## **Table of Contents**

Abstract	i
About BEL	ii-iv
1. Introduction	1-7
1.1 Project Overview	1
1.2 Objectives	2
1.3 Scope	5
2. System Design	8-14
2.1 Architecture Overview	8
2.2 Backend: Flask Framework	9
2.3 Frontend: HTML, CSS, JavaScript	11
2.4 Real-Time Data Visualization with Chart.js	13
2.5 Containerization using Docker	14
2.6 Deployment on Render	14
3. Application Features	15-18
3.1 Real-Time System Monitoring	15
3.2 Configurable Polling Interval	17
3.3 RESTful API Design	17
3.4 Secure and Scalable Infrastructure	18
4. Technical Implementation	19-26
4.1 Flask Application Structure	19
4.2 Blueprint Architecture	21
4.3 REST API Endpoint Implementation	21
4.4 Frontend User Interface	22
4.5 Data Handling and Polling	24
4.6 Docker Configuration and Containerization	25
4.7 Deployment Pipeline on Render	26
5. Security Considerations	27-30
5.1 Environment Variable Configuration	27
5.2 Disabling Debug Mode in Production	27
5.3 Secure API Communication	28
5.4 Role-Rased Access Control (Future Improvement)	28

5.5 Logging and Monitoring	29
6. Performance Optimization	31-33
6.1 Minimizing Latency in Polling	31
6.2 Efficient Data Processing	31
6.3 Caching Strategies	32
6.4 Load Handling and Scalability	33
6.5 Profiling and Monitoring	33
7. AI-Powered Anomaly Detection	34-42
7.1 Overview of Anomaly Detection Models	34
7.2 Integration Plan	36
7.3 Potential Algorithms for Anomaly Detection	39
7.4 Benefits of AI Integration.	39
7.5 Challenges and Mitigation	41
8. Scalability and Future Improvements	43-45
8.1 Multi-System Monitoring	43
8.2 Predictive Analytics	43
8.3 Alert and Notification System	44
8.4 Enhanced Dashboard and Visualization	44
8.5 Performance and Infrastructure Scaling	45
8.6 Security Enhancements	45
9. Testing and Quality Assurance	46-48
9.1 Unit Testing	46
9.2 API Testing	47
9.3 Load and Stress Testing	47
9.4 Security Audits	48
9.5 Continuous Integration (CI) Testing	48
10. Deployment and Maintenance	49-50
10.1 CI/CD Pipeline Overview	49
10.2 Monitoring and Logs	49
10.3 Troubleshooting and Issue Resolution	50
10.4 Deployment on Render Platform	50
11. Conclusion and Future Scope	51-52
References	53
Acknowledgement	54