BOHR International Journal of Internet of things, Artificial Intelligence and Machine Learning
2024, Vol. 3, No. 1, pp. 40–44
DOI: 10.54646/bijiam.2024.27
www.bohrpub.com

CASE STUDY

Transforming hospital crowd management: a case study on Pravesh electronic visitor management system

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Received: 02 March 2024; **Accepted:** 26 August 2024; **Published:** 03 October 2024

In this case study, we will delve into the development and impact of "Pravesh—An Electronic Visitor Management System," envisioned to streamline hospital crowd management, especially in the IP and OP departments of small to large-scale hospitals in India. Dr. Kalaivani and Mr. Arun Senthilkumar (co-founders) were inspired by a personal encounter to improve patient care outcomes and reduce the manual workload of the hospital staff by streamlining the visitor and attender management. Pravesh was developed using a Low-Code/No-Code platform in combination with an Agile-based Scrum Framework. The application comprises two passes: a visitor pass which can be generated by scanning a QR code placed at the hospital registration desk, and an attender pass that will be issued to a patient's attendee during an inpatient registration by the hospital front-desk executives. Pravesh was pilot tested at a 30-bedded hospital in Bengaluru, successfully demonstrating its effectiveness in saving staff time and improving patient safety by limiting the number of visitor footfalls at the hospital per day. The positive feedback received from the hospital crowd management. The incorporation of technology in healthcare settings has facilitated overcoming the challenges faced by healthcare professionals as well as patients. Additionally, the founders are planning to scale up Pravesh with new features to fit the specific needs of different hospitals to position itself in the current Indian healthcare ecosystem.

Keywords: hospital crowd management, electronic visitor management, Low-Code/No-Code, Agile-based Scrum Framework, visitor pass, attender pass

1 Introduction

One of the major issues for India's overcrowded hospitals is managing the large volumes of patient inflow, especially in the outpatient departments (OPDs) and managing patient's attenders in the inpatient departments (IPDs). Regardless of the use of technological advancements and strategies like scheduling, tokens, and QR code technologies in OPDs (1, 2), adoption of these technologies for IPD crowd management is still limited and remains a manual and cumbersome process in many small and medium hospitals (3). This demand for effective visitor management prompted the development of an electronic visitor management system (EVMS) (4, 5). This case study delves into the course of development of an EVMS called "Pravesh" that simplifies hospital crowd management through an Agile-based Scrum Framework and a Low-Code/No-Code platform.

2 Case presentation

The founders said that the idea for Pravesh bloomed from a personal experience encountered by the founders themselves while they paid a visit to a multi-specialty hospital in Bengaluru for an emergency. Additionally, they faced challenges in accessing the hospital ward, looking at the

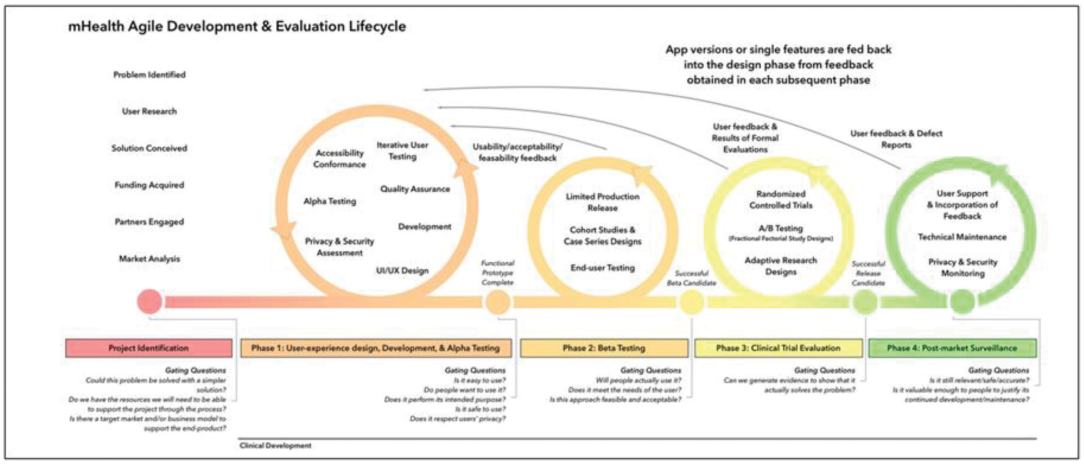

FIGURE 1 | mHealth agile development and evaluation lifecycle [adapted from Wilson et al. (6)].

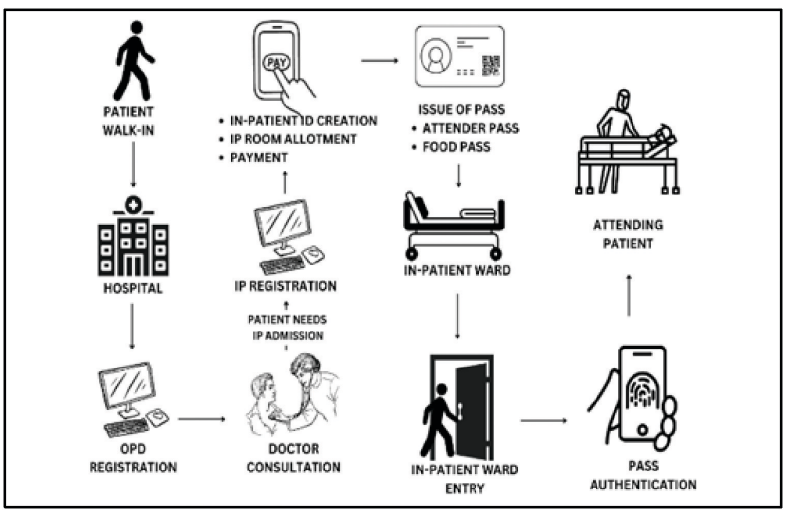

FIGURE 2 | Workflow for Pravesh attender pass.

inefficient crowd management the idea sparked to build an EVMS. "It all started when we had to pay a visit to a nearby hospital due to an emergency. After waiting for two long hours, we realized visitors could access patient wards without passes or authorization. The hospital made us wait because they lacked visitor tracking, compromising patient safety. Managing visitors manually in a registry was time-consuming. This experience highlighted the need for a quicker system to streamline visits and ensure safety."—Founders. Motivated by this experience, the founders embarked on a mission to develop a solution that would enhance patient safety and reduce the burden on hospital staff. The development process adopted the mHealth Agile Framework Development and Evaluation Lifecycle by Wilson et al. (6) **Figure 1**, integrating clinical stages of healthcare product development into a continuous agile process.

The development and implementation of Pravesh encountered several challenges, reflecting the broader issues in healthcare application development. The primary challenges included the lack of efficient visitor management solutions in existing Hospital Information Management Systems (HMIS), the slow pace of traditional healthcare application development, and the absence of a streamlined process for managing patient visitors.

One of the major challenges faced by the Scrum team was in integrating the visitor management system with the existing HMIS, which required running multiple compatibility and interoperability tests. Fortunately, the Agile-based Scrum Framework facilitates iterative development, allowing the team to adapt the application to evolving requirements efficiently.

The team used a Low-Code/No-Code platform (7–9) to overcome the following challenges by accelerating the development without compromising the quality of the visitor management system. This approach enabled the team to create a user-friendly, efficient application within the stipulated 2-month timeline.

Positive feedback from the chairman, his team, patients, and their attenders/visitors during the pilot testing has validated Pravesh's impact on reducing crowd related

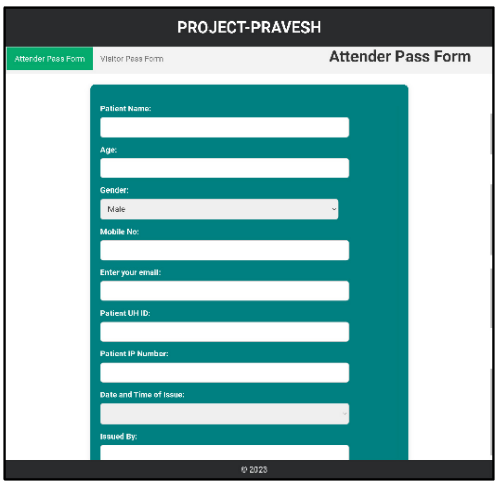

FIGURE 3 | Pravesh attender pass–UI.

FIGURE 4 | Sample of the attender pass generated through Pravesh.

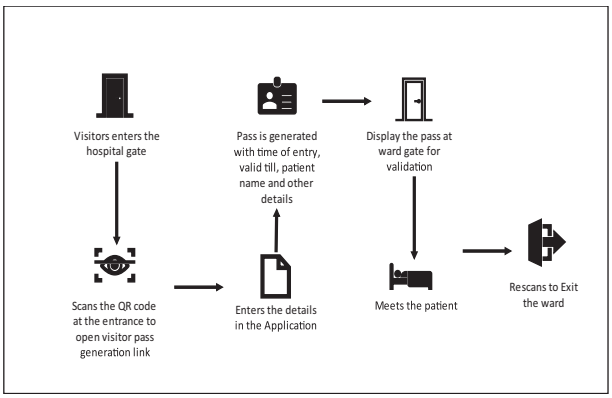

FIGURE 5 | Workflow for Pravesh visitor pass.

challenges and improving patient safety. The digital passes not only streamlined processes but also provided real-time data on visitor management.

A Scrum team was constituted, comprising a Scrum Master, a Product Owner, and three Developers. The project's overarching goal was defined as the "Development and User testing for the visitor management application for small-scale hospitals." The timeline for the project was set at 2 months, from April to May 2023. The development process involved creating a product backlog, defining sprint backlogs, and establishing sprint goals (10).

Pravesh features two types of passes: the attender pass and the visitor pass (**Figure 1**). The attender pass is issued during in-patient registration, containing patient and attender details.

When a patient is admitted to the IPD, an attender pass is generated at the time of registration along with the patient registration, refer **Figure 2**. The attender pass includes the patient's details such as name, age, gender, Unique Health ID, registration number, date and time the pass was issued, and the validity duration of the pass as shown in **Figure 3**. Upon the patient's admission, this pass is issued to the attending family member or caregiver. The attender can use this pass to enter and exit the hospital ward by having the ward staff scan it. This allows the hospital staff who are stationed in the wards to track attenders and visitors. The attender pass contains patient details, is generated during IPD registration as shown in **Figure 4**, and enables attenders to access the ward while allowing staff to monitor visitors. The pass system aims to facilitate attenders while maintaining security and appropriate access within the wards.

Additionally, the visitor pass allows visitors to scan a QR code at the hospital entrance, input their details, and generate a pass, refer **Figure 5**. This pass displays patient and visitor information as shown in **Figure 6**, enabling the hospital to monitor entry and exit times, reducing crowds at registration desks. Pravesh's paperless approach aimed to streamline attender and visitor management, minimizing the workload on hospital staff.

The pilot test occurred at a 30-bedded hospital in Bengaluru, dealing with 50–60 IPDs monthly. Visitor and attender passes were generated, marking a shift from traditional methods.

"PRAVESH's digital pass system for visitors and attenders is not only practical, but it saves our staff's valuable time," said the Hospital Chairman. "By keeping track of every visitor, it also enhances patient safety by limiting guest numbers."

"At first it was a little difficult to cope up with the generation of attender pass and visitor pass using PRAVESH, because we had to repetitively tell the people who were visiting the hospital to visit IP patients that they can themselves scan and generate passes through their phone. Some would listen, some would not. But after a week or something people themselves started to ask us to keep a QR at the entrance. It definitely reduced our workload and helped us have a better track of people who visit the Inpatients." Registration desk members shared their experience of using PRAVESH.

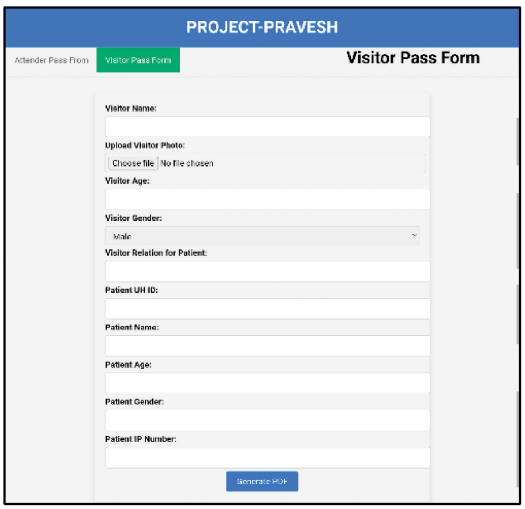

FIGURE 6 | Pravesh visitor pass–UI.

3 Discussion

The development and implementation of Pravesh encountered several challenges, reflecting the broader issues in healthcare application development. The primary challenges included the lack of efficient visitor management solutions in existing HMIS, the slow pace of traditional healthcare application development, and the absence of a streamlined process for managing patient visitors (11).

One of the major challenges faced by the Scrum team was in integrating the visitor management system with the existing HMIS, which required running multiple compatibility and interoperability tests. Fortunately, the Agile-based Scrum Framework facilitates iterative development, allowing the team to adapt the application to evolving requirements efficiently.

The team used a Low-Code/No-Code platform (7, 8, 12) to overcome the following challenges by accelerating the development without compromising the quality of the visitor management system. This approach enabled the team to create a user-friendly, efficient application within the stipulated 2-month timeline.

Positive feedback from the chairman, his team, patients, and their attenders/visitors during the pilot testing has validated Pravesh's impact on reducing crowd related challenges and improving patient safety. The digital passes not only streamlined processes but also provided real-time data on visitor management.

4 Future steps of scale up

The successful piloting of Pravesh paves the way for a broader implementation of it across other medium to large-scale hospitals. Future developments will involve expanding and improving the application in response to input from the pilot hospital. For the ecosystem to be widely adopted, Pravesh must be integrated with more extensive HMIS systems that follow the ABDM requirements (13, 14) and undergo compatibility testing across various hospital configurations.

In order to guarantee scalability, Pravesh must tackle certain obstacles including data security, user education, and system efficiency as it expands to accommodate bigger institutions with increased patient traffic. Adapting to the changing healthcare landscape will require constant observation and incremental changes.

Scaling Pravesh will require close collaborations with government agencies, technological companies, and healthcare facilities. This entails taking care of data privacy, adhering to regulations, and creating a viable business plan for long-term profitability.

5 Conclusion

This case study on Pravesh—An EVMS is a testament to the revolutionary potential of using Low-Code/No-Code platforms and an Agile-based Scrum Framework. The Agile-based Scrum Framework made the development of the application easier by facilitating smaller achievable steps set for each sprint goal in an iterative manner. The use of Low-Code/No-Code platform for the development of this application laid a foundation for accurate development without involving a high-end coder in the development team. With the amalgamation of healthcare and technology, healthcare professionals can now indulge in designing their ideas into actual products providing simple solutions for the pressing healthcare issues in the current healthcare scenario. In addition, addressing the challenges associated with visitor management in hospitals by optimizing the visitor and attender management processes, Pravesh also improves patient safety and overall hospital efficiency.

After Pravesh's successful pilot experience in a 30-bedded hospital in Bengaluru, which served as evidence proving the project's intended efficacy in crowd management. Because of its adaptable architecture and capacity to handle a range of healthcare scenarios, this application can also be adopted by medium and large-scale hospitals seeking a user-friendly way to manage crowds.

Author contributions

All authors made significant contributions to the drafting and revising of the article, agreed to the submission of the current version of the article in this journal. PP was involved in the development of the article along with data acquisition and analysis. AP provided oversight and guidance for drafting of the manuscript.

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Materials utilized from other sources for the development of this article are cited with the relevant references. Permission and verbal consent were obtained from the founders of the application for drafting this article.

Acknowledgments

We acknowledge the support of Dr. Kalaivani and Mr. Arun Senthilkumar, founders of Pravesh, for giving us the opportunity to interview them and produce this case study.

Conflict of interest

The authors declare that being a case representation of the igniting journey of budding entrepreneurs, consent was taken from the founders of the application to develop this case study for educational purposes only and does not draw any commercial or financial relationships that could be construed as a potential conflict of interest.

References

1. Uniyal P. *Visitor management system for hospitals. truMe*. (2023). Available online at: https://www.trume.in/visitor-management-system-for-hospitals/ (accessed February 02, 2024).
2. NHA. *Ayushman bharat digital mission*. (2024). Available online at: https://abdm.gov.in/ (accessed February 02, 2024).
3. Noorhuzaimi M, Junaida S, Noraziah A, Huei Chen K. E-visitor information management system(E-VIMS) using MyKad. *Proceedings of the 2008 1st international conference on the applications of digital information and web technologies (ICADIWT)*. Ostrava: (2008). p. 44–9.
4. Oktaviandri M, Foong K. Design and development of visitor management system. *MEKATRONIKA*. (2019) 1:73–9.
5. Masters D, Scott P, Barrow G. *Sustainable visitor management system: A discussion paper*. Bengaluru: Bengaluru and Environmental Science. (2020).
6. Wilson K, Bell C, Wilson L, Witteman H. Agile research to complement agile development: A proposal for an mHealth research lifecycle. *NPJ Digit Med*. (2018) 1:46.
7. ProQuest. *72 development of a simple visitor management app for GOSH DRIVE*. (2024). Available online at: https://www.proquest.com/openview/833c364a9621dd371f8c2048579c751a/1?pq-origsite=gscholar&cbl=2041043 (accessed February 02, 2024).
8. Lorenzi D, Vaidya J, Chun S, Shafiq B, Atluri V. Enhancing the government service experience through QR codes on mobile platforms. *Government Inform Q*. (2014) 31:6–16.
9. Sahay A, Indamutsa A, Di Ruscio D, Pierantonio A. Supporting the understanding and comparison of low-code development platforms. *Proceedings of the 2020 46th Euromicro conference on software engineering and advanced applications (SEAA)*. Portoroz: (2020). p. 171–8.
10. Kalaivani S, Senthilkumar A, Prabhune A, Durairaj MB, Bhat SS. Application of Scrum framework and Low Code No Code platform for development and implementation of In-patient electronic visitor management system to optimise hospital operations. *Proceedings of the 2024 international conference on intelligent and innovative technologies in computing, electrical and electronics (IITCEE)*. Bangalore: (2024).
11. Hermes S, Riasanow T, Clemons E, Böhm M, Krcmar H. The digital transformation of the healthcare industry: exploring the rise of emerging platform ecosystems and their influence on the role of patients. *Bus Res*. (2020) 13:1033–69.
12. Liu S, La H, Willms A, Rhodes RE. A "no-code" app design platform for mobile health research: Development and usability study. *JMIR Form Res*. (2022) 6:e38737.
13. National Portal of India. *Ayushman bharat digital mission (ABDM)*. (2024). Available online at: https://www.india.gov.in/spotlight/ayushman-bharat-digital-mission-abdm (accessed February 02, 2024).
14. National Portal of India. *Ayushman bharat digital mission (ABDM) sandbox guidelines*. (2024). Available online at: https://www.india.gov.in/ayushman-bharat-digital-mission-abdm-sandbox-guidelines (accessed February 02, 2024).