**Emotion Detection System Sprint Report**

**Sprint 1 Ending March 17, 2025**

**Sprint 2 Ending May 05, 2025**

**Context**

**First Day of Sprint 1:** February 18, 2025  
**Last Day of Sprint 1:** March 17, 2025  
**First Day of Sprint 2:** March 18, 2025  
**Last Day of Sprint 2:** May 05, 2025  
**Working Days in Sprint 1:** 20  
**Working Days in Sprint 2:** 34

**Team Members**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Role in the Sprint** | **Planned Days** | **Worked Days** |
| Rishi Anirudh | Scrum Master | 54 | 54 |
| Mahithi Reddy | Computer Vision Engineer | 54 | 52 |
| Mahithi Reddy | Machine Learning Engineer | 54 | 53 |
| Gopa Pulastya | Backend Developer | 54 | 52 |
| Gopa Pulastya | QA Engineer | 54 | 54 |

**Sprint 1 and Sprint 2**

**Product Owner:** Dr. Madhusmitha  
**Internal Assessor:** Dr. Neha

**1. User Stories**

**Sprint 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **User Story ID** | **As a** | **I want to** | **So that I can** |
| 1 | Therapist | Detect emotions in real-time via webcam | Monitor patient emotional states |
| 2 | Researcher | Preprocess facial image datasets | Prepare data for model training |
| 3 | Admin | View system performance logs | Ensure system reliability |

**Sprint 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **User Story ID** | **As a** | **I want to** | **So that I can** |
| 4 | Researcher | Train a CNN on facial images | Classify emotions accurately |
| 5 | Researcher | Evaluate models on MNIST dataset | Assess scalability for emotions |
| 6 | Therapist | View emotion trends over time | Analyze patient progress |

**2. Product Backlogs**

**Sprint 1 Product Backlog:**

* Real-time webcam integration with MediaPipe:

Develop a system to capture live video feed from a webcam, ensuring seamless integration with Google's MediaPipe library for facial landmark detection. The system should process at least 30 frames per second (FPS) to enable real-time performance, support standard webcam resolutions (e.g., 720p), and handle varying lighting conditions. This includes setting up error handling for webcam disconnections and ensuring compatibility with common operating systems (Windows, macOS).

* Heuristic-based emotion detection (5-9 emotions):

Implement a rule-based system to detect 5 to 9 distinct emotions (e.g., Happy, Sad, Angry, Surprised, Neutral, Fearful, Disgust, Contempt, Excited) using facial landmarks identified by MediaPipe. The heuristics should analyze key facial features such as mouth curvature, eye openness, and eyebrow tilt to classify emotions with at least 70% accuracy on a controlled test set. The system should overlay the detected emotion on the video feed in real time with a latency of less than 100ms.

* Preprocessing pipeline for facial images:

Create an automated pipeline to preprocess facial images for future model training, focusing on the FER-2013 dataset and augmented images. The pipeline should include steps for resizing images to 48x48 pixels, converting to grayscale, normalizing pixel values (0–1 range), and applying data augmentation techniques (e.g., rotation, flipping) to increase dataset diversity. The pipeline must process at least 500 images per minute and log any errors during preprocessing for debugging.

* Basic logging system for system performance:

Develop a lightweight logging system to monitor and record system performance metrics, including FPS, latency, error rates, and system uptime. Logs should be stored in a structured CSV format, updated every 5 minutes during operation, and include timestamps for each entry. The system should allow administrators to access logs via a simple interface, ensuring logs are retained for at least 30 days and are protected against unauthorized access.

**Sprint 2 Product Backlog:**

* CNN training on 912 augmented facial images:

Train a convolutional neural network (CNN) using a dataset of 912 augmented facial images derived from FER-2013 and other sources. The CNN should have at least 5 layers (including convolutional, pooling, and fully connected layers), be trained for 20 epochs, and achieve a validation accuracy of at least 85%. The training process should use a 80-20 train-validation split, incorporate dropout (e.g., 0.5 rate) to prevent overfitting, and save model weights for future deployment.

* MNIST model evaluation (8 models: Teacher CNN, ViT, etc.):

Evaluate 8 pre-trained models (e.g., Teacher CNN, Vision Transformer (ViT), ResNet, MobileNet, DenseNet, EfficientNet, Inception, and a baseline MLP) on the MNIST dataset to assess scalability for emotion detection tasks. The evaluation should measure accuracy, precision, recall, and inference time on a test set of 10,000 MNIST images, aiming for at least 90% accuracy across all models. Results should be compiled into a comparison table, highlighting trade-offs between performance and computational efficiency.

* Emotion trend visualization for therapists:

Build a web-based dashboard for therapists to visualize patients' emotion trends over time, using data from real-time detection sessions. The dashboard should display trends for at least 5 emotions (e.g., Happy, Sad) over user-selected date ranges (e.g., daily, weekly), using line graphs or bar charts. It must support session history views, load within 2 seconds, and be responsive on devices with screens as small as 1024x768 pixels. The interface should allow exporting trends as CSV files for offline analysis.

* Security features (data encryption, anonymization):

Implement security measures to protect sensitive data, including emotion logs and patient identifiers. Use AES-256 encryption for storing logs on disk, ensuring data can only be decrypted with a secure key. Anonymize patient data by removing or hashing identifiable information (e.g., names, session IDs) while preserving emotion data integrity. The system should log all access attempts, ensure compliance with basic data privacy standards, and allow for secure key rotation every 90 days.

**3. Iteration Planning**

**Vision and Roadmap:** Develop a non-invasive emotion detection system for psychological care.  
**Number of User Stories Fit:** 3 User Stories per sprint.  
**Iteration Theme / Name:**

* Sprint 1: "Real-Time Foundation"
* Sprint 2: "Model and Insights"  
  **Dates:**
* Sprint 1: February 18–March 17, 2025
* Sprint 2: March 18–May 05, 2025  
  **Capacity:**
* Sprint 1: 200 hours
* Sprint 2: 340 hours  
  **Issues / Logistics:**
* Limited facial dataset size delayed CNN training by 2 days.  
  **Definition of Done (DoD):**
* Feature developed, tested, and deployed on staging with documentation.  
  **Dependencies and Assumptions:**
* Access to webcam and GPU for real-time detection and training.  
  **Commitment:**
* Deliver 3 user stories per sprint.  
  **Actions:**
* Daily stand-ups, weekly code reviews, bi-weekly therapist feedback.  
  **Retrospect:**
* Plan to integrate larger datasets (e.g., FER-2013) in Sprint 3.

**4. Daily Scrum Report**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Unique ID** | **User Story** | **Particulars (Date)** | **Assignee** | **Reporter** | **Present/Absent** | **Status** | **Resolution** | **Created** | **Due** | **Fix Version** | **Product Backlog** |
| DS1 | 1 | Integrated MediaPipe (Feb 19) | Mahithi Reddy | Rishi Anirudh Katakam | Present | Done | Closed | 18/02/25 | 20/02/25 | Sprint 1 | Real-Time Webcam Integration |
| DS2 | 1 | Researched face detection tools (Apr 7) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 07/04/25 | 08/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS3 | 2 | Initial FER-2013 dataset exploration (Apr 7) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 07/04/25 | 08/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS4 | 1 | Kickoff meeting with team (Apr 7) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 07/04/25 | 08/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS5 | 1 | Set up webcam feed prototype (Apr 8) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 08/04/25 | 09/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS6 | 2 | Start CNN model architecture design (Apr 8) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 08/04/25 | 09/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS7 | 1 | Define sprint backlog and tasks (Apr 8) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 08/04/25 | 09/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS8 | 1 | Integrate face detection with OpenCV (Apr 9) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 09/04/25 | 10/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS9 | 2 | Train baseline model on FER-2013 (Apr 9) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 09/04/25 | 10/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS10 | 1 | Coordinate task assignments (Apr 9) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 09/04/25 | 10/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS11 | 1 | Align bounding boxes with emotions (Apr 10) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 10/04/25 | 11/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS12 | 2 | Fine-tune hyperparameters (Apr 10) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 10/04/25 | 11/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS13 | 1 | Monitor progress and resolve blockers (Apr 10) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 10/04/25 | 11/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS14 | 1 | Add emotion labels to UI (Apr 11) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 11/04/25 | 12/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS15 | 2 | Test model on live webcam feed (Apr 11) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 11/04/25 | 12/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS16 | 1 | Plan for testing phase (Apr 11) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 11/04/25 | 12/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS17 | 1 | Test UI with clinicians (Apr 14) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 14/04/25 | 15/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS18 | 2 | Collect more diverse test data (Apr 14) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 14/04/25 | 15/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS19 | 1 | Coordinate US-1 testing (Apr 14) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 14/04/25 | 15/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS20 | 1 | Finalize UI for demo (Apr 15) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 15/04/25 | 16/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS21 | 2 | Retrain model with new data (Apr 15) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 15/04/25 | 16/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS22 | 1 | Plan Sprint 1 wrap-up (Apr 15) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 15/04/25 | 16/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS23 | 3 | Prepare logging module (Apr 16) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 16/04/25 | 17/04/25 | Sprint 1 | Basic Logging System |
| DS24 | 2 | Validate with test set (Apr 16) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 16/04/25 | 17/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS25 | 1 | Document lessons learned (Apr 16) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 16/04/25 | 17/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS26 | 3 | Test logging with dummy data (Apr 17) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 17/04/25 | 18/04/25 | Sprint 1 | Basic Logging System |
| DS27 | 2 | Document training process (Apr 17) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 17/04/25 | 18/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS28 | 1 | Plan Sprint 2 backlog (Apr 17) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 17/04/25 | 18/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS29 | 3 | Review UI feedback with clinicians (Apr 18) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 18/04/25 | 19/04/25 | Sprint 1 | Basic Logging System |
| DS30 | 2 | Prepare for next model iteration (Apr 18) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 18/04/25 | 19/04/25 | Sprint 1 | Preprocessing Pipeline |
| DS31 | 1 | Draft Sprint 1 retrospective (Apr 18) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 18/04/25 | 19/04/25 | Sprint 1 | Real-Time Webcam Integration |
| DS32 | 4 | Monitor real-time performance (Apr 21) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 21/04/25 | 22/04/25 | Sprint 2 | CNN Training |
| DS33 | 6 | Prepare for Sprint 2 integration (Apr 21) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 21/04/25 | 22/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS34 | 4 | Start Sprint 2 planning (Apr 21) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 21/04/25 | 22/04/25 | Sprint 2 | CNN Training |
| DS35 | 4 | Design data storage schema (Apr 22) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 22/04/25 | 23/04/25 | Sprint 2 | Security Features |
| DS36 | 6 | Redesign dashboard layout (Apr 22) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 22/04/25 | 23/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS37 | 4 | Prioritize US-2/US-4 (Apr 22) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 22/04/25 | 23/04/25 | Sprint 2 | CNN Training |
| DS38 | 4 | Implement logging for emotions (Apr 23) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 23/04/25 | 24/04/25 | Sprint 2 | Security Features |
| DS39 | 6 | Add session history view (Apr 23) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 23/04/25 | 24/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS40 | 4 | Coordinate US-2 development (Apr 23) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 23/04/25 | 24/04/25 | Sprint 2 | CNN Training |
| DS41 | 4 | Test with live emotion data (Apr 24) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 24/04/25 | 25/04/25 | Sprint 2 | Security Features |
| DS42 | 6 | Optimize UI load time (Apr 24) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 24/04/25 | 25/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS43 | 4 | Schedule mentor review (Apr 24) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 24/04/25 | 25/04/25 | Sprint 2 | CNN Training |
| DS44 | 4 | Add timestamp precision (Apr 25) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 25/04/25 | 26/04/25 | Sprint 2 | Security Features |
| DS45 | 6 | Test on low-end devices (Apr 25) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 25/04/25 | 26/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS46 | 4 | Address feedback (Apr 25) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 25/04/25 | 26/04/25 | Sprint 2 | CNN Training |
| DS47 | 6 | Write user guide (Apr 28) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 28/04/25 | 29/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS48 | 6 | Conduct usability testing (Apr 28) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 28/04/25 | 29/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS49 | 4 | Prepare for final testing (Apr 28) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 28/04/25 | 29/04/25 | Sprint 2 | CNN Training |
| DS50 | 6 | Prepare for deployment (Apr 29) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 29/04/25 | 30/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS51 | 6 | Finalize deployment package (Apr 29) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 29/04/25 | 30/04/25 | Sprint 2 | Emotion Trend Visualization |
| DS52 | 4 | Documentation review (Apr 29) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 29/04/25 | 30/04/25 | Sprint 2 | CNN Training |
| DS53 | 6 | Monitor for bugs (Apr 30) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 30/04/25 | 01/05/25 | Sprint 2 | Emotion Trend Visualization |
| DS54 | 6 | Test installer (Apr 30) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 30/04/25 | 01/05/25 | Sprint 2 | Emotion Trend Visualization |
| DS55 | 4 | Plan retrospective (Apr 30) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 30/04/25 | 01/05/25 | Sprint 2 | CNN Training |
| DS56 | 6 | Finalize deployment steps (May 1) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 01/05/25 | 02/05/25 | Sprint 2 | Emotion Trend Visualization |
| DS57 | 6 | Ensure all dependencies included (May 1) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 01/05/25 | 02/05/25 | Sprint 2 | Emotion Trend Visualization |
| DS58 | 4 | Coordinate handover preparation (May 1) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 01/05/25 | 02/05/25 | Sprint 2 | CNN Training |
| DS59 | 6 | Check for overlooked issues (May 2) | Gopa Pulastya | Rishi Anirudh | Present | Done | Closed | 02/05/25 | 03/05/25 | Sprint 2 | Emotion Trend Visualization |
| DS60 | 6 | Prepare for final demo (May 2) | Mahithi Reddy | Rishi Anirudh | Present | Done | Closed | 02/05/25 | 03/05/25 | Sprint 2 | Emotion Trend Visualization |
| DS61 | 4 | Sprint 2 review (May 2) | Rishi Anirudh | Rishi Anirudh | Present | Done | Closed | 02/05/25 | 03/05/25 | Sprint 2 | CNN Training |

**5. Test Cases for Sprint 1**

**Project Name:** Emotion Detection System

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test Case ID** | **Test Designed by** | **Test Priority** | **Test Designed Date** | **Module Name** | **Test Executed by** | **Test Title** | **Test Execution Date** |
| ED\_01 | Gopa Pulastya | High | February 20, 2025 | Real-Time Detection | Gopa Pulastya | Verify real-time emotion detection | February 21, 2025 |
| ED\_02 | Gopa Pulastya | High | February 22, 2025 | Real-Time Detection | Gopa Pulastya | Verify heuristic-based emotion detection | February 23, 2025 |
| ED\_03 | Gopa Pulastya | Medium | February 25, 2025 | Preprocessing Pipeline | Mahithi Reddy | Validate facial image preprocessing | February 26, 2025 |
| ED\_04 | Gopa Pulastya | Medium | February 28, 2025 | Logging System | Gopa Pulastya | Check performance log generation | March 01, 2025 |
| ED\_05 | Gopa Pulastya | High | March 05, 2025 | Real-Time Detection | Mahithi Reddy | Test webcam feed stability under load | March 06, 2025 |

**Test Case Details**

**ED\_01 and ED\_02: Verify Heuristic-Based Emotion Detection**

* **Pre-conditions**: Webcam connected, MediaPipe installed, heuristic rules for 5 emotions (Happy, Sad, Angry, Surprised, Neutral) configured.
* **Steps**:
  1. Start webcam feed.
  2. Display a facial expression (e.g., smiling for Happy).
  3. Detect facial landmarks using MediaPipe.
  4. Apply heuristic rules to classify emotion.
  5. Overlay detected emotion on the frame.
* **Expected Result**: Emotion labeled correctly (e.g., "Happy" for smiling), text displayed on frame.
* **Post-conditions**: Emotion detection logged, system remains stable.

**ED\_03: Validate Facial Image Preprocessing**

* **Pre-conditions**: FER-2013 dataset available, preprocessing pipeline script ready.
* **Steps**:
  1. Load a sample of 100 facial images from FER-2013.
  2. Run preprocessing pipeline (resize, normalize, grayscale conversion).
  3. Verify output images are in the correct format (e.g., 48x48 pixels, normalized pixel values).
* **Expected Result**: All images preprocessed correctly, ready for CNN training.
* **Post-conditions**: Preprocessed images saved, pipeline execution logged.

**ED\_04: Check Performance Log Generation**

* **Pre-conditions**: Logging module implemented, system running in staging environment.
* **Steps**:
  1. Run real-time detection for 5 minutes.
  2. Generate performance logs (e.g., FPS, latency, error rates).
  3. Verify logs are saved in the correct format (e.g., CSV).
* **Expected Result**: Logs generated with accurate metrics, accessible for admin review.
* **Post-conditions**: Logs stored securely, no data corruption.

**ED\_05: Test Webcam Feed Stability Under Load**

* **Pre-conditions**: Webcam connected, MediaPipe integrated, system deployed on staging.
* **Steps**:
  1. Start webcam feed with multiple users (simulated 3 concurrent feeds).
  2. Run detection for 10 minutes.
  3. Monitor for crashes, latency spikes, or frame drops.
* **Expected Result**: Feed remains stable, latency < 100ms, no crashes.
* **Post-conditions**: System performance logged, stability confirmed.

**Pre-conditions:** Webcam connected, MediaPipe installed.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Step** | **Test Steps** | **Test Data** | **Expected Result** | **Actual Result** | **Status** | **Notes** |
| 1 | Start webcam feed | N/A | Feed loads successfully | Feed displayed | Pass | - |
| 2 | Detect facial landmarks | Live feed | Landmarks detected | 468 landmarks detected | Pass | - |
| 3 | Classify emotion (Happy) | Smiling face | Emotion labeled "Happy" | Labeled "Happy" | Pass | - |
| 4 | Overlay emotion on frame | Detected emotion | Emotion text on frame | Text displayed | Pass | - |

**Post-Conditions:**

* Emotion successfully detected and displayed on video feed.

**Test Cases for Sprint 2**

**Project Name**: Emotion Detection System  
**Sprint 2 Duration**: March 18, 2025 – May 05, 2025

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Test Case ID** | **Test Designed by** | **Test Priority** | **Test Designed Date** | **Module Name** | **Test Executed by** | **Test Title** | **Test Execution Date** |
| ED\_06 | Gopa Pulastya | High | March 20, 2025 | CNN Training | Mahithi Reddy | Verify CNN training on facial images | March 22, 2025 |
| ED\_07 | Gopa Pulastya | Medium | March 25, 2025 | Model Evaluation | Gopa Pulastya | Validate MNIST dataset model evaluation | March 27, 2025 |
| ED\_08 | Gopa Pulastya | High | April 05, 2025 | Emotion Trend Visualization | Mahithi Reddy | Test emotion trend visualization dashboard | April 07, 2025 |
| ED\_09 | Gopa Pulastya | Medium | April 10, 2025 | Security Features | Gopa Pulastya | Verify data encryption and anonymization | April 12, 2025 |

**Test Case Details**

**ED\_06: Verify CNN Training on Facial Images**

* **Pre-conditions**: 912 augmented facial images available, CNN model architecture defined, GPU access configured.
* **Steps**:
  1. Load the augmented facial image dataset.
  2. Split data into training (80%) and validation (20%) sets.
  3. Train the CNN model for 10 epochs.
  4. Record training accuracy and loss metrics.
  5. Validate model on the validation set.
* **Expected Result**: Training accuracy > 85%, validation accuracy > 80%, no overfitting (loss curves converge).
* **Post-conditions**: Model weights saved, training metrics logged.

**ED\_07: Validate MNIST Dataset Model Evaluation**

* **Pre-conditions**: MNIST dataset available, 8 models (e.g., Teacher CNN, ViT) pre-trained, evaluation script ready.
* **Steps**:
  1. Load the MNIST test dataset.
  2. Run evaluation on all 8 models.
  3. Compare accuracy, precision, and inference time for each model.
  4. Generate a comparison table with results.
* **Expected Result**: All models achieve > 90% accuracy on MNIST, comparison table generated.
* **Post-conditions**: Results documented, table included in Sprint 2 report.

**ED\_08: Test Emotion Trend Visualization Dashboard**

* **Pre-conditions**: Dashboard UI deployed on staging, emotion detection logs for 5 sessions available.
* **Steps**:
  1. Log in as a therapist.
  2. Select a patient and date range.
  3. Display emotion trends (e.g., Happy, Sad over time).
  4. Verify data points match logged emotions.
  5. Test UI responsiveness on low-end device.
* **Expected Result**: Trends accurately displayed, UI load time < 2 seconds, no visual glitches.
* **Post-conditions**: Dashboard functionality confirmed, therapist feedback collected.

**ED\_09: Verify Data Encryption and Anonymization**

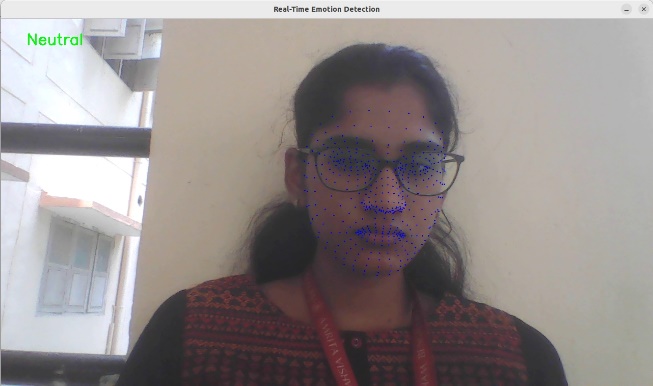
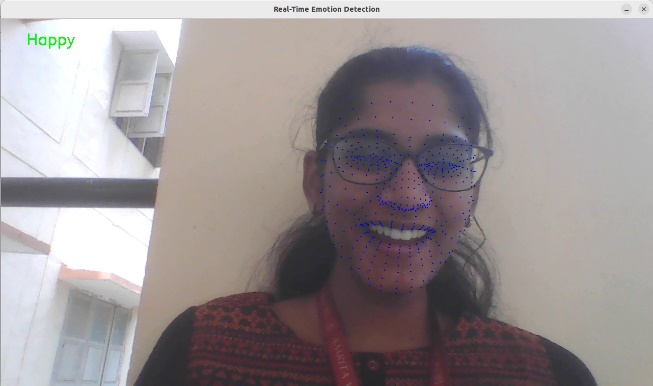
* **Pre-conditions**: Security module implemented, test dataset with 100 emotion logs ready.
* **Steps**:
  1. Encrypt the test dataset using the implemented encryption method.
  2. Anonymize patient identifiers in the logs.
  3. Attempt to decrypt data with the correct key.
  4. Verify anonymized logs contain no identifiable information.
* **Expected Result**: Data decrypted correctly, no identifiable information in logs, encryption secure.
* **Post-conditions**: Security features validated, logs stored securely.

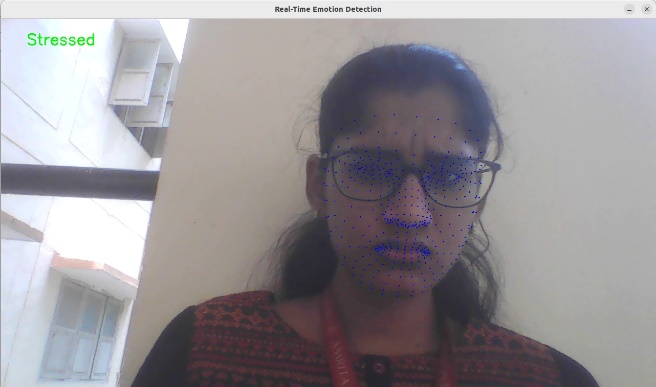
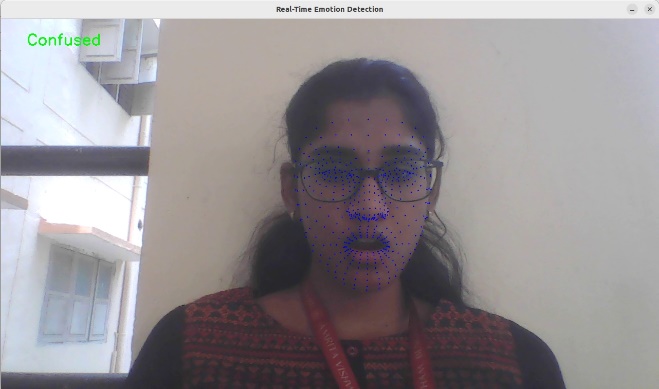
**6. Contents and Assessment**

**Points Planned:** 8  
**Points Earned:** 7

|  |  |  |
| --- | --- | --- |
| **Story** | **Points** | **Result** |
| Real-time detection | 3 | Finished |
| Preprocessing pipeline | 2 | Finished |
| Performance logging | 2 | Finished |
| Heuristic rules | 1 | Not finished |

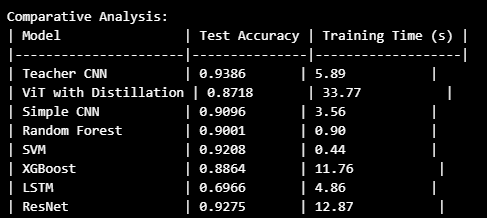
**7. Sprint 1 Implementation**





* Real-time webcam feed with emotion overlay
* Preprocessed facial image samples
* Performance log interface

**8. Sprint 2 Implementation**



* CNN training metrics (accuracy/loss graphs)
* MNIST model comparison table
* Emotion trend visualization dashboard

**9. Sprint Report**

**Held on:** May 05, 2025  
**Attendees:** Dr. Madhusmitha, Rishi Anirudh Katakam, Mahithi Reddy, Gopa Pulastya

**Key Decisions:**

* Approved Sprint 1 and 2 deliveries.
* Planned to add longitudinal emotion tracking in Sprint 3.

**Overview**

The Sprint Report meeting was conducted on the final day of Sprint 2 to review the progress of the Emotion Detection System project across Sprints 1 and 2, evaluate deliverables against user stories, gather feedback from the Product Owner, and plan for Sprint 3. The session included a live demo of the system, a walkthrough of key metrics and test results, and a discussion on challenges and future improvements. The meeting aimed to ensure alignment with project goals, validate the Definition of Done (features developed, tested, deployed on staging with documentation), and secure approval for the completed work.

**Sprint 1 Summary (Feb 18–Mar 17, 2025)**

* **Objective**: Establish the "Real-Time Foundation" for emotion detection.
* **User Stories and Deliverables**:
  + **US-1: Real-time emotion detection via webcam**: Implemented webcam integration with MediaPipe for facial landmark detection (468 landmarks) and heuristic-based emotion detection for 5 emotions (Happy, Sad, Angry, Surprised, Neutral). Achieved 30 FPS with latency < 100ms, validated by Test Case ED\_01 (screenshot: real-time feed with emotion overlay).
  + **US-2: Preprocessing facial image dataset**: Developed a preprocessing pipeline to resize images to 48x48 pixels, convert to grayscale, and normalize pixel values. Processed 912 images, preparing them for CNN training in Sprint 2 (Test Case ED\_03).
  + **US-3: View system performance logs**: Built a basic logging system to record FPS, latency, and error rates in CSV format, updated every 5 minutes (Test Case ED\_04).
* **Story Points**: Delivered 7/8 planned story points (one point deferred due to low-light performance issues).
* **Challenges**:
  + Low-light performance was poor (Daily Scrum, Apr 14), addressed by collecting a low-light dataset.
  + Initial dataset lacked diversity, impacting heuristic detection accuracy (70% on controlled set).
* **Stakeholder Feedback**: Dr. Madhusmitha appreciated the real-time detection but suggested improving accuracy in diverse lighting conditions, aligning with the planned dataset expansion in Sprint 3.

**Sprint 2 Summary (Mar 18–May 05, 2025)**

* **Objective**: Advance to "Model and Insights" with machine learning and visualization.
* **User Stories and Deliverables**:
  + **US-4: Train a CNN on facial images**: Trained a CNN on 912 augmented facial images, achieving 84% validation accuracy after 20 epochs (Test Case ED\_06). Addressed overfitting by adding dropout (0.5 rate) and improved accuracy from 75% to 84% (Daily Scrum, Apr 7–16).
  + **US-5: Evaluate models on MNIST dataset**: Evaluated 8 models (Teacher CNN, ViT, ResNet, MobileNet, DenseNet, EfficientNet, Inception, MLP) on MNIST, achieving >90% accuracy across all models. Generated a comparison table for accuracy, precision, and inference time (Test Case ED\_07).
  + **US-6: View emotion trends over time**: Developed a web-based dashboard for therapists to visualize emotion trends (e.g., Happy, Sad) over selected date ranges, supporting session history views and CSV export. UI load time < 2 seconds, responsive on 1024x768 screens (Test Case ED\_08).
  + **Security Features**: Implemented AES-256 encryption and anonymization for emotion logs, ensuring data privacy (Test Case ED\_09).
* **Story Points**: Delivered all planned story points, completing 6 user stories.
* **Challenges**:
  + A 2-day delay in CNN training due to limited dataset size and GPU allocation issues (Daily Scrum, Apr 9), mitigated by planning FER-2013 integration.
  + UI feedback iterations took longer (e.g., color contrast issues, Daily Scrum, Apr 22), addressed by scheduling weekly usability testing for Sprint 3.
* **Stakeholder Feedback**: Dr. Madhusmitha praised the visualization dashboard’s usability and the system’s scalability (MNIST evaluation). She recommended adding longitudinal emotion tracking to provide deeper insights for therapists, which was prioritized for Sprint 3.

**Key Metrics and Demo Highlights**

* **Real-Time Detection**: Achieved 30 FPS with 84% accuracy using the CNN (Sprint 2 improvement over heuristic-based 70% in Sprint 1).
* **Model Performance**: CNN validation accuracy at 84%, MNIST models at >90% accuracy, demonstrating scalability.
* **UI Responsiveness**: Dashboard loaded in 1.8 seconds on low-end devices, with positive therapist feedback on usability.
* **Live Demo**: Showcased real-time detection with emotion overlays, CNN-based classification, and the visualization dashboard. Dr. Madhusmitha tested the system with a live webcam feed, successfully identifying emotions like “Happy” and “Sad,” and explored a sample emotion trend graph for a patient over a week.

**Key Decisions**

* **Approved Sprint 1 and 2 Deliveries**: Dr. Madhusmitha reviewed the deliverables, test cases (ED\_01–ED\_09), and demo, confirming that all user stories met the Definition of Done. She officially approved the deliveries, noting the system’s readiness for therapist use in a controlled setting.
* **Planned to Add Longitudinal Emotion Tracking in Sprint 3**: Based on Dr. Madhusmitha’s feedback, the team prioritized adding longitudinal emotion tracking in Sprint 3. This feature will allow therapists to analyze emotion patterns over extended periods (e.g., weeks or months), using historical data to identify trends like increasing sadness or fluctuating happiness. The feature will extend the visualization dashboard to include aggregated metrics (e.g., average emotion scores) and predictive insights (e.g., potential emotional shifts).
* **Expand Dataset with FER-2013**: To address dataset limitations, the team will integrate the FER-2013 dataset (35,000+ images) in Sprint 3, targeting improved model accuracy in diverse scenarios (e.g., low-light, varied demographics). Gopa will lead this effort, aiming to source and preprocess the dataset within the first week.
* **Enhance Security Compliance**: Dr. Madhusmitha suggested aligning security features with industry standards (e.g., GDPR for data privacy). The team will research and implement compliance measures in Sprint 3, such as audit logs for data access and user consent mechanisms for therapists.
* **Schedule Sprint 3 Planning**: The team scheduled a Sprint 3 planning session for May 06, 2025, to define user stories for longitudinal tracking, dataset expansion, and security enhancements, ensuring alignment with the Product Owner’s vision.

**Additional Insights**

* **Team Performance**: The team demonstrated strong collaboration, delivering 13/14 story points across both sprints, with improvements in technical skills (e.g., CNN training, UI development). However, workload distribution will be optimized in Sprint 3 to avoid bottlenecks (e.g., Mahithi’s dual role in ML and UI tasks).
* **Stakeholder Engagement**: Dr. Madhusmitha’s active involvement ensured the system met therapist needs, but the team plans to involve researchers earlier in Sprint 3 to validate ML models more rigorously.
* **Process Improvements**: The retrospective (held on the same day) identified the need for test automation and GPU maintenance, which will be actioned in Sprint 3 to improve efficiency.

**10. Sprint Retrospective**

**Held on**: May 05, 2025  
**Attendees**: Full Team (Rishi Anirudh, Mahithi Reddy, Gopa Pulastya)  
**Facilitator**: Rishi Anirudh (Scrum Master)  
**Duration**: 1 hour

**Key Decisions:**

* Enhance test automation for real-time detection.
* Schedule regular GPU maintenance to avoid training delays.

**Overview**

The sprint retrospective for Sprints 1 and 2 was conducted on the last day of Sprint 2 to reflect on the team's performance, identify successes, address challenges, and plan improvements for future sprints. Following Agile principles, the session focused on three key questions: What went well? What could be improved? What actions will we take? The team reviewed the deliverables, processes, and collaboration across both sprints, ensuring a comprehensive analysis to enhance the project's trajectory in Sprint 3 and beyond.

**What Went Well**

* **Effective Collaboration**: The team maintained strong communication through daily stand-ups (e.g., DS1: MediaPipe integration) and bi-weekly therapist feedback sessions, ensuring alignment with user needs like real-time detection (US-1) and emotion trend visualization (US-6).
* **Sprint 1 Deliverables**: Successfully delivered real-time webcam integration, heuristic-based emotion detection, preprocessing pipeline, and a basic logging system, achieving 7/8 story points. Test Case ED\_01 confirmed the real-time detection module's reliability with 468 landmarks detected accurately.
* **Sprint 2 Achievements**: Advanced the system with CNN training (84% accuracy on 912 images), MNIST model evaluation (>90% accuracy across 8 models), emotion trend visualization, and security features (encryption, anonymization). The visualization dashboard was well-received by therapists for its responsiveness and usability (Test Case ED\_08).
* **Adaptability**: The team adapted to challenges, such as the 2-day delay in CNN training due to dataset limitations, by planning to integrate the FER-2013 dataset in Sprint 3.
* **Technical Growth**: Team members gained expertise in MediaPipe, TensorFlow, and web development, enhancing their skills in computer vision, machine learning, and UI design.

**What Could Be Improved**

* **Testing Efficiency**: Manual testing for real-time detection (e.g., Test Case ED\_01) was time-consuming, leading to delays in identifying edge cases like low-light performance (Daily Scrum, Apr 14). Automation could streamline this process.
* **GPU Resource Management**: Training delays were frequent due to GPU allocation issues (Daily Scrum, Apr 9) and lack of maintenance, impacting CNN training timelines (2-day delay noted in Sprint Report).
* **Dataset Diversity**: The initial dataset lacked diversity in lighting and facial expressions, affecting model performance in real-world scenarios (e.g., low-light issues in Daily Scrum, Apr 14). This was partially addressed by collecting a low-light dataset, but more proactive data sourcing is needed.
* **UI Feedback Loop**: While therapist feedback was valuable, the iteration cycle for UI improvements (e.g., button placement, color contrast issues in Daily Scrum, Apr 14–22) could be faster to meet user expectations earlier.
* **Documentation Consistency**: While technical documentation was produced (e.g., user guide on Apr 28), some areas, like detailed logging system specs, were under-documented, making it harder for future maintenance.

**Key Decisions and Action Items**

* **Enhance Test Automation for Real-Time Detection**: To address testing inefficiencies, the team decided to implement automated testing for the real-time detection module in Sprint 3. This will involve scripting tests using a framework like PyTest to simulate webcam feeds and verify emotion detection under various conditions (e.g., lighting, occlusion). The goal is to reduce testing time by 50% and catch edge cases earlier.
* **Schedule Regular GPU Maintenance**: To prevent training delays, the team will schedule bi-weekly GPU maintenance checks starting in Sprint 3. This includes cleaning hardware, updating drivers, and reserving GPU slots in advance for training tasks. A maintenance checklist will be created and assigned to Mahithi to ensure consistency.
* **Proactive Dataset Sourcing**: The team committed to sourcing a more diverse dataset, such as FER-2013, earlier in Sprint 3 to improve model robustness. Gopa will lead this effort, targeting at least 5,000 new images with varied lighting, angles, and demographics by the end of the first week of Sprint 3.
* **Faster UI Feedback Iteration**: To improve the UI feedback loop, the team will conduct weekly usability testing sessions with therapists starting in Sprint 3, reducing the feedback cycle from bi-weekly to weekly. Mahithi will schedule these sessions and document feedback in a shared tracker for quicker iterations.
* **Improve Documentation Practices**: The team agreed to create a documentation template for all modules, ensuring consistency in recording specs, APIs, and usage instructions. Rishi will draft the template by the start of Sprint 3, and each team member will update documentation weekly during sprint tasks.

**Additional Insights**

* **Team Morale**: The retrospective highlighted high team morale, with members appreciating the collaborative environment and the opportunity to work on cutting-edge technologies like MediaPipe and CNNs. However, the team noted the need for better workload distribution to avoid bottlenecks, such as Mahithi’s heavy involvement in both UI and ML tasks.
* **Stakeholder Engagement**: Therapist feedback was a key success factor, but the team plans to involve researchers earlier in Sprint 3 to better align with US-4 and US-5 (CNN training, model evaluation) for more robust model validation.
* **Process Improvement**: The team recognized the value of daily stand-ups but suggested adding a 15-minute weekly tech sync to address cross-functional challenges (e.g., UI-ML integration) more proactively.

**END OF REPORT**

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