CS 837: Healthcare Application Development: Overview of projects

Term 2, 2023-24

T K Srikanth
Jaya Sreevalsan Nair

IIIT Bangalore

Project Themes

1. Self-help therapy apps monitored by doctors - with activities, assessments, forums, chat
2. Tele-consulting platform (audio only - phone calls) with multiple clinics/docs
3. Tele-consulting platform (audio/video/chat)
4. Collaborative diagnostic platform - enabling clinicians/radiologists/pathologists to review and share comments on medical images
5. Hospital system integrated with ABDM sandbox, supporting common use-cases
6. App (phone/tablet) for field workers to extend health service from hospital to the home
7. Standards-compliant hospital app (SNOMED CT), and interchange of health data between hospitals (FHIR)
8. Hospital information system with tablet-based app for busy doctors

All projects will have two or more portals/apps, admin screens, some analytics/dashboards

1. Self-help app monitored by doctor/therapist

- 4 parts:
  - Q&A forum
    - Anyone can view posts and responses.
    - Registered users can post questions
    - Trained responders prepare responses. Moderator edits and approves responses
    - Anyone can "flag" posts as inappropriate. Reviewed/deleted by moderator
  - Useful resources (videos, etc. see MindNotes or PUSHD for content)
  - Self-assessment and self-help tools (e.g GAD7 and PHQ9. see Wellness Check for examples.)
  - Connect with professional
    - Chat-like interaction - answered by one of available experts
    - Emergency - direct audio call to listed helpline
- Senior doctor can view all of the above except patient identifiable information
- Multi-lingual, accessible
- *automated screening of posts for emergency conditions or harmful posts

2. Tele-consulting platform (phone based) with multiple clinics/docs

On the lines of the TeleManas solution:

1. Callers dial into the counselling service using a single number. Can choose language and other options. Callers can use simple (feature) phones
2. Calls are connected to one of the available counsellors at an identified "counselling center"
3. Counsellors can record data about callers - name, age, gender etc as well as summary of conversation
4. For repeat calls from same number, the history of calls is shown to the counsellor, along with demographic information of callers
5. Counsellors can schedule callbacks - with date/time. System will prompt them for this and enable easy call-out
6. For privacy reasons, actual phone number of caller is not shown to any user
7. Option for audio recording of call - with strong security mechanisms (voice call can be simulated)
8. Senior doctor should be able to oversee call and counsellor activity in real time

3. Tele-consulting platform (audio/video/chat)

1. Patients can "call" platform - serviced by one of available doctors
2. Call and conversation can be supported by either chat or audio/video (WebRTC) channel. Should simulate incoming/outgoing calls, as well as waiting/busy conditions
3. Online consultation, recording of clinical details, issue of prescription
   - Patient can upload clinical records (history)
   - Mechanism for doctor to see prior history and add details, and register follow-ups
   - Mechanism for doctors to view callers and follow-ups
   - Prescriptions only for video calls or where identity of caller can be verified
4. Handling repeat callers
5. Consent for sharing record with other hospitals
6. Ability for senior doctor to monitor activities across channels
7. *Audio calls can also be done from regular phones (non-WebRTC - no app needed). No appointments needed for this
8. *Chatbot as a possible initial interaction for chats. Can help patients navigate the app better

See, for example, eSanjeevani

4. Collaborative diagnostic platform - Tele-radiology

1. Doc prescribes tests for patient
2. Lab uploads images and remarks
3. Radiologists can view images and doctor notes, and add annotations and impressions
   a. Should be able to zoom/pan the image and add line/polygon annotations and notes
   b. Each radiologist markings should be viewable separately
4. Doc reviews radiologist impressions and notes and makes final diagnosis
   a. May have back-and-forth with radiologist(s) for further details
5. Patient can view images with radiologist impressions and doc diagnosis (not the annotations or chat). Can provide consent to other docs and authorized reps to view reports
6. *Should be able to handle images in DICOM formats. Also look at PACS

5. Integration of Hospital system with ABDM

Design and implement a simple hospital health information system with basic use cases

Design and implement integration layer to connect your system to ABDM sandbox

Should support key use cases of Milestones 1, 2, 3 (register patient with ABHA ID, pull records from other HIP, push records on request to other HIU)

Demonstrate interworking with ABDM PHR app

Demonstrate data sharing using 2 instances of same (or similar) HIS - each able to function as HIU/HIP. Show Health records shared are FHIR compliant.

6. Extending care to the home - enabling health workers

1. Field health workers visit houses and screen all members of a family using standardized questionnaire
2. Those identified with mental health conditions are referred to doctor for local area
3. Doctor evaluates and prescribes treatment, and any followup needed. Records diagnosis with ICD10 codes (entry should be simple)
4. Health worker should track and complete followups. App helps them with schedule, alerts etc
5. Tablet-based app for health worker. Should support offline capability
6. Doc can view data of patients they have treated, as well as summary data of patients in their local area (e.g district or taluka)
7. Provides API for state level dashboard that shows data across such programs
8. Multi-lingual (for field worker)

7. Standards compliant storage and exchange of health data

Hospital information system that is standards compliant

Helps doctors in recording in SNOMED CT compliant codes.

Exchanges information in FHIR format (demonstrate with simple app or second instance of same solution)

UI should simplify mode of entry (docs should not need to use SNOMED CT codes directly)

Links to drug databases for ease and consistency of entry

Patient should be able to view "understandable" records - no Codes, etc.

See for example: CDAC's toolkit for SNOMED CT

8. HIS with user-friendly Doctor app

1. Enable typical hospital flow
   a. Patient registers, reviewed at OP, referred for admission (IP)
   b. Nurses and residents in the ward manage patient - can view and add records, including images
   c. Doctor/consultant performs "rounds", views data on tablet. Reviews and updates data and treatment plan. Usability is key
2. Only nurses/residents on duty can access records. Similarly primary doc and those who have treated patient can access records
3. Pharmacy can view prescriptions
4. Patient and/or authorized persons can provide consent for data sharing
5. *Look at various ways to make doctor app usable - including voice input

Common considerations

- Management of patient demographic data - and ensuring privacy
- Management of patient health data - structuring across visits
- User on-boarding: self-registration or by admin/invitation - authenticating the user
- Login - and appropriate security mechanisms
- Security of API's, security of transmitted data,
- security of stored data
- Consistency of data/state across different apps (different roles/users)
- Admin/super-admin functionality
- Dashboards

For certain apps:

- Consent (where applicable)
- Integration with other healthcare systems
- Offline mode

Common Considerations

Separate analytics dbs for dashboards/reports. Does not contain personal/sensitive information

Use standard dbs for locations (https://lgdirectory.gov.in/)_, diagnosis (ICD10 or SNOMED CT), etc

Ensure adherence to privacy requirements - consent, minimization, purpose, retention, erasure, security safeguards (encryption) etc