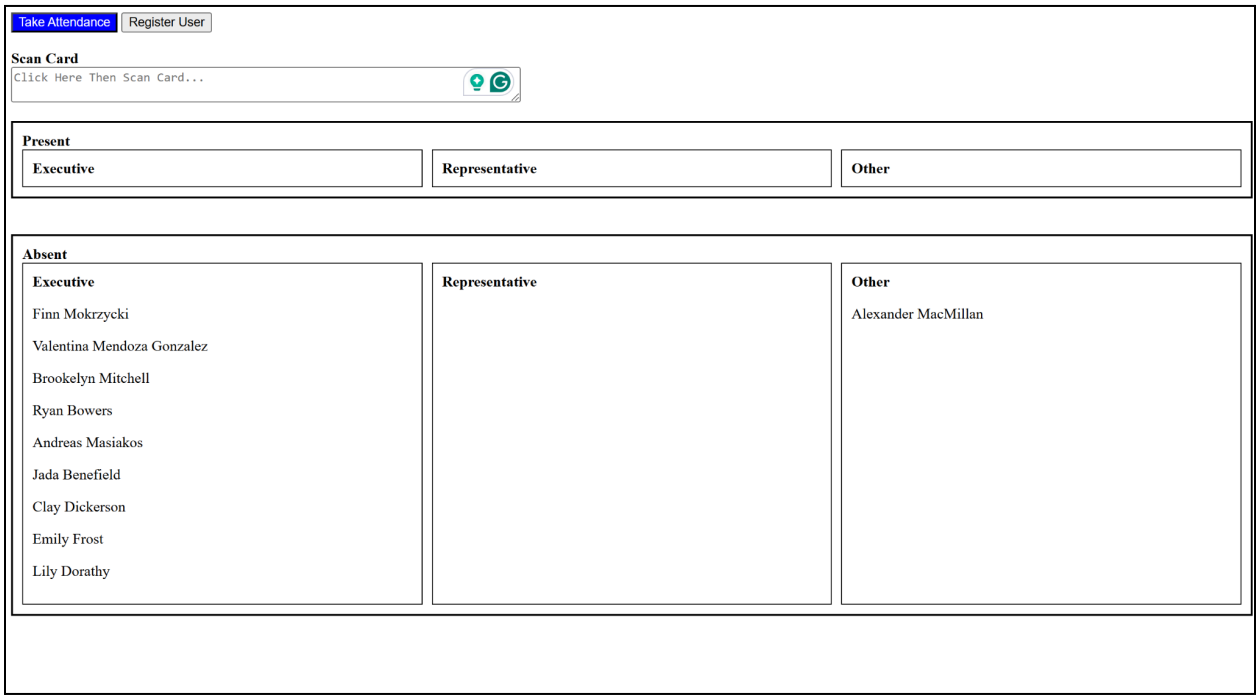
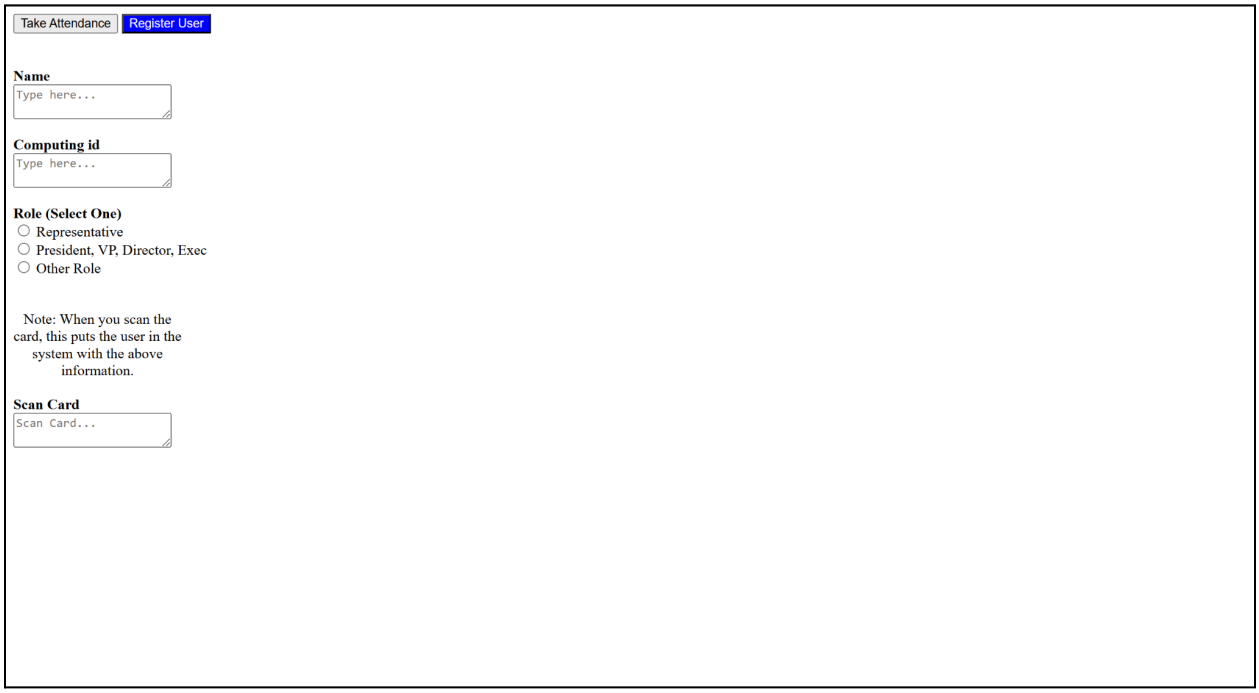
Attendance Tracker





Goal

Create an attendance tracker that uses physical RFID cards for each user to log tabular data to verify compliance with the new attendance policy.

Context

The University of Virginia Student Council introduced new attendance requirements for its executive members. Previously, no formal system existed for tracking who did or did not attend meetings; attendance was merely noted in meeting minutes. This lack of rigor led to confusion when verifying compliance with attendance requirements at the end of each semester.

To address this gap, I implemented an RFID-based attendance system, providing members with scannable cards that easily link each individual to a unique record in an attendance database. This initiative streamlined the entire process—reducing errors, saving time, and allowing administrators to visualize attendance trends over the semester. LINK

Goals

1. **Accurate Attendance Tracking**
    - Replace informal methods (meeting minutes) with precise, automated logs.
    - Ensure that Council members who fail to meet the attendance requirements can be easily identified.
2. **Ease of Use**
    - Provide a straightforward check-in process for users, requiring minimal training.
    - Enable quick, real-time display of “Present” vs. “Absent” members at any meeting.
3. **Data Accessibility**
    - Record attendance in a format suitable for analytics and semester-long trend analysis.
    - Generate reports or visualizations in tools such as Power BI, enabling clearer oversight for Council leadership.

System Components & Workflow

RFID Hardware

- **RFID Scanner**: A USB plug-and-play device that acts like a keyboard input. Link
- **RFID Cards**: 100 individual cards purchased to distribute to Student Council executives (and any additional roles deemed necessary). Each card carries a unique tag ID. Link

When an individual scans their card, the RFID scanner inputs the unique ID into a designated text field on the attendance website.

Web Application

1. **Attendance Dashboard**
    - **Real-Time Visualization**: Displays who is “Present” vs. “Absent” in separate sections, sorted by role (e.g., Executive, Representative, Other).
    - **Scan Field**: A simple text box that automatically receives the RFID tag ID from the scanner.
2. **User Registration**
    - A minimal registration page allows new users to be bound to an RFID card by scanning it first and then entering their details (name, role, etc.).
    - Data is stored in Google Sheets via macro scripts.
3. **Data Management & Logging**
    - Each scan event is recorded with a timestamp, user ID, and relevant meta-information.
    - The data is then consolidated and fed into Power BI, where attendance over time can be visualized for the entire semester.

Database & Integration

- **Google Sheets**
    - Macro scripts automatically capture new registrations and attendance logs.
    - Since the sheets are cloud-based, they can be easily integrated with Power BI or other platforms for further analysis.
- **Power BI**
    - The final step is to visualize the data (e.g., frequency of attendance per person, average meeting attendance, and trends over weeks/months).
    - This provides an at-a-glance understanding for Council leadership and helps ensure members meet requirements.

Implementation Details

1. **Hardware Setup**
    - A standard USB RFID reader was plugged into a computer used at meeting venues.
    - Each council member received a unique RFID card.
2. **Application Flow**
    - **Scan**: Member scans their card on arrival.
    - **Lookup**: The website matches the scanned ID to the user’s record in Google Sheets.
    - **Display**: The member is moved from “Absent” to “Present” in real-time.
    - **Log**: Data (timestamp, user, role) is written to Google Sheets for analytics.

3. **Technical Considerations**
    - **Data Transfer**: Macro scripts were used to push scanned attendance data from the front end to Google Sheets.
    - **Ease of Deployment**: The web page is minimal to ensure quick loading on any device. The RFID scanner emulates keyboard input, so no additional drivers or complex setup is required.
    - **Security & Access Control**: Basic security measures ensure only designated admins can register new cards or modify attendance data.

Challenges & Lessons Learned

1. **Previous Location-Based Tracking Issues**
    - An earlier iteration attempted to verify user presence via device-based location tracking.
    - Using the University's VPN introduced inaccuracies: sometimes, the system showed users as out-of-bounds despite being on-site.
    - The RFID approach eliminated the reliance on location data, thereby improving consistency.
2. **Hardware & Compatibility**
    - Ensuring the RFID reader worked seamlessly across different browsers and operating systems.
    - The device's "keyboard emulation" proved effective but necessitated that the webpage's scan field always be in focus.
3. **Adoption & User Compliance**
    - Members had to remember their RFID cards. While simpler than location-based tracking, there was still a learning curve for consistent usage. When they did not have the card, it required a manual logger.
    - Clear instructions (e.g., "Scan your card upon entry") and friendly reminders reduced forgetfulness.

Benefits & Outcomes

1. **Streamlined Attendance**
    - No more roll calls or manual sign-in sheets; scanning a card takes seconds.
    - Real-time data provides immediate clarity on quorum and overall attendance.
2. **Accurate Data for End-of-Semester Reviews**
    - Administrators can quickly identify which members met the new attendance requirements.
    - Reduced confusion and guesswork when verifying compliance.
3. **Data Analytics & Insights**
    - Integration with Power BI reveals attendance trends—identifying which meetings had the highest or lowest turnout.
    - Identify which people lacking information from meeting to share later

Future Improvements

1. **Enhanced Role Management**
    - Expand the system to track attendance for different subcommittees.
    - Implement varying permission levels to allow certain users to generate specific reports.
2. **Automation & Notifications**
    - Send automated emails if a member is nearing their absence limit.
    - Provide reminders for upcoming meetings or urgent notifications if attendance is mandatory.
3. **Mobile/NFC Integration**
    - Explore smartphone NFC scanning to reduce reliance on physical cards.
        i. Note: I tried with NFC previously, too, and there are issues across old Samsung phones, leading to an equity issue.
    - Potentially integrate with student ID cards.
4. **Additional Analytics**
    - Dashboards that compare multiple semesters' data side by side.