ABSTRACT

The Dental Collaboration Platform for Orthodontics – MGPGIDS is a web-based application developed to streamline both academic and clinical workflows within the Department of Orthodontics and Dentofacial Orthopaedics. This platform addresses the inefficiencies of manual record-keeping by digitizing various processes such as patient case management, academic records, and faculty operations. Built using the MERN stack (MongoDB, Express.js, React.js, Node.js), the platform offers a robust and scalable architecture. It supports three primary user roles: Faculty, Students (BDS and MDS), and Patients. Each role is equipped with role-specific functionalities to ensure efficient collaboration and management.

The **Faculty module** plays a pivotal role in overseeing academic operations, including managing student attendance, internal assessments, and clinical case evaluations. Faculty members can upload academic resources such as seminar notes and presentations, review patient cases submitted by students, and provide timely feedback. They also have full access to update both academic and patient records, ensuring data integrity and accuracy. Additionally, faculty members can maintain their professional profiles, showcasing academic achievements and seminar involvement. This system fosters a collaborative academic environment by promoting transparency, consistency, and streamlined communication.

1. INTRODUCTION

The **Dental Collaboration Platform for Orthodontics – MGPGIDS (Faculty Module)** is a comprehensive web-based application developed to streamline academic and clinical workflows within the Department of Orthodontics and Dentofacial Orthopaedics. The primary objective of the platform is to replace traditional manual record-keeping methods with a digital system that enhances operational efficiency, accuracy, and data accessibility.

The platform is developed using the **MERN stack**—**MongoDB**, **Express.js**, **React.js**, and **Node.js**—which provides a modern, scalable, and interactive environment. The system offers role-based access to two main user groups:

- **Faculty Members:** Oversee and manage academic activities such as student attendance, internal assessments, clinical case reviews, and resource sharing. Faculty also maintain professional profiles highlighting seminars, research, and academic contributions.
- **Students (BDS & MDS):** Submit clinical case details for faculty review, access academic resources such as seminar notes and presentations, and track their academic performance.

The **Faculty Module** serves as a key component in ensuring academic quality and clinical oversight. It equips faculty members with essential tools to manage student progress, evaluate case documentation, share academic content, and maintain accurate records. This module significantly contributes to building an efficient and collaborative digital environment within the department. This report focuses on the **Faculty Module**, outlining its system analysis, design, implementation, and core functionalities that support academic and administrative operations.

2. PROFILE OF THE INSTITUTION

Name of the Institution: Mahatma Gandhi Postgraduate Institute of Dental Sciences (MGPGIDS)

Location: Pondicherry, India

Type: Government Dental Institution

Affiliated University: Pondicherry University

2.1 Overview:

Mahatma Gandhi Postgraduate Institute of Dental Sciences (MGPGIDS) is a premier dental institution in South India, renowned for its excellence in dental education, patient care, and clinical research. The institute offers undergraduate (BDS), postgraduate (MDS), and doctoral programs, with a focus on developing competent dental professionals who contribute to society through ethical and skilled practice.

MGPGIDS is equipped with modern infrastructure, advanced dental laboratories, and a dedicated team of highly qualified faculty members. The institution is committed to promoting academic excellence, innovation in dental sciences, and community-based healthcare.

2.2 Department of Orthodontics and Dentofacial Orthopaedics:

The Department of Orthodontics and Dentofacial Orthopaedics at MGPGIDS specializes in the diagnosis, prevention, and treatment of dental and facial irregularities. It plays a key role in both academic and clinical training for undergraduate and postgraduate students. The department integrates modern

orthodontic practices with academic learning, fostering a collaborative environment among faculty and students.

2.3 Role in Project Development:

The department initiated the development of the **Dental Collaboration Platform** as part of an internal academic project to enhance record management and faculty-student interaction. The system aims to improve clinical documentation, automate academic workflows, and facilitate efficient supervision.

3. SYSTEM ANALYSIS

3.1 System Study

The current academic and clinical management system used by the Department of Orthodontics and Dentofacial Orthopaedics is largely manual and paper-based. This traditional approach has several drawbacks:

- Academic records, student attendance, and internal assessments are stored physically, which increases the chances of loss, damage, or errors.
- Clinical case submissions and evaluations are managed manually, causing delays in feedback and reducing efficiency.
- Sharing academic resources such as seminar notes or presentations is limited to offline methods or basic email communication.
- There is no centralized system for maintaining faculty achievements, seminar involvement, and research contributions.

To overcome these limitations, the proposed **web-based Faculty Module** offers a centralized digital platform where faculty members can manage student data, academic records, case evaluations, and learning materials efficiently. This improves collaboration, transparency, and academic performance tracking while ensuring data security and real-time access.

3.2 Software and Hardware Requirements

3.2.1 Software Requirements

- Operating System: Windows 10/11, Linux, or macOS
- Frontend: React.js

- Backend: Node.js with Express.js
- Database: MongoDB
- Code Editor: Visual Studio Code
- Browser: Google Chrome, Mozilla Firefox, or Microsoft Edge
- Package Manager: npm (Node Package Manager)
- API Testing Tool: Postman
- Version Control: Git with GitHub or GitLab
- Other Tools: MongoDB Compass (for managing the database)

3.2.2 Hardware Requirements

- Processor: Minimum Intel Core i3 6th Gen or AMD equivalent (Recommended: i5/i7 or Ryzen)
- RAM: Minimum 4 GB (Recommended: 8 GB or more)
- Storage: Minimum 100 GB HDD (Recommended: 256 GB SSD or more)
- Display: 14-inch monitor with 1366x768 resolution (Recommended: Full HD 1920x1080)
- Internet: Stable internet connection required
- Graphics: Integrated graphics (No dedicated graphics required)

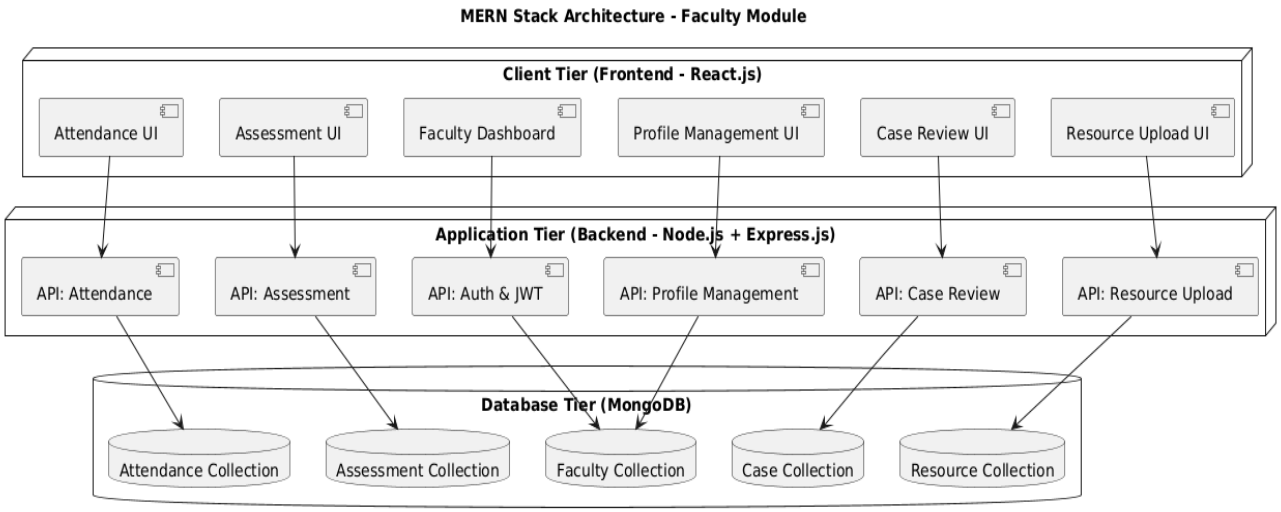
4. SYSTEM DESIGN

The system design of the Faculty Module of the Dental Collaboration Platform for Orthodontics-MGPGIDS focuses on modularity, scalability, and ease of use for academic and clinical data management. The design is layered into multiple tiers and visually represented using architecture and data flow diagrams to ensure clarity in system behavior.

4.1 Architecture Abstract

The system follows the **MERN stack architecture**, which includes:

- **Client Tier (Frontend - React.js)**: Handles user interface components for faculty users.
- **Application Tier (Backend - Node.js + Express.js)**: Manages APIs, business logic, and authentication.
- **Database Tier (MongoDB)**: Stores all collections such as attendance, assessments, faculty profiles, etc.



Explanation:

- The client interacts with the application tier via REST APIs.
- Each UI component corresponds to a backend API and connects to a specific database collection.
- The system is designed for clear separation of concerns and efficient data handling.

4.2 Component-Wise Detailed Design

The system consists of the following key modules:

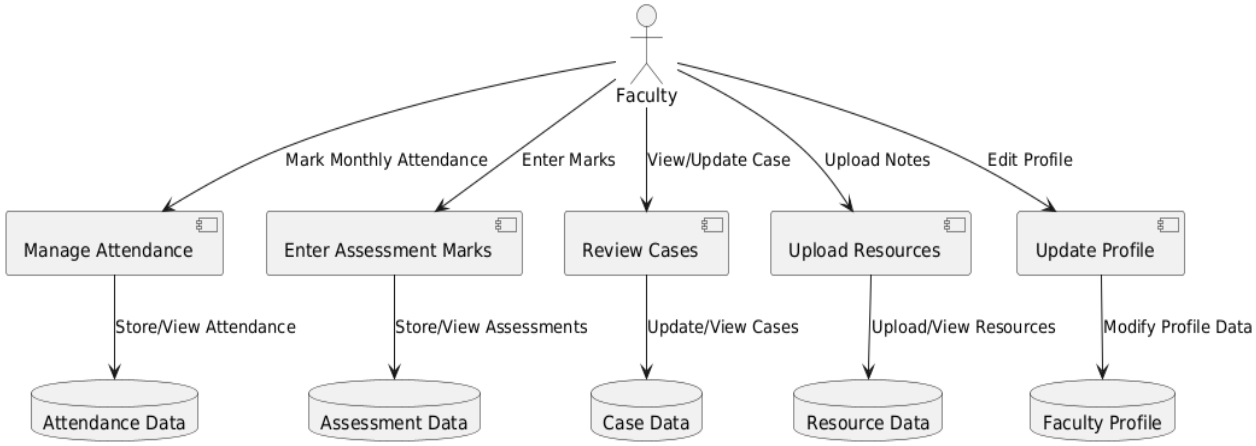
- **Attendance Module**: Faculty can mark monthly attendance and view semester-wise summaries.
- **Assessment Module**: Faculty can enter marks for Assessment 1 and 2.
- **Case Review Module**: Faculty can view, update, and mark clinical cases as completed.
- **Resource Upload Module**: Faculty can upload learning materials.
- **Profile Management Module**: Faculty can view and edit their own profile data.

Each module is composed of:

- **UI Layer**: React components specific to each functionality.
- **API Layer**: Express.js APIs for CRUD operations.
- **Data Layer**: MongoDB collections to persist relevant data.

4.3. Data Flow Diagram (DFD)

The DFD shows how data flows between the user (faculty), system processes, and data stores.



Explanation:

- The **Faculty** initiates all actions.
- Each action (e.g., entering attendance, uploading resources) corresponds to a **process block**.
- Processes interact with **data stores** to store and retrieve information.
- The diagram shows a clear, single-level abstraction suitable for system-level documentation.

5. IMPLEMENTATION

The implementation of the Faculty Module leverages the **MERN stack (MongoDB, Express.js, React.js, Node.js)** to deliver a seamless, responsive, and role-specific experience for faculty users. Each module was developed following modern web development best practices, ensuring scalability, maintainability, and performance.

5.1 Technology Stack

- **Frontend**: React.js
    - Built using reusable components
    - React Router for navigation
    - Axios for API communication
- **Backend**: Node.js with Express.js
    - RESTful API development
    - JWT-based authentication
    - Middleware for route protection and validation
- **Database**: MongoDB
    - Collections for Attendance, Assessment, Case Review, Resources, and Faculty Profiles
    - Mongoose for schema definition and database interactions

5.2 Module-Wise Implementation

1. Attendance Module

- Faculty can mark attendance month-wise.
- Automatically calculates semester average attendance.

- Stores data in Attendance collection.

2. Assessment Module

- Faculty can input marks for Assessment 1 and 2.
- View existing marks, but cannot edit once entered (controlled by backend logic).
- Stored in Assessment collection.

3. Case Review Module

- Faculty can view all student-submitted cases.
- Update case status and mark as “Completed”.
- Stored in Case collection.

4. Resource Upload Module

- Allows faculty to upload academic files (notes, images, etc.).
- Stored in Resource collection with metadata.

5. Profile Management Module

- Faculty can update their own contact details, qualifications, etc.
- Profile data is stored and retrieved from the Faculty collection.

5.3 Security & Access Control

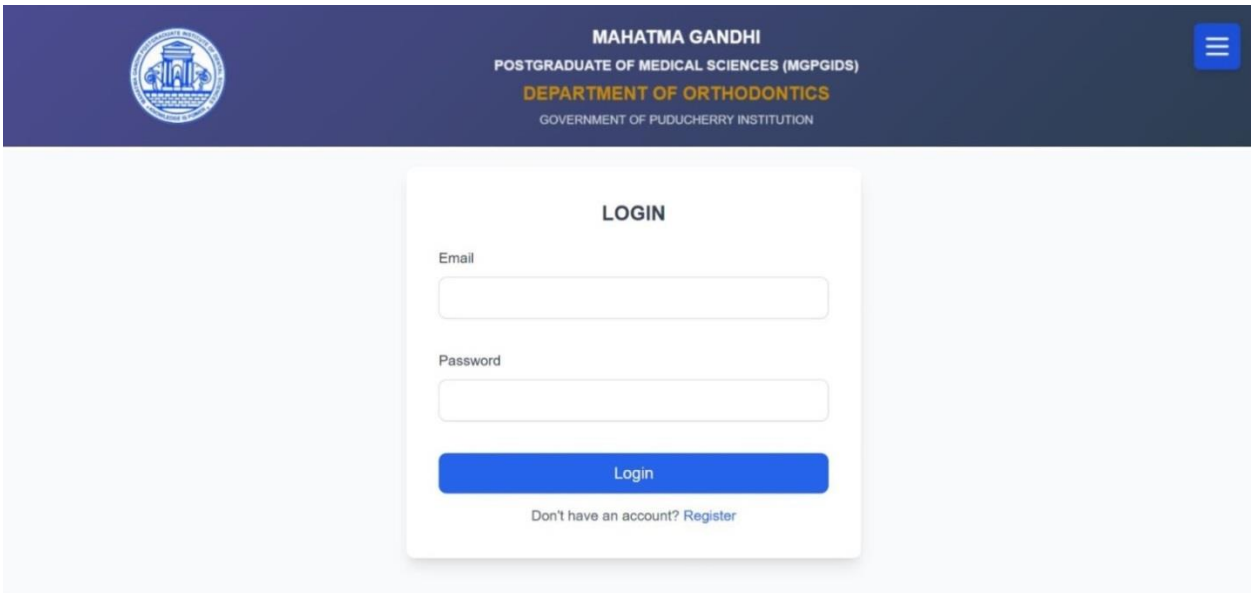
- Role-based access: Only faculty users can access this module.
- JWT tokens are used for secure API communication.
- Input validations are performed both on client and server sides.

5.4 Hosting & Deployment

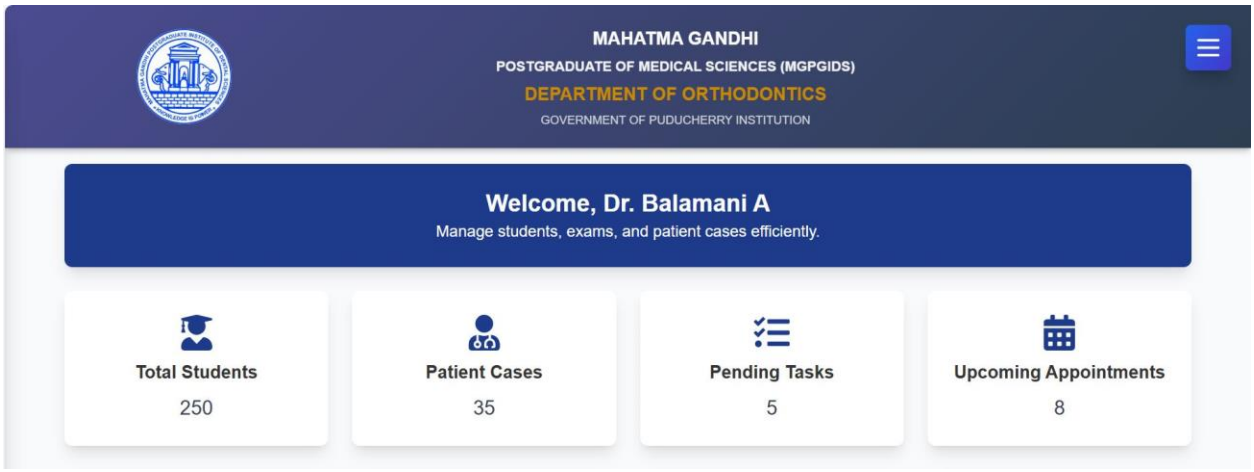
- **Frontend**: Deployed via Netlify or Vercel.
- **Backend API**: Deployed using Render or Railway.
- **Database**: MongoDB Atlas for cloud-hosted NoSQL database.
- **Environment Configuration**: Sensitive information managed via .env files.

6. SCREENSHOTS

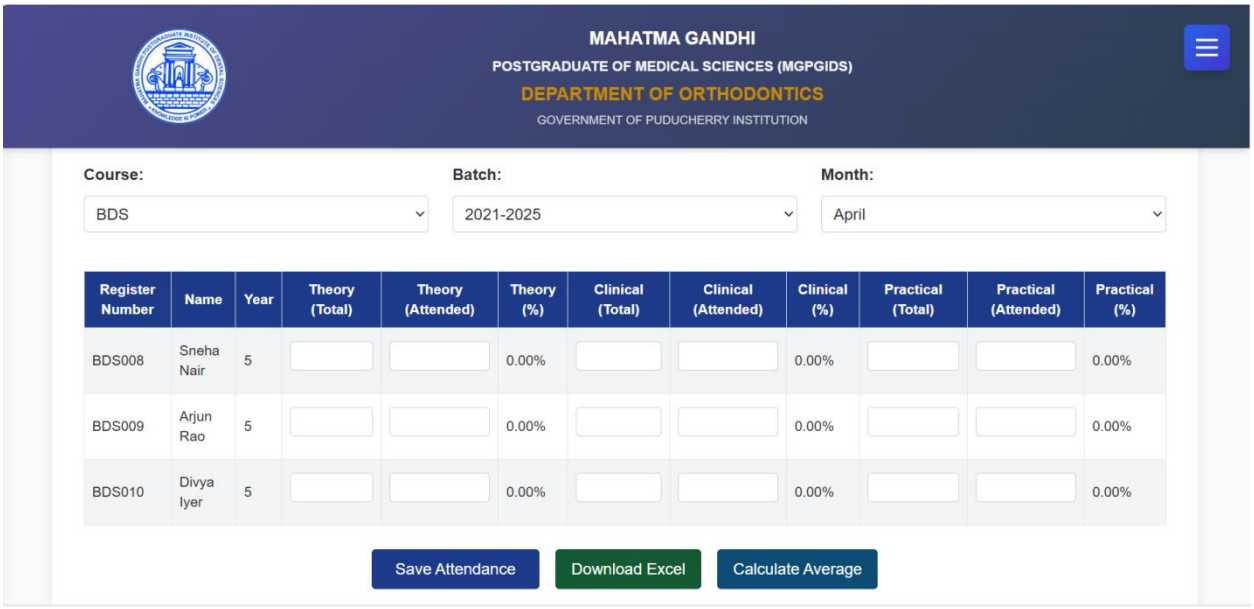
Login Page



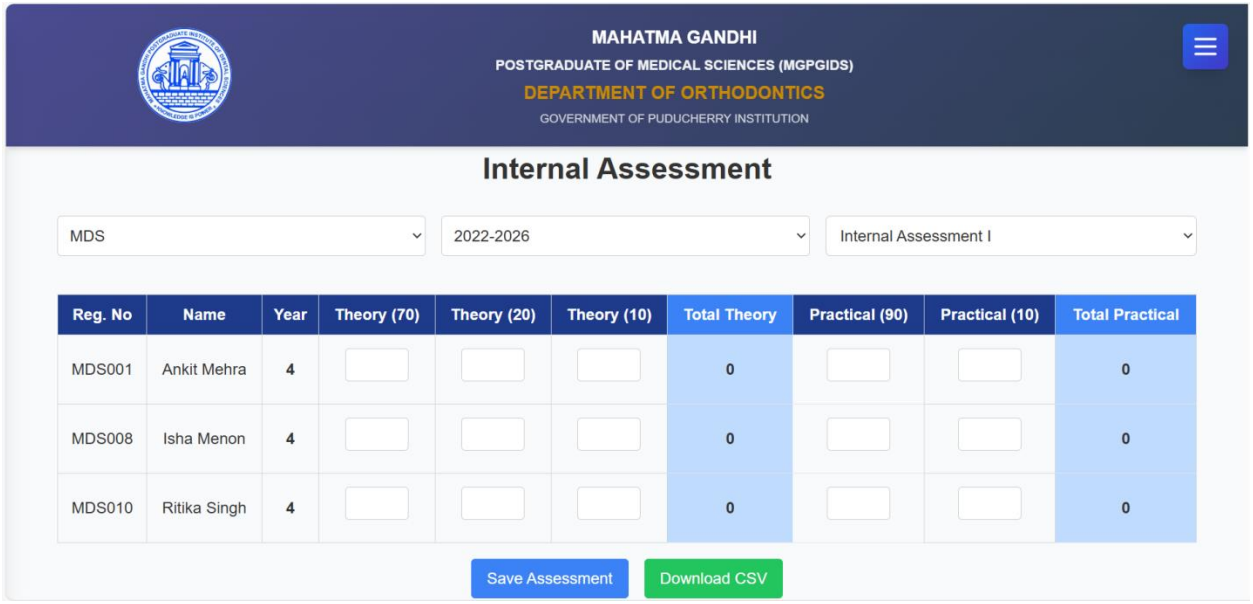
Faculty Dashboard



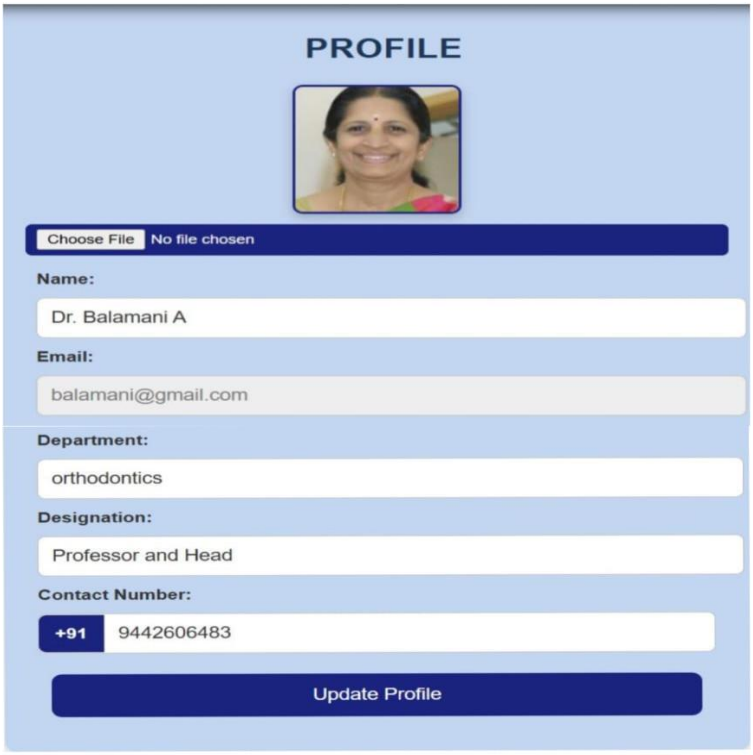
Attendance Module

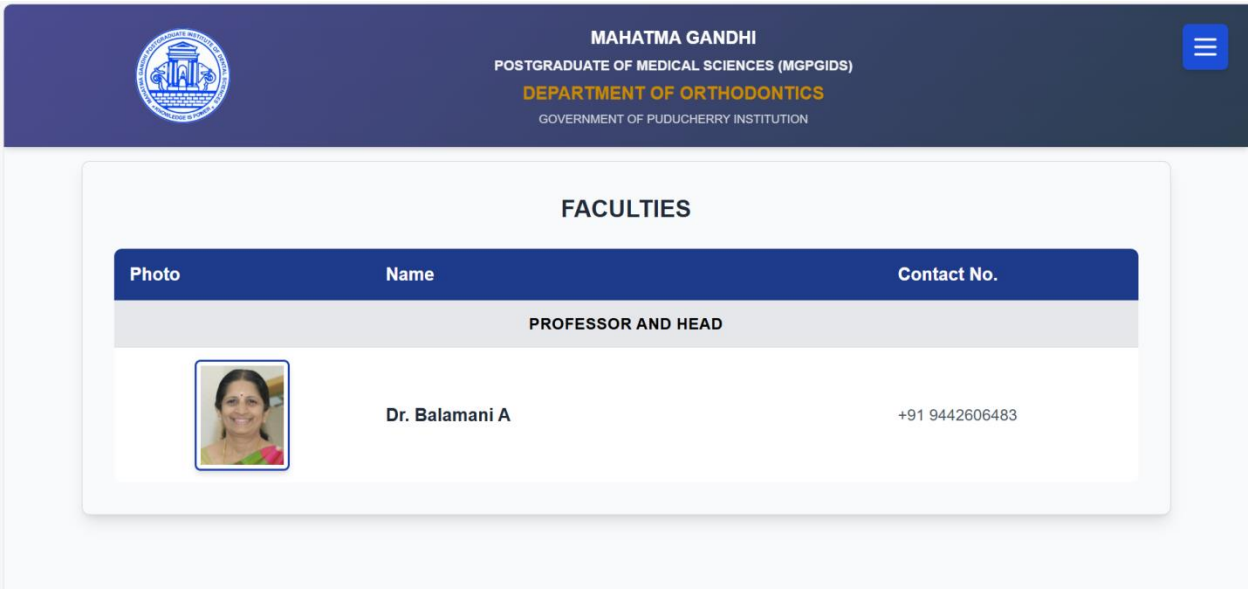


Assessment Module



Profile Management





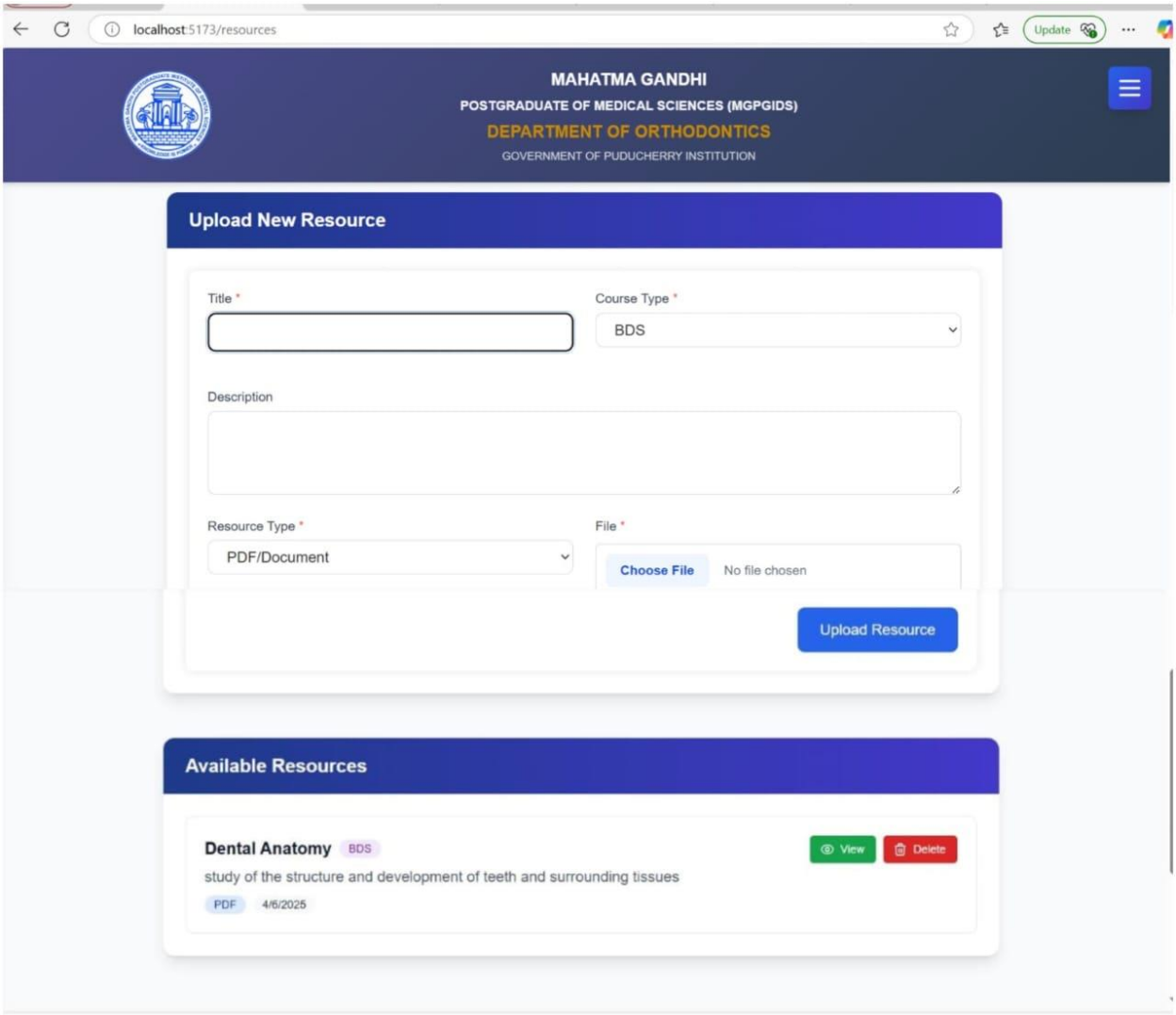
Add Faulty Activity


MAHATMA GANDHI
POSTGRADUATE OF MEDICAL SCIENCES (MGPGIDS)
DEPARTMENT OF ORTHODONTICS
GOVERNMENT OF PUDUCHERRY INSTITUTION
ADD FACULTY ACTIVITIES
Faculty Name: DR. BALAMANI A
Enter activities...
Add Activity


Stored Activities
Nodal Officer, Anti Ragging Cell, MGPGIDS. Edit Delete
Member, Departmental Promotion Committee, Group C staff, MGPGIDS. Edit Delete
Member, Purchase committee, MGPGIDS. Edit Delete
Member, Institute Review Board, MGPGIDS. Edit Delete
Convenor, Public Grievance Redressal Committee, MGPGIDS. Edit Delete


MAHATMA GANDHI
POSTGRADUATE OF MEDICAL SCIENCES (MGPGIDS)
DEPARTMENT OF ORTHODONTICS
GOVERNMENT OF PUDUCHERRY INSTITUTION
FACULTY DETAILS
DR. BALAMANI A, Professor and Head
• Nodal Officer, Anti Ragging Cell, MGPGIDS.
• Member, Departmental Promotion Committee, Group C staff, MGPGIDS.
• Member, Purchase committee, MGPGIDS.
• Member, Institute Review Board, MGPGIDS.
• Convenor, Public Grievance Redressal Committee, MGPGIDS.
• Convenor, Pondent, Institute Journal, MGPGIDS.
• Convenor, Orientation Committee, BDS, MGPGIDS.
• Internal Examiner, Orthodontics, for Final BDS, Pondicherry University.
• External Member, Institute Review Board, Sri Venkateswara Dental College and Hospital, Ariyur, Pondicherry.

Resource Upload



7. CODING

1.**Faculty Login and Authentication (Backend - auth.js)**

```
// Faculty login authentication using Express.js and MongoDB
router.post('/login', async (req, res) => {
  const { email, password } = req.body;
  try {
    const user = await Faculty.findOne({ email });
    if (!user) {
      return res.status(404).json({ message: 'User not found' });
    }
    const isMatch = await bcrypt.compare(password, user.password);
    if (!isMatch) {
      return res.status(400).json({ message: 'Invalid credentials' });
    }
    res.status(200).json({ message: 'Login successful', user });
  } catch (err) {
    res.status(500).json({ message: 'Server error' });
  }
  })
```

2. Attendance Marking by Faculty (Backend - attendanceController.js)

```
// Marking attendance for a student (monthly-based)
exports.markAttendance = async (req, res) => {
  const { studentId, month, status } = req.body;
  try {
```

```
    const record = await Attendance.findOne({ studentId, month });
    if (record) {
      record.status = status;
      await record.save();
    } else {
      await Attendance.create({ studentId, month, status });
    }
    res.status(200).json({ message: 'Attendance updated' });
  } catch (error) {
    res.status(500).json({ message: 'Error updating attendance' });
  }
};
```

3.Assessment Marks Submission (Backend- assessmentController.js)

```
// Add assessment marks (1st and 2nd assessments)
exports.submitAssessment = async (req, res) => {
  const { studentId, assessmentNumber, marks } = req.body;
  try {
    await Assessment.create({ studentId, assessmentNumber, marks });
    res.status(200).json({ message: 'Marks submitted' });
  } catch (err) {
    res.status(500).json({ message: 'Error submitting marks' });
  }
 };
```

4.Case Review & Status Update (Backend - caseController.js)

```
// Faculty reviews and updates the status of case reports
```

```
exports.updateCaseReview = async (req, res) => {
  const { caseId, status, feedback } = req.body;
  try {
    await Case.findByIdAndUpdate(caseId, { status, feedback });
    res.status(200).json({ message: 'Case updated successfully' });
  } catch (err) {
    res.status(500).json({ message: 'Update failed' });
  }
 };
```

5.Uploading Academic Resources (Frontend - React Component)

```
function UploadResource() {
  const [file, setFile] = useState(null);
  const handleSubmit = async () => {
    const formData = new FormData();
    formData.append('resource', file);
    await axios.post('/api/upload', formData);
  };
  return (
    <div>
      <input type="file" onChange={e => setFile(e.target.files[0])} />
      <button onClick={handleSubmit}>Upload</button>
    </div>
  );
}
```

6. Profile Management by Faculty

```
// Updating faculty profile details
router.put('/updateProfile/:id', async (req, res) => {
  const { id } = req.params;
  const updatedData = req.body;
  try {
    await Faculty.findByIdAndUpdate(id, updatedData);
    res.status(200).json({ message: 'Profile updated successfully' });
  } catch (err) {
    res.status(500).json({ message: 'Update failed' });
  }
});
```

8. CONCLUSION

The Faculty Module of the Dental Collaboration Platform for Orthodontics – MGPGIDS effectively digitizes academic workflows for faculty members. Developed using the MERN stack, it streamlines attendance tracking, internal assessment entry, and case reviews, reducing manual effort and ensuring data accuracy. Faculty can upload academic materials and manage their profiles, enhancing communication and transparency. The system simplifies academic management, improves efficiency, and provides a strong foundation for further digital integration in the department.