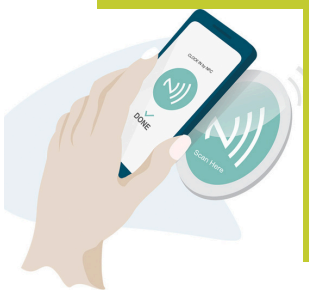
CASE STUDY FOR THE DIGITAL TIME ATTENDANCE SYSTEM



- **Innovating Employee Attendance with Real-Time NFC and QR Solutions.**
- **Fast, Reliable, and Inclusive Attendance Tracking for Modern Workplaces.**

AT A GLANCE

Challenges

- Manual attendance tracking inefficiencies.
- Limited options for non-NFC phones and remote workers.
- Data errors and lack of real-time updates.

Benefits

- **Direct Cost Savings:** R20 per NFC sticker with minimal setup costs.
- **Operational Efficiency:** Reduced manual effort by 90%.
- **Inclusivity:** Multiple backup solutions for diverse user needs..

RESULTS

- **Direct Cost Savings:** R10 per card including the NFC sticker attached.
- **Operational Efficiency:** Reduced manual effort by 90%.
- **Inclusivity:** Multiple backup solutions for diverse user needs.

OBJECTIVES

The Digital Time Attendance System aims to streamline attendance tracking with real-time updates and inclusive solutions like NFC stickers, QR codes, and a login portal. It reduces manual errors, improves accountability, and ensures accessibility for all employees. Supervisors gain instant access to data for approvals and reporting, enhancing efficiency across the workplace.

SOLUTIONS

- **NFC Stickers:** Easy tap-and-go functionality.
- **QR Code Backup:** Instant scanning for non-NFC devices.
- **Login Portal:** Supervisor-approved remote sign-ins.
- **Admin Dashboard:** Comprehensive monitoring and analytics.
- **Reception QR Gun:** Ensures accessibility for users without smartphones.

BENEFITS

Benefit One

A seamless attendance tracking system that improves employee accountability and reduces errors.

Benefit Two

Streamlined user experience with minimal training requirements.

Benefit Three

Flexible contingency options (QR codes, login portal) ensure 100% accessibility.

Benefit Four

Actionable data insights through the admin dashboard for better workforce planning.

Challenges and Solutions

1. Server and Hosting Challenges

Challenge: Render and Clever Cloud had limitations on their free tiers.
Solution: Migrated the backend from Render to Xneelo for better efficiency and reliability.

Challenge: Clever Cloud only allowed a maximum of 5 simultaneous connections.
Solution: Moved to Xneelo, which supports 197 connections, reducing crashes and improving performance.'

Challenge: Transitioning from an Express server to a PHP server required learning new technologies.
Solution: Adapted by learning PHP through resources like W3Schools and internal guidance.

Challenge: Deploying to Xneelo was a new experience, requiring the use of FileZilla for file transfers.
Solution: Learned to establish connections using credentials and manually transfer code using FileZilla.

2. Database Migration Challenges

Challenge: The database needed to be migrated from Clever Cloud to Xneelo.
Solution: Successfully transferred the MySQL database while maintaining data integrity and API functionality.

3. API and Backend Issues

Challenge: API communication issues due to CORS and request handling errors.
Solution: Adjusted server headers and refined API request handling to resolve errors.

Challenge: Render's cold start delays caused inconsistent response times.
Solution: Optimized server configurations and monitored API performance.

4. Frontend Integration Issues

Challenge: Struggled with pulling and displaying dynamic data from the backend.
Solution: Debugged API responses, verified endpoint configurations, and collaborated with backend developers for a smoother data flow.

5. Hardware and Raspberry Pi Setup

Challenge: Setting up a Raspberry Pi without an HDMI cable for a user interface.
Solution: Used SSH via a computer connected through a LAN cable.

Challenge: The provided SD card was faulty, preventing the OS from loading.
Solution: Purchased a new SD card to speed up the setup process.

Challenge: The wireless receiver component didn't work, limiting command-line access.
Solution: Used a wired connection to share internet access from a computer.

6. Learning New Technologies

Challenge: Limited budget restricted access to advanced tools and services.
Solution: Used open-source resources, free-tier services, and cost-effective alternatives.

Challenge: Learning PHP for the transition from Node.js.
Solution: Studied PHP syntax through W3Schools and consulted with experienced developers.

Challenge: Learning to integrate Google Sheets into the application.
Solution: Wrote Google Apps Script to automate specific functions, but ultimately decided against full integration as it wasn't essential.

7. Project Management and Collaboration

Challenge: Transitioning from a development role to project management.
Solution: Developed leadership skills, improved communication, and took on accountability for team progress.

Challenge: Adjusting to a fast-paced project, having joined two weeks after its inception.
Solution: Quickly familiarized with the codebase, clarified responsibilities, and adapted to team workflows.

Challenge: Choosing technologies and adjusting workflows without causing setbacks.
Solution: Balanced familiar and new technologies to maintain progress while ensuring long-term scalability.

Meet The Team

Daniel Umetor

Role:
Backend Developer & Deployment

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I started by setting up the server, ensuring all necessary dependencies were installed, and configuring environment variables for smooth operation. After testing the backend locally, I pushed the code to a repository and attempted to deploy it on Render. This involved setting up the build and start commands, defining environment variables, and troubleshooting any errors that occurred during the process. I also had to make adjustments to ensure the server could handle API requests properly and remain responsive after deployment.

The deployment process came with several obstacles that required extensive debugging. Initially, I faced build failures due to missing dependencies and incorrect configurations, forcing me to repeatedly update the package.json file. Environment variables also posed a challenge, as Render failed to recognize some of them, leading to crashes until I carefully reconfigured the settings. Another issue was the cold start delays caused by Render's free tier, which put the server to sleep after inactivity, making response times inconsistent. Additionally, CORS and API communication errors prevented the backend from properly interacting with external services, requiring modifications to the server's headers and request handling. Overcoming these challenges took time, but through persistence and troubleshooting, I successfully deployed the server and ensured it functioned as expected.

Moeghamad Taahir Du Toit

Role:
Product Management & Backend Developer

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I developed the team structure and organized our workflow. Choosing the technologies was an issue as we would commit to something and then a small change to the workflow would force us to change the technologies we used and therefore move backwards I worked on creating the raspberry pi.

It was our first experience using a raspberry pi and we didn't have access to and HDMI cable so no user interface. The SD card provided didn't work so the OS couldn't load. The wireless receiver component didn't work so i couldn't use the wireless command line. I connected a computer and shared its connection through a Lan cable. I bought an SD card since they were takimg too long and since it had internet connection now i used the SSH on the computer to interact with the device

Mahmud Isaacs

Role:
Frontend Developer

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I mainly assisted in the frontend, making sure the UI/UX looked and functioned as expected. My focus was on ensuring the interface was both visually appealing and user-friendly while integrating dynamic data from the backend. I was also responsible for integrating the backend endpoints into the frontend. Using these endpoints, I added functionality to the schedule button and implemented both the Single User View and Global User View. Although the data for these views was already available, minor adjustments were required to optimize their display. Through strong collaboration and effective communication between the backend and frontend teams, the project was completed ahead of schedule, with the originally planned two-week sprint cycle successfully finished in just three days.

Challenge: I struggled a bit with pulling the data from the backend. At first, the data wasn't coming through properly, which caused issues with rendering dynamic content on the frontend. This made certain elements either load incorrectly or not appear at all, affecting the overall functionality of the application.

Solution: I took a step back and carefully debugged the issue by checking the API responses, verifying the endpoint configurations, and ensuring the frontend was correctly handling the fetched data. I also collaborated with the backend team to clarify data structures and improve request handling. After tweaking the requests, refining the data flow, and testing across different scenarios, I successfully got everything to display as it should, ensuring a smooth user experience.

Robyn Carnow

Role:
Product Management

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Being part of project management has significantly contributed to my growth, both as an individual and a professional. Transitioning from the mindset of a developer troubleshooting bugs to a role that requires facilitating communication between team members was a fast and substantial adjustment—but one that I thoroughly enjoyed.

Many assume that project management is solely about documentation and directing a team, but the reality is far more dynamic. The role demands maintaining team synergy, assessing feasibility, taking accountability, and ensuring that project milestones are met within deadlines.

One of my biggest initial challenges was shifting from a developer's relatively quiet role to actively leading team sprints. However, this experience has strengthened my confidence, allowing me to overcome my hesitation in speaking up. I now express my thoughts more clearly and assertively, ensuring productive discussions and collaboration.

Simanye Somdaka

Role:
Backend Developer

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For Project 1, my role was primarily consultative rather than hands-on. I provided recommendations on hosting solutions and backend platform selection, suggesting AWS Lambda/S3 and CI/CD pipelines using Kubernetes/Docker. These suggestions were made in collaboration with the Project/Product Manager (Robyn) to align with the project's needs.

One of the main challenges was determining the most efficient and scalable hosting solution for the backend. This was addressed through research and discussions with the backend team, ensuring that the selected platforms met the project's technical requirements.

Awodwa Hendrick

Role:
Backend Developer

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One of the primary challenges I faced was joining the project two weeks after its inception. To get up to speed, I first had to clarify my role within the team and then delve into the existing codebase to gain a comprehensive understanding of its intricacies. This experience taught me the importance of adaptability, effective communication, and rapid knowledge acquisition in fast-paced project environments. Myself and Abdurahman collaborated on all aspects of backend development for the new features. They worked together to structure SQL queries that formatted data correctly for the export logs feature and developed the necessary API endpoints to support this functionality. Additionally, they implemented backend logic to track user sign-ins, identifying latecomers who had not checked in by 9 AM and sending email notifications to the administrator. They also created a script that rechecked missing names at 1:30 PM, marked absentees, and forwarded the updated list to the administrator.

Zubayr Abdullatief

Role:
Frontend Developer

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Worked on the the design and frontend implementation, Successfully completed with minor issues. The user interface is fully functional, visually polished, and aligns with the intended design specifications. Components regarding the capacity of usage was a issue but was abruptly fixed and all components worked as expected.

Caleb Okkers

Role:
UI/UX Designer & Frontend Developer

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A challenge faced was juggling two projects with lots of design work but the workload was easily handled due to a very competent team.

Nazneen Abrahams

Role:
UI/UX Designer

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I contributed to the Digital Tagging System by designing an intuitive user interface in Figma, developing interactive prototypes, and ensuring seamless NFC and QR-based attendance tracking. Additionally, I conducted a detailed case study to highlight its impact and created a mockup for the updated Social Impact page, aligning it with the project's vision and goals.

Abdurahmaan_Charif

Role:
Backend & Database Developer & Server Customisation

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The database used was MySQL running on the Dev plan (free tier) on CleverCloud, connected to a Express Server in Node.JS.

There were 3 main entities in mind when creating the tables storing data that being the administrator, the employees/students and all of their logs. The backend created with this in mind with the feature such as authentication for an admin user to login and view the users data logs.

These data logs are uploaded through an endpoint on the API by RFID tags being scanned into a reader and the relevant user data is uploaded on the database where Admin users can see their data in real-time.

Project had hit limitations in regards to technologies that could be used due to finances, as such we had to re-evaluate our options and look for more cost effective methods. This lead us to migrating our server to an XNEELO one which required the backend technologies to change.

Taking on the challenge of adopting new technologies such as PHP and its different software such as XAMPP and FileZilla we managed to successfully host our backend on XNEELO through a PHP server for a more cost effective option.

PHP was a technology that was new to me and was quite unique yet shares similarities with technologies I was familiar with. The deploying process to XNEELO was also a unique experience by using GUI interface software such as FileZilla to establish the connection using credentials and dragging our code to the server.

Myself and Awodwa collaborated on all aspects of backend development for the new features. They worked together to structure SQL queries that formatted data correctly for the export logs feature and developed the necessary API endpoints to support this functionality.

Additionally, they implemented backend logic to track user sign-ins, identifying latecomers who had not checked in by 9 AM and sending email notifications to the administrator. They also created a script that rechecked missing names at 1:30 PM, marked absentees, and forwarded the updated list to the administrator.

In conclusion the project was quite the learning experience and while there were some challenges on the way it resulted with lessons to take away and new skills to gain.

Challenges:
Smaller pool of technologies to work with being free
Integrate Google Sheets
Learn PHP and its software

Solutions
Used technologies that I was familiar with and suited the project

Learned to write scripts that on google sheets that perform the some of the functions that the app does.
Decided not to go forward with the integration as it will not affect the actual app in the long run
Used sites like W3chools to pick up on PHP syntax as well as consult with some internal resources for further understanding.

Collaboration
Teamwork and communication was smooth and efficient.
Team members were resourceful and helped reach solutions.
Feedback was helpful and helped with the development of the project