

**Project Design Phase-II**  
**Solution Requirements (Functional & Non-functional)**

Date	31 January 2025
Team ID	LTVIP2026TMIDS42870
Project Name	electric motor temperature prediction using machine learning
Maximum Marks	4 Marks

**Functional Requirements:**

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User input Management	Input form for motor parameters (torque, current, RPM) * Input fields for temperature measurements (ambient, coolant) * Form validation with error messages for invalid inputs * Default values provided for quick testing * Support for both web interface and API input
FR-2	Temperature Prediction Engine	* Preprocess input data using StandardScaler from transform.save * Generate rotor temperature prediction in real-time * Return prediction with 2 decimal precision * Handle batch predictions for multiple data points
FR-3	Results Visualization	* Show input parameters alongside prediction for reference * Color-code temperature based on safety levels: - Green: Normal operation (< 80°C) - Yellow: Warning (80-95°C) - Red: Critical (> 95°C) * Display prediction timestamp
FR-4	API Endpoints	* GET /info - Model information (type, features, importance) * GET /api - API documentation endpoint * POST /score - JSON API for programmatic predictions * POST /predict - Alias for /score endpoint
FR-5	Model Management	* Model evaluation metrics (MAE, R <sup>2</sup> ) display * Feature importance analysis * Model versioning capability * Retraining with new data support
FR-6	Data Management	* CSV data import/export functionality * Data validation and cleaning pipeline * Train/test split automation (80/20) * Data persistence in pmsm_temperature_data.csv

## Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	<p>Web interface should be intuitive with clear labels and instructions</p> <ul style="list-style-type: none"> <li>* All input fields should have proper labels and placeholder text</li> <li>* Results should be displayed prominently within 2 seconds</li> <li>* Error messages should be descriptive and user-friendly</li> <li>* Interface should be responsive and work on mobile devices</li> </ul>
NFR-2	<b>Security</b>	<ul style="list-style-type: none"> <li>* Input validation on both client and server side</li> <li>* API endpoints protected against excessive requests (rate limiting)</li> <li>* No sensitive data stored in logs</li> <li>* CORS properly configured for API access</li> <li>* Environment variables for configuration (not hardcoded)</li> </ul>
NFR-3	<b>Reliability</b>	<ul style="list-style-type: none"> <li>* Model files should be validated before loading</li> <li>* Fallback mechanism if models fail to load</li> <li>* Consistent prediction accuracy (<math>MAE &lt; 5^{\circ}C</math>)</li> <li>* 99.9% uptime for critical prediction service</li> <li>* Automatic recovery from failures</li> </ul>
NFR-4	<b>Performance</b>	<ul style="list-style-type: none"> <li>* Web page load time &lt; 2 seconds</li> <li>* Support for at least 100 concurrent users</li> <li>* Model training time &lt; 30 seconds for 10,000 samples</li> <li>* Memory usage &lt; 500MB under normal load</li> <li>* Efficient feature scaling using pre-fitted StandardScaler</li> </ul>
NFR-5	<b>Availability</b>	<ul style="list-style-type: none"> <li>* Health check endpoint for monitoring</li> <li>* Graceful degradation if models unavailable</li> <li>* Quick restart capability (&lt; 10 seconds)</li> <li>* Port conflicts handled gracefully (fallback ports)</li> <li>* Comprehensive logging for troubleshooting</li> </ul>
NFR-6	<b>Scalability</b>	<ul style="list-style-type: none"> <li>* Docker containerization ready for orchestration</li> <li>* API can handle increased load with load balancing</li> <li>* Model files can be served from shared storage</li> <li>* Batch prediction support for high throughput</li> <li>* Caching layer can be added for frequent predictions</li> </ul>