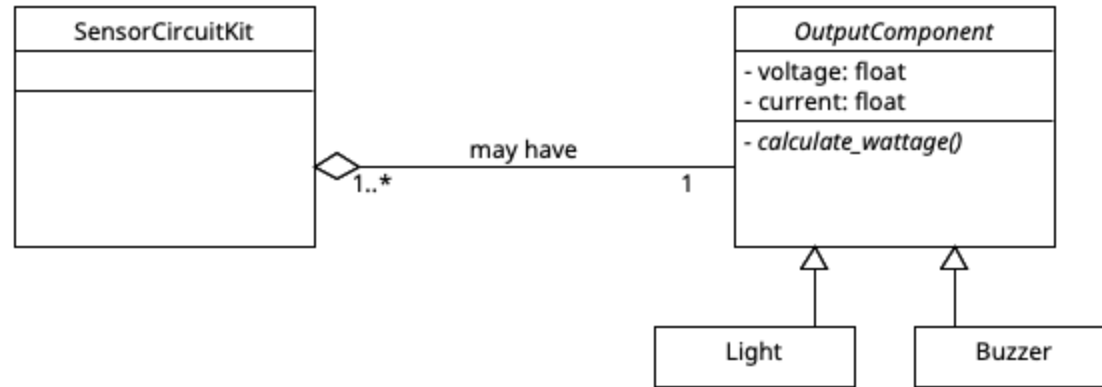
Explanation:

Aggregation: SensorCircuitKit may have either Light or Buzzer.

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Composition
Between CircuitKit & Component
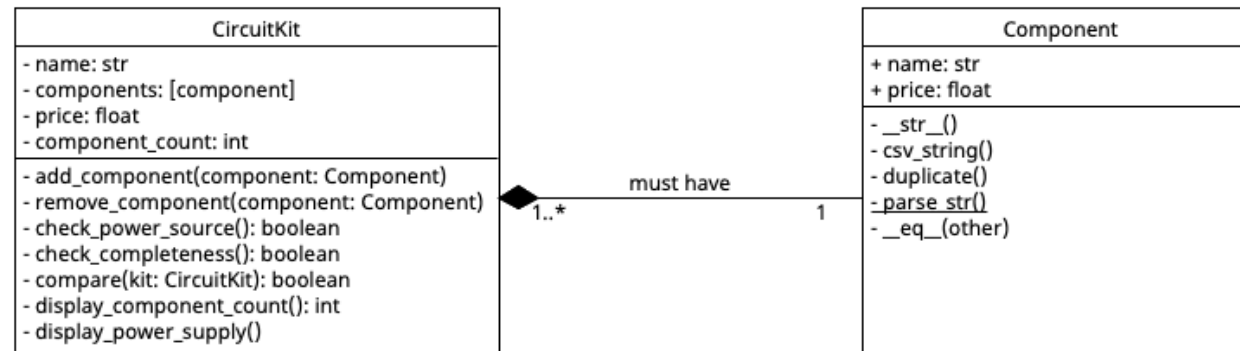
Explanation:

Aggregation: Component is integral to Circuitkit and depend on its lifecycle for existence

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Composition
Between CircuitKit & PowerSource
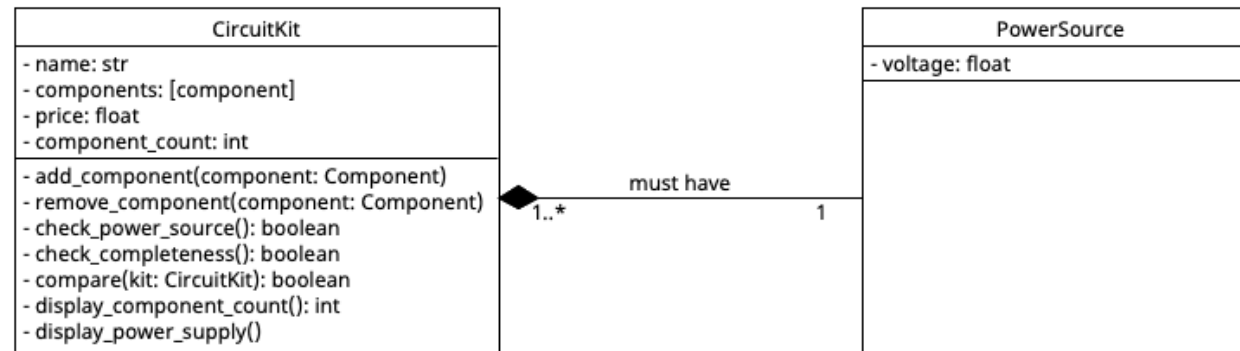
Explanation:
Aggregation: A PowerSource is an essential component of a CircuitKit, as the circuit cannot function without a power source.

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Composition

Between SensorCircuitKit & Sensor
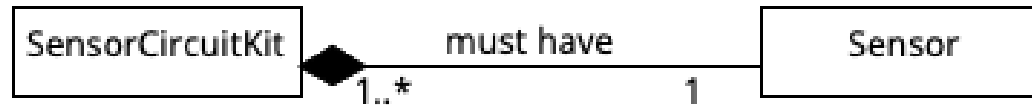
Explanation:

Aggregation: The Sensor is essential for the functionality of the SensorCircuitKit because it provides the key input needed for the kit's operation.

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Composition

Between LightCircuitKit & Light
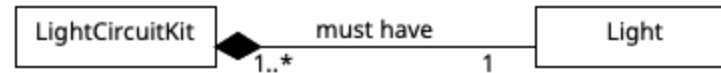
Explanation:
Aggregation: Lights are essential for the operation of the LightCircuitKit, as they provide the primary visual output.

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Composition

Between LightCircuitKit & Switch

LightCircuitKit	◆ must have	Switch
	1..* 1	
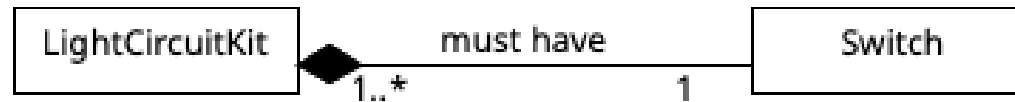
Explanation:

Aggregation: A Switch is essential for the operation of the LightCircuitKit, as it allows users to control the circuit's state.
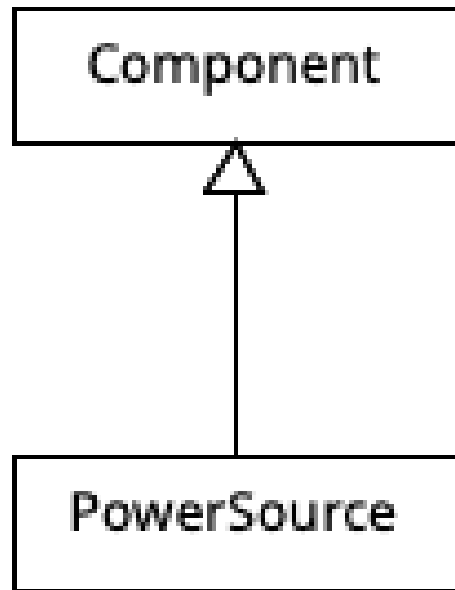
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Inheritance

Wire&Component
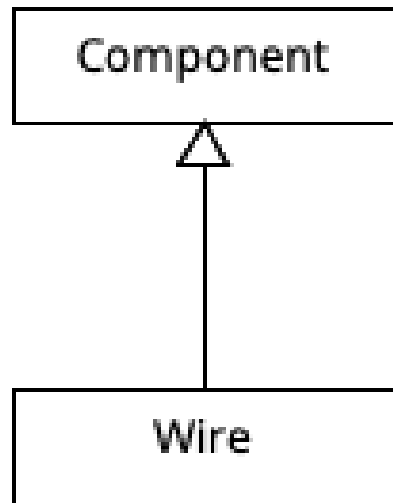
Explanation:

Inheritance relationship:

Wire is a specific type of Component. This allows us to reuse common attributes and methods from the Component class while adding wire-specific attributes like length.

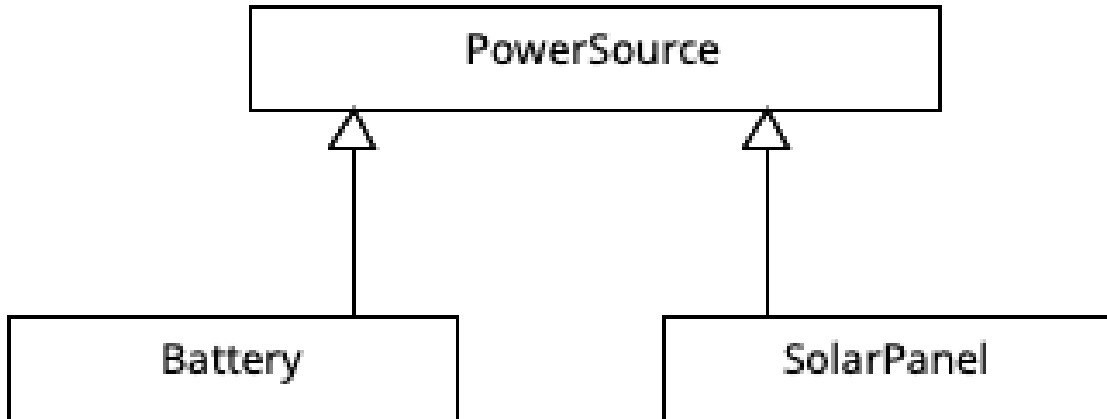Yiyao Lai,   Heng Teng

Inheritance

PowerSource&Component

Component

PowerSource

Explanation:

Inheritance relationship:

PowerSource is a general type of Component. This helps encapsulate shared behaviors of batteries and solar panels under one parent class.

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Inheritance

## PowerSource & Battery, SolarPanel

Explanation:

Inheritance relationship:

Battery is a specialized type of PowerSource. This captures the unique properties of batteries, like size, while sharing voltage with its parent class.

SolarPanel is another specialized type of PowerSource. It inherits voltage while adding attributes like current and methods to calculate wattage.

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Inheritance
OutputComponent & Component
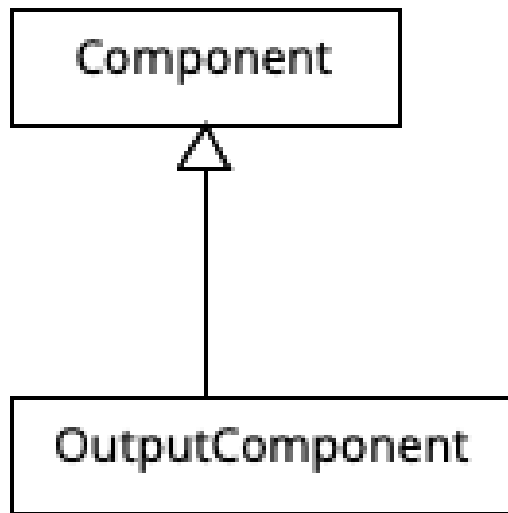
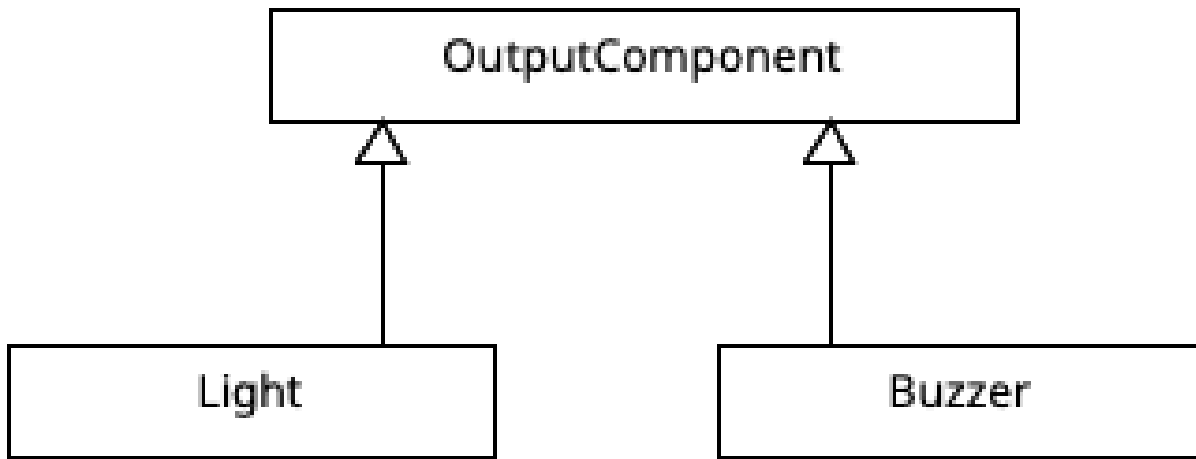Explanation:
Inheritance relationship:

OutputComponent inherits attributes and methods from Component. It is a type of Component.

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Inheritance

**OutputComponent**&**Light**, **Buzzer**

Explanation:

Inheritance relationship:

Light is a type of Component. This helps organize light-specific attributes like color and current while sharing basic Component behavior.

Buzzer is a specialized OutputComponent designed to handle sound output in circuits, inheriting power-related attributes and extending sound-specific features.

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Inheritance
InputComponent&Component

Component
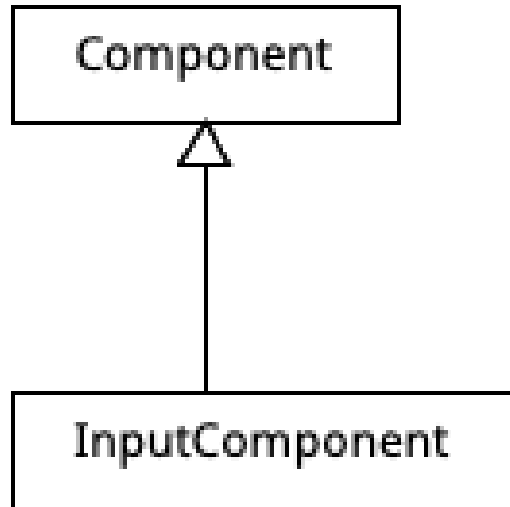
InputComponent

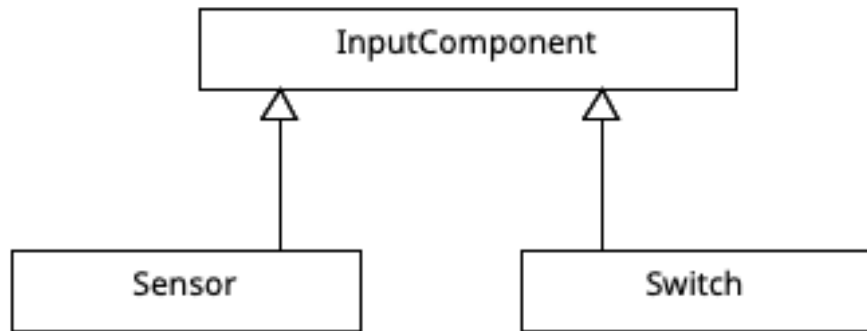Explanation:
Inheritance relationship:
InputComponent inherits attributes and methods from Component. It is a type of Component.

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Inheritance

## **InputComponent** & **Sensor**, **Switch**

Explanation:

Inheritance relationship:

Sensors and switches are considered input components because they detect changes in the environment or system and send signals to the control system. Sensors measure physical properties like temperature, light, or pressure, while switches detect the presence or absence of something (such as on/off status) and send a corresponding signal. Both act as the system's "senses," providing the necessary information to trigger actions or responses.

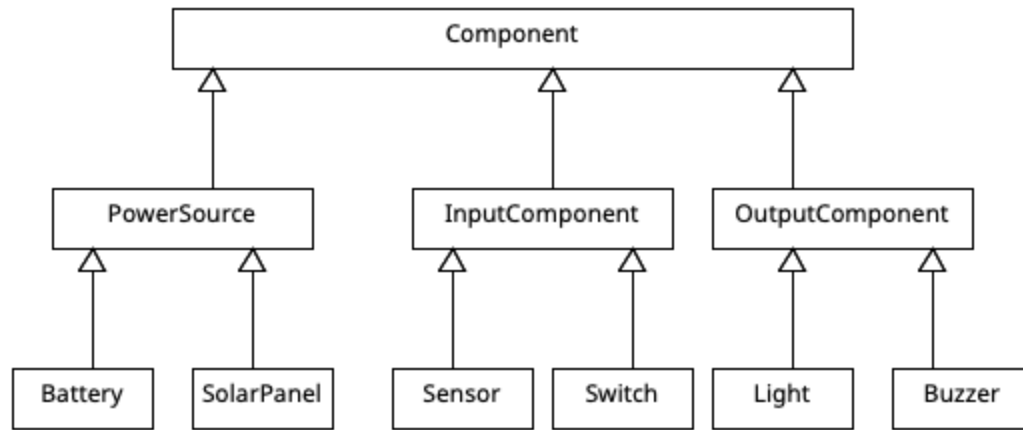Yiyao Lai, Heng Teng

Inheritance
CircuitKit & LightCircuitKit, SensorCircuitKit
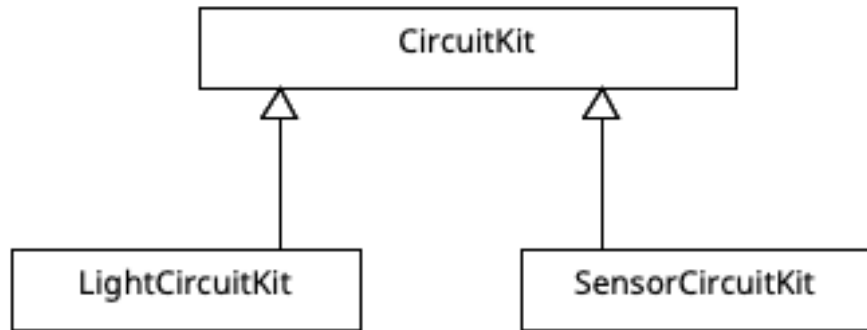
Explanation:
Inheritance relationship:
CircuitKit have two type which are Light circuitkit and sensor CircuitKit.

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Multiple Inheritance

Explanation:
Multiple Inheritance relationship:
Component are the base class of PowerSource, Input & Output component but there are more classes inheritted from these children classes which are (Battery, Solarnel, Sensor, Switch, Light, Buzzer)
e.g: Battery & SolarPanel are the type of power supply so it lead to it inheritted from PowerSource.

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