



# School of Technology Management & Engineering NMIMS, Navi Mumbai Campus

## Log Book for Capstone Project AY 25-26

**Programme:** B. Tech / Artificial Intelligence and Data Science

**Title of the Project:** Passive CAPTCHA for Web Bot Detection

**Faculty Mentor:** Dr. Preeti Agarwal

Group ID	Roll No	SAP ID	Name	Contact No.	Signature	Grades (15M)
2	A092	70562200062	Tanay Koli	9820244949		
2	A095	70562200066	Aryan Khatu	9503634969		
2	A088	70562200058	Smit Patil	9833955560		

Week no.: 1 – 2

Date of Reporting: 31 / 08 / 2025

Period: 03 / 08 / 2025 to 17 / 08 / 2025

**Work carried out:** Initial project setup focused on establishing the foundational architecture for the multi-modal bot detection system. Created basic project structure with separate modules for web log analysis and mouse movement tracking. Implemented a simple React-based login page interface with event listeners to capture user interactions. Set up preliminary data collection pipelines and configured development environments. Progress was intentionally measured as we focused on proper architecture planning rather than rapid implementation.

**Faculty mentor remarks:**

**Faculty mentor signature with date:**

Week no.: 3 – 4

Date of Reporting: 26 / 09 / 2025

Period: 17 / 08 / 2025 to 31 / 08 / 2025

**Work carried out:** Significant advancement in core detection capabilities with the implementation of a CNN-based mouse movement analysis model trained on synthetic and real user data. Developed sophisticated web log analysis using ensemble methods combining Random Forest and XGBoost classifiers to identify suspicious request patterns. Created the fusion module architecture that intelligently combines detection scores based on confidence levels. Established RESTful API endpoints for real-time bot detection and integrated the backend Python services with the frontend React application. Implemented initial caching mechanisms to optimize performance.

**Faculty mentor remarks:**

**Faculty mentor signature with date:**

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Week no.: 5 – 6

Date of Reporting: 27 / 09 / 2025

Period: 31 / 08 / 2025 to 14 / 09 / 2025

**Work carried out:** Enhanced the system with additional security layers including honeypot traps for automated form-filling bots and behavioral biometrics analysis of keystroke timing and scroll patterns. Optimized model loading and inference to achieve sub-second detection times even on standard hardware. Integrated reCAPTCHA scores with our machine learning results using a weighted decision system. Developed comprehensive testing framework with simulated bot behaviors and legitimate user sessions. Improved the UI with real-time feedback mechanisms and non-intrusive security challenges that maintain excellent user experience for legitimate users.

**Faculty mentor remarks:**

**Faculty mentor signature with date:**

Week no.: 7 – 8

Date of Reporting: 03 / 10 / 2025

Period: 14 / 09 / 2025 to 28 / 09 / 2025

**Work carried out:** Finalized the adaptive fusion algorithm with dynamic confidence-based weighting that significantly improved detection accuracy to 97% in controlled tests. Conducted extensive A/B testing with various bot simulation scenarios and refined threshold parameters based on results. Implemented session persistence and cross-device tracking for enhanced security. Began drafting our research paper titled "Multi-Modal Bot Detection Using Behavioral Biometrics" for submission to the International Conference on Web Security. Developed and integrated the novel cursor entropy analysis technique that measures the randomness in human mouse movements, which proved to be a surprisingly effective discriminator between human and bot behavior even with sophisticated bot simulations.

**Faculty mentor remarks:**

**Faculty mentor signature with date:**

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