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# DiaWell: design and development of an artificial intelligence–assisted smartphone application for type 2 diabetes self-management in a resource-constrained South Indian setting

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# Abstract

### Background

Type 2 diabetes mellitus (T2DM) is a major and rising burden in India, where routine care in public and tertiary hospitals is constrained by limited follow-up and self-management support. Advanced closed-loop and continuous-sensing digital systems are largely unaffordable for patients in Tier-II Indian cities, and few mobile applications are designed for the linguistic, economic, and connectivity realities of these settings. We describe the design and development of DiaWell, a locally adapted, artificial intelligence (AI)–assisted smartphone application for T2DM self-management, intended to be usable on ordinary Android devices with intermittent internet access.

### Implementation

DiaWell was developed through an agile, iterative prototyping process informed by focus groups and interviews with diabetic patients, caregivers, and clinicians. Requirements were elicited and separated into functional and non-functional specifications. The application adopts a client–server architecture: a React Native (Expo, TypeScript) mobile client and a Node.js/Express.js backend exposing RESTful APIs secured by JSON Web Token authentication. A dual-layer data design—on-device AsyncStorage plus a centralised server database—supports offline data entry with automatic synchronisation on reconnection. The backend was deployed on a cloud platform (AWS) and the client distributed as an Android application.

### Results

The development produced a fully functional application with two role-based interfaces. The patient role supports secure registration, recording of blood glucose, blood pressure, body mass index and weight, food logging with AI-assisted calorie estimation, medication reminders, upload of prescriptions and laboratory reports, foot-image capture, health tips, and generation of health reports. The doctor role provides a dashboard to review patient records, identify high-risk patients, issue digital prescriptions, and view health trends. Offline-first operation, secure authentication with automatic token refresh, and a responsive interface supporting light and dark themes were implemented to suit low-resource use.

### Conclusions

This development report shows that a locally adapted, offline-capable, AI-assisted diabetes self-management application can be built with an accessible technology stack for a resource-constrained South Indian context. The architecture and feature set are described in reproducible detail and provide a foundation for subsequent formal usability and effectiveness evaluation; clinical benefit was not assessed in this study.


# Background

Type 2 diabetes mellitus (T2DM) is one of the most rapidly escalating non-communicable disease challenges of the twenty-first century, and India carries the second-largest national burden globally, with an estimated 101 million adults affected [1, 2]. Effective management depends on sustained self-monitoring, medication adherence, dietary control, and regular clinical follow-up; yet structured self-management support and continuity of care are frequently limited in busy public and tertiary care facilities [3]. This gap contributes to persistently poor glycaemic control and a heightened risk of microvascular and macrovascular complications [3, 4].

Digital health tools, and mobile applications in particular, have emerged as a scalable adjunct to conventional diabetes care. Systematic reviews report that mobile phone applications improve glycaemic control when used alongside medical therapy, with the effect enhanced by feedback from healthcare professionals [5, 6]. Our group has previously shown, in the same South Indian setting, that smartphone- and web-based interventions can improve glycaemic control and quality of life among T2DM patients [7, 8, 9, 10]. Artificial intelligence (AI) is increasingly applied within these tools for decision support, risk stratification, and dietary estimation [11, 12].

However, most sophisticated digital diabetes systems—continuous glucose sensors and closed-loop platforms—are developed for, and priced for, high-resource settings, and remain out of reach for the majority of patients attending public and tertiary care hospitals in Tier-II Indian cities such as Mysuru. There is a corresponding scarcity of mobile applications explicitly engineered for the constraints of these settings: ordinary Android devices, intermittent internet connectivity, varying digital literacy, and the need for both patient self-management and clinician oversight within a single tool. This paper addresses that gap by describing, in reproducible detail, the design and development of DiaWell, a locally adapted, AI-assisted smartphone application for T2DM self-management. A companion study reports its effectiveness on glycaemic control and quality of life; here we focus on the requirements, architecture, implementation, and feature set of the application itself.

## Implementation

# Development approach and setting

DiaWell was developed at the Department of Community Medicine, JSS Medical College and Hospital, Mysuru, following institutional ethics approval (JSS/MC/PG/23–24/2023-24). Development preceded and enabled a subsequent effectiveness study. Creation of the application was preceded by an assessment of the current situation and identification of gaps and obstacles in glycaemic management for diabetic patients. User requirements and desired features were collected methodically through focus groups and interviews with diabetic patients, caregivers, and medical experts. The application was then designed, built, tested, and refined through multiple iterations following an agile prototyping approach, until a fully functional application supporting diabetes management for both patients and healthcare professionals was achieved.

## Requirements analysis

Requirements were derived from the needs of diabetic patients and healthcare professionals and separated into functional and non-functional categories. Functional requirements included: secure login and registration for both patients and doctors; recording and monitoring of blood glucose, blood pressure, body mass index (BMI), weight, and calorie intake; medication tracking with reminder notifications; the ability for doctors to view patient records, identify high-risk patients, and generate digital prescriptions; and AI-assisted calorie estimation and dietary recommendation. Non-functional requirements included: offline data entry with automatic synchronisation when connectivity is available; a simple, responsive, and user-friendly interface; data security and privacy through secure authentication and storage; and reliable performance with minimal network usage and rapid response times.

## System architecture

DiaWell follows a client–server architecture (Fig. 1). The mobile client allows patients to record and manage their health data, while the server stores and manages information in a central database. Data entered by users are stored locally when there is no internet connection and are automatically synchronised with the server once connectivity is restored. This offline-first design was a deliberate response to the intermittent connectivity typical of the target setting.

## Frontend

The client was developed in React Native within the Expo framework, using TypeScript. It follows a component-based architecture that makes the application modular, reusable, and maintainable. The interface is responsive and supports both light and dark themes. It provides screens for user authentication, health monitoring, medication reminders, appointment scheduling, and doctor–patient interaction, and includes graphical representations of blood glucose trends and health reports so that patients and clinicians can monitor progress.

## Backend

The backend was built with Node.js and Express.js following a RESTful architecture. It manages user authentication, business logic, and communication between the client and the database, and provides APIs for patient management, doctor assignment, health-record management, appointments, medication reminders, digital prescriptions, and AI-assisted calorie analysis. It ensures secure data exchange, reliable synchronisation of offline data, and efficient access to patient information through the doctor dashboard.

# Data design

A dual-layer database design supports both offline and online functionality. On the client, health records —blood glucose, blood pressure, BMI, medication details, and appointments—are stored locally using AsyncStorage, allowing uninterrupted use without connectivity. On the server, a centralised relational database stores patient profiles, health records, prescriptions, appointments, and clinical alerts. When connectivity is restored, locally stored data are automatically synchronised with the server so that both patients and doctors have access to the latest information.

## API and security

Communication between client and server uses RESTful APIs supporting user authentication and management and full create, read, update, and delete (CRUD) operations for blood glucose readings, blood pressure, BMI, calorie logs, medication reminders, appointments, and digital prescriptions. The application uses JSON Web Token (JWT) authentication to secure API access; when a user's access token expires it is automatically refreshed, allowing requests to continue without interrupting the user experience. This provides secure, reliable, and seamless communication between client and backend.

## Deployment

The Node.js backend was deployed on a cloud service provider (Amazon Web Services), and the mobile client was distributed as an Android application. Prerequisites for use are an Android device with an internet connection, application installation, and permission grants for camera, gallery, notifications, and storage. The development workflow, from situation analysis through requirements gathering and iterative prototyping to the delivered application, is summarised in Fig. 2.

## Results

The development process produced a fully functional application with two role-based interfaces—patient and doctor—designed to work together within a single system (Table 1).

Table 1
DiaWell application features by user role.

| User role | Features |
|---|---|
| Patient | Register / login; complete profile; record blood glucose; record BMI; food logging with AI-assisted calorie estimation; upload prescriptions; upload laboratory reports; capture foot images; view health tips; set medication reminders; generate health reports; manage profile; graphical blood-glucose trend visualisation. |
| Doctor | Login; dashboard; patient list; patient details; identify high-risk patients; create digital prescription; view health trends; update profile. |
| Shared / system | Client–server architecture; offline data entry via AsyncStorage with automatic synchronisation; JWT authentication with automatic token refresh; RESTful CRUD APIs; responsive UI with light/dark themes; AWS cloud backend; Android client. |

# Patient interface

The patient role supports registration and login, profile completion, and a comprehensive set of self-management functions: recording of blood glucose and BMI, food logging with AI-assisted calorie estimation, upload of prescriptions and laboratory reports, capture of foot images for monitoring, viewing of health tips, setting of medication reminders, generation of health reports, and profile management. Graphical visualisation of blood glucose trends allows patients to track their own progress over time.

# Doctor interface

The doctor role provides secure login and a dashboard from which clinicians can view their patient list and individual patient details, identify high-risk patients, create digital prescriptions, review health trends, and update their profile. This gives clinicians continuous oversight of enrolled patients between physical visits, a capability rarely available in routine outpatient diabetes care in the setting.

# Non-functional characteristics

Offline-first operation with automatic synchronisation, secure JWT-based authentication with automatic token refresh, a responsive interface with light and dark themes, and minimal network dependence were realised as specified. Together these characteristics were intended to make the application usable by patients with modest devices, variable connectivity, and a range of digital literacy.

## Discussion

This report describes how a locally adapted, offline-capable, AI-assisted diabetes self-management application was constructed for a resource-constrained South Indian setting using a widely available technology stack. Three design decisions are central to its relevance. First, the offline-first, dual-layer data design directly addresses intermittent connectivity, a frequent barrier to mHealth adoption in Tier-II Indian settings, by allowing patients to record data without interruption and synchronising when a connection returns. Second, the integration of both patient self-management and clinician oversight in a single system enables continuity of care between visits, aligning with evidence that healthcare-professional feedback amplifies the glycaemic benefit of diabetes applications [5, 6]. Third, the use of an accessible, component-based framework (React Native/Expo) with a conventional Node.js/Express.js backend makes the architecture reproducible and adaptable by other groups working in similar settings.

The application extends our group's earlier smartphone- and web-based diabetes interventions in the same setting [7, 8, 9, 10] by adding AI-assisted dietary estimation, offline-first operation, and an integrated clinician dashboard. Its feature set—covering monitoring, medication support, dietary guidance, and clinician review—is consistent with components associated with effective diabetes self-management tools, while its engineering is deliberately lightweight rather than dependent on continuous sensors or closed-loop hardware.

# Limitations and future work

Several limitations should be stated explicitly. First, this paper reports the design, architecture, and implementation of the application; it is a development report and does not itself evaluate clinical effectiveness, and no claim of clinical benefit should be inferred from it. Second, no formal quantitative usability evaluation using a standardised instrument (such as the System Usability Scale) was conducted as a distinct output, so the usability of the interface is described qualitatively from the iterative development process rather than measured. Third, requirements were elicited from patients, caregivers, and clinicians at a single tertiary care centre in Mysuru, so the design reflects the needs of that context and may require adaptation elsewhere. Fourth, formal security penetration testing and independent code audit were outside the development scope, and the security description reflects implemented design choices rather than verified assurance. Fifth, the AI-assisted calorie estimation depends on image quality and the coverage of the underlying food database, and its accuracy has not been independently validated; this component should be regarded as supportive rather than a substitute for dietetic assessment. Finally, the application currently targets Android devices only, and long-term maintenance, scalability under load, and real-world sustained engagement remain untested. Future work includes formal usability and accuracy studies, security auditing, iOS support, and integration with laboratory and health-system records. The effectiveness of DiaWell on glycaemic control and quality of life is reported separately.

## Conclusions

DiaWell is a locally adapted, AI-assisted, offline-capable smartphone application for T2DM self-management, developed through an agile, user-informed process for a resource-constrained South Indian context. Its client–server architecture, offline-first data design, secure API layer, and integrated patient and clinician interfaces are reported here in reproducible detail. This is a development report: the application's usability and clinical effectiveness were not evaluated in this study and require dedicated investigation before conclusions about patient benefit can be drawn.

# Availability and requirements

**Project name**

DiaWell.

**Operating system**

Android.

**Programming languages**

TypeScript/JavaScript (React Native, Expo; Node.js, Express.js).

**Other requirements**

Android device with internet connection; camera, gallery, notification, and storage permissions; cloud (AWS) backend.

**Availability**

The application and source code are available from the corresponding author on reasonable request.

**Any restrictions to use by non-academics**

Use for research and non-commercial purposes by arrangement with the corresponding author.

# Abbreviations

AI
Artificial intelligence
API
Application programming interface
APK
Android application package
AWS
Amazon Web Services
BMI
Body mass index
CRUD
Create, read, update, delete
HbA1c
Glycated haemoglobin
JWT
JSON Web Token
QOL
Quality of life
REST
Representational state transfer
T2DM
Type 2 diabetes mellitus
WHOQOL-BREF
World Health Organization Quality of Life – BREF instrument.

# Declarations

### Ethics approval and consent to participate

Development of the application and the associated study were approved by the Institutional Ethical Committee of JSS Medical College, JSS Academy of Higher Education & Research, Mysuru (approval number JSS/MC/PG/23–24/2023-24). Written informed consent was obtained from participants involved in requirements gathering. All methods were carried out in accordance with the Declaration of Helsinki and relevant institutional guidelines and regulations.

## Clinical trial number

Not applicable. This article reports the design and development of a software application and does not report a clinical trial.

## Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

## Funding

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## Author Contribution

K.M. and S.K.D. conceived and designed the application. K.M. coordinated requirements gathering, development, and testing. K.M. and S.K.D. drafted the main manuscript text. A.G. contributed to system design, validated the development workflow, and prepared Figures 1 and 2. L.S.A. critically revised the manuscript for important intellectual content. S.K.D. supervised the work as corresponding author. All authors reviewed and approved the final manuscript.

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# Data Availability

The DiaWell application and its source code, which are the research outputs described in this study, are available from the corresponding author on reasonable request. This article reports the design and development of a software application; no participant-level clinical datasets were generated or analysed for this development report.

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# Figures

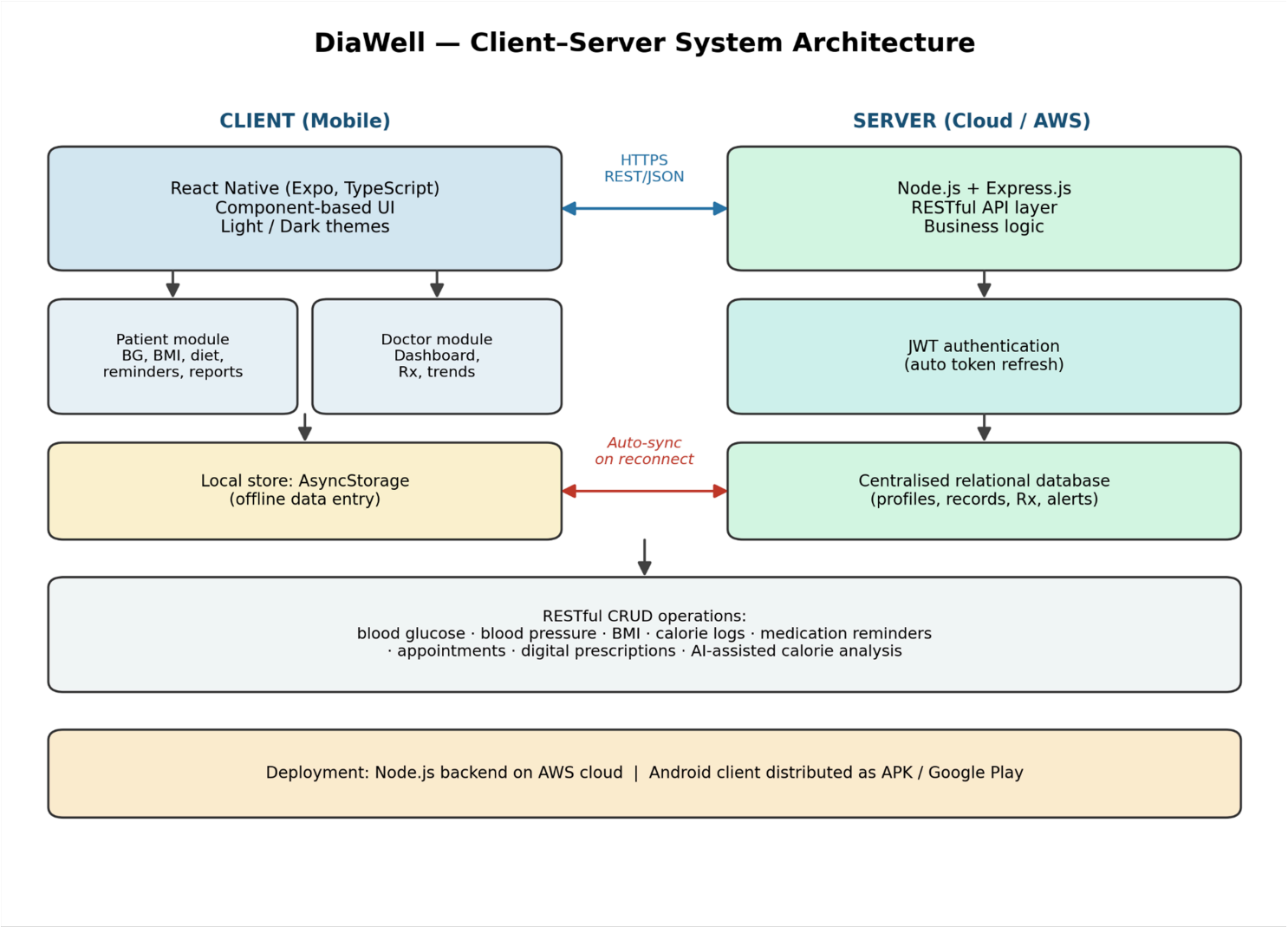



**Figure 1**

DiaWell client–server system architecture. A React Native (Expo/TypeScript) mobile client with on-device AsyncStorage communicates over secure RESTful APIs with a Node.js/Express.js backend and centralised relational database deployed on AWS; locally stored data are automatically synchronised on reconnection.

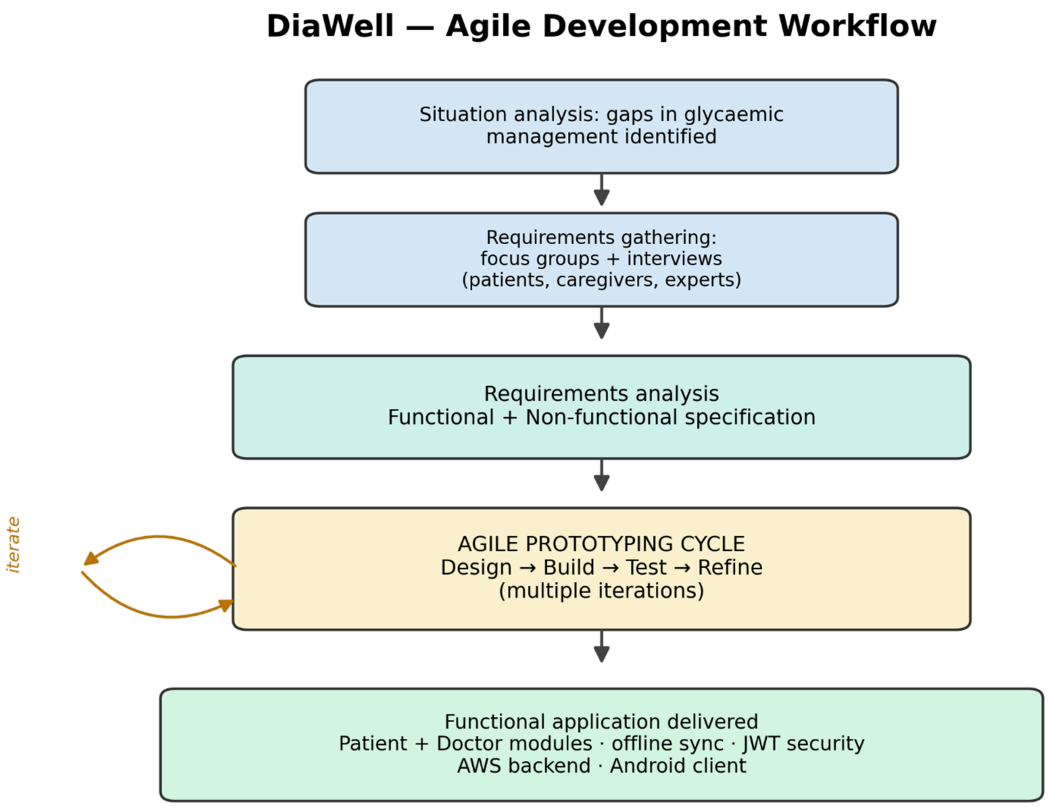



**Figure 2**

DiaWell agile development workflow, from situation analysis and requirements gathering (focus groups and interviews) through iterative design–build–test–refine prototyping to the delivered application.