Software Requirements Specification

# Introduction

## Purpose

This project is something that aims to aid the Bradford City of Culture (BD25) Academic Evaluation Team to evaluate and manage their levels of crowd engagement. This effort is important for the local community, tourists, and participants in the events. This is to keep track of what was and what currently is available, as well as the engagement of all the people within the events.

## Intended Audience

The BD25 java system is intended for multiple users including the administration team, stakeholders, and users of the BD25 community. The administration team will be on the admin side of the GUI as they are the people that are intending to measure the engagement of each BD25 activity/event. The stakeholders will be invested in the project as they will provide insights into how they want the system to be created. Finally, the users of the BD25 community will be involved as they will be the ones using the client GUI to view each event taking place within BD25 and then with links to the official city of culture website they can then buy tickets or book places where needed.

## Product Scope

The senior management executive for the Bradford City of Culture agreed that they should invest in a computer-based system to evaluate crowd engagement in such present and future activities with a clear respect for legal, social, ethical and professional issues (LSEPI). The proposed system aims to support the process of responsible enrolment and participation, and the possible delivery of machine learning models of crowd engagement for BD25 activities.

## References

Bradford Culture Company Limited (2024) What’s on. https://bradford2025.co.uk/whats-on/ Accessed 20 March 2025.

# Overall Description

The BD25 System is a comprehensive standalone application that will integrate existing data management infrastructure, utilised to provide a computer-based solution that manages all activities with proper documentation. The system manages, tracks and analyses data effectively to organise activities, record participant engagement, and process collected information for academic analysis. It is crucial to data collection, research and coordinator teams to track crowd engagement. The system provides an interface, handles the data, and provides a business logic layer also, for user management, and can exchange data with external information records if necessary.

**2.2 Product Functions**

Activity Management: BD2025 allocated appropriate responsibilities by Senior Staff Members (SSM) and Activity Coordinators (AC) to plan, create, modify, and cancel audience engagement activities. Goal, location, time, and resources needed for each action are all outlined in the documentation.

Team Coordination: Activity Coordinators allocate Data & Information Group (DIG) members to tasks, delegate tasks, and plan information gathering techniques for every meeting.

**Data Capture and Recording** - DIG members can document several forms of data during actions, including Audio Recordings of Participant Engagements, Image and Video documentation of crowd behavioural aspects as well as Structured Observation notes and calculations through participant feedback through structured research.

**Equipment Management** - The system tracks assignment and usage of recording equipment (cameras, microphones, mobile devices) for each activity, ensuring proper resource allocation.

**Data Storage & Organization** - Collected information is stored with appropriate data:

* Source activity and collection date
* DIG member responsible for collection
* Data type classification
* Verification of trusted provenance
* Privacy and consent compliance markers

**Compliance Verification** - Built-in checks ensure all activities and data collection efforts adhere to university standards for legal, social, ethical, and professional conduct. (LSEPI)

**Appropriate Roles**

Senior Staff Members (SSM)  
SSMs require full administrative access to approve activities, assign coordinators, and ensure compliance with research standards.

Activity Coordinators (AC) - Operational managers handling specific research activities. such as assign DIG teams and monitor data collection.

DIG Members - Field staff specializing in data capture.

System Administrators - IT professionals maintaining platform infrastructure.

Occasional Users

The BD25 System has been developed to run on a hybrid environment of the university servers and cloud environment, which would be Microsoft’s OneDrive. Software required would be Linux/Windows for back-end server purposes, Java assisted in creating the code and MySQL managed, organize and hosted the database.

The User Interface is compatible with all modern web browsers and can be incorporated on mobile too. Allowing quality integration for crowd analysis and databases (e.g., MySQL) to organize activity details and user roles. Devices: Works with drones (e.g., DJI models), cameras, microphones, and mobile devices for data collection to record relevant data in appropriate formatting and research integrity. Web scraping tools will pull external data from approved websites. Data transfers will use encryption (SSL), and users will log in securely. Regular backups will protect against data loss.

The BD25 Information System will operate within several key constraints. The system must run on existing university servers without needing any hardware upgrades. Development is fixed to Java and MySQL, to ensure seamless collaboration across team-members and encouraging technology stack to ensure long-term support. Role-based access controls and data encryption are required for all sensitive information to maintain and protect participant sensitive data and privacy.

# External Interface Requirements

## User Interfaces

The BD25 system features a user-friendly interface design across all visible components. A responsive web interface will function seamlessly on both desktop and mobile devices. Each user’s role will receive a personalised dashboard displaying only relevant information and functions. Mobile forms support offline data collection in field settings with limited connectivity. Navigation elements and error handling will remain consistent throughout all system modules. All interfaces comply with relevant requirements to ensure that the user interface is compatible with all users.

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| **Interface Element** | **Description** |
| Navigation bar | Similar and consistent design across all pages this includes navigation to the dashboard, activities, data management, and admin interfaces |
| Dashboards | Every dashboard tailored to role, for example activity coordinators see the event scheduling tools and relevant material and the DIGL’s can view the data overview. |
| Activity Management Panel | Will allow activity coordinators to edit, create and cancel activities and view through a tailored dashboard. |
| Data Labelling Interface | For DIGM’s to view captured data including audio, image and video. select, preview and save any edits. |
| Help and Support | A help button on all screen to open contextual help or a guided tour for the appliable page. |

**3.2:**

The BD25 information system interface will connect with a variety of hardware devices for the live data collection. The system is designed to interface with digital cameras, audio recording, motion sensors, drones, and mobile devices through communication protocols like USB and Wi- Fi. All system components are fully compatible with university-issued Windows and macOS desktop/laptop computers, as well as iOS and Android-based tablets and smartphones used by data collection teams in the field.

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| Devices | Interface Type | Data Interaction | Protocol |
| CCTV Cameras | USB | Video and object tracking | ONVIF/RTSP |
| Microphones | USB | Audio recording and analysis of event mood | Audio capture |
| Drones | Wi-Fi/Bluetooth | Aerial video and image capture | REST API |
| Motion Sensors | USB | Counts the entries and exits | JSON |

## Software Interfaces

Multiple software interfaces enable system integration within the university environment. Direct connection to the university authentication directory provides secure sign in. Database interfaces support both structured data and media storage requirements. Integration with established machine learning frameworks facilitates powerful data analysis capabilities. All components use standard formats including JSON and XML for reliable data exchange between system modules.

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| Component | Type | Purpose | Integration Methods |
| Database MySQL | Database | Stores the activity data, relevant user roles, session information. | API’s or connectors ( e.g JDBC) |
| File Storage System | Object/File Storage | Stores video, image and audio recordings from the activities | Java I/O |
| Media devices e.g cameras, drones and microphones | Input devices | Data capture from the live events | Java device API’s or manual import |
| External Data Sources ( for event listings) | Web API’s | Supplements internal data with context (e.g updates on the live events) | Http Client |

## Communications Interfaces

Secure communication is essential to support in time data exchange, coordination, and stakeholder engagement central to the BD25 City of Culture programme. The system facilitates smooth, encrypted interaction between activity coordinators, DIG leaders, and DIG members involved in capturing and processing information during BD25 events.

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| Component | Description |
| Communication Protocol | All system interactions including dashboard used by AC’s, SM’s and DIG members can be secured by HTTPS. |
| Encryption Standards | Communication between the components like data uploads from devices such as drones, cameras and microphones should be encrypted through TLS. |
| Email Notification | Automatic email updates notify relevant personnel, examples could include changes to activities and crowd engagement reports. |
| Field Data Sync | The system should support data collection, allowing DIG members to capture images, audio, and video in areas with low connectivity and sync data later. |
| Uploads | Designed to accommodate multiple BD25 events running in parallel, the system supports simultaneous data uploads from several mobile teams. |
| Security Measures | All data is logged and protected , with strict access control on user roles e.g AC, DIGL, DIGM and etc, and should be in line with all LSEPI issues and considerations. |

# System Features

**Activity Management**

Description and Priority:

This feature enables users to manage activities within the system, including creation, deletion, and listing.

Priority: High Benefit: 9 | Penalty: 8 | Cost: 4 | Risk: 3

Stimulus/Response Sequences:

1. User selects “Create Activity” → System prompts for activity details → User enters details → System confirms activity creation.

2. User selects “Delete Activity” → System displays list of activities → User selects one → System deletes the selected activity.

**DIG Member Management**

Description and Priority:

Enables the addition, listing, and removal of DIG (Data & Information Group) members assigned to activities. Priority: High Benefit: 8 | Penalty: 7 | Cost: 3 | Risk: 2

Stimulus/Response Sequences:

1. User selects an activity → System shows DIG members → User adds or removes a member → System updates the member list.

**Data Capture Operations**

Description and Priority:

Manages the process of capturing data for selected activities. Priority: Medium Benefit: 7 | Penalty: 6 | Cost: 5 | Risk: 4

Stimulus/Response Sequences:

1. User starts data capture → System initiates and records data → User stops capture → System stores records.

**LSEPI Compliance Checking**

Description and Priority:

Ensures activities comply with legal, social, ethical, and professional issues. Priority: High Benefit: 9 | Penalty: 9 | Cost: 2 | Risk: 6

Stimulus/Response Sequences:

1. System automatically checks compliance on activity creation → Notifies user if non-compliant.

# Other Nonfunctional Requirements

**Performance requirements**

The system should perform reliably and efficiently under various amounts of workloads, it should also perform well during periods of high public engagement, live events, and peak data submission windows. The performance requirements below aim to ensure that user experience, data integrity, and real time responsiveness are maintained across all user roles and system components. Another requirement is label submission and AI feedback. Feedback from AI assisted suggestions during data labelling must be provided within around 3 seconds. This is because Quick feedback is essential for maintaining labeler focus and efficiency. Scalability and requirement are also essential, the system should be able to support up to 2,000 concurrent users without degradation in performance beyond specific thresholds, this is used to support city wide events with many users submitting or accessing data simultaneously.

**Safety Requirements**

The system must ensure that its operation is harmless to users, participants, data subjects or the organization. The following requirements define potential risk, safeguards, and required compliance with relevant ethical and regulatory standards. The first requirement is data privacy and protection which ensures the users confidentiality and integrity of personally identifiable information collected from event participants and users. This safeguards encryption which must be used for all data transmissions, access controls are important and role-based authentication, so it ensures that there is no unauthorized data access. Anonymization techniques must also be applied to all public- facing datasets. Another requirement is regulatory compliance which must with UK GDPR, Data Protection Act 2018, and relevant university of Bradford data policies, the reason being for this is because of loss or exposure of personal data could cause reputational damage, legal consequences, and harm users that are using the system. The system should be aware of content moderation and misuse prevention which means that it should prevent the upload or display of harmful, offensive, or inappropriate content. The safeguards that should be implemented are automatic content filtering which should be AI or keyword based, moderation queue for manual approval by designated DIG members. Or reporting mechanism for inappropriate content filtering. All of this is needed to prevent any reputational harm and ensuring the system is safe and inclusive for all users.

There are bound to be operational failures and data loss. The safeguards from this include automatic daily backups stored on secured offsite servers. The system of health monitoring with automated alerts for abnormal behavior. Regular penetration testing and vulnerability scanning to check for any faults in the systems software. All these methods ensure data availability, reliability and recovery capability in case of disaster scenarios.

**Security Requirements**

The system must ensure robust protection of sensitive data and uphold the privacy rights of all users and data subjects. Security measures must prevent unauthorized access, data breaches, and misuse of information, while privacy practices must align with ethical and legal standards. For example, user authentication and access control, all users must authenticate using a secure login mechanism. Access to data and systems features must be role-based with permissions defined for SM, AC, DIGL, DIGM. This prevents unauthorized access to sensitive features and data, ensuring that users only access information relevant to their responsibilities. Data requirement is also a form of security requirement which ensures that all data in transit must be encrypted using TSL 1.2 or higher. All stored data at rest must be encrypted. This protects the user and participant data from interception, tampering, or theft. There is a regulatory compliance and certifications, the applicable standards and policies are as follows, UK GDPR, data protection act 2018, university of Bradford information security policy, NCSC cyber essentials (Recommended for production deployment). Before the system continues it must pass the ISRA. Also, it is essential annually privacy impact assessments must be conducted to reassess data risks.

**Software Quality Attributes**

The system needs to ensure that it meets a range of quality characteristics to ensure long-term effectiveness, stakeholder satisfaction and ease of evaluation. The following attributes have been identified based on the needs of users and the development team. The system should support intuitive navigations, with no more than 3 clicks to access key actions, this is an ease-of-use learning, the system should Favor day to day simplicity for regular users over simplified onboarding. This is because AC’s and DIG members will be using the system frequently during events and need minimal friction. Availability is also another requirement, which means that the system should be able to handle up to 1000 concurrent users without any distortion and make sure that there is no loss of data, this prevents disruption during busy event periods. The system should be maintained to a high standard whereby the codebase should follow modular architecture, with documented API’s and version control, enabling bug fixes, and feature additions within 3 working days of request prioritization, all of this ensures the system can evolve alongside BD25 changing requirements.

The system's application portability must be deployable on university-managed cloud servers (Linux based), also local developer's machines (via docker). This ensures flexible deployment during both development and evaluation phases. Another requirement which must be met is the components reusability such as the data labelling interface and reporting module must be reusable across other projects with minimal customization, this is because it adds long term value and efficiency for related academic projects.

**Business Rules**

The BD25 system will operate based on the following business rules to make sure of ethical use, role accountability, data integrity, and process consistency. There are certain role-based function access, for example senior members (SM) can access oversee all system data and configuration, they can approval final reports and authorize AI model deployments. Activity coordinators may create and manage engagement activities within their assigned scope. They can input activity outcomes and they can upload media or engagements forms. However, they are not able to access any sort of training data, AI models or system wide metrics. DIG members may annotate, label and upload data with assigned activities. On the other hand, DIG leaders have the privilege to approve/reject data labels submitted by DIG members, they are also able to initiate AI model training sessions etc.

Ethical governance is a requirement, AI models must not be deployable for carrying out decisions without LESPI review and DIG leader signing off. Any data used for training must be consented to and anonymized. Also, must ensure that public reports must be fact checked and digitally assigned by a senior member before release.

Data collection and integrity is important for collecting all data which must be timestapped and where possible to maintain traceability. No user can permanently delete data- records can only be archived or flagged for review. Edited data must preserve historical versions.

# Other Requirements

The scenario that we were given required us to place a number of the Bradford City of Culture events into a system so that each event’s engagement percentage could be recorded based on a list of certain attributes regarding the events. As an additional feature we decided that we would implement a database table that held all the events that would then connect to the java code via a personalized method. The reason that we went for this is because we wanted to add an extra layer of complexity to the code so that we could elevate it beyond what the specification wanted.