UNIVERSITY of TASMANIA

KIT519 - Software Engineering & HCI

Assignment 2

High-Fidelity Prototyping

Group Number :43

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Executive Summary

The increased demand for effective and sustainable trash management on the University of Tasmania campus led to the development of the Smart Bin Monitoring System. The waste collection system offers automatic scheduling, comprehensive analytics, and real-time monitoring through the integration of IoT (Internet of Things) technology with an intuitive user interface. In order to provide a user-friendly and efficient solution, this study describes the design process, system characteristics, and implementation of important human-computer interaction (HCI) principles.

Low-fidelity drawings and wireframes were created at the start of the project to conceptualise the main features, which included customisable reporting tools, contamination detection, and real-time bin status updates. These designs developed into a high-fidelity prototype that was constructed with **Balsamiq** and **Figma**, guaranteeing that the design process prioritised both usability and functionality.

The Smart Bin Monitoring System is an example of a sustainable waste management strategy that uses cutting-edge technology to cut waste, improve efficiency, and support the environmental objectives of the university.

Introduction

Sanitation is a major concern for institutions – corporate institutions in particular – like universities. Thus, the Smart Bin Monitoring System tackles the problem of effective waste collection and contamination management with help of ITS, IoT and real time data and reports. Thus, by applying the data intensive approach the system allows campus staff to minimize overflows, optimize recycling, and optimize the flows of waste disposal to specific treatment facilities. This project continues from Assignment 1, where participants created low-fidelity designs to distill the usability and technical improvements for the system at hand.

Design Process

1. **Low-Fidelity Sketches**

   Low-fidelity sketches were made early in the design process with an emphasis on usability, accessibility, and essential features. Based on user requirements found through PACT analysis (People, Activities, Context, and Technologies), these sketches made sure that every design element matched the demands of the users and the overall objectives of the system.

- **Real-Time Monitoring Interface:** The sketch included a simple interface with colour-coded indicators for fill levels (green for empty, yellow for partially full, and red for full) and contamination detection that showed the condition of the bins in real time. The intention was to give users a brief summary of the bin conditions so they could take prompt action when needed. In addition, the design featured an interactive map that made it simple to find bins on campus and obtain bin details by simply clicking on markers.
- **Data Visualisation and Reporting:** Creating a reporting dashboard was a crucial component of the low-fidelity stage. Charts and graphs showing bin utilisation, contamination incidents, and trends in trash management over time were included in this illustration. To create customised reports, users could filter data according to location, date, or kind of bin. In order to help users track waste reduction efforts and highlight areas for improvement, the goal was to create a visual depiction of waste management performance.
- **Notification and Navigation System:** In order to inform users of significant occurrences like bins These low-fidelity sketches served as a means of exploring several design alternatives and getting preliminary comments. The main goals were to pinpoint crucial user interactions and guarantee a flawless user experience from the system. The drawings served as a starting point for the interface's subsequent refinement.

  Visual Suggestion: To illustrate the evolution from concept to prototype, include pictures of the low-fidelity designs for the reporting dashboard, alerting system, and real-time monitoring interface.

2. **High-Fidelity Prototype**

The group moved on to creating a more refined high-fidelity prototype after getting input on the low-fidelity sketches. Creating an aesthetically pleasing, fully interactive interface that closely mirrored the finished system was the main goal of this stage. Using Figma, the high-fidelity prototype's advanced design features and interactions were created to replicate the real user experience.Real-Time Monitoring: Live bin status updates and alerts for contamination.

- **Real-Time Monitoring:** With interactive features and colour-coded visualisations, the high-fidelity prototype showed real-time updates of bin statuses. On the map, users could click on bin markers to get more information about pollution alarms, fill levels, and the date the bin was last emptied. Users could zoom in and out of the interactive map to concentrate on particular parts of the campus.
- **Data Analytics and Custom Reports:** Users can now create comprehensive reports on bin utilisation, contamination incidents, and waste collection trends using the improved reporting interface. Users could see important data points with the interactive bar charts and line graphs featured in the high-fidelity prototype. You might personalise reports by choosing particular date ranges, bin locations, or bin kinds. Additionally, the prototype offered download choices in Excel and PDF formats, making record-keeping and data sharing simple.
- **Visualisation of Trends and Insights:** The high-fidelity prototype improved the Trends and Insights function, giving consumers a thorough rundown of current developments in waste management. Data on contamination incidents, bin fill rates, and collection efficiency over time were available for users to view. Users were able to monitor their progress towards waste reduction targets and spot trends in bin usage with the aid of visual aids like pie charts and line graphs.
- **Notification System:** In the high-fidelity prototype, the notification system worked well, sending out notifications in real time for contamination problems and full bins. The action buttons on notifications were clearly visible, enabling users to promptly address problems or respond to alarms. Notifications might be filtered by date or severity using other options contained in the system.

Design Elements and Accessibility:

- **Simplicity:** The high-fidelity prototype's design remained clear and easy to use. To make sure that users could quickly understand the function of each button and feature, both text labels and icons were used. Users with different degrees of technical experience could utilise the system because of its simple layout, which also lessened cognitive burden.
- **Multilingual Support:** The prototype included a language toggle that made it simple for users to move between languages. This improved the usability of the software by guaranteeing that users with varying language preferences could access the system without issue.
- **Interactive Feedback:** The high-fidelity prototype offered user actions visible feedback. For instance, the system confirmed that the bin was being scanned when users pressed the scan button by displaying an animation. In line with the concepts of human-computer

interaction (HCI), this interactive feedback assisted users in understanding the consequences of their actions.

Aspects That Encourage Technology Acceptance:

- **Efficient Content administration:** The high-fidelity prototype's admin interface was intended for easy content administration. This feature made it easy for users to update notifications, waste management reports, and instructional materials. In order to support the objective of delivering accurate and timely information, the system made sure that all content was kept up to date.
- **Easy to Follow Instructions and Accessibility:** The prototype's instructional material was created to be brief and provide step-by-step instructions on how to manage waste and recycle materials. A wide range of users, including those with differing levels of technical expertise and linguistic competency, could utilise the system thanks to its easy iconography and language toggle option.

How Design Laws Were Applied in the Smart Bin Monitoring System :

Human-computer interaction (HCI) and usability concepts played a major role in the design of the Smart Bin Monitoring System, allowing users to engage with it with ease and complete important tasks quickly. The following design principles were used in the system's interface design:

1. **Fitts's Law and Hick's Law in the Dashboard Page :**

- **Fitts' Law:** According to this law, the size and distance to a target (such a button or other clickable object) determine how long it takes to travel towards it. We put this approach to use on the Dashboard Page by enlarging and positioning the most significant buttons and clickable elements—like warnings, report generation, and bin status indicators—closer to the places where users regularly interact. This guarantees that users may easily and rapidly do necessary actions, such as verifying full bins or retrieving contamination reports.
- **Hick's Law:** This law emphasises that when there are more options available, it takes longer to make a decision. The Dashboard Page was created to give users a clear set of options and to keep the interface simple and concentrated on the most important elements in order to reduce decision fatigue. Limiting the number of options available right away—for example, by displaying only the most important statistics and alerts—allows people to make decisions fast without becoming bogged down by extras. This improves the usability and responsiveness of the system.

2. **Jakob’s Law in the Login and Sign Up Pages :**

- According to **Jakob's Law**, users favour user interfaces that function similarly to the websites and programs they are already accustomed to using. The design of the Sign Up and Login pages adhered to this idea by using common, widely-used principles seen in the majority of web apps. To guarantee that users can navigate

these sites intuitively, features like a "Create New Account" button, a "Forgot Password?" link, and the username and password boxes at the top are included. We minimised the learning curve and confusion for new users by sticking to these well-known principles, which made the authentication procedure as seamless as possible.

3. **Law of Proximity in the Dashboard and Report Pages :**

- Law of Proximity: According to this Gestalt principle, things are regarded as connected when they are near one another. This legislation was used to put related elements together for easy comprehension on the Dashboard Page and the Report Page. For instance, the dashboard's placement of the recent activity logs, alarms, and real-time bin statuses allows users to rapidly identify and comprehend the connections between these components. Similar to this, users may create and comprehend reports more easily on the Report Page by grouping filtering choices and visual data (charts, graphs) logically and not having to browse around the page for relevant controls.

Technology Integration

Smart Bin System on the other hand uses state of the art IoT sensors to capture information such as fill state of bins and contamination within a bin in real time. Remote systems in the bins collect data on a real-time basis, which are then delivered to the system's backend for analysis and presentation. Users are also able to be alerted when a bin is full in order to schedule a pick up and avoid over-flowing of the bin. Such a combination of real-time data and smart technology contributes positively to the optimization of the whole system (Stec et al., 2007).

User-centered design, and its potential benefits

The usability of the Smart Bin System remains one of the most important features when designing the application. Key design principles include:

- Ease of Use: The conception of the interface presupposes simplicity: the strategic data should be placed in such a way that a user does not need to navigate through the interface.
- Visual Data Representation: Figures and especially charts, graphs and maps are employed to make the data more comprehensible as well as manageable for the users (R et al., 2023).
- Actionable Alerts: Such communications can guarantee that members of staff are informed about particular bins which must be attended to without delay so as to avert the occurrence of incidents such as; bin overflow and bin contamination.

Benefits:

- Improved Efficiency: It also means that bin collection routes are most efficient that would eliminate unproductive movements and consequently costs.
- Enhanced Sustainability: Through monitoring of wastes that are contaminated and promoting of recyclable items the system promotes sustainability of the university.
- Data-Driven Decisions: The website offers reporting to show users how they can optimize waste and resource management in their organizations.

Final Design Overview (Screenshots of High-Fidelity Prototype):

1. **Sign up Page**
   New users can register and create an account in the system using the Sign Up Page. Name, email address, phone number, role (indicating if the user is an administrator, staff member, or regular user), password, and a field for confirmation are all form fields on the page. In order to prevent unauthorised access, this page makes sure users enter proper information and strong passwords. Users may easily register and begin using the system thanks to the interface's emphasis on usability.

   Functionality:
   - Account Registration: This feature enables new users to sign up by providing a secure password and personal data.
   - Role Assignment: Allows users to specify their roles (staff, admin, etc.) within the system, which establishes their permissions for access.
   - Data validation verifies that the information entered is accurate and adheres to the necessary formats, particularly for passwords and emails.

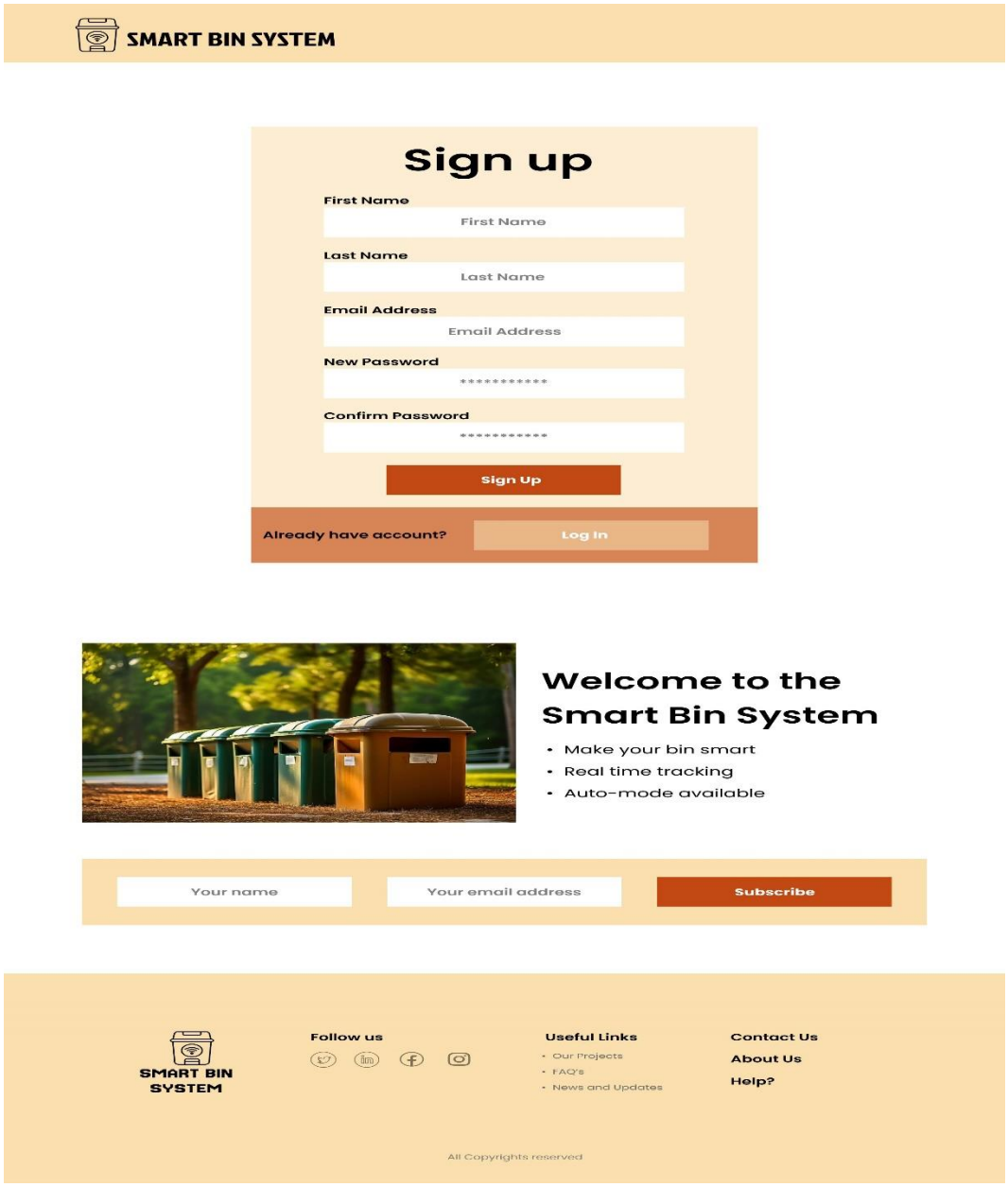


Figure 1: Signup Page

2. Login Page

The main portal via which users access the Smart Bin Monitoring System is the Login Page. Key elements of its straightforward and secure design are the input areas for passwords and email addresses or phone numbers. The page also has a "Create New Account" option for new users to register and a "Forgot Password?" link for those who need to retrieve their account access. This page keeps all users' login credentials safe and guarantees that only authorised people can access the system. With usability in mind, the interface is created so that users can log in quickly and easily.

Functionality:

- User authentication makes ensuring that the system can only be accessed by authorised users who have the proper login information.
- Password Recovery: If users misplace their login information, they can retrieve their accounts by using the Forgot Password tool.
- Account Creation: Points brand-new users to the registration page.

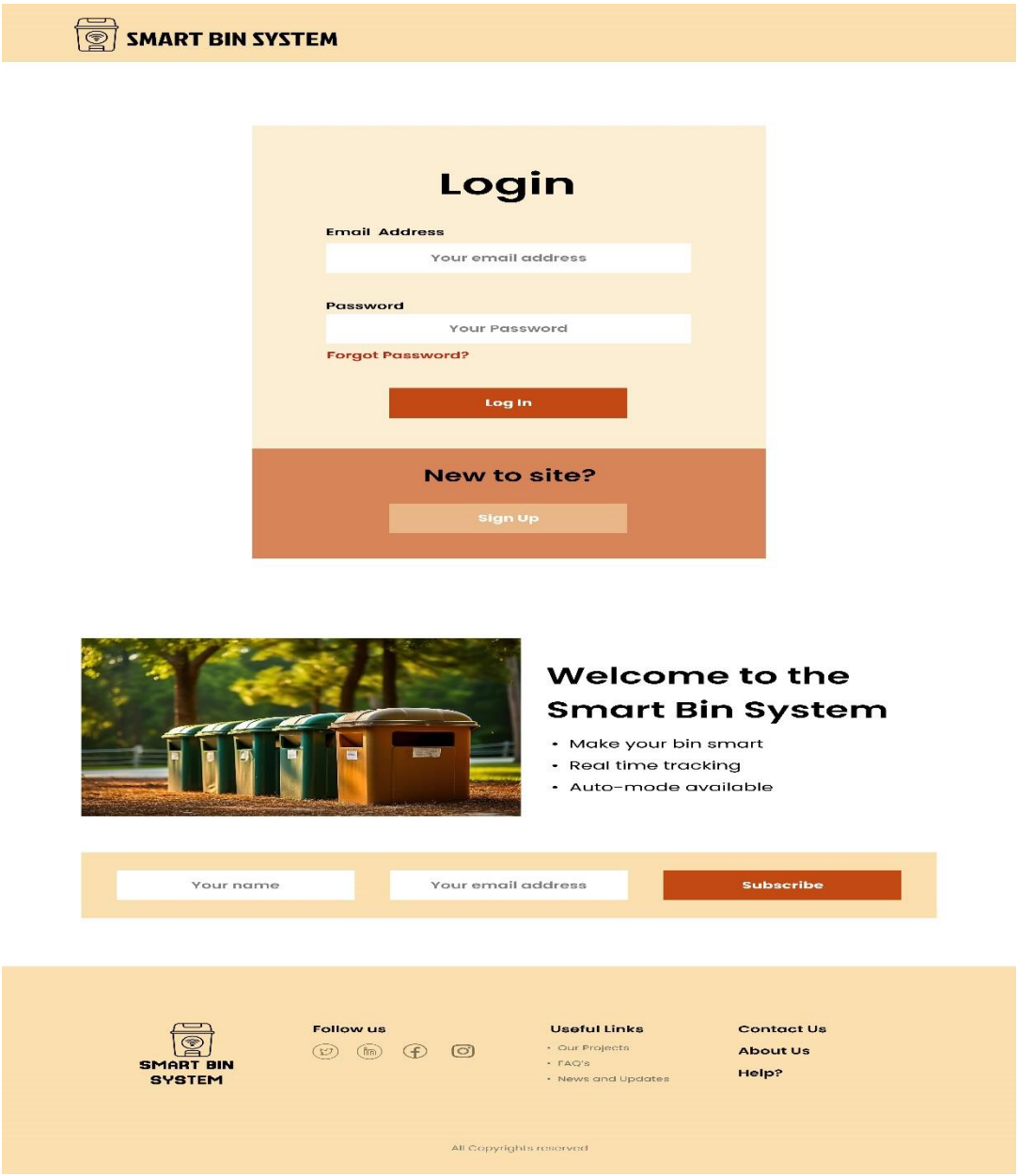


Figure 2: Login Page

3. DashBoard

The Dashboard Page offers a quick summary of the current bin statuses together with real-time monitoring visualisations that are colour-coded. Users can view the number of bins that are full, contaminated, or in need of maintenance on this page, which serves as the system's control centre. Weekly statistics are also included, displaying the frequency of pickups and the average amount of time bins are filled. Furthermore, the Recent Activity column records the most recent activities taken in relation to the bins (such as

reports of contamination or emptied bins). Facility managers may make fast judgements with the dashboard by using past data and the current bin status.

Functionality:

- Real-Time Monitoring: Uses colour-coded indicators to show bin statuses in real time (green for empty, yellow for filling, and red for full).
- Important Measures: displays critical data such as average pickup times, weekly pickups, and contamination alerts.
- Recent Activity Logs: For tracking reasons, this feature offers a history of recent bin-related activity.

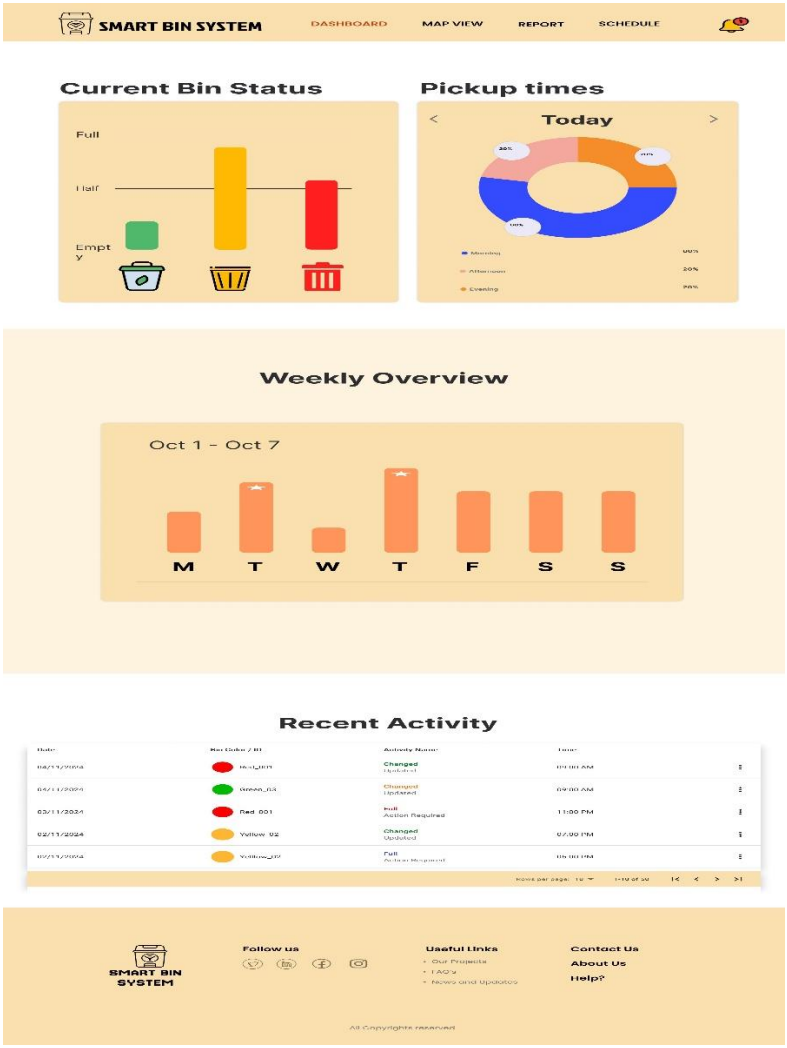


Figure 3: DashBoard Page

4. Schedule Page

Users can schedule waste collection and bin pickups with the help of the Schedule Page. Users can choose the bin ID, pickup date, and address to create a new schedule. To assist facility managers in staying organised, the page also includes a task list that shows scheduled and completed pickups in addition to a maintenance calendar. This website helps keep bins from getting too full or contaminated and guarantees that waste collection happens on schedule.

Functionality:

- Task Scheduling: By choosing the bin ID, pickup date, and address, users can arrange for bin pickups.
- Task List Management: Shows a list of all tasks, both finished and pending, together with their respective statuses.
- Updating a maintenance calendar might help you plan ahead by giving you a summary of the scheduled maintenance jobs and pickups.

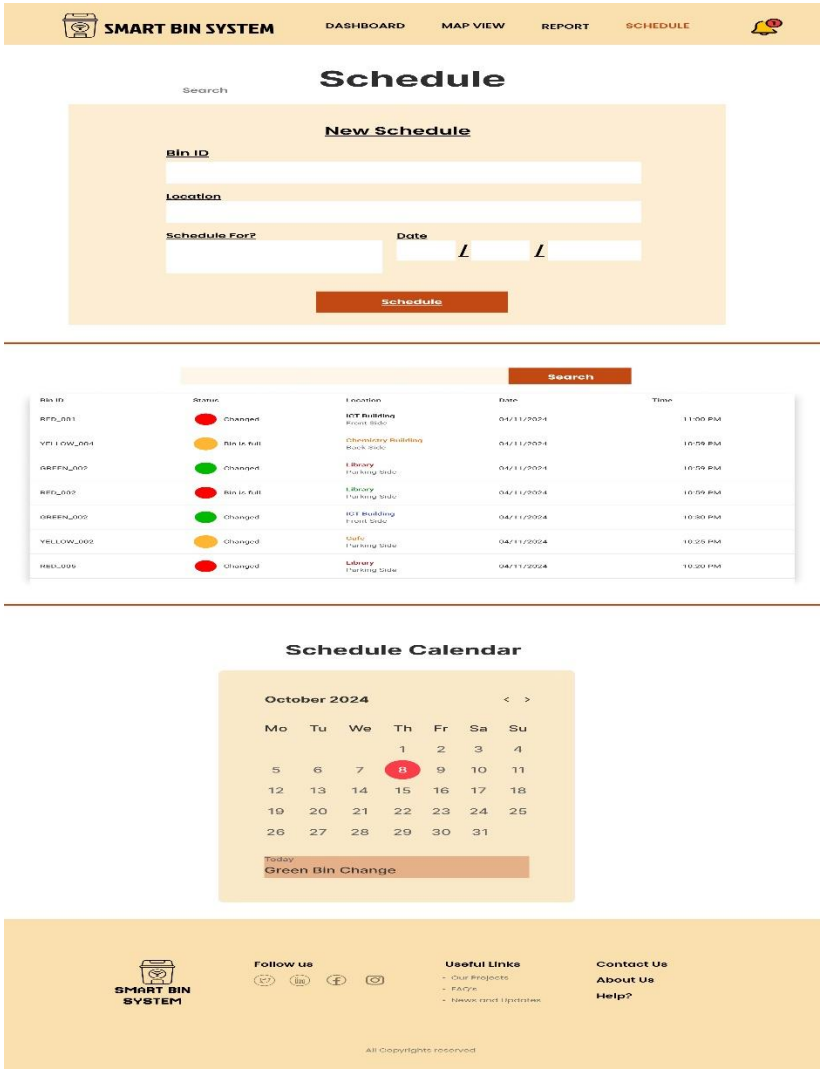


Figure 4: Schedule page

5. Real-Time Monitoring Page/ Map Page

A geographical representation of every bin on campus can be found on the Map View Page. Bin locations are shown on a map with colour-coded markers that indicate the status of each bin: green indicates an empty bin, yellow indicates a partially filled bin, and red indicates a full or contaminated bin. Using the search box at the top, users can look for bins based on status, bin ID, or location. Users can examine precise information about a bin, including its fill percentage, last collection date, and any contamination alarms, by clicking on the bin marker. Facility managers can use this portal to see the entire campus and see which bins need maintenance.

Functionality:

- Bin Location Display: Displays each bin's location on a map along with status markers that are colour-coded.
- Users can look for specific bins by location, bin ID, or status using the search functionality.
- Comprehensive Bin Information: When a user clicks on a bin marker, they can get comprehensive information about the state of that bin.

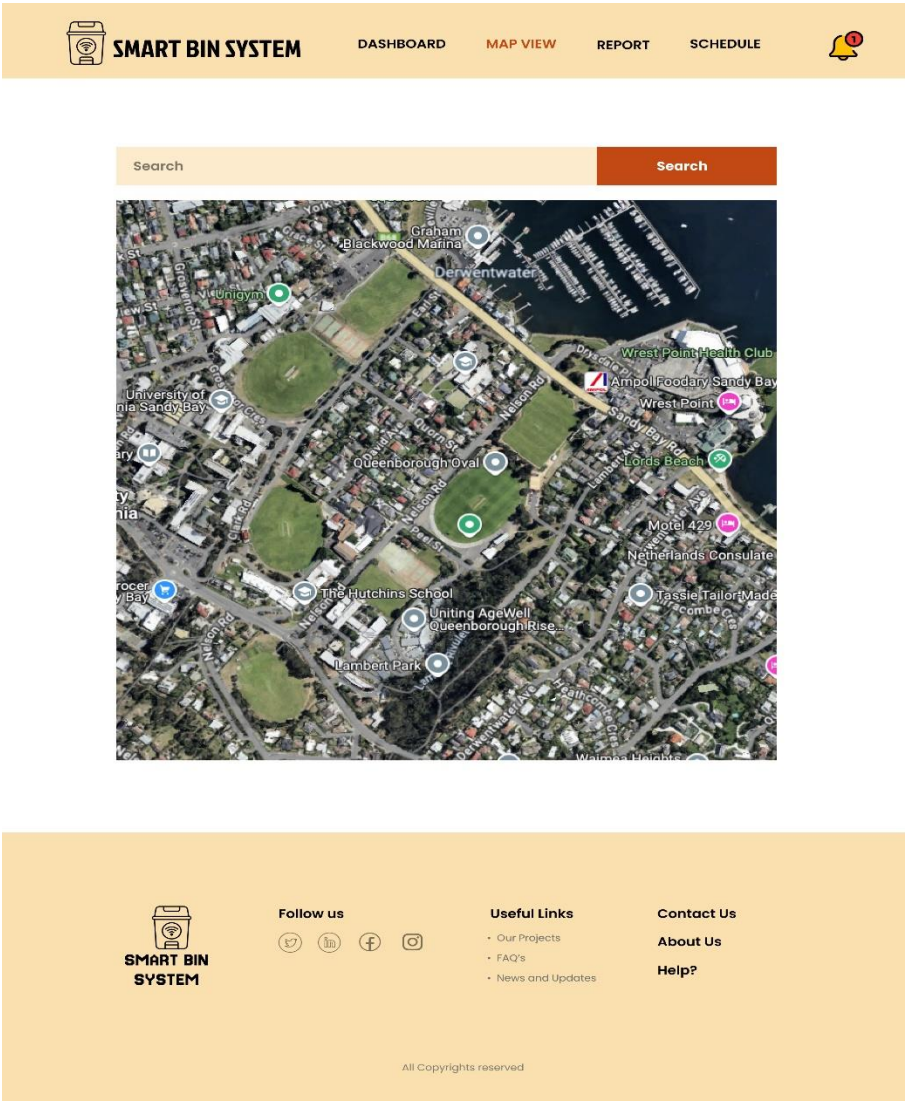


Figure 5: Bin monitoring / Map Page

6. Reports Page

Users can create personalised reports on waste collection performance, contamination levels, and bin utilisation using the Report Page. Users can make sure they can generate the precise data they require by filtering reports based on status, bin location, and date range. Additionally, the page offers the ability to export reports in a variety of formats, including Excel, CSV, and PDF, for additional analysis or record-keeping. Users find it easier to comprehend trends and patterns in bin utilisation over time when visual components like bar charts and line graphs are included.

Functionality:

- Custom Report Generation: Based on parameters like date, location, and bin state, users can generate comprehensive reports.
- Data Visualization: Provides graphical representations of bin usage, contamination rates, and other relevant parameters.
- Exporting reports: Reports can be exported for external use or archiving in a variety of formats, including PDF, CSV, and Excel.

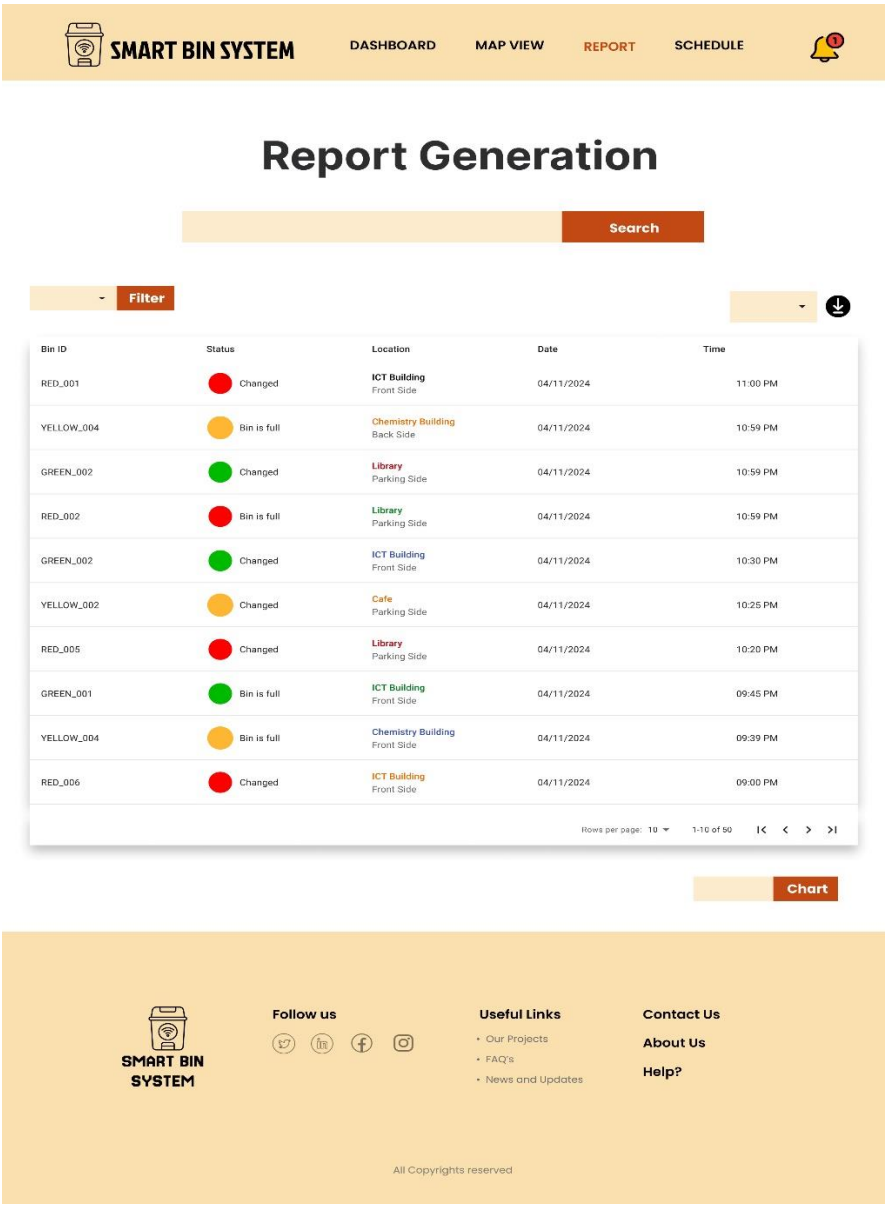


Figure 6: Report Page

7. **Notification**
   Users can receive notifications and updates on significant occurrences, such full bins or contamination detections, from the notification page. The notifications are arranged chronologically and include information about the type of alert along with a "View" button for further details. Facility managers may ensure that bins are dealt to quickly and effectively by using this page to remain on top of crucial concerns in real-time.

Functionality:

- Real-Time Alerts: Shows notifications for things like system updates, full bins, and contamination problems.

- Users can click on an alert to get additional details and take action using the Detailed Alert get feature.
- Filter and Search: To rapidly locate particular alerts, users can filter notifications based on date or type.

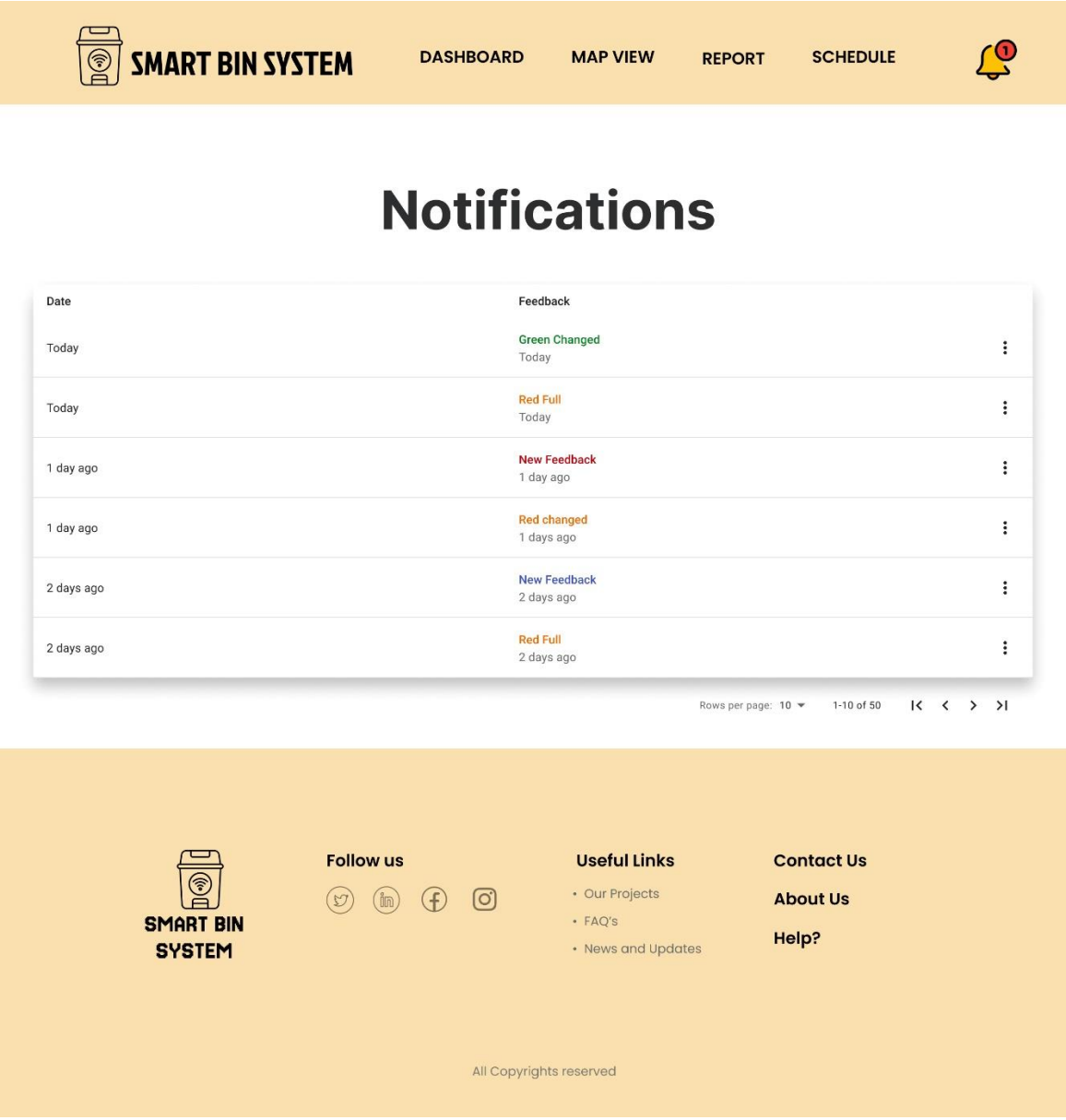


Figure 7: Notification Page

8. Feedback Page

Users can report problems, offer suggestions for improvements, and offer comments on the system via the comments Page. The name, comment, date, and status (i.e., whether the feedback has been handled) of the student are displayed in a table format beside the feedback. Users have the option to filter results by date or look for certain comments. By

providing a forum for user interaction, this website guarantees that the system will keep getting better thanks to user feedback.

Functionality:

- Feedback Submission: Users are able to provide comments, recommendations, and bug reports regarding the system.
- Feedback Tracking: Provides a list of all comments made, along with an indication of when they were answered.
- Users have the ability to search for and filter feedback based on dates or other parameters.

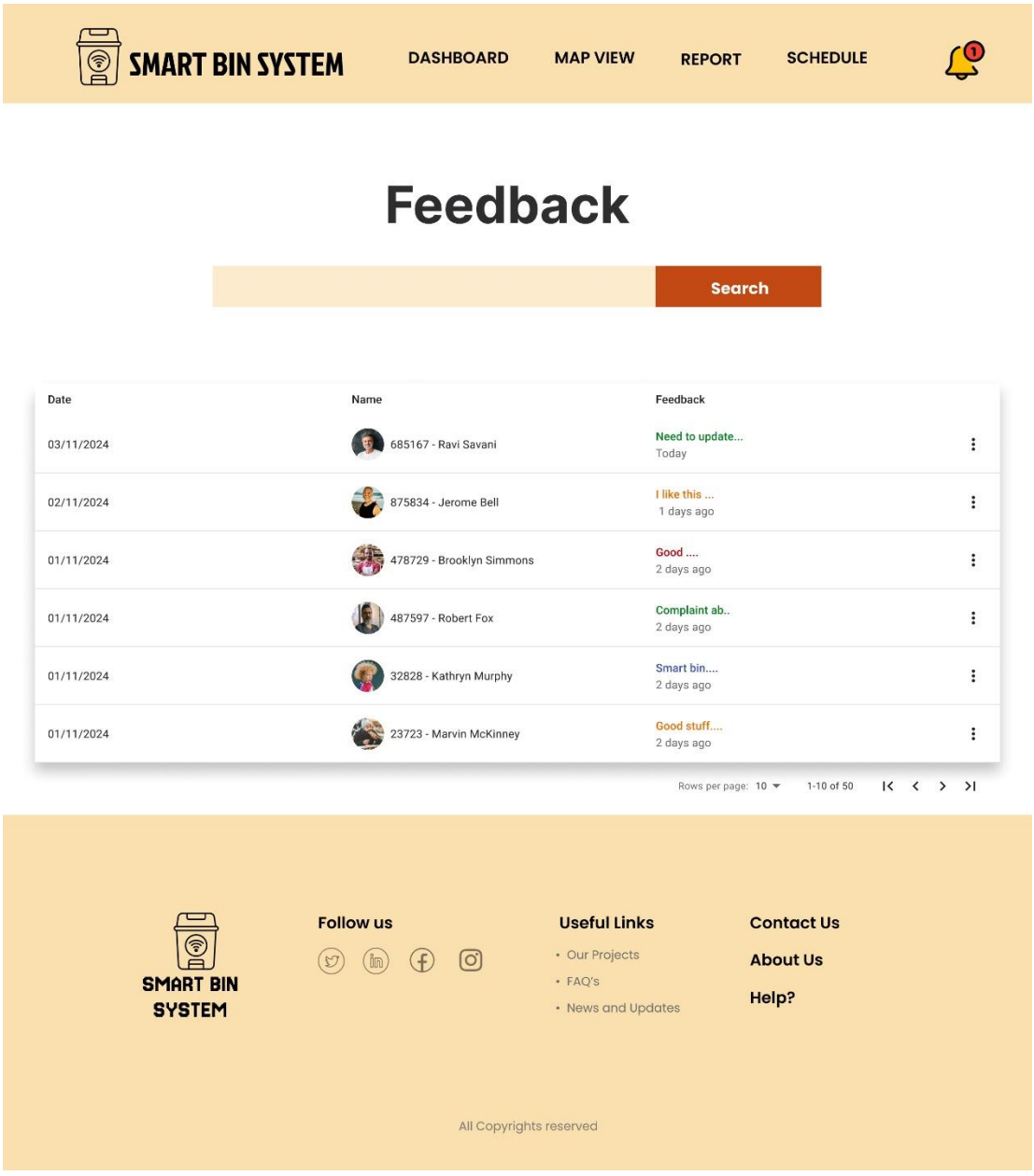
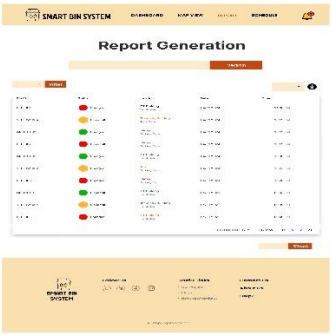
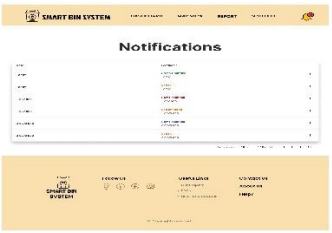
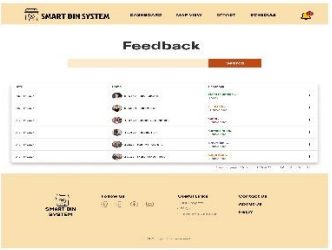


Figure 8: Feedback Page

Final Hi-Fi Prototype Layout:







Final Hi-Fi prototype Figma link :

https://www.figma.com/design/bSQpZt1CkkXq7nLp5qk7ZM/FInal-Figma?node-id=203-7258&node-type=canvas

Individual Reports:

Group Member 1 (Parth Patel):

Contributed to the design and development of key user-facing pages, ensuring a smooth and user-friendly interface across all aspects of the system. The contributions focused on creating intuitive navigation and providing clear access to real-time data, reports, and system information.

- **Home Page:** Designed the home page to provide users with an immediate overview of the Smart Bin Monitoring System. It included quick access buttons for key features, allowing users to navigate seamlessly across different sections of the system.

- **Login Page:** Developed a secure and simple login interface, focusing on ease of access and password recovery options for users, ensuring a smooth authentication process.

- **Monitoring Page:** Created a real-time bin monitoring interface with color-coded indicators for bin statuses and contamination alerts. The page allowed users to monitor bin statuses at a glance and take immediate action when necessary.

- **Schedule Page:** Designed to give users a clear overview of chores that are due and those that have already been accomplished, the scheduling interface allows users to create, view, and manage bin collection schedules.

- **Report Page:** Designed the report generation interface where users could customize and download reports on bin usage, contamination, and waste collection trends. Visual data representations, such as bar charts and line graphs, were used to help users analyze the data effectively.

- **Success Story Page:** Developed the success story page to highlight key achievements in waste management and sustainability efforts, providing users with a motivational overview of how the system has improved waste management processes.

- **About Page:** Created the about page to give users an understanding of the system's purpose, development process, and the team behind the Smart Bin Monitoring System.

Here is the Report of Parth Patel (Individual):

Design Process:

The proposed Smart Bin System brings a shift in focus placing real-time data from sensors installed within bins placed across the university into a visual setting. The interface need to be as simple as possible to work with and adapted to maintenance staff and sustainability teams who require real-time data on different waste levels and contamination. Here's how the design was approached:

1. Persona Development:

The direct user of the Smart Bin System interface is university maintenance people. Everyone requires the real-time information about the condition of waste bins. Their primary tasks include:

- Supervising the general bin fill up levels in different facilities.
- Being notified when bins are full or are carrying dirt in them.
- Responding to alarms to contain overflows of wastage, or the spread of contaminants to other areas.

2. Scenario Creation:

One of the most common cases can be the moment when a member of the staff comes to work and enters the system to find out which bins should be addressed as soon as possible. The system should display:

- The levels of fill at which all bins that are being monitored.
- Notifications that the bin concerned contains prohibited materials.
- Animated signboards indicating bins' position and its availability for use in real time.

3. Sketch Development:

The graphical user interface was simplified in its overall appearance as well as the functionality of all controls used. The core elements of the design include:

- Real-time bin status on a dashboard, in terms of fill level with such color codes: green for low fill level, yellow for nearing full, red for full and or contaminated).
- Al Map view of campus with bin locations highlighted. Further details, including the fill level percentage and contamination status, are available when the user clicks on a bin.
- There are always alerts and notifications so that the priority work is clearly visible at the top of the screen space.

4. Visual Design Choices:

To enhance usability, the design focuses on:

- Patterns used in order to identify bin status so that there is contrast between different states.
- Easy to click buttons that are large enough to be clicked with a mouse on the desktop as well as with a finger on a smartphone.
- Simplified design to reduce incidence of cluttering the screen with unnecessary information.
-

5. System Integration:

- first to note that the interface interacts with sensors and cams located in the bins. Information collected from such sensors is processed and presented in the user interface for decision-making by the staff. Privacy issues were solved by putting measures that made it impossible to capture personal details of the individuals, thus meeting legal requirements on the data privacy act.

6. Designs Lo-fi from Balsamiq Design:

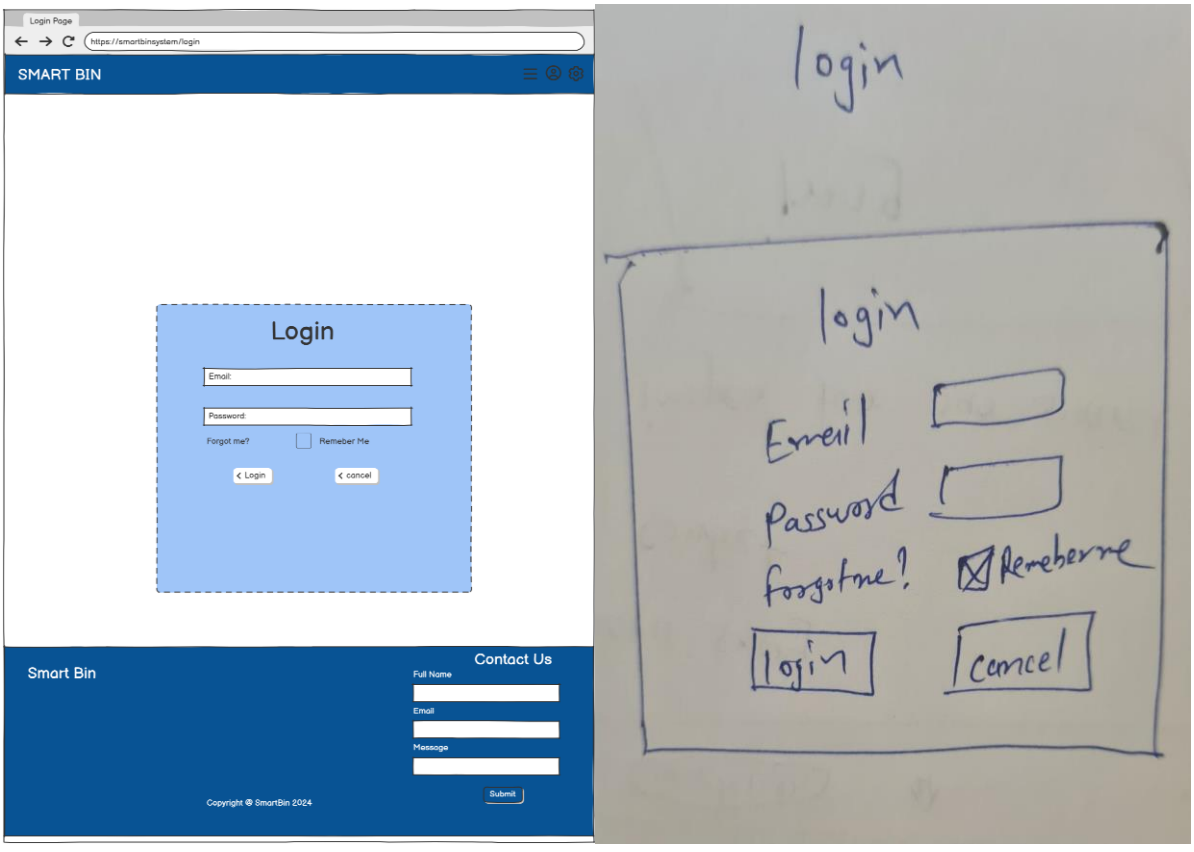


Figure 1: Login Page

1. **Login Page**:

- This page (Figure 1) is a straightforward login screen with fields for "Email" and "Password" and options for "Remember Me" and "Forgot Password?". The design is focused on ease of use with clear navigation and simple access for users logging into the system.

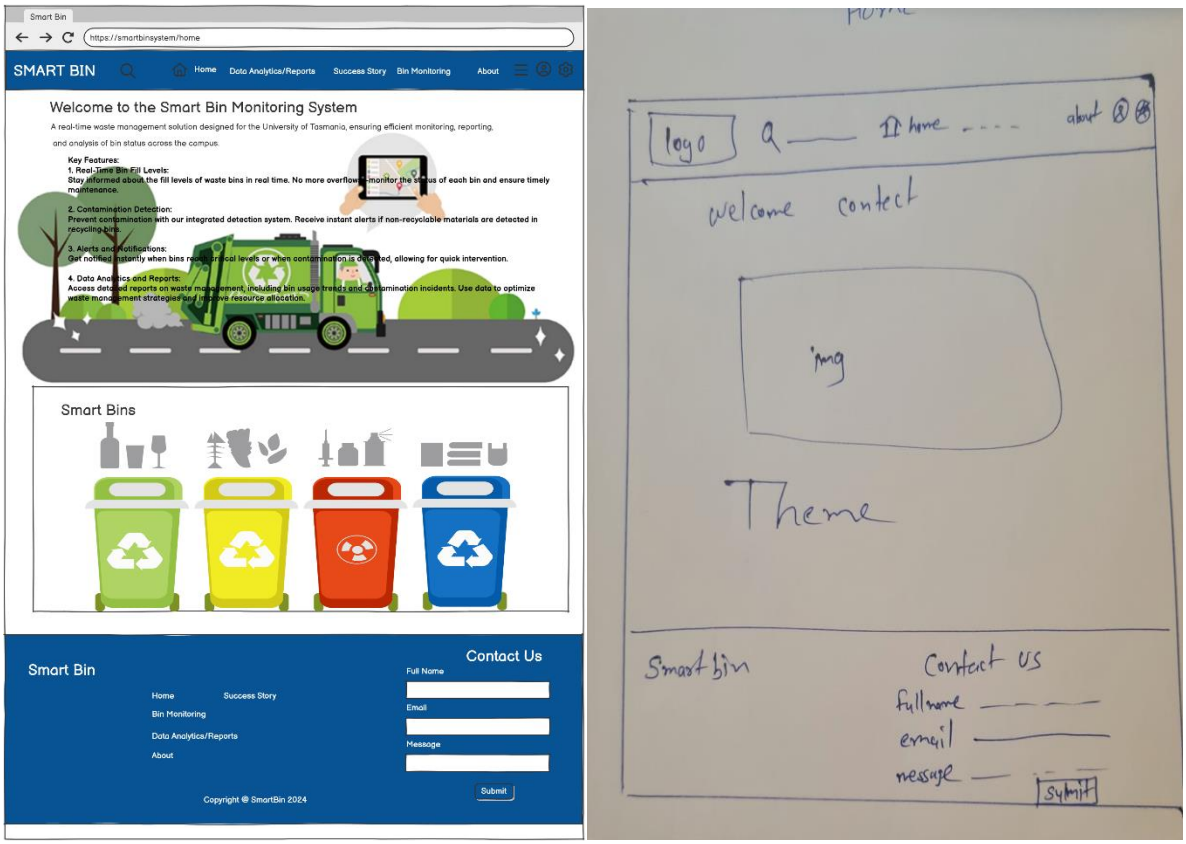


Figure 2: Home Page

2. **Home Page**:

- The home page (Figure 2) welcomes users to the Smart Bin Monitoring System and highlights key features such as real-time bin fill levels, contamination detection, and data

analytics. The layout is clean and designed to provide quick access to core features of the system.

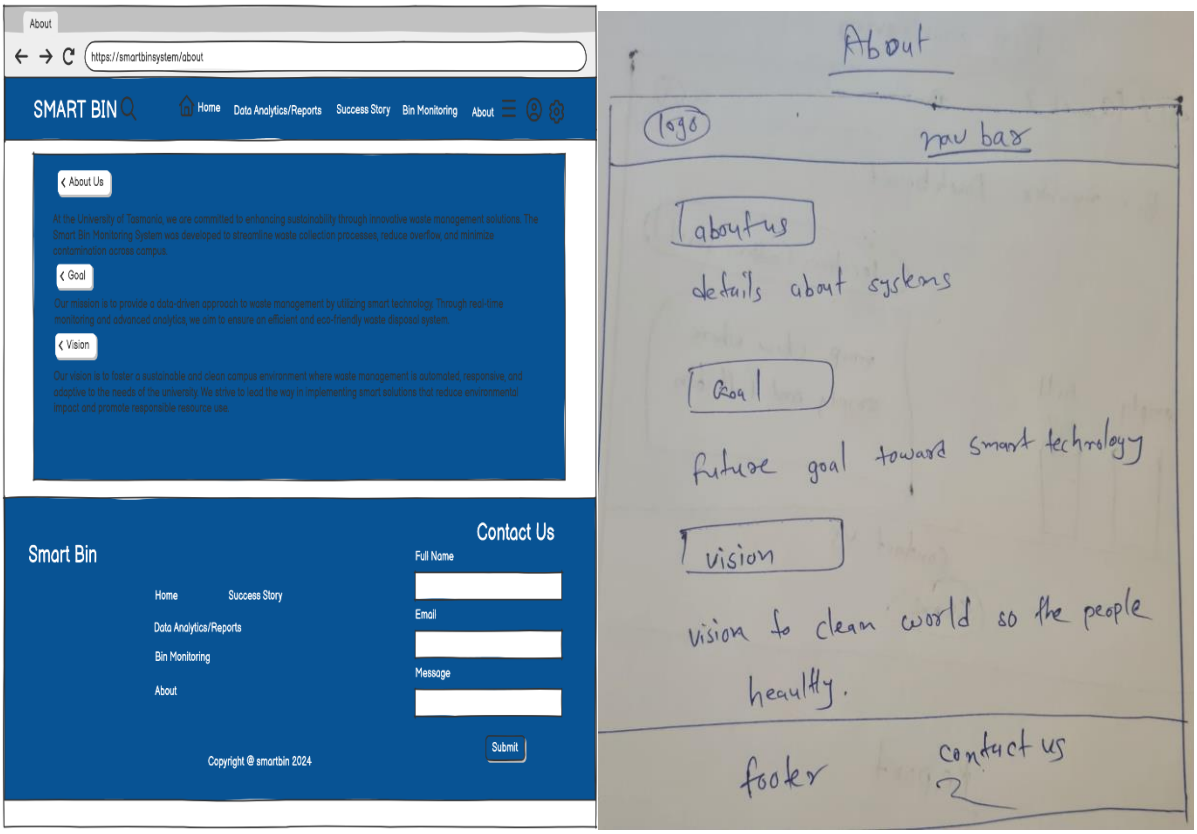


Figure 3: About Page

3. **About Us Page**:

- This page (Figure 3) provides information about the system's goals and mission, emphasizing sustainability and efficiency in waste management. The design is informative, with sections on the system's vision and goal.

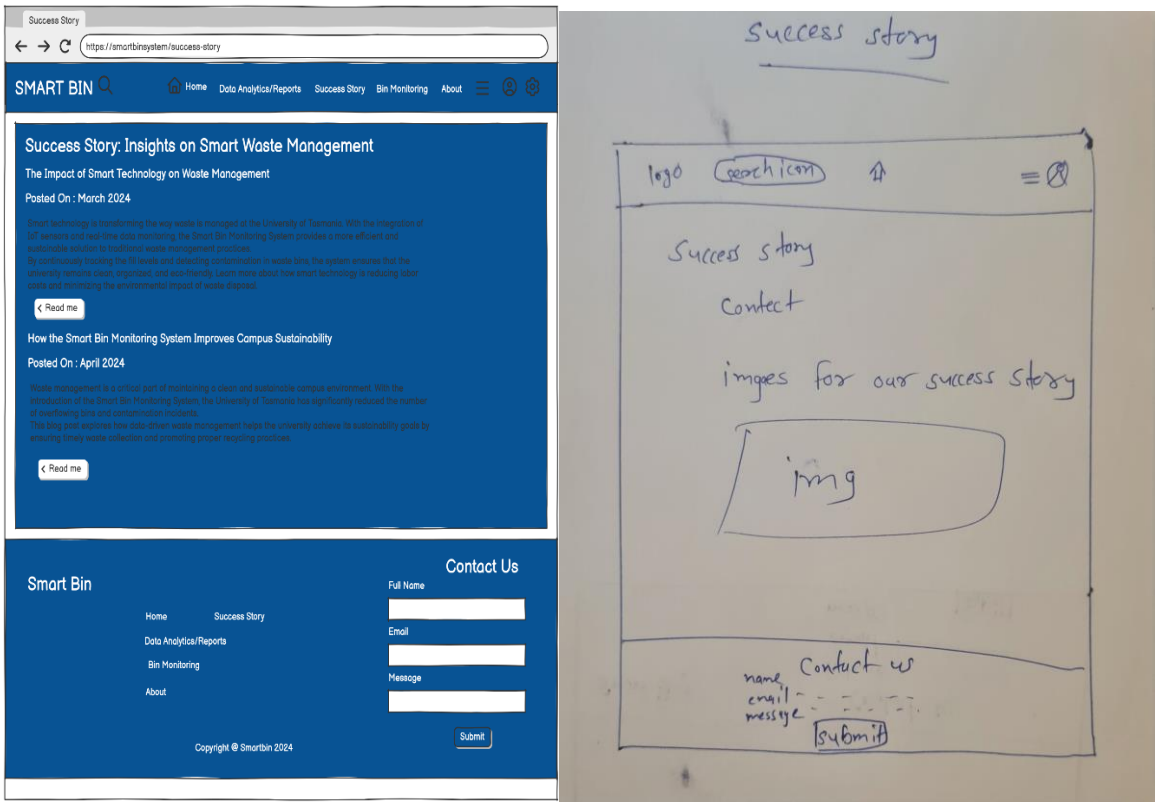


Figure 4: Success Story

4. **Success Story Page**:

- The success story page (Figure 4) showcases the impact of the Smart Bin System, describing how it improves waste management at the University of Tasmania. This page highlights how smart technology is transforming traditional waste management processes.

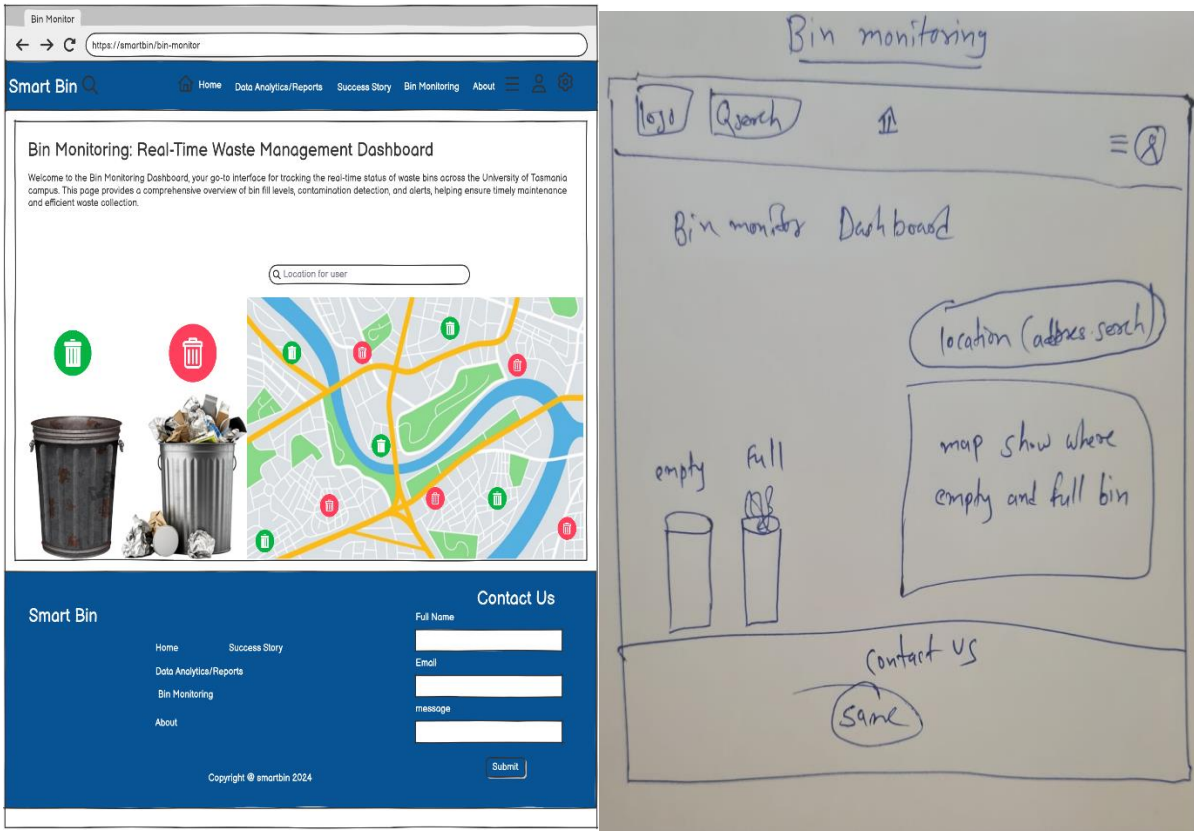


Figure 5: Bin Monitoring Page

5. **Bin Monitoring Page**:

- This page (Figure 5) is the core dashboard of the Smart Bin System, showing real-time bin statuses, including their fill levels and contamination alerts. The design includes an interactive map for bin locations, providing an intuitive interface for maintenance teams to track and manage bin statuses.

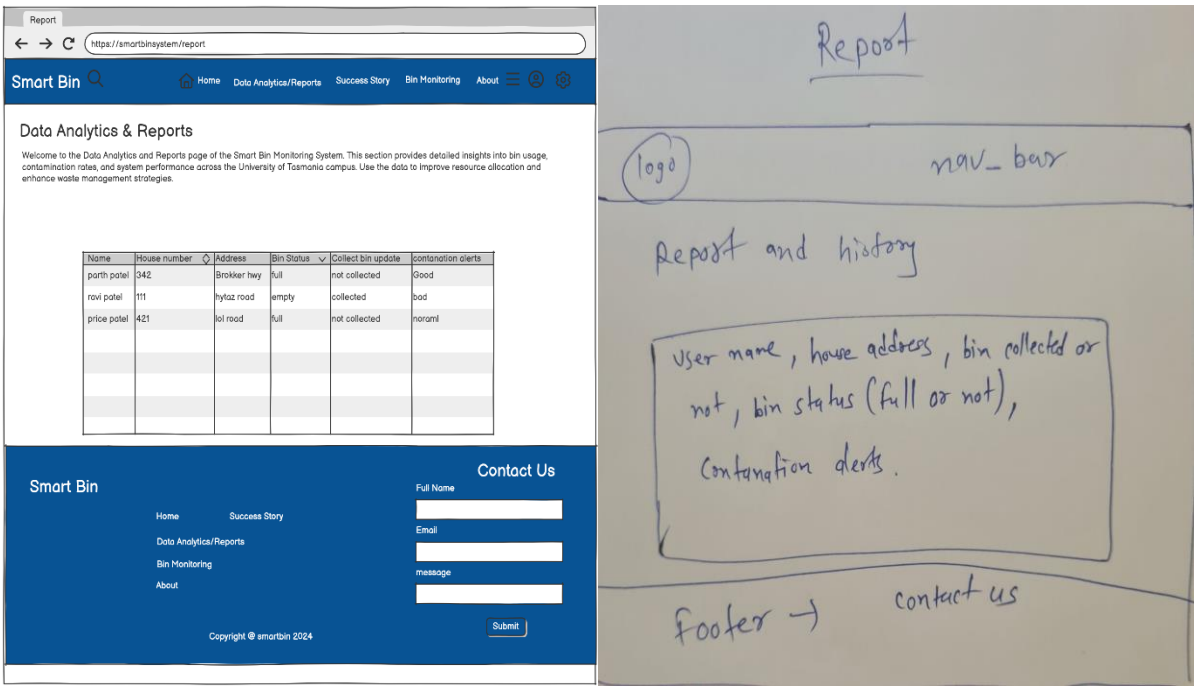


Figure 6: Data Analytics and Reports Page

6. **Data Analytics & Reports Page**:

- The analytics page (Figure 6) provides detailed insights into bin usage, contamination rates, and performance metrics. It helps users analyze data and optimize waste collection strategies based on the information provided.

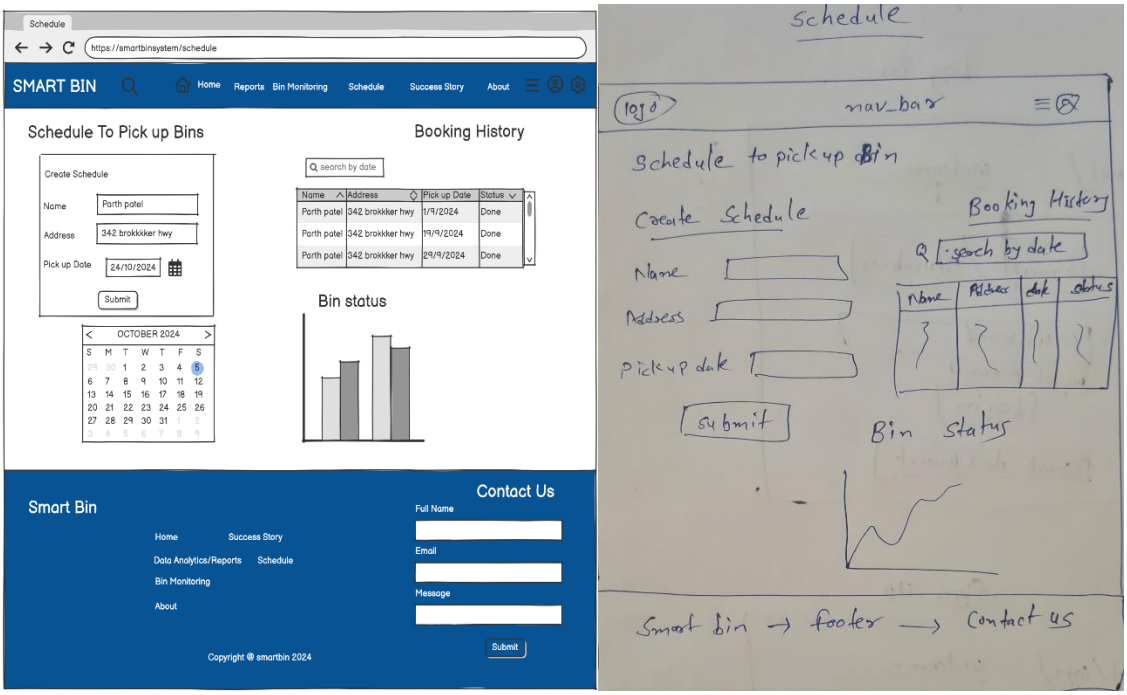
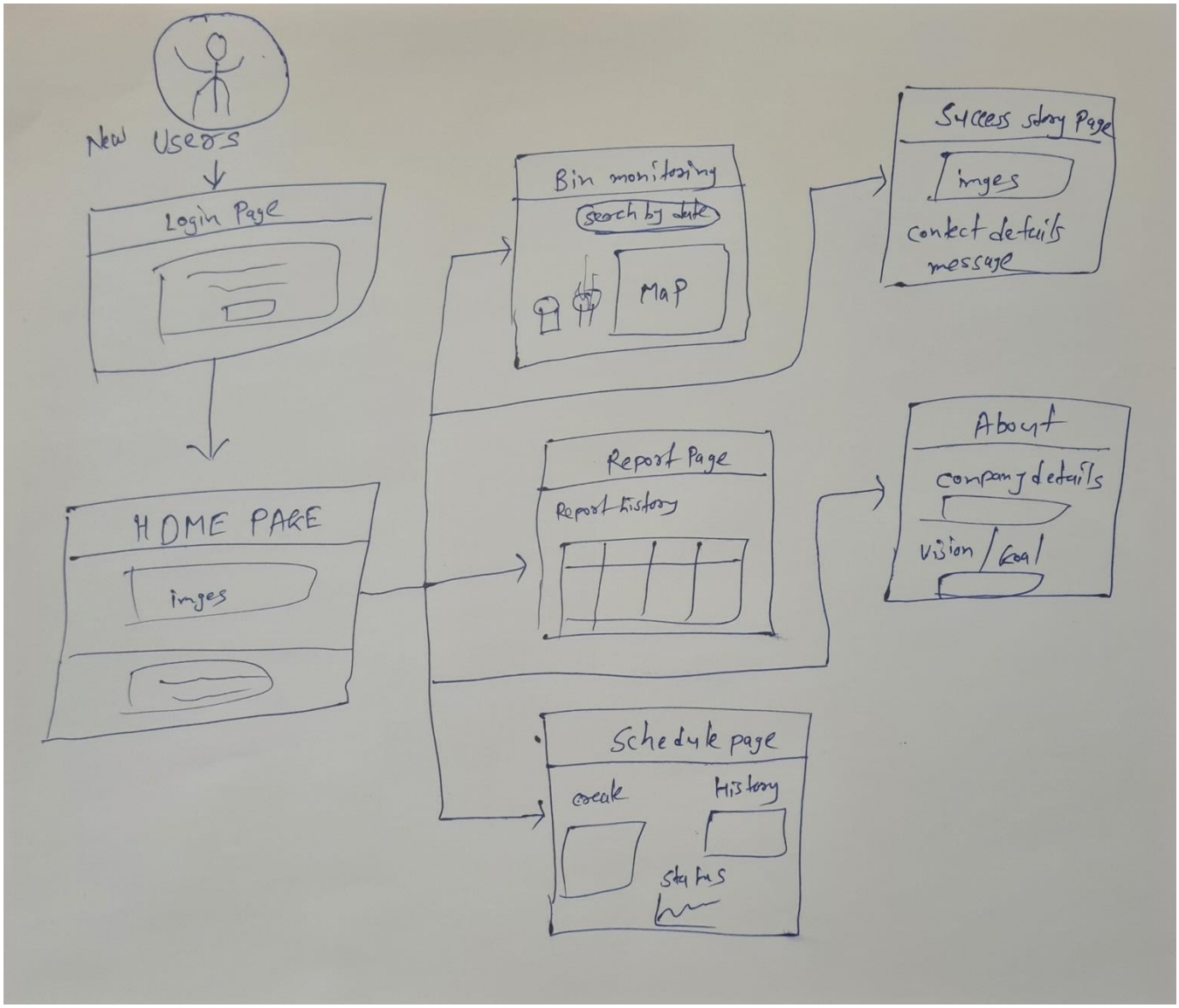


Figure 7: Schedule page

7. **Schedule Page:**

- **Create Schedule**: Input fields for name, address, and a date picker to schedule a bin pickup, with a submit button to confirm the details.
- **Booking History**: A table that lists past or upcoming bookings with name, address, pickup date, and status (e.g., Done).
- **Bin Status Visualization**: A bar chart displaying bin fill levels, helping users assess which bins need attention.
- **Calendar**: A monthly view for scheduling future pickups.

Final Lofi Sketch To demonstrate :



Design Principles

- The principles of Fitts's Law were used to specify dimensions and positions of buttons and clickable components for easy and rapid use.
- Actualization of Hick's Law was important in containing the number of options made available in the menu.
- Consistency: This acts as steps that make different web pages appear similar to reduce confusion that may result from learning of new interfaces every time one accesses a new page.
- Accessibility: WCAG guidelines have been adopted in the design of the site to cater for people with disabilities, where techniques such as high contrast and larger clickable areas is used.

Technology Acceptance design :

- Perceived ease of use: Through the intuitive design, there will be less demand from users, which enhances user satisfaction.
- Perceived usefulness: It also provides efficiency, which enhances the perceived worth of the web site.

Group Member 2 (Ravi Savani):

Contributed significantly to the development of core system functionalities, focusing on both user interaction and data management features. The design approach emphasized accessibility, real-time data tracking, and an intuitive interface.

- **Login Page:** Developed a secure login interface that provided seamless user authentication, ensuring quick access to the system for registered users.
- **Sign Up Page**: Created the user registration interface, making it easy for new users to create accounts by entering essential details, ensuring proper validation of information.
- **Dashboard Page:** Designed the main dashboard, providing a comprehensive overview of bin statuses, key metrics, and recent activity logs, allowing users to monitor real-time data on waste management.
- **Schedule Page:** Built the scheduling interface where users can create, view, and manage bin pickup schedules, providing a clear overview of upcoming and completed tasks.
- **Report Page:** Developed the report generation tool that allows users to create custom reports based on bin usage, contamination rates, and collection efficiency, with options to export data in various formats.
- **Map Page:** Designed an interactive map that displays bin locations and statuses across the campus, using color-coded markers to help users quickly identify bins that need attention.
- **Notification Page:** Created the notification system that alerts users to important events like full bins and contamination detections, ensuring timely action on critical issues.
- **Feedback Page:** Developed the feedback interface, allowing users to submit comments, suggestions, or report issues, with a system for tracking and addressing user feedback.

Here is the Report of Ravi Savani (Indivdual):

1. ## Sign-Up and Sign-In Pages:

Reasoning by Design
Users can create new accounts or log in to the system with ease using the straightforward, user-friendly interface seen on the sign-up and sign-in sites. Every page is made with fewer distractions and well-defined input areas.

Principles of HCI/UX Employed error correction The forms' clear fields and labels assist users in inputting information without making mistakes.
Consistency: A seamless user experience is ensured by the design's consistency on both the sign-up and sign-in pages.

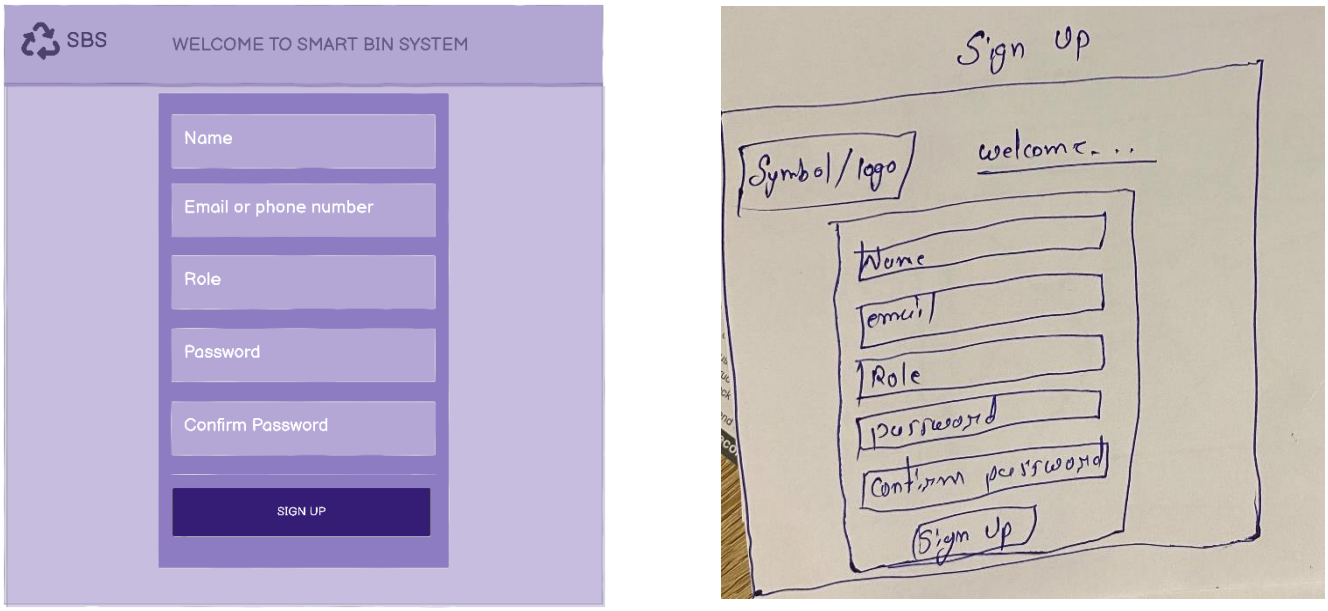


Figure 1: sign up

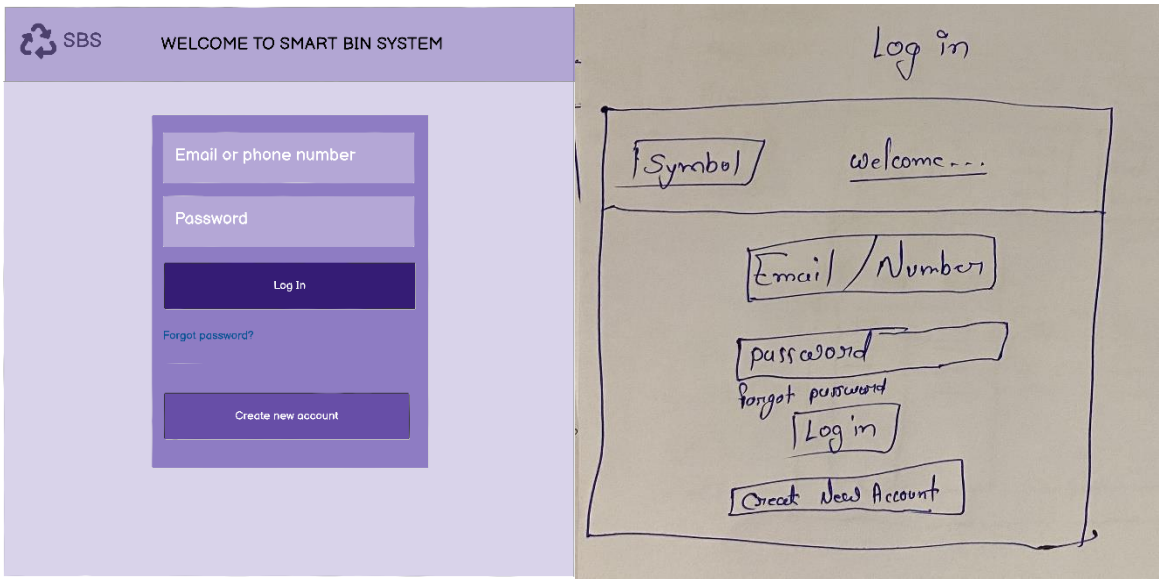


Figure 28: sign in

2. **Dashboard :**

Reasoning by Design

Weekly statistics, recent activities, and bin statuses are all summarised on the dashboard. Simple graphs and pie charts are used to visualise key parameters, such as average replace times and average pickup times, providing customers with rapid insights into waste collection trends.

Principles of HCI/UX Used Feedback: To guarantee that customers are always aware of system performance, the dashboard offers real-time data on bin statuses and collection parameters.rds and consistency: To guarantee user familiarity, the design makes use of common data visualisation techniques (pie charts, bar graphs)

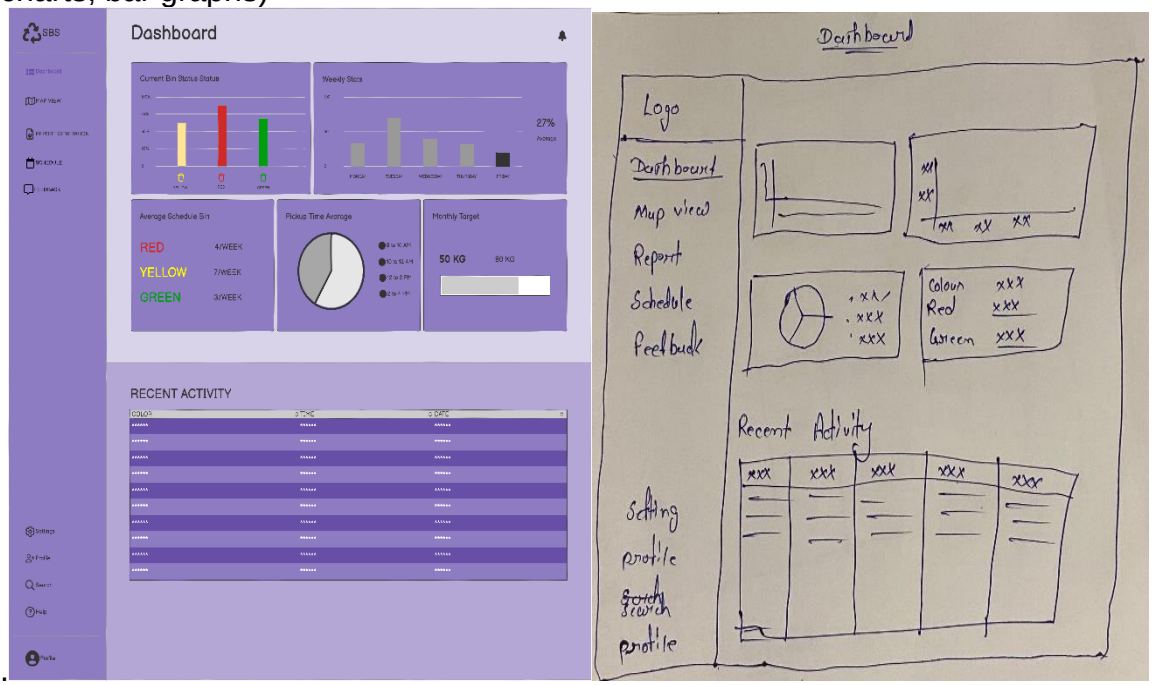


Figure 3: DashBoard

3. **Map View:**

Reasoning by Design

The map view offers a geographical representation of bin statuses across a campus. The bins are color-coded to show their current state (green, yellow, red), and users can search for specific bin locations or filter by color.

HCI/UX Principles Used

Spatial organization**:** The map is designed to reflect real-world locations, making it easier for users to identify where bins are and their statuses.

Aesthetic and minimalist design**:** The map is simple yet effective, reducing unnecessary clutter and focusing on bin locations and statuses.

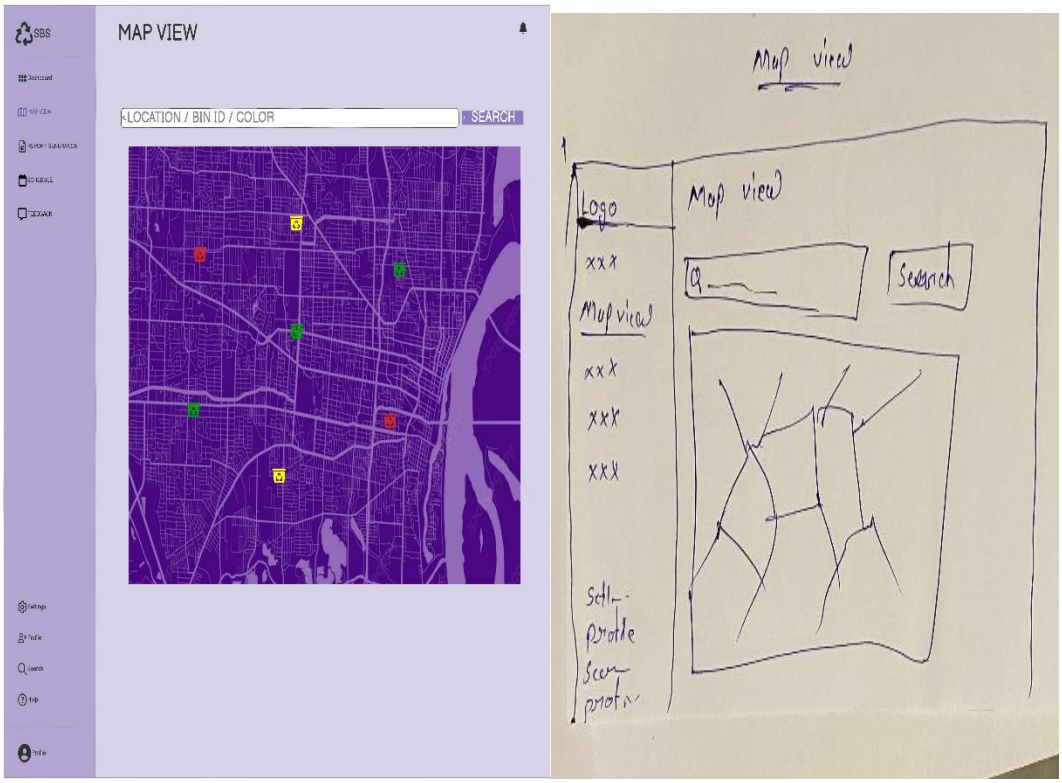


Figure 4 : map view

4. **Report :**

Reasoning by Design

Facility managers can generate and download reports based on consumption figures, contamination alarms, and bin statuses using the report generating tool. Users can sort the design by bin colour, status, and location using a table arrangement. The "Download" button makes exporting reports easier.

Principles of HCI/UX Employed

Recognition over recall: Users can easily build the reports they require with the help of the clear labelling and easy navigation of the report generating system. User control: Users can create live graphs or export reports, giving them more options for data analysis.

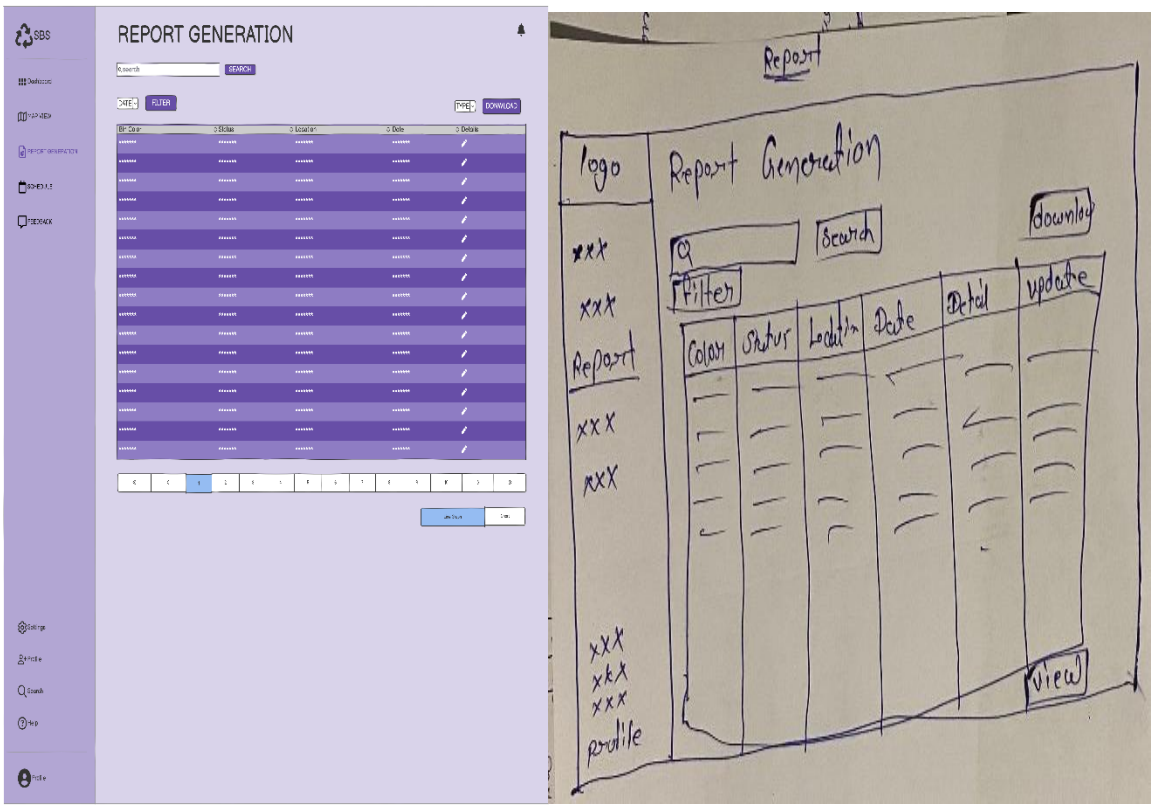


Figure 5:Report

5. **Feedback** :

Reasoning by Design

Users can report problems or offer recommendations about the system or bins on the feedback page. Feedback is arranged in a table format according to student names, comments, dates, and statuses, which facilitates fast filtering, sorting, and response by administrators.

Principles of HCI/UX Employed

Flexibility and ease of use: Using parameters like date or status, administrators can rapidly search, filter, and reply to comments in this table.
User freedom and control: Users can choose how to view feedback, which improves their ability to interact with the system.

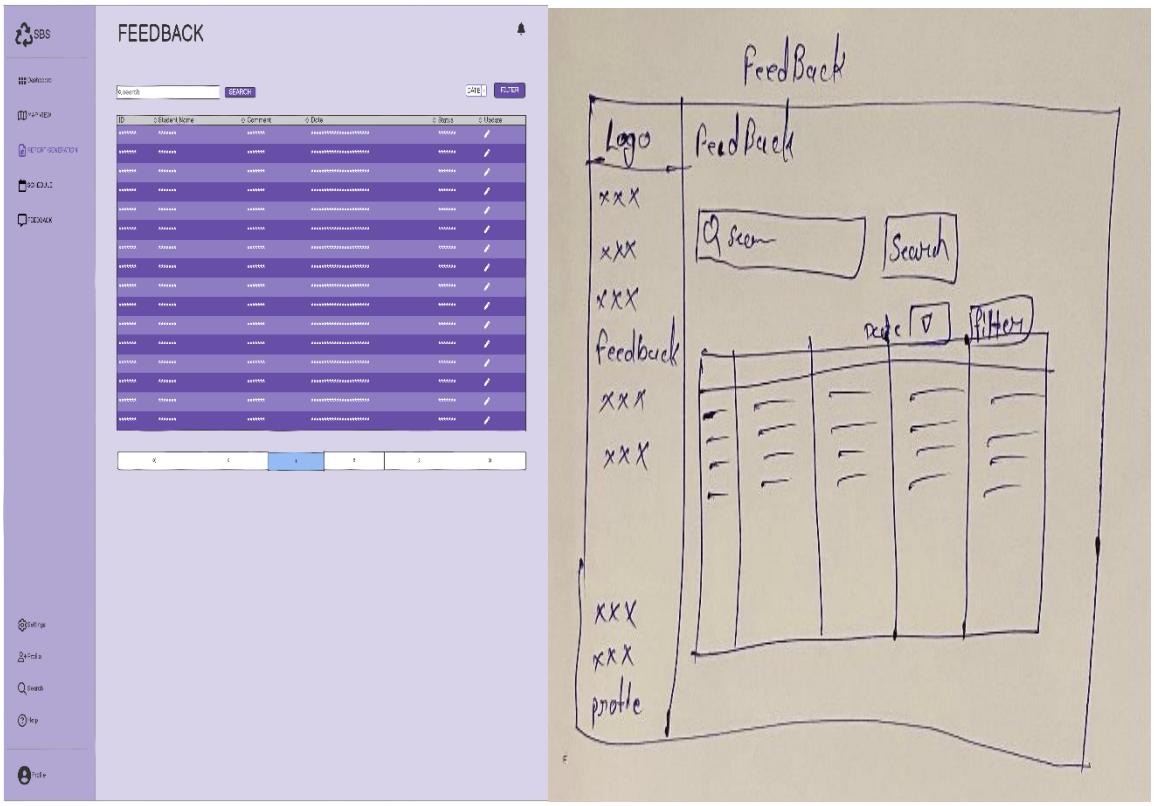


Figure 6: FeedBack

6. **Notification :**

Reasoning by Design

The notification page is intended to give users fast updates on contamination alerts, scheduling modifications, and bin status. With the help of straightforward text and a "Action" column with clickable links, readers can quickly obtain further information or take appropriate action. By keeping the design simple, users are spared from information overload and can concentrate on important warnings alone.

Principles of HCI/UX Employed

Visibility of system status: The user receives prompt feedback about any modifications or problems (e.g., bins filling up, schedule alterations).
Recognition trumps recall: Notifications are visible to users without requiring them to remember where they are, which ensures faster reaction times.

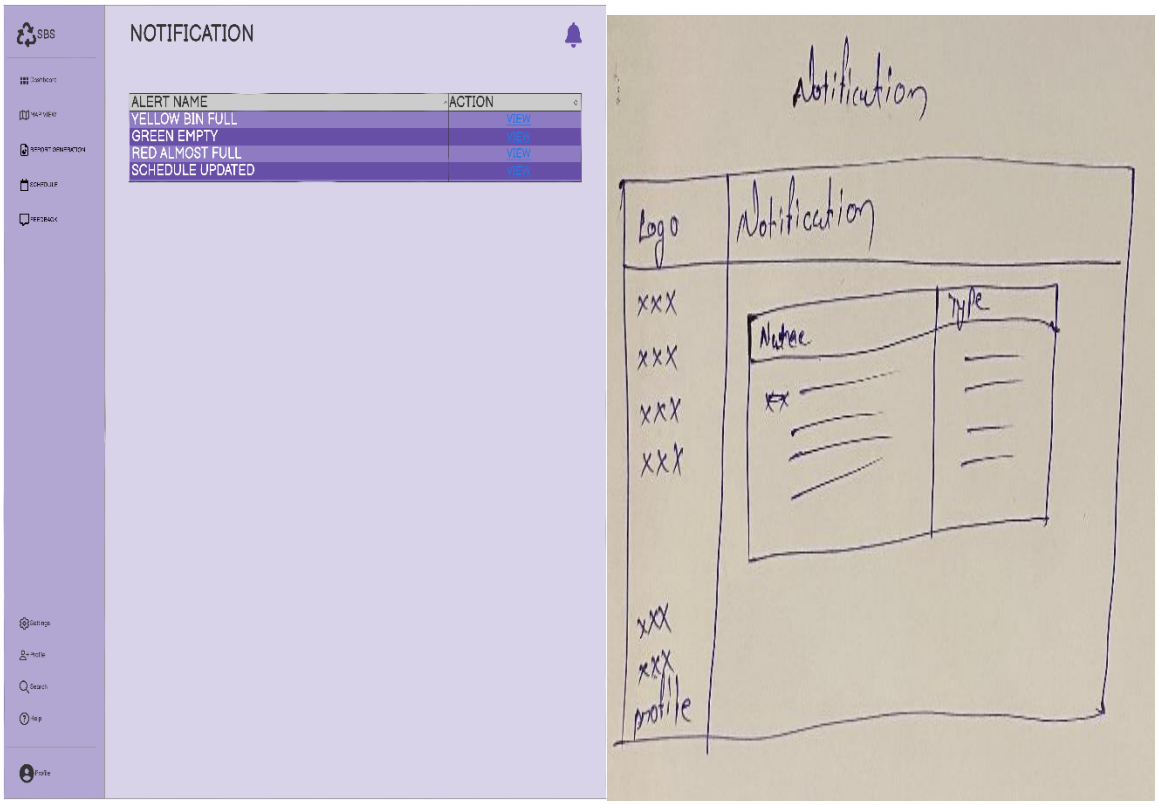


Figure 7: Notification

7. **Schedule** :

Reasoning by Design
The schedule page allows administrators to set up collection schedules based on bin IDs and locations. A maintenance calendar is also included on the page to help with scheduling and managing collection routes.

Principles of HCI/UX Used User control: Administrators have complete control over maintenance and bin collection schedules via the schedule page.
Flexibility: Schedules can be readily changed, and users can instantly update the status of work.

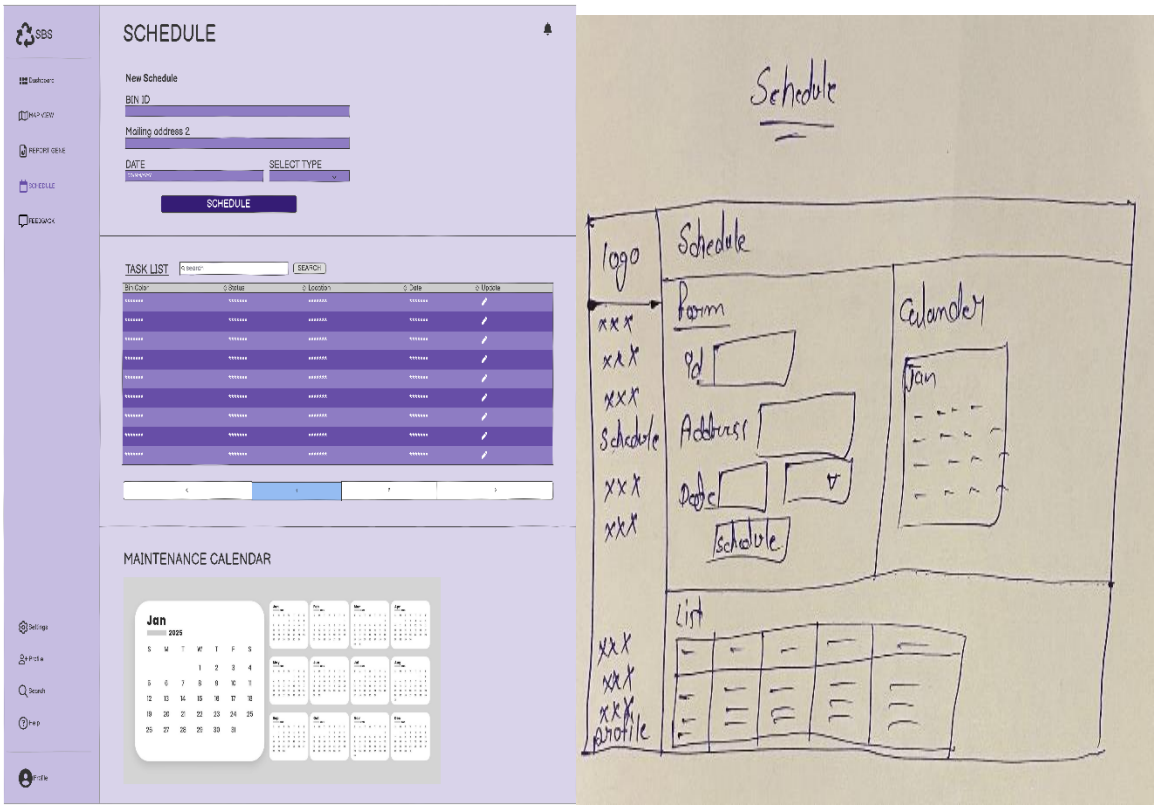
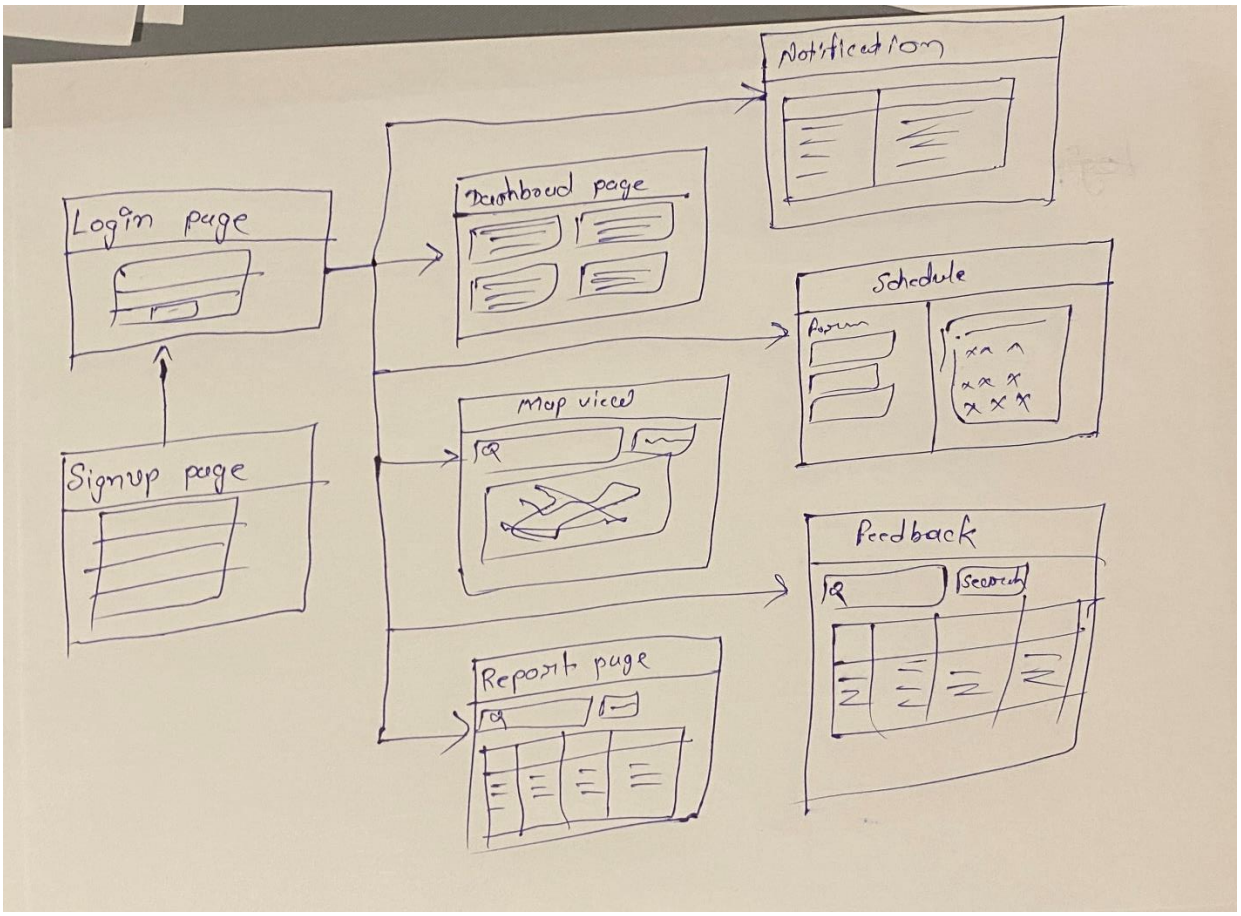


Figure 8: Schedule

Final Sketch :



Group member 3 (Prince Patel) Report:

Login Page Design

The login page provides a simple and secure entry point for users who access the Smart Bin System using their university-provided credentials.

Key Components:

- **Username and Password Input Fields**: Two input fields labeled "Username" and "Password." The user will enter their university credentials into these fields, ensuring the information is processed securely.
- **Login Button**: Below the input fields, a large, clearly visible "Login" button allows the user to submit their credentials and proceed to the dashboard.
- **Forgot Password Link**: Positioned under the login button, a "Forgot Password?" link redirects the user to the forgot password page if they have trouble logging in.

Design Considerations:

- **Usability**: The layout of the login page is kept minimal to reduce cognitive load, with prominent input fields and action buttons. The login flow is clear, with easy navigation to the forgot password page if needed.
- **Security**: By requiring university-issued credentials, this system provides secure access and maintains user data confidentiality.

3. Forgot Password Page Design

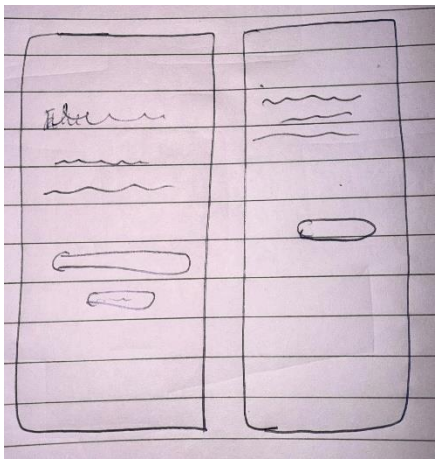
The Forgot Password page helps users recover their account in case they've forgotten their login credentials.

Key Components:

- **Email Input Field**: The user is prompted to enter their email address associated with their account.
- **Send Reset Link Button**: Once the email is entered, the user can click the "Send Reset Link" button, triggering an email with reset instructions.
- **Success Page**: After successfully sending the reset link, the user is redirected to a confirmation page that informs them the email has been sent. This page includes a button labeled "Back to Login" to help the user return and log in after resetting their password.

Design Considerations:

- **Efficiency**: The process for resetting the password is streamlined to minimize frustration. The user only needs to enter their email, and the system handles the rest.
- **Feedback**: The user is given immediate feedback with a confirmation message, ensuring they know the reset process was successful.



4. Dashboard Design

The dashboard is the central hub of the Smart Bin System, where users can monitor bin statuses, perform searches, and view notifications about specific bins.

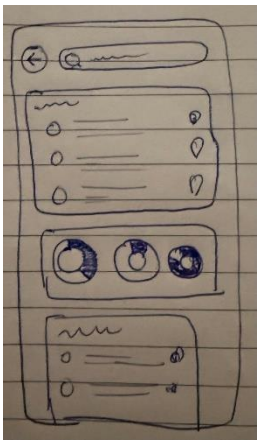
Key Components:

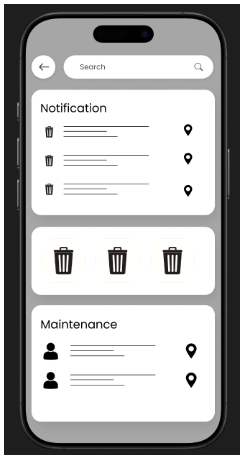
- **Search Bar**: Positioned at the top of the page, the search bar allows users to quickly search for bins by bin status, type, or location. Users can enter keywords such as "Green Bin" or "Location ID" to filter results.
- **Notification Box**: Below the search bar is a notification area displaying key details of specific bins. Each notification shows the **Bin Type**, **Bin ID**, **Location ID**, and **Bin Status**. The last icon allows the user to tap and view the bin’s location on a university map.
- **Bin Interaction**: When the user taps on any notification or search result, they are directed to the **Bin Details Page**.
- **All Bin Status Bar**: At the bottom of the dashboard, users can see the current status of all bins across the university, categorized by color (Green, Yellow, Red). This section provides a summary of the number of bins in each category, with the option to view specific bins on a map.

Design Considerations:

- **Search Efficiency**: The search bar is highly functional, allowing users to filter by multiple criteria (status, type, location) quickly and effectively.
- **Notification System**: The notification box provides a concise summary of bin statuses, allowing users to take action with a single tap, whether it's viewing more details or updating bin status.

- **Status Overview**: The "All Bin Status" section presents a comprehensive snapshot of the system’s current state, enabling quick decision-making and management of bins.





5. Bin Details Page Design

The Bin Details Page provides in-depth information about a selected bin, allowing the user to manage its status and request services.

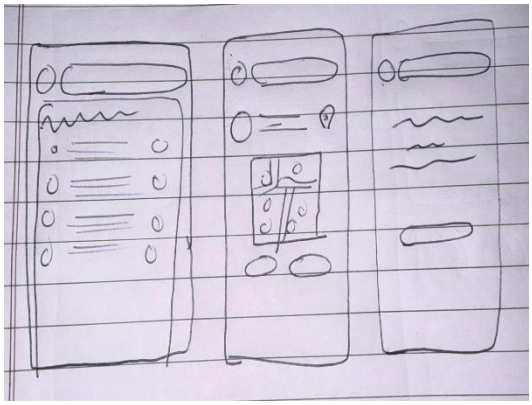
Key Components:

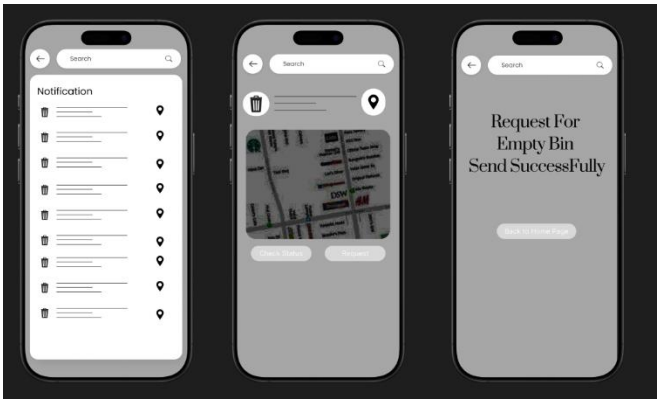
- **Bin Information**: This section displays key details such as **Bin ID**, **Location ID**, and a **Map** showing the exact bin location on campus.
- **Action Buttons**:
    - **Request Bin Emptying**: Allows the user to send a request to empty the bin.
    - **Check Bin Status Again**: Refreshes the bin’s status, updating it in real-time.
    - **Cancel**: Cancels any current action and returns the user to the dashboard notification page.

Design Considerations:

- **User Control**: The action buttons allow the user to manage the bin without overwhelming them with unnecessary choices. The actions are limited to what the user needs most (emptying, checking, and canceling), making the interface straightforward and efficient.

- **Real-Time Updates**: The "Check Bin Status Again" feature ensures that users always have up-to-date information, helping them make informed decisions about the bins.





6. Design Justification and Process

This low-fidelity prototype was developed with the user's needs in mind, following key HCI and UX principles to ensure an intuitive and functional interface.

HCI Principles:

- **Minimizing Cognitive Load**: The design simplifies user interactions by presenting only the necessary information and actions at each stage. By reducing complexity, users can quickly understand how to navigate the system without confusion.
- **Visibility of System Status**: At every stage, users are kept informed about what is happening, whether it's through confirmation messages (e.g., after a password reset) or real-time bin status updates.

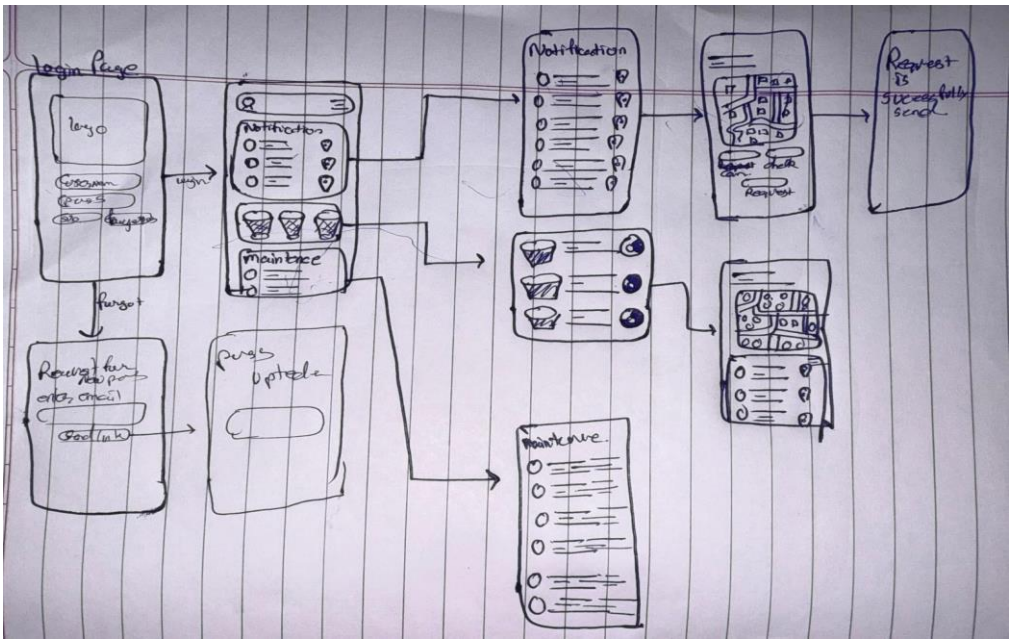
UX Considerations:

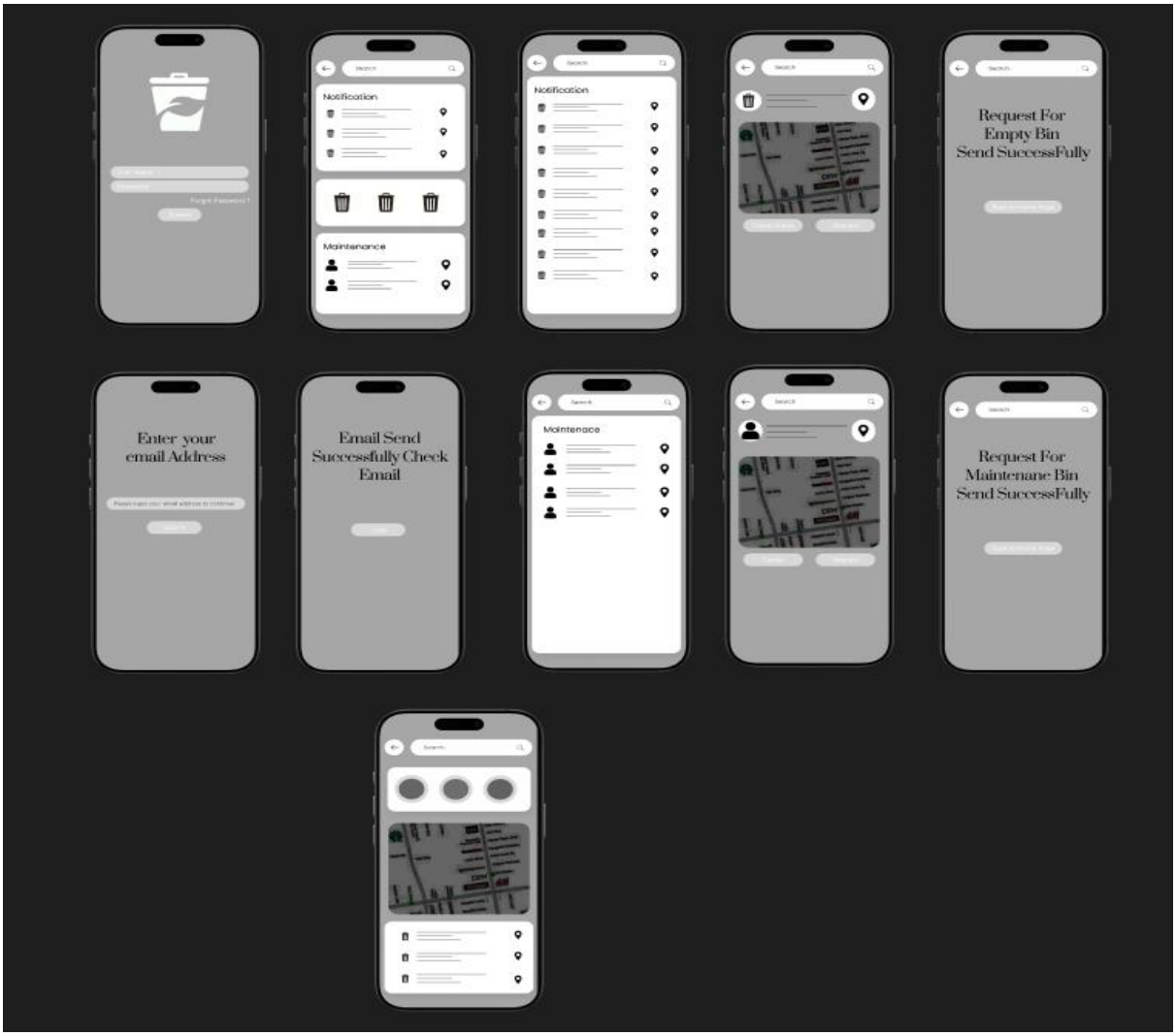
- **User-Friendly Layout**: All elements are centrally located for easy access, ensuring that users can quickly perform tasks like searching for bins or requesting bin emptying services. The use of icons and clear labels further enhances the experience by reducing the need for lengthy instructions.
- **Task Completion Efficiency**: Each component of the interface is designed to help users complete their tasks with minimal effort. The prominent search bar and action buttons ensure that users can find information and act upon it in a few clicks.

Technology Acceptance:

- **Easy Access to Core Functions**: By providing quick access to critical system functions (search, notifications, bin details), the design encourages frequent use of the system. Users are more likely to accept and adopt the system because of its clear and straightforward functionality.

7. Screenshots




Notification
Maintenance
Request For Empty Bin Send SuccessFully
Enter your email Address
Email Send Successfully Check Email
Maintenace
Request For Maintenane Bin Send SuccessFully

All Member Balsamiq Design and Figma Links :

- Member 1 (Parth Patel): https://balsamiq.cloud/syzjxk4/pka0cij
- Member 2 (Ravi Savani): https://balsamiq.cloud/syzjxk4/pnw322a
- Member 3 (Prince Patel):

https://www.figma.com/design/PtoAMalW7NrtP6aR68WF7E/Untitled?node-id=0-1&t=LBn8wPtdQcsbNSkR-1

Conclusion

The Smart Bin Monitoring System offers the University of Tasmania a comprehensive, user-centred solution to waste management issues. Through the integration of actionable warnings, comprehensive reporting, and real-time monitoring, the system enables facility managers to effectively oversee bin statuses, monitor contamination, and optimise trash collection procedures.

Human-computer interaction (HCI) principles, such as Fitts' Law and Hick's Law, are the foundation of the system's architecture, guaranteeing that users can interact with the interface effectively. Instantaneous input is made possible by IoT technology, allowing for quick responses to bin conditions as they occur. With their clear layouts and visually appealing parts that are colour-coded, the Dashboard and Report pages facilitate users' ability to quickly access critical data and make well-informed decisions.

Both high-fidelity and low-fidelity prototypes were used in the development process to enable iterative design adjustments based on user feedback. This strategy made sure that the finished product would satisfy the many objectives of campus facility managers while also being aesthetically beautiful and functional. In the end, the system uses data-driven decision-making and efficient resource allocation to improve waste management efficiency, save operating costs, and support the university's sustainability goals.

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