

**TOBB ETU**

**Economy & Technology University**

**BIL 495 / YAP 495**

**Project Management Plan (PMP)**

**Reference:** IEEE 1058 / ISO/IEC 12207

**Project Title:** A Unified Web-Based Platform for Real-Time NICU Signal Monitoring and AI-Assisted Diagnosis

**Institutional Partner:** Ertunç Özcan Import & Representation

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## 1. Project Overview

***Project Goal:***Develop an integrated, secure, and responsive clinical web platform that collects real-time neonatal physiological data from IoMT-enabled devices, analyzes it using AI-based diagnostic models, and presents it through an interactive dashboard for clinicians and hospital staff.

***Deliverables:***

* Fully functional prototype of NICU Clinical Dashboard.
* AI module for respiratory and cardiac risk detection.
* IoMT middleware supporting MQTT / HL7 / FHIR standards [4].
* Role-based secure access system (admin / clinician / nurse).
* Comprehensive technical documentation and final report.

**Key Stakeholders:**

* **Project Team (Manifetch):** İrem Onaran, Merve İçkilli, Şevval Neva Varol, Sacide Sena Filiz
* **Academic Supervisor:** Çiğdem Avcı (TOBB ETÜ BIL 495 Instructor)
* **Institutional Partner:** ERTUNÇ ÖZCAN Import & Representation (IoMT device supplier)
* **End Users:** Clinicians, NICU nurses, hospital IT staff, and healthcare researchers

## 2. Organization and Roles

| **Task** | **Team Member(s)** | **Description** |
| --- | --- | --- |
| Data Collection & Preprocessing | Şevval Neva Varol | Designed the overall layout of the clinical dashboard and prepared simple wireframes for the interface to be used by clinicians and nurses. |
| Backend Development | Merve İçkilli | Developed the server-side logic, handled data communication between the dashboard, AI module, and medical devices. |
| AI Model Development | Sacide Sena Filiz | Built the web interface for data visualization and integrated the main functions of the dashboard. |
| Dashboard Development & Integration | İrem Onaran | Worked on data preprocessing and implemented the first version of the AI-based diagnostic module for signal analysis. |
| System Testing & Optimization | Şevval Neva Varol | Tested each module of the system, identified bugs, and ensured all parts worked together smoothly. |
| Documentation & Presentation | Merve İçkilli | Prepared the project documentation, final report, and presentation materials for academic and industrial review. |

## 3. Project Schedule

The active development phase of the project will start in **Spring 2026**, focusing on data processing, AI module development, and full system integration.

The schedule below reflects the technical workload and expected progression.

A detailed Gantt Chart showing week-by-week progress will be provided separately (see *Appendix A: Gantt Chart*).

| **Milestone** | **Description** | **Timeframe (Weeks)** | **Deliverable / Output** |
| --- | --- | --- | --- |
| M1 – Data Acquisition & Preprocessing | Collect neonatal physiological data (ECG, SpO₂, respiration) from open datasets or synthetic simulators. Perform preprocessing (cleaning, normalization, segmentation). | Week 1–2 | Clean, structured dataset ready for model training and backend integration. |
| M2 – Backend Implementation & Data Handling | Set up backend environment, configure database, and develop secure API endpoints for data transfer and storage. Ensure IoMT communication support (MQTT/HL7). | Week 3–5 | Functional backend capable of receiving and storing real-time or batch NICU data. |
| M3 – AI Model Development | Design AI model architecture, select relevant features, and perform model training and validation for respiratory and cardiac anomaly detection. | Week 6–7 | Validated AI model achieving acceptable accuracy (≥ 85%) on neonatal datasets. |
| M4 – Dashboard Development & Integration | Design and implement UI/UX layout; integrate dashboard frontend with backend and AI module for real-time visualization and alert display. | Week 8–9 | Web dashboard capable of displaying live signal data and AI diagnostic results. |
| M5 – System Testing & Optimization | Perform integration testing, latency measurement, and system performance optimization. Fix bugs and enhance user interface responsiveness. | Week 10–11 | Stable and optimized system with verified data flow from device to dashboard. |
| M6 – Documentation & Presentation | Prepare final technical documentation, project report, and presentation materials for TOBB ETÜ and Ertunç Özcan evaluation. | Week 12 | Completed final report, presentation slides, and demo-ready prototype. |

## 4. Budget and Resources

**4.1 Technical Resources:**

| **Resource Type** | **Details / Tools** | **Provided By** |
| --- | --- | --- |
| Development Environment | VS Code, GitHub, Docker (for backend integration) | Team |
| Programming Languages | Python (AI module), JavaScript/React (Frontend), Node.js/Flask (Backend) | Team |
| Data Simulation Tools | BioSPPy [6], NeuroKit2 [7] for signal simulation | Team |
| AI/ML Libraries | NumPy, Pandas, Scikit-learn [8], TensorFlow / PyTorch [9] | Open Source |
| Databases | PostgreSQL or MongoDB (for patient signal data) | Team |
| Datasets | PICS-DB & MIMIC-IV Waveform Databases (via PhysioNet) [1], [2] | Open Access |

**4.2 Financial Estimation:**

This project does not require direct financial expenditure.  
All required software tools and datasets are open-source.  
Estimated equivalent value of resources:

* Software Licenses (Figma, Docs): Free-tier academic use
* Mentorship & Data Access: Provided by industrial partner (Ertunç Özcan)

Thus, the overall monetary cost is minimal, focusing on human effort and computing resources rather than direct expenses.

## 5. Risk Management

| **Risk ID** | **Risk Description** | **Likelihood** | **Impact** | **Mitigation Strategy** |
| --- | --- | --- | --- | --- |
| R1 | Data acquisition delays — public neonatal datasets may be large or slow to process, causing delays in AI model training. | Medium | High | Prepare early data samples and synthetic datasets (using BioSPPy/NeuroKit2) to begin preprocessing before full dataset download completes. |
| R2 | Integration issues between backend, AI module, and dashboard (API incompatibility or latency). | Medium | High | Use modular design and early API testing between teams. Establish common data schema and JSON format. |
| R3 | AI model performance below expectations due to noisy or imbalanced neonatal data. | Medium | High | Apply signal denoising and data augmentation. Use multiple datasets (PICS-DB + MIMIC-IV) for better generalization. |
| R4 | Limited real-world data access from hospitals or industry partners (ethical constraints). | High | Medium | Use anonymized or synthetic data in early stages. Request data-sharing approval early from Ertunç Özcan and hospital ethics board. |
| R5 | Time constraints during development (12 weeks) — overlapping modules may cause bottlenecks. | High | Medium | Implement weekly sprint meetings. Prioritize critical modules (data preprocessing → backend → AI). Keep a 1-week buffer for testing. |
| R6 | System reliability and testing limitations — lack of access to real NICU devices for live testing. | Medium | Medium | Simulate IoMT device signals using generated data streams. Validate data flow integrity through unit and integration testing. |
| R7 | Data privacy and legal compliance issues (HIPAA/GDPR) | Low | High | Use anonymized open-source datasets only. Avoid storing personal identifiers. Follow data-handling policy provided by Ertunç Özcan. |
| R8 | Team coordination difficulties due to overlapping roles or workload imbalance. | Medium | Medium | Define clear responsibilities in PMP (Section 2). Use shared GitHub repository and weekly progress reports. |
| R9 | Hardware limitations for AI model training — limited GPU or computing resources. | Medium | Medium | Train models on smaller subsets, optimize model size, or use Google Colab for GPU resources. |

## 6. Quality Assurance

This section defines the review, audit, and evaluation processes applied throughout the NICU platform project, ensuring alignment with ISO 9001 Quality Management [3] and TOBB ETÜ 2025 Capstone Guidelines [5].

Quality assurance activities focus on both technical performance and societal compliance, addressing realistic conditions such as economic, environmental, ethical, and legal constraints.

### 6.1 Quality Review and Audit Process

* **Weekly Internal Reviews:** Each development phase (data, backend, AI, dashboard) will be reviewed weekly by the project manager to ensure tasks align with the defined requirements and performance metrics.
* **Bi-Weekly Code Audits:** Code quality and integration between backend, AI, and dashboard modules will be verified using version control history (GitHub commits) and peer review checklists.
* **Testing Validation:** Integration and performance tests will ensure reliability and accuracy of real-time monitoring. Test logs will be documented and reviewed at the end of each sprint.
* **External Evaluation:** Midterm and final audits will be conducted under the supervision of TOBB ETÜ advisors and the industrial partner (Ertunç Özcan R&D).  
   Feedback will be recorded and corrective actions applied before final delivery.

### 6.2 Quality Review and Audit Process

| **Category** | **Quality Metric** | **Verification Method** |
| --- | --- | --- |
| Functionality | Real-time data visualization without latency over 1 sec | Performance testing & code profiling |
| AI Accuracy | ≥ 85% accuracy in respiratory/cardiac anomaly detection on test data | Model validation metrics (Precision, Recall, F1-score) |
| Usability | Clinicians can navigate dashboard and interpret signals easily | Usability testing with mock users |
| Reliability | Continuous operation for ≥ 8 hours without system crash | Stress testing with synthetic data streams |
| Security | All data transfers encrypted (HTTPS/TLS) | API security audit |
| Compliance | HIPAA/GDPR adherence and ethical anonymization | Documentation review |
| Maintainability | Modular code structure and clear documentation | Code inspection checklist |

### 6.3 Quality Constraints and Realistic Conditions

| **Constraint Type** | **Evaluation and Impact** | **Compliance / Mitigation** |
| --- | --- | --- |
| Economic / Financial | No direct monetary budget; limited to free-tier and academic resources. | Use open-source software (Python, React, Figma, etc.) and institutional computing resources. |
| Environmental | Minimal environmental footprint due to software-based nature. | Use virtual servers and cloud tools to reduce hardware waste. |
| Socio-Cultural | System aims to improve neonatal care, aligning with humanitarian values. | Ensure user-friendly interface for clinicians; local language support can be added later. |
| Health and Safety | Platform handles health-critical data; reliability is essential. | Implement validation layers before clinical deployment; initial version for research use only. |
| Legal and Ethical | Use of patient data subject to data protection laws (HIPAA/GDPR). | Use only anonymized public datasets; obtain institutional ethics approval before real data use. |
| Technological | Limited computing power for AI model training. | Use lightweight AI architectures; pre-train models offline if needed. |
| Temporal (Time) | 12-week development cycle may limit large-scale testing. | Follow strict milestone schedule and modular integration. |
| Safety & Security | Data integrity and access control must be guaranteed. | Implement authentication and encrypted communication (JWT, HTTPS). |
| Sustainability | Long-term use requires maintainable code and scalability. | Modular design and open API architecture for future expansion. |

### 6.4 Continuous Improvement

### Quality assurance is an iterative process, not a one-time audit.

## After each major milestone, the team will conduct a “Post-Review Meeting” to identify lessons learned.

## All review notes will be stored in the GitHub “/docs/QA\_Log.md” file to ensure traceability and accountability.

## Feedback from clinicians and mentors will be incorporated into subsequent updates.

## 7. Appendix

Appendix A – Gantt Chart

The detailed project Gantt Chart is provided as a separate file: [manifetch\_gannt\_chart](https://docs.google.com/spreadsheets/d/13bCO5WRWidXOnbMIK49_eF526DlFillv3YdOwDCglH4/edit?gid=0#gid=0)

This file includes week-by-week progress for all main tasks and milestones:

Phase 1: Data Handling & Preparation (Week 1–2)

Phase 2: Backend Development (Week 3–4)

Phase 3: AI Model Development (Week 5–6)

Phase 4: Dashboard Development (Week 7–8)

Phase 5: System Testing & Optimization (Week 9–10)

Phase 6: Documentation & Presentation (Week 11–12)

## 8. References

*[1] PhysioNet, Preterm Infant Cardio-Respiratory Database (PICS-DB), 2020. [Online]. Available: https://physionet.org/content/picsdb/*

*[2] PhysioNet, MIMIC-IV Waveform Database, 2022. [Online]. Available: https://physionet.org/content/mimic4wdb/*

*[3] International Organization for Standardization, ISO 9001:2015 – Quality Management Systems – Requirements, Geneva, Switzerland, 2015.*

*[4] IEEE Standards Association, IEEE Std 1058-2017 – Standard for Project Management Plans, New York, NY, USA, 2017.*

*[5] TOBB University of Economics and Technology, Bitirme Projeleri Kılavuzu 2025 – Computer Engineering Department, Ankara, Türkiye, 2025. [Online]. Available: https://drive.google.com/drive/folders/1pN9ms4G14hZ-auGCevyi1-p2c9IBl5h2*

*[6] BioSPPy Developers, BioSPPy: Biosignal Processing in Python, 2023. [Online]. Available: https://biosppy.readthedocs.io*

*[7] M. Makowski, T. Pham, and D. Martinerie, NeuroKit2: A Python Toolbox for Neurophysiological Signal Processing, 2023. [Online]. Available: https://neurokit2.readthedocs.io*

*[8] F. Pedregosa et al., Scikit-learn: Machine Learning in Python, Journal of Machine Learning Research, vol. 12, pp. 2825–2830, 2011.*

*[9] Google Brain Team, TensorFlow: Large-Scale Machine Learning on Heterogeneous Systems, 2016. [Online]. Available: https://www.tensorflow.org*