Emergency Patient Record Transfer System

Aditya Ajay
Computer Science Engineering
Amal Jyothi College of Engineering
Kottayam, India
adityaajay2026@cs.ajce.in

Akhil S Nambiar
Computer Science Engineering
Amal Jyothi College of Engineering
Kottayam, India
akhilsnambiar2026@cs.ajce.in

Midhun P Mathew
Computer Science Engineering
Amal Jyothi College of Engineering
Kottayam, India
midhunpmathew@amaljyothi.ac.in

Adon Jobi
Computer Science Engineering
Amal Jyothi College of Engineering
Kottayam, India
adonjobi2026@cs.ajce.in

Aiswarya Manoj
Computer Science Engineering
Amal Jyothi College of Engineering
Kottayam, India
aiswaryamanoj2026@cs.ajce.in

***Abstract*—Emergency Patient Record Transfer System is a proposed project which aims to reduce the time to get treated for patients who are being transferred from one hospital to another. In emergency medical situations, rapid and accurate transfer of patient records between hospitals is crucial for optimal care. Existing methods often involve manual processes, leading to delays, errors, and potential miscommunication. Emergency Patient Record Transfer System proposes a digital platform that facilitates the transfer of critical patient information during emergency transfers. Leveraging secure data exchange protocols and interoperable data standards, the system aims to streamline the process, enhance patient safety, and improve care coordination. This system features secure data exchange, standardized data formats and access control mechanisms.**

Keywords—medical, patient transfer, health, software

I. INTRODUCTION

The current scenario involving in patient transfer involves transferring the patient along with their record. This approach has worked out so far but has a drawback of wastage of patient's time - which is critical especially in emergencies. Our project – EmPaRT – attempts to bridge the gap between the sending hospital and receiving hospital by providing an interface to send the patient detail in advance so that the receiving hospital can have a general idea of what to expect from the patient's condition. While it is true that re-examination is necessary, the fact that the receiving hospital can have a heads-up information on the patient will help in speeding up the entire process.

More than a controlled centralized store of health records, EmPaRT aims to provide the right information to the involved hospitals. By leveraging the advancements in technology in the past few years combined with the basic data requirements for responding immediately to a health emergency, EmPaRT will be able to handle the transfer of record between two hospitals.

The data transfer protocols are complex. Various hospitals have their own way to protect patient records. This may also be by keeping the patient records in-house. To respect this aspect, the EmPaRT system minimizes data collection.

II. LITERATURE REVIEW

A. Electronic Health Records

Electronic Health Records (EHR) [1] are the medical records of a single patient which is stored in a digital format. Instead of storing the medical records by pen and paper approach, EHR stores them in digital format making it easy to access as well as share. EHRs have positively affected the healthcare industry which always strive to provide better care for patients [6].

B. Patient Transfer

Patient transfer [2] in our project refers to the transfer of a patient from one hospital to another. Since various aspects could lead to a transfer, it should be done systematically and according to evidence-based guidelines. The key elements of safe transfer involve decision to transfer and communication, pre-transfer stabilisation and preparation, choosing the appropriate mode of transfer, i.e., land transport or air transport, personnel accompanying the patient, equipment and monitoring required during the transfer, and finally, the documentation and handover of the patient at the receiving facility. The documentation should be clear at all stages of a transfer.

C. Current State of Patient Transfers

Inter-hospital transfer of patients is quite common but not optimized. The patient is not being transferred to the highest quality hospital [3]. The lack of interoperability between HER leads to duplicate testing as well [4]. Duplicate testing was found in more than 30% of cases while 20% had at least one duplicate testing not clinically indicated. Study also suggest that incompatible electronic record can also lead to potentially costly duplicate testing.

In addition to the above state, transfer documentation was frequently absent with overall completeness of 58.3% [5]. Adverse effects occurred in 42% of the patients within 24 hours of arrival, with in hospital mortality of over 15%. Higher completion rate of transfer documentation resulted in lower in hospital mortality, reduced adverse effects and reduced duplication of labour. According to research [7],

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documentation error rate in cancer diagnosis was found to be around 15%.

III. PROJECT STRUCTURE

A. Frontend

The frontend of the project is HTML-CSS-JS. However, instead of pure HTML, we opted for Jinja, a templating engine built on HTML that provides seamless integration with the backend. Moreover, it is supported by the creators of Flask, so having it as frontend boosts the easiness of integration of backend and frontend. It has been tested to provide a simple yet to the point layout for the staff to operate. There are separate logins for the admin, the hospital administrator and the staff(s). The admin can add and delete (remove) hospitals and get an overview on the number of transfers made through the system. The hospital administration can add or remove the staff, get an overview of the transfers where their hospitals were involved and change their password. The staff user role allows for the actual transfer of records as well as reading the records. It also has a UI for the initial system setup which aids in creating

B. Backend

The backend is powered by Python using Flask. It has sign in methods for admin, hospital and staff. It also has the data access objects for the MongoDB database collections. The MongoDB connection is controlled via environment variables set inside a .env file. The PyJWT library aids in implementing JWT [8] to ensure a secure yet simple user authentication workflow. For the convenience of the user, the session persists for 15 days after which the user has to re-login again.

C. Database

For adapting to the everchanging novelties in the medical and allied industries, we chose MongoDB as our database. Mongo has the advantage of allowing dynamic fields in each record and is best for unorganized data. Moreover, as the healthcare industry evolves, the data collected for diagnosis and treatment of a patient changes. SQL is not ideal for this scenario and hence a strong NoSQL database like MongoDB fits the gap well.

IV. WORKFLOW

The project requires a certain flow. First, the admin user has to be setup. This is a one-time step and cannot be repeated as long as there is a database collection for the admin user.

After setting up the admin user, they must set up accounts for hospitals which are to be part of the EmPaRT network. This is the role of the admin user – hospital user management. By providing separate roles, the role-based access control mechanism can be used for enabling access to data which is essential to each role.

The hospital administrator sets up the staff user(s). The staff user management is hence handled by the users with hospital admin role.

The staff users are able to send and receive records. While the data being sent is stored in the central MongoDB database server, only staff user has read/write access to it. The staff user, when sending the record, stores the information to the database. When retrieving the record, the record is well formatted as tables.

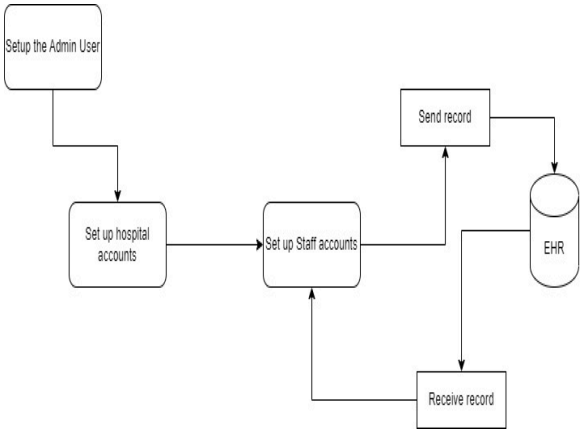

Figure 1: EmPaRT Workflow

A. ***Benefits of the System***

Reduced Treatment Delays

By providing immediate access to a patient's EHR, the receiving hospital can start treatment without waiting for physical records or relying on slow fax-based systems. This can significantly reduce wait times, especially in emergency cases where rapid intervention is crucial.

Improved Accuracy and Data Integrity

The use of digital records ensures the accurate transmission of data without the risk of errors that could occur with handwritten notes or misinterpreted fax documents. Digital records can be validated, checked, and updated in real time, ensuring accuracy.

Enhanced Patient Outcomes

With fast access to complete and accurate patient data, healthcare providers can make informed decisions and tailor treatment plans quickly, improving overall patient outcomes.

Better Resource Allocation

Hospitals can make more effective use of their resources by knowing in advance the patient's condition and required treatments, which can help prioritize care and allocate resources more efficiently.

B. ***Limitations***

Our system may provide advantages in patients' health. However, it comes with some limitations.

- *Infrastructure Dependency*

The system's functionality heavily relies on the availability of stable internet and technological infrastructure. In remote

areas or regions with limited access to reliable network infrastructure, transferring patient records might be problematic.

- *Privacy Concerns*

Although the system uses secure communication protocols, data privacy remains a critical concern in healthcare. Unauthorized access to patient records, data breaches, and hacking could compromise patient confidentiality.

- *Integration Challenges*

Different hospitals use varying healthcare management systems. Integrating these diverse systems into a seamless record transfer network can be complex and may require significant investment in terms of both time and money.

- *User Training*

This system requires the staff to be trained on how to use it. This can be limiting, especially when new technology means new technical details.

- *Switching the hospital in the middle of a transfer*

A transfer is not a simple process. The patient may feel to change the hospital while they are transferring or situations may arise which require urgent divert to another hospital. The current implementation works on the assumption that such a situation does not arise.

V. Results

A few screenshots of our project which has been completed has been included:

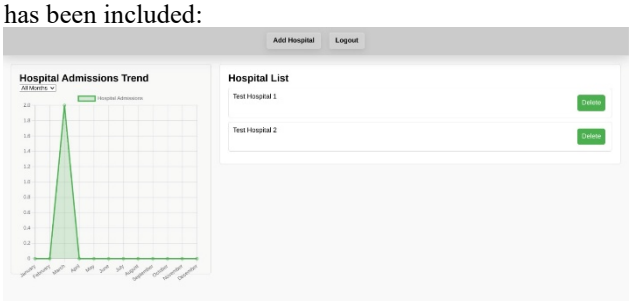

Figure 2: Admin Dashboard

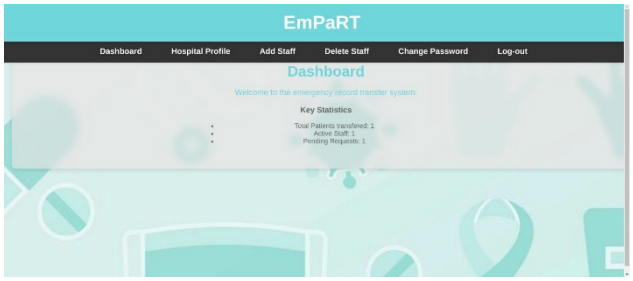

Figure 3: Hospital Dashboard

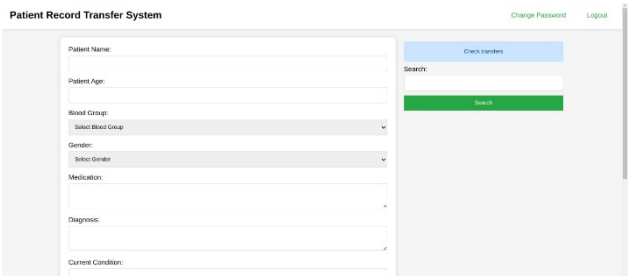

Figure 4: Staff - Transfer Record

Figure 5: Staff - View Record

VI. Abbreviations and Acronyms

- EmPaRT: Emergency Patient Record Transfer System - our proposed system.
- EHR - Emergency Health Record.
- JWT - JSON Web Tokens. JSON Web Tokens are the secure way to authenticate a user.
- HTML - Hyper Text Markup language. HTML is used to structure webpages.
- JS - JavaScript. Standardized by ECMA (Ecma international), JS is the most widely used language for the web. It provides functionality for the webpages.
- CSS - Cascading Style Sheet. It is used to style the webpages.
- Admin - Administrator
- UI - User Interface
- DB – database
- regex – regular expression.

VII. Conclusion and Future Scopes

EmPaRT offers a promising solution to improve emergency patient care by enabling faster and more efficient record transfers. Future improvements could include enhanced security measures, AI-powered predictive analytics for triaging patients, and integration with Electronic Health Record (EHR) systems to ensure seamless interoperability across different healthcare institutions. Also, file upload capabilities can be done to ensure various digital results reach the receiving hospital and minimizing the need for human input. A notification system can be added to show the incoming records. Also, a module which integrates well with emergency response vehicles and ambulances can help in live location and hospital switching in the middle of a transfer.

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