Promoting Conversations between NHS Staff through an optimized Human Computer Interaction and data science driven System

A self-reporting care quality measurement dashboard

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ABSTRACT

Monitoring performance over time and providing evidence for meeting regulations is a common need in many industries. Furthermore, there is a growing necessity for employers, mentors, and organizations to engage in meaningful conversations that promote honesty. This paper introduces a bespoke web platform that allows healthcare staff to perform self-reports to measure themselves against a framework of standards and has been designed with the end users in mind.

CCS CONCEPTS

• **Human-centered computing → Visualization**

KEYWORDS

Web Application; Visualization; Self Reporting

1 INTRODUCTION

The Welsh Government's Health and Care Standards [1] provide a consistent framework for healthcare staff to provide high-quality care. Unfortunately, there is a severe lack of data on how clinicians are meeting these Standards, which need to be made more meaningful, whilst reducing the significant pressure they are under. It is very difficult for them to judge, improve, or enter conversations about their performance.

This platform enables healthcare staff to enter conversations about their performance and communicate about the Standards in a meaningful way. It is an adaptable, user-centered and intuitive online platform for staff to perform honest self-reports through a series of short questions on their own devices in their own time. The data is visualizable by themselves, managers, hospitals, or health boards, and is anonymized to promote honesty and privacy.

2 HUMAN COMPUTER INTERACTION (HCI)

The *Fogg Behavior Model* [2] shows that Ability (i.e., ease of use in this context) and Motivation are key drivers for the success of an action or behavior:

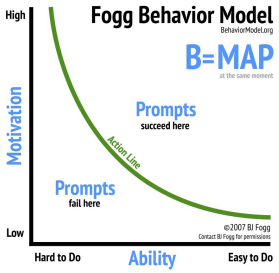

Figure 1. The Fogg Behavior Model [2]

To ensure the success of an action (i.e., filling out self-reports) we designed the platform following many design principles such as feedback and visibility [3] so the platform is:

Intuitive: The vertical navigation bar at the top of the page is a common trend on many websites, enabling users to easily navigate the site by following their intuition. Moreover, when changing between user types, the overall interface of the platform and order of the navigation menu buttons stays uniform. Also, the user profile dropdown and links to logout/sign in are at the top-right of the screen, another popular trend for modern web-apps.

Visible: The core UI elements have been designed to be obvious, with highlighted or large call-to-action buttons where action is necessary, or using standard icons (e.g., an 'X' for 'close') to represent common functionality.

Responsive & easy-to-use: For every action that a user takes, a visible reaction is shown in the form of a page change, an alert dialog, a temporary toast message at the top of the screen, or permanently displayed notification. When areas of the webpage are loading, a loading icon or message is displayed to help users see the current system state.

To make the platform easy to navigate, the navigation bar boldens/highlights the link for the page the user is currently on, to help orient themselves on the website. Our comprehensive User Manual also explains in detail how each page and feature of the platform works.

In addition to the above, we incorporated the user request of the self-report being able to be completed in under 3 minutes. These aspects ensure our platform upholds the Ability and Motivation drivers of the Fogg Behavior Model [2]. Consequently, this facilitates the best mechanism for self-reporting and enabling meaningful conversations.

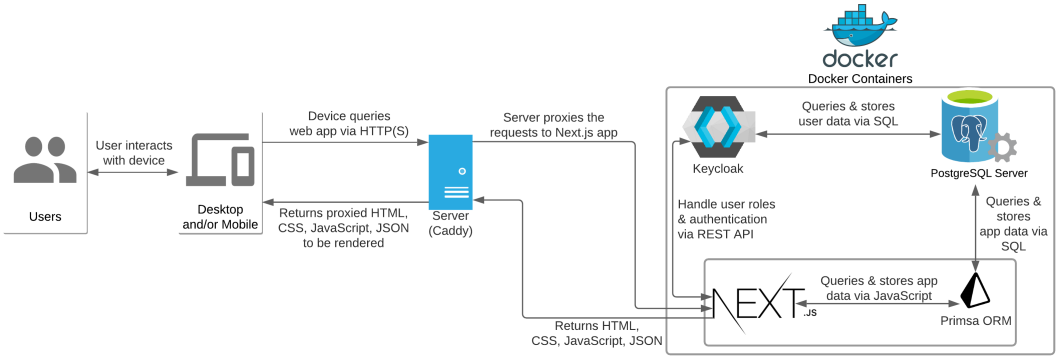

Figure 2. System Architecture Diagram

3 DESIGN AND IMPLEMENTATION

Figure 2 shows the platform's System Architecture Diagram. The entire system is containerised via Docker to make it easily deployable and Next.js is used to develop the web-application, including a REST API for use in the client. Prisma acts as an object-relational mapper (ORM) to interact with a PostgreSQL database to provide important safety mechanisms such as automatic query sanitisation. Additionally, Keycloak enables identity and access management [4].

The development focused on extensibility and adaptability, therefore it has been designed to work for any potential use case, not only in the NHS: the REST API can easily be adapted to interact with other entities on a similar hierarchical level; the web-app can also be styled easily per an organisation's needs; and the login system can be configured to use most existing authentication systems provided they support open standards such as OpenID Connect, OAuth, or SAML.

The login system was an important aspect of the system: it needed to be both secure and simple/straightforward for users to use. Crucially, it needed to be adaptable and easy to configure in future – for example, to use the NHS Single Sign-On (SSO), or another organisation's own SSO. Our meetings with the NHS showed us that much of their authentication infrastructure is spread across many different services, and not all healthcare staff are able to authenticate with one single mechanism. However, this is in active development and it will likely be possible to authenticate *most* users soon using a system like NHS Identity [5]. As a result, we integrated the open-source tool Keycloak for identity and access management, due to its powerful features such as Identity Brokering [4] which facilitate connections with external authentication providers.

We designed a 'join code' system to allow department managers or hospitals to invite clinicians or department managers respectively to a department. This is in the form of unique URLs that can be generated and distributed to delegate the work-effort to those directly responsible for the others. This reduces the risk of delays in other management staff needing to invite users they are not directly responsible for.

Decisions were made to ensure client devices perform minimal work such as rendering or calculation: all pages are server-side rendered, and most calculations are made in the API, on the server. This is needed to ensure the platform is usable, so users can use the platform on any device, at any time without detriment to performance.

Finally, to ensure the platform is iterable, an OpenAPI specification [6] has been created to document the REST API. Three automated test suites ensure the platform is fully functioning on every deployment: component unit tests using Enzyme [7], API integration tests, and entire-system end-to-end tests using Puppeteer [8].

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