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Review Article

Shree Clinical Laboratory Management Application: Enhancing Workflow and Data Management Efficiency

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Abstract: The goal of the Clinical Laboratory Management Application is to improve the accuracy and efficiency of laboratory work in healthcare environments. Every clinical laboratory needs to maintain test records, and generating reports in the correct format can be quite complex. Additionally, managing the financial activities associated with patient tests poses challenges for lab technicians. This application addresses these issues, offering a user-friendly solution that simplifies record-keeping and report generation. This application will aim at creating advancement in manual keeping of clinical data records. This application streamlines processes such as sample tracking, result reporting, inventory management, and compliance with regulatory standards. Clinical Laboratory Management's features, which include user-friendly interfaces, automated workflows, and strong security measures, not only support quality improvement initiatives but also increase operational efficiency, which ultimately improves patient outcomes and makes the healthcare delivery system more efficient.

Keywords: Sample Tracking, Quality Control, Report data management, Automatic report generation, Data security.

1. Introduction

The project title "**Shree Clinical Laboratory Management**" is an application developed for Shree Laboratory, Tembhurni to manage all the tests of patients. This app is mainly developed for lab technicians.

This application contains many features related to managing tests of patients. By using this application lab technicians reduce the complexity of tests management. This application also generates the report and this generated report can be easily shared via Whatsapp, Email and various messaging applications. This application stores date wise history of tests. The "Clinical Laboratory Management app" also generates the bill of patients. It also gives information about total tests of patients. In this app one more feature for lab technicians is he can update the test price according to his perspective. This software system will aim at creating advancement in manual keeping of clinical data records.[1]

Managing the reports and report history manually is so complex. This problem is overcome in this application by maintaining the all reports records in real time database. Also, this application allows lab technicians to update test prices easily based on market conditions or laboratory policies, ensuring flexibility in pricing management.

This application is developed for the purpose of controlling the laboratory workflow and simplifying the operations for increasing patient care. By the development of an attractive GUI, this application makes the communication easier with the Lab technician. This application will help in improving the patient's convenience towards the clinical lab which will be useful according to the business manner.

2. Literature Review

2.1 Summary of Medical Report Maker PDF:
Medical Report Maker PDF is easy to use and allows you to create the medical report you need. Medical Report Maker PDF app allows you to publish reports on the web using Android phones and tablets and makes it very easy to share reports via messaging apps, social media and email. Medical Report Maker PDF is the new way to create reports in the world. The app allows you to create all your advertisements anytime and anywhere using your smartphone. This app is provided for doctors to write reports easily. You can create reports and share or print them in PDF format.[2]

Features of Medical Report Maker PDF:
1) Form entry data, Form filter report data
2) Generate the PDF report on your phone and email it on-site.

3) Send an image report with Email, SMS, WhatsApp.
4) CBC Report.
5) Compatible with all Android 8 devices.

2.2 Summary of Free Path Lab Software:

Easy lab management and low cost. This software has advanced features such as a user-friendly interface, multiple lab schedules, custom templates, batch management, and digital test reports. In addition, it increases automation in the laboratory workflow, simplifying laboratory operations and promoting patient care. It is free to manage clinical laboratory reports with normal values and test details for any pathology laboratory in India.[3]

Features of Free Path Lab Software:

1) This software is a powerful database.
2) The owner can make a report on the laboratory tests of the patients done in the laboratory.
3) Here we can enter additional information needed to write a patient report while looking at output data.
4) All test reports can be saved to test history.

2.3 Summary of Medical Report & Rx Maker:

Medical Report and Rx Maker is a simple and user-friendly mobile application designed to simplify the process of creating medical reports. Generated reports (PDF) can be easily shared via messaging programs or e-mail. Facilitate communication between clinical laboratory staff and patients. Medical Reports and Rx Builder to generate clinical laboratory reports and easily import and manage clinical laboratory reports for patients. Secure storage of patient data and quick access. Applying medication reports with Rx Maker is a new way to increase the efficiency and accuracy of clinical practice. This software is used to manage all health reports. You can also view reports created in the Health Report and History of Rx Maker app.

The Health Report and Rx Maker Create project will become a report generation system and replace the old manual report preparation system. Clinical Report and Rx Maker free app provides features like cell count, normal range, test name, details while making clinical reports. Medical Reports and Rx Maker mobile pharmacy application is very useful for generating medical reports and saving time.[4]

Feature of The Medical Report & Rx Maker app:

1) Generate medical test reports with standard format.
2) Shows your total Test reports and his history.
3) Mobile-friendly layout for access on various devices, including tablets and smartphones.
4) You can add remarks, due date and time in your test.

2.4 Summary of Oxy Software:

The Oxy software is designed to provide lab invoices and reports for various laboratory tests performed in clinics, including the CBC test, thyroid, kidney, and liver functions. The Oxy Software works with conventional configuration systems that are Windows-based. Installing software is a very easy process. Oxy Software provides the unique facility to make Bills & Reports in PDF format, we can print out it. The user can plan to send on WhatsApp and save on their desktop.

Oxy Software has built-in functionality that makes it easy to handle and customize. For example, labs can create their own letterhead logo, address, and contact information with only one click. Oxy Software provides facilities to generate bills and reports of tests.[5]

Feature of Oxy Software:

1) Easy Setup, more Flexibility.
2) Fast & Friendly Support.
3) It provides the facility for printing the reports and bills.
4) Cost Effective.
5) Customization facility
6) Provides Security and Privacy.

2.5 Summary of Flab Pathology Software:

Flabs pathology Software is developed to be accessible to labs for small as well as larger size centers. With this software, users can easily manage the patient activities such as registration, automate lab analysis, and generate QR coded reports and share them to the patients for easier access and sharing. Flabs Pathology Software provides a patient dashboard where patients can access and download their reports easily by performing their login activity. This software helps patients to stay informed about their health, and they can view their reports anytime, and can take necessary actions accordingly.[6]

Feature of Flab Pathology software:

1) Streamlined Lab Operations.
2) Enhanced Patient Experience.
3) Secure data backups and recovery options.
4) Provides patient login dashboard.

2.6 Summary of RX Easy Prescription Maker:

Rx Easy Prescription Maker is a tool for busy doctors and healthcare professionals for managing their daily work. With its simple and user-friendly interface, users can easily create and manage works such as patient notes, write prescriptions, and keep track of their schedule. This application also allows users to store and manage their patient's medical information, making it easy to provide the best quality care. Whether you are in the clinic laboratory, hospital the Rx Easy Prescription Maker is a must-have to be installed in every healthcare professional.[7]

Feature of Flab Pathology software:

1) User-friendly interface.
2) Share prescriptions with patients.
3) Modern way to print prescriptions.
4) Export and import of medicines and patient records.
5) Save patient data in excel file form.
6) Activated on an unlimited number of Android devices.
7) Flexibility.

2.7 Summary of LabSmart software:

Labsmart is an application software that can easily generate and share lab reports with patients and doctors. Apart from printing, reports can be delivered to the patients via email, SMS and WhatsApp. The Labsmart provides online customer support for managing their problems while interacting with the software. UPI QR coded bills and lab reports can be printed. Patients can get their lab reports by scanning the Bill QR code. The generated PDF's can be shared with the patients. Apart from user friendly features, Labsmart offers outstanding support to help you run your business stress free. Labsmart is working with the latest technologies to provide a secure and reliable solution.[8]

Feature of LabSmart software:
1) Run on multiple computers
2) Access over phone anytime, anywhere.
3) Easy to operate
4) Online customer support

2.8 Summary of MyOPD ZIP-Prescription Maker:
MyOPD ZIP is a complete software solution to help manage various aspects of a business or practice, such as scheduling, Client management, financial transactions and other essential features which is very useful for doctors to manage patient's records. It is available for all android devices and select google Chromebook at same time. It is very useful for finding patients all information fast therefore to get quick decisions MyOPD ZIP allows to store/capture all medical reports of patients in detail and save in pdf as well as print them on to the blank paper.[9]

Feature of MyOPD ZIP-Prescription Maker:
1) Makes it easy to access their records, prescriptions and schedule appointments.
2) Printing certificates and custom prescriptions with images for making the clinic look more professional.
3) Handle everything from patient records to payments.
4) Keeps safe records of patients from another and we don't lose important data.

2.9 Summary of Health Amaze:
The Health Amaze is India's first Smart Pathology Laboratory Information Management System (LIMS). Health Amaze provides a user-friendly software that increases its demand in the market. The Health Amaze facilitates seamless data entry for test results and provides feature support for automated calculations through sophisticated algorithms. When the reports are generated the Health Amaze gives an alerting message to the customers via E-mail or SMS messaging that the reports are ready for retrieval. Additionally, reports can be conveniently shared with patients through email or WhatsApp, which helps in improving customer convenience.

All laboratory reports are enhanced with a unique QR code embedded in the header, allowing patients to effortlessly scan and download their report PDFs digitally.[10]

Feature of Health Amaze software:
1) Online access to pathology reports
2) PDF Facility in single click.

3) Attractive and user-friendly software.
4) 24x7 service support.
5) Blazing fast onboarding of patients and quick Invoicing service

2.10 Summary of MYLAB Software:
MyLab Pathology Reporting Software is a windows-based software for the Laboratory Centre. It is very easy to use Pathology Lab. System is more user friendly & Easy to use. Users who have normal windows knowledge can operate the system easily and create attractive Lab reports. My Lab software report generator software is designed to streamline the creation of clinical reports by automating data integration, analysis, and formatting. It aims to enhance the efficiency and accuracy of lab operations while ensuring compliance with healthcare standards. My Lab software provides an attractive UI, an SMS gateway API can be used for sending the message at the time of patient registration, new tests can be added as per requirements, and even a formula can be defined for auto calculation of values. My Lab software provides additional features such as patient searching based on mobile number and ID. [11]

Feature of MyLab Software:
1) On registration Patient will get Invoice / Bill after Registration.
2) Bar Code can be printed.
3) Different collection center can be defined in the software, Collection
4) Centre wise rate list can be maintained in the system.
5) Patient reports had different formats for Printing.
6) Reports can be exported to PDF format and send by email with a single click.

2.11 Summary of HELTHRAY Software:
Introducing our Healthray lab management software, designed to optimize operations while minimizing costs. With a user-friendly interface and advanced functionalities, it allows for comprehensive data recording and customizable templates. Effortlessly manage appointments and generate digital test reports. Our solution enhances automation in laboratory workflows, ensuring efficient operations and improved patient-centric care.

Lifecycle management of your lab inventory. It sounds like a great idea, and with Healthray pathology lab software, it truly is. The timely actions—along with alerts and push notifications that initiate them—make all the difference. Pathology lab software can quicker generate bills along with electronic billing that has modernization features. Believing the long paper-based processes, it's high time to terminate them and adopt digital reporting-based software such as Healthray pathology lab software. Use our free pathology lab software so that you can be saved from additional cost on installation. This-platform , while requiring basic-configuration-is rather straightforward to get up and running with. Impact of Pathology Reporting Software on Lab Growth Furthermore, these ways consist of scalability in terms of workflow management and interoperability with the various departments. [12]

Feature of HELTHRAY Software:
1) Quickly retrieve information.
2) Modern Billing.
3) Digital Reporting.

3. Objective

1) The main objective of our project is to make efficient test management which is user friendly and at the same time powerful.
2) Maintain the tests records date-wise.
3) To produce an application which manages patient tests and allows lab technicians to share this test report on social media applications like Whatsapp, Email.
4) To generate a clinical test report.
5) To support better patient care by improving workflow efficiency and ensuring timely communication of test results, thereby increasing patient satisfaction and convenience.
6) To develop an attractive and user-friendly graphical interface that enhances interaction between lab technicians and the application, improving overall usability.
7) To simplify the billing process for patients by generating accurate bills based on tests performed, thereby improving financial transactions and transparency.
8) To allow lab technicians to update test prices easily based on market conditions or laboratory policies, ensuring flexibility in pricing management.

4. Problem Statements

The clinical laboratories consistently face numerous challenges and frustrations related to the generation and management of reports for various tests. The current processes are often inefficient, leading to errors and delays in patient diagnosis and treatment. Many existing systems are overly complex and necessitate substantial manual input, hindering healthcare professionals' ability to efficiently manage their tasks.

To address these issues, there is a critical need for a streamlined and efficient Android application, **"Shree Clinical Laboratory Management"**, that generates laboratory test reports in PDF format. This application produces accurate reports rapidly and enables healthcare providers to seamlessly share these PDFs with patients through various communication channels, including email and messaging applications. By optimizing the reporting process and enhancing user-friendliness, this application aims to improve workflow in laboratories and ensure superior patient care.

Additionally, the generated reports are stored securely for long-term access, allowing for easy retrieval whenever patients need them. This feature not only facilitates patient engagement but also fosters trust between patients and their healthcare providers.

5. Methodology
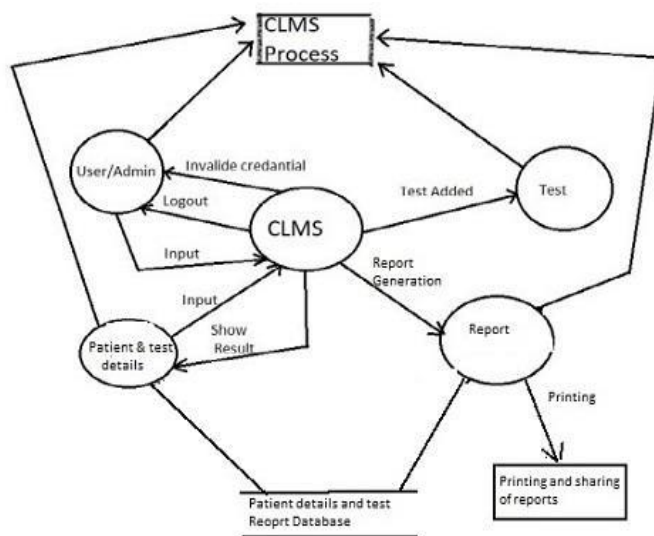### 5.1 DFD LEVEL-2:

fig. DFD level-2

5.2. Explanation:
Our Project "Shree Clinical Laboratory Management" Android application has 4 to 5 activities. Above flow diagram shows flows of activities in our application.

First activity is sign up page: Here users have to register themselves to this application.

Second activity is Patients Details: In this activity there is the patient's details such as name, mobile number, age, gender and select test.

Third activity is reporting details: In this generate report in proper format. And it can be shared via social media platforms such as Whatsapp, Email.

Fourth activity is to maintain report history: In this activity we can maintain all report data in the database.

5.3 Modules and Functionality

Table 1. Modules & functionality

Modules	Functionality
Registration	Lab technician can register using user name, mobile number, email, password and lab name
Login	Lab Technicians can login to the application by using email and password.
Patients Details	Lab technician takes patients details like patient name, aga, gender and mobile number
Sample test selection	Lab technicians can select tests according to patient requirements.
Report generation	After getting test data. It generates reports in proper format.
Report Sharing	Generated reports can be shared on social media platforms like Whatsapp and email.
Report history	Maintain report history date wise.
Bill generation	Generate bill as per total tests of patients.
Test price	Lab technicians can change the test price as per his perspective.

6. Results

1. Improve efficiency: This android application improves workflow efficiency by using automation sample report generation.
2. Enhance data management: This application maintains the date wise history of the sample reports. Making it easier to maintain patient details.
3. Reduce complexity: This application reduces the sample management complexity. And also reduce invoice management complexity.
4. Report sharing: This application provides report sharing to patients via social media platforms such as Whatsapp and Email.

7. Discussion

Shree Clinical Laboratory Management Application With better enhancement in laboratory workflow management for development. The application helps by automating and outsources test management & reporting of which several pain points often take place in traditional laboratory settings.

Having a real-time database at hand not only makes for an easy operation, but also guarantees the data will always be updated and available fluently; this is key to efficiently offering patient care. Even more importantly, utilizing the feature of history tracking allows for lab technicians to bring insight into full health trends that contribute to rationalized clinical decisions.

8. Future scope

The Shree Clinical Laboratory Management application has significant potential for future enhancements that can further streamline laboratory operations and improve patient care.

1. Integration with Electronic Health Records (EHR):
- Future versions could integrate seamlessly with EHR systems, enabling real-time data sharing between laboratories and healthcare providers for more coordinated patient care.
2. Mobile Application Development:
- Developing a mobile version of the application would allow lab technicians and patients to access test information and reports conveniently, enhancing user engagement and accessibility.
3. Patient Portal Features:
- Creating a dedicated patient portal would empower patients to view their test results, track their medical history, and manage billing information directly, fostering greater patient involvement in their healthcare.
5. Telehealth Integration:
- Incorporating telehealth functionalities would enable lab technicians and healthcare providers to conduct virtual consultations to discuss test results and recommendations, improving communication.
6. Customizable Reporting and Visualization Tools:

- Enhancing reporting features to allow for customizable templates and advanced data visualization could aid healthcare providers in interpreting results more effectively.
8. Compliance and Security Enhancements:
- Implementing features to ensure compliance with local regulations and enhancing data security measures will protect sensitive patient information and maintain trust.
9. Multi-Language Support:
- Adding multi-language options can make the application accessible to a broader audience, accommodating non-English-speaking users.
11. Feedback and Improvement Mechanism:
- Implementing a user feedback system will facilitate continuous improvement of the application based on user experiences and needs.

By focusing on these future enhancements, the Shree Clinical Laboratory Management application can evolve into a comprehensive solution that significantly improves.

9. Conclusion

In summary, "Shree Clinical Laboratory Management", an advancement towards automation and digitalisation of the routine processes in clinical labs to ease the workload needed for report generation as well as patient data management. With a lack of clinical laboratories in mind, this Android application tackles various issues those laboratories deal with including the lengthy process to produce and manage test reports; as well as data accuracy and security. This not only speeds up the turnaround orders in a fraction of time, but it also saves all pre-manual work so that lab technicians can concentrate on patient care and accurate testing, while minimizing risk for human error within test result recording.

The application uses a real-time database to save sensitive patient data in a genuine way. After generating the test reports in PDF format, reports can be shared to patients. Sharing allows patients to download reports in PDF format and share them directly through social media or email, which is a premium way for patients as they could be the main receivers who expect their healthcare data to be more convenient with easy access. It includes a feature to manage user accounts like log in, sign out and delete the account which enables access control making it more secure so that only authenticated users can access this app along with improved privacy as for yourself also you want your other members do not read or edit their records without knowing them.

Specifically cost for labs by test, the software is an essential tool that has been designed with flexibility and compliance in mind. Easy, smooth managed all-in-one solution for Clinical Diagnostics Laboratories to streamline workflows and essential tools required in managing tests & reports more effectively with "Shree Clinical Laboratory Management". This app surely increases operational effectiveness along with the standards of care one gives to a patient, making it an elevated landmark in laboratory management application.

Conflict of Interest

I declare that during the development of this application they do not have any conflict of interest.

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