**Program Architecture and Design Requirements**

1. **Functional Requirements (grouped by domain)**
2. ***Sensor monitoring:*** continuous monitoring of temperature, humidity, and motion sensors, log sensor data periodically.
3. Actuator Control: automated control of heating, humidity and egg turning based on thresholds. Remote manual control for heating ventilation and egg turning.
4. Data storage and processing: store data in DBMS, use prediction algorithms to estimate optimal hatching times and detect anomalies.
5. Remote access: provide graphs showing log data and the predicted future values on the mobile user interface, include user input handling for controlling the thresholds manually.
6. Alerts and notifications: send alerts for anomalies ( low/high temperature or humidity), notify user when hatching or manual intervention is required.
7. User Interface: real-time data visualization with graphical trends and prediction graphs, control buttons for remote setup of the operation modes (constants/thresholds).
8. **Quality Attributes**
9. Performance: [HIGH PRIORITY]

* The system shall respond to actuator control commands within 2 seconds of receiving sensor data or user input, ensuring real-time operation.
* The server shall process prediction computations within 500 milliseconds for datasets of up to 10,000 records.(minimum standard for simple computing machines)

1. Scalability: [HIGH PRIORITY]

* The system shall support the addition of up to 10 sensors and actuators without performance degradation.(can scale for 10 more products)
* The back-end shall handle up to 1,000 concurrent users accessing the mobile application and database.(multi-user interface minimum requirement)

1. Reliability: [HIGH PRIORITY]

* The system shall operate with an uptime of 99.9% under standard conditions.
* Communication between the micro-controller and server shall succeed in at least 95% of attempts during network fluctuations.(4.9% fault should be handled)

1. Maintainability: [MIDIUM PRIORITY]

* The system’s modular codebase shall allow for the addition or removal of a feature within 4 hours by a qualified developer.
* Each code module shall be documented to provide an average readability score of at least 85% (measured by software documentation standards of Flesch-Kincaid).

1. Security: [LOW PRIORITY]

* The mobile application shall implement two-factor authentication with a success rate of 99% during penetration tests.

1. Usability: [HIGH PRIORITY]

* The mobile application interface shall have a user task completion time of less than 10 seconds for common tasks.
* The app shall achieve a usability rating of 4.5/5 during user experience testing with a sample size of 10 users(students).