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RosterPro

1. IDENTIFICATION

Problem Background

Internationally, 42% of the total health expenditure goes to paying the workforce (WHO, 2006). This means the rostering system is crucial to optimising the resources that go into this sector. However, creating rosters has proven to be challenging because it is subject to numerous unpredictable factors. Currently in Assisi Hospice, it takes about 10 working days to create each month's roster, which is about half the working days in a month.

Problem Statement

A way to reduce the time taken to create a baseline roster for manpower allocators in order to optimize workforce rosters based on position, priority, and requirements/needs.

Existing Solutions



Commercially available solutions tend to be expensive with high maintenance costs and require a steep learning curve. There are also issues with connecting to existing calendar systems.

Feasibility

Medium technical confidence because relevant previous project experience would help to find out how to build on lack of coding skills.

Stakeholders

Administrative staff and clinicians will need to be convinced and consulted to understand their needs.

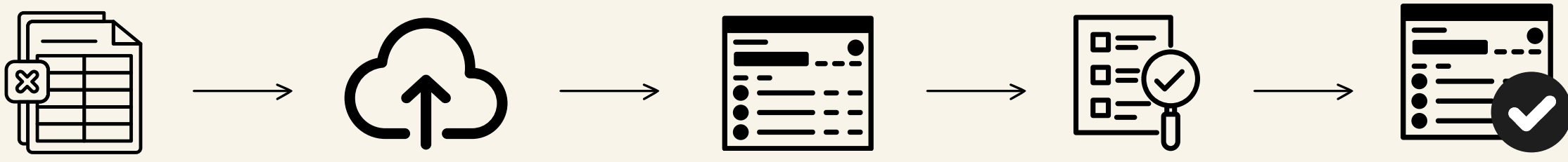
Market Size

Global workforce optimisation market size is expected to almost triple:

USD8.25B in 2023 → USD22.45B in 2033

3. OUR PROTOTYPE

User Journey: From Input to Final Roster



Data Preparation:
Users fill out Profile and Leave Excel files with necessary information.

Data Input:
Users upload pre-formatted Profile, Leave Excel files via the GUI.

Roster Generation:
Click "Process & Save Roster" to generate and save the roster automatically.

Validation & Editing:
Upload edited rosters to the Roster Checker, which flags constraint violations.

Finalisation:
Once validated, the roster is ready for use.

How Well Did the Solution Address the Needs?

Must Haves

- Automated Rostering: Implemented with a robust algorithm for automatic roster generation.
- Editable Personnel Profiles: Fully customisable via the Profile and Leave Excel sheets.
- Ranking Priorities: Ranking of doctors within each role-type to prioritise scheduling.
- Data Integration: Seamless data inputs from Profile and Leave Excel sheets.
- Post-Generation Changes: Roster checker allows amendments to be validated after edits.

Good-To-Haves

- Backup Assignments: Included with a dedicated column in the roster.
- Fair Scheduling: Point-based system incorporated ensures fairness in shift allocation.
- User-Friendly Interface: Graphical User-Interface (GUI) simplifies tasks for users (i.e. file selection, roster generation, and error checking)

Ease of Use and Novelty of Final Prototype

Ease of Use

- Intuitive Design: GUI enables easy file uploads, roster generation and checking of updated rosters.
- Minimal Barriers: No coding skills required; runs via an executable file.
- Error Feedback: Clear prompts guide users to address constraint-related issues efficiently.

Novelty

- Combines fairness and backup features directly into the rostering process.
- Modular code allows easy updates and future scalability.
- GUI validation offers a unique way to manage post-generation edits.

2. IDEATION

Our group identified 3 main subsystems to address the clinical need based on our needs criteria, ranked from 1 (least relatable) to 5 (most relatable).

Must-Have Criteria

Good-to-Have Criteria

Feasibility Criteria

SUBSYSTEM 1 - PREPROCESSING

- Able to edit Profile Document of personnel
- Extracting data from profile document and leave document to help with rostering algorithm

- Automate data collection

- Confidence level

Criteria	Pre-built template using Excel sheet	Extract from current Excel sheet	Online portal to access leave
1.	5	1	2
2.	5	3	5
1.	1	1	5
1.	5	5	1
Total:	16	10	13

SUBSYSTEM 2 - ALGORITHM

- Automated rostering
- Have ranking priority

- Back up for all positions (replacement if doctor takes urgent leave)
- fairness in scheduling (balanced work hours through point system)

- Confidence level

Criteria	Multi-level ranking constraints	Weighted scoring logic	Penalty based constraints
1.	5	5	5
2.	5	4	4
1.	3	3	3
2.	4	4	2
1.	5	3	2
Total:	22	19	16

SUBSYSTEM 3 - ROSTER DISPLAY METHOD

- Able to edit roster after it is generated

- Statistics for leave each month
- Have a roster be accessible through a mobile app

- Confidence level

Criteria	Excel	Dashboard	Mobile Application
1.	5	1	1
1.	2	5	5
2.	3	3	5
1.	5	3	2
Total:	15	12	12

4. CONCLUSION

1 CODE VALIDATION

We verified rostering conditions are met as shown in the tables.

Date	Ward 1	Leave
1 Oct	RA	RD
2 Oct	RA	RA
3 Oct	RA	RC

✓ Checks line by line to prevent rostering of doctors on leave.

PH	Ward 1	On Call
No	RA	RB
No	RA	RD
Yes	RA	RC

✓ Algorithm does not assign doctors in Wards on Public Holidays.

Date	Ward 1	On Call
1 Oct	RA	RB
2 Oct	RB(AM)	RA
3 Oct	RA	RC

✓ Checks each line to ensure no doctors are in wards in PM shift after an on call day.

Day	On Call
Sat	RA
Sun	RD
...	
Sat	RA
Sun	RC

✓ Algorithm does not assign doctors on call on consecutive weekends.

2 UNIT TESTING

We tested various scenarios (inputs) to verify if the outcomes are both logical and can be successfully generated.

Day	Ward 1	On Call
Sat	RA	RB
Sun		RD
Mon	RA	RC

✓ Algorithm does not assign doctors in Wards on weekends.

Date	IDM	On Call
1 Oct	RD	RA
2 Oct	RA	RD
3 Oct	RB	RC

✓ Algorithm doesn't assign doctors on call when they have team meetings (IDM) the next day.

Date	On Call
1 Oct	RA
2 Oct	RD
3 Oct	RA

✓ Algorithm does not assign doctors on call within a 3 day period.

3 MANUAL TESTING

We get the inputs for December to generate a base roster and compare it with the roster Assisi has created for December.

SOLUTION VIDEO



SCAN ME

Sources

O'Connell, M., Barry, J., Hartigan, I., Cornally, N., & Saab, M. M. (2024, March 13). The impact of electronic and self-rostering systems on healthcare organisations and healthcare workers: A mixed-method systematic review. Wiley Online Library. <https://onlinelibrary.wiley.com/doi/full/10.1111/jocn.17114>