

# Software Design Document for Wind-farm Multi-objective control toolbox

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## 1. Overview

The Wind-farm Multi-objective control toolbox is a Python-based application that finds optimal solutions for Multi-objective control of wind farms as part of the TWAIN project.

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## 2. Functional Overview

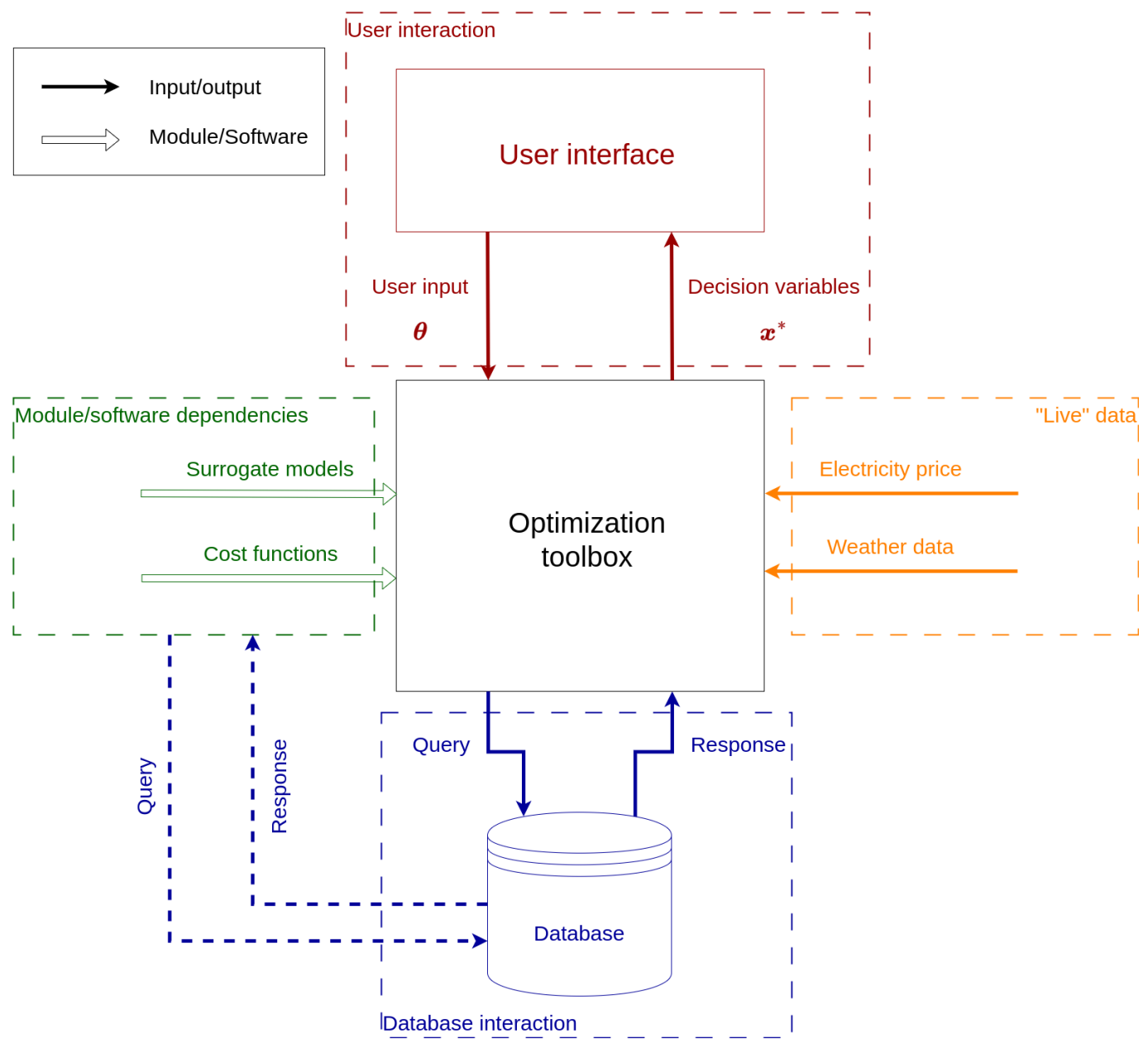
The software provides the following core functionalities:

1. User interface
    - specify scenarios (User input)
      - GUI
      - Web service
      - CLI
      - API
    - visualize optimization result (decision variables)
      - GUI
      - Web service
    - export optimization result (decision variables)
  2. Use existing tools/libraries to compute decision variables
    - surrogate models
    - cost functions
    - electricity price
    - ...
  3. Exploit data maintained within TWAIN project (database)
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## 3. Architecture

High-level interaction with TWAIN

**Diagram**

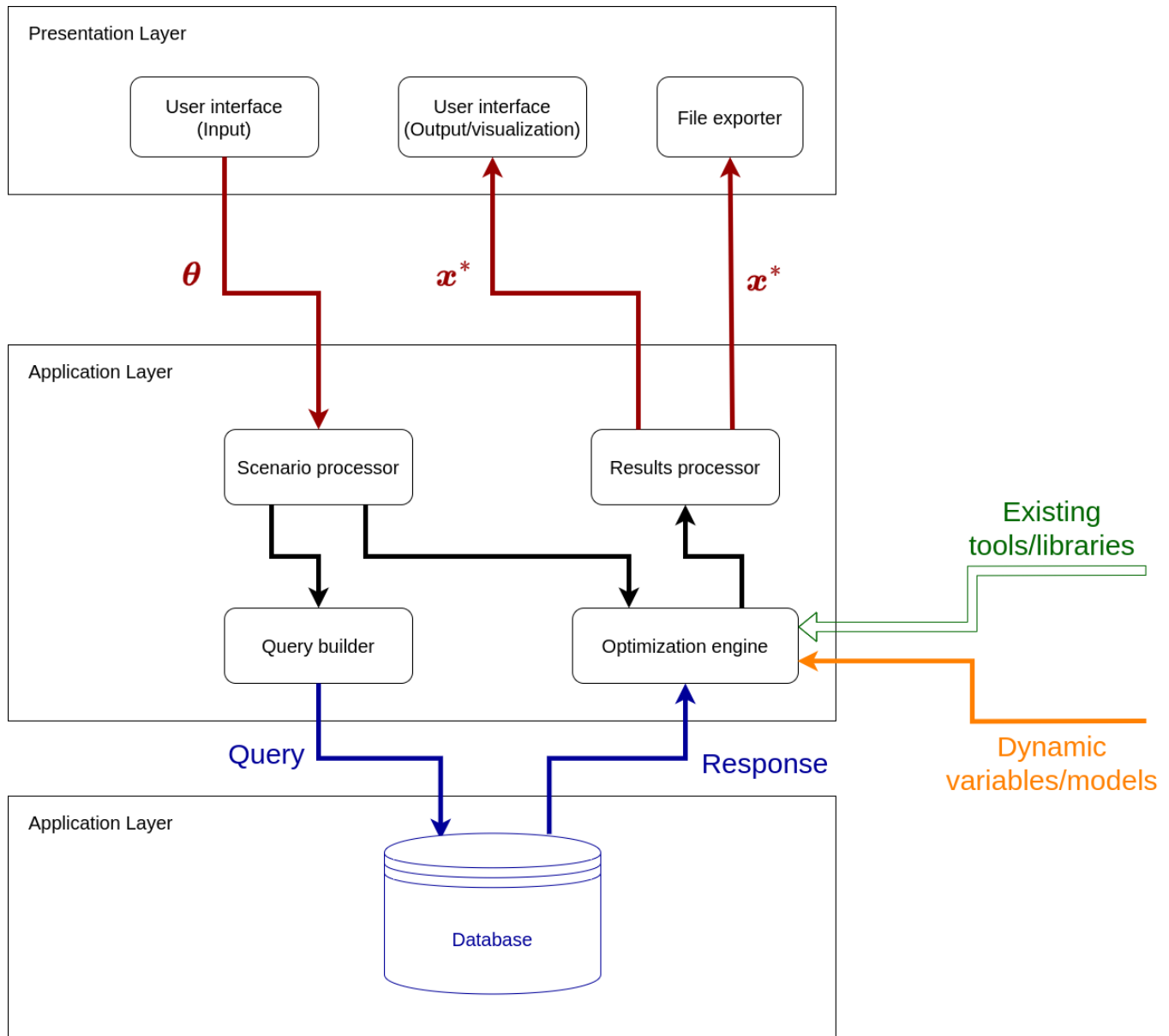


Layered Design

The system consists of three primary layers:

- **Presentation Layer:** Handles user interaction (GUI, Web application, file export).
- **Application Layer:** Processes data, scenario specifications, optimization.
- **Database Layer:** Manages retrieval of data from TWAIN database(s)

Diagram



## 4. Detailed Design

### Component 1: User interface (Input)

- **Purpose:** Allows the user to specify scenario parameters
- **Inputs:**
  - User input
- **Outputs:**
  - Scenario parameters
    - Wind-farm specific parameters
    - Multi-objective weights
    - ...
- **Interfaces:**
  - GUI, Web service, CLI or API for user input
  - passes user input to scenario processor
- **Key Functions:**
  - [Function Name]: [Description of the function.]

- **Constraints:**

## Component 2: Optimization engine

- **Purpose:** Compute optimal values for decision variables
- **Inputs:**
  - user-defined parameters
  - data from TWAIN database
- **Outputs:**
  - optimized decision variables
- **Interfaces:**
  - receives user-defined parameters
  - requests data from TWAIN data base
  - receives data from TWAIN data base
  - passes optimized parameters to results processor
- **Key Functions:**
  - **Surrogate model**: surrogate model used to compute WT loads, power, ...
  - **Cost function 1**: evaluate first cost function
  - **Cost function 2**: evaluate second cost function
  - ...
  - **Optimizer**: compute optimization
  - ...
- **Constraints:**

## Component 3: [Component name]

...

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## 5. Data Design

### Database Schema

See other TWAIN WPs

### Scenario parameters

e.g.

- Number of wind turbines
- Size/type of wind turbines
- wind rose
- ...

### Optimization parameters

e.g.

- Wind farm layout
- wind turbine control strategies

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## 6. Error Handling

- Invalid input: ...
- Optimization failure: ...
- ...

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## 7. Future Considerations

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## 8. References

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## Appendix