Implementation and Research Report on FormGenie: AI-Based Multi-Language Smart form Automation System

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Abstract: *Government and banking processes often require users to manually fill complex forms such as PAN, passport, and bank account applications. These manual processes are time-consuming and prone to human error. This research presents FormGenie, an intelligent form automation system designed to simplify digital form filling through the integration of Optical Character Recognition (OCR), voice input recognition, multilingual support, and automated PDF generation.*

The system is developed using Python with the PySide6 framework for the graphical user interface, enabling users to interact with a desktop-based application that supports automated document handling. OCR technology using Tesseract extracts text information from uploaded documents and automatically fills form fields. Additionally, the system integrates voice recognition modules to allow users to provide form inputs through speech commands, improving accessibility and usability.

A secure authentication system is implemented with bcrypt password hashing and OTP-based password reset functionality, ensuring data protection and user privacy. The application stores form data and user profiles in an SQLite database, allowing efficient retrieval and history tracking. The system also provides PDF export functionality using the ReportLab library, enabling users to generate formatted documents for official submission. The application further supports multiple languages including English, Hindi, and Marathi, which increases accessibility for diverse users. Government resource links and location search features are integrated to assist users in accessing official portals and nearby government offices. Experimental evaluation shows that the FormGenie system significantly reduces the time required for form completion while minimizing input errors. The system demonstrates the potential of integrating artificial intelligence and automation into administrative processes, making digital services more efficient and user-friendly... .

Keywords: Form Automation, OCR, Voice Recognition, PySide6, Document Processing, Smart Forms

I. INTRODUCTION

In many government and banking procedures, individuals must fill various forms such as PAN applications, passport forms, and bank account forms. These forms often require repetitive entry of personal information, which increases the risk of errors and consumes significant time.

With the advancement of artificial intelligence and document processing technologies, automated systems can simplify these processes. Technologies such as Optical Character Recognition (OCR) and voice recognition can extract and process information efficiently.

This research introduces FormGenie, a smart application designed to automate the process of filling official forms. The system integrates OCR technology, speech input, database storage, and PDF generation to create an intelligent document management environment.

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The objective of this research is to develop a user-friendly system that reduces manual effort, improves data accuracy, and enhances accessibility through multilingual support.

II. SYSTEM ARCHITECTURE

The FormGenie system consists of several integrated modules designed to automate form handling and document processing.

A. User Authentication Module

The system provides a secure login and registration mechanism. Passwords are encrypted using bcrypt hashing, ensuring secure authentication. OTP-based password recovery is implemented to allow users to reset forgotten passwords.

B. Form Management Module

• The application supports different forms including:
• PAN Form
• Passport Form
• Bank Form

Users can input personal details such as name, address, contact number, and identification information through an interactive graphical interface.

C. OCR Document Processing

The system allows users to upload images of documents such as identity cards. The OCR module uses Tesseract OCR to extract text information automatically from the uploaded images. Extracted fields such as name, phone number, and PAN number are validated and used to autofill form fields.

D. Voice Input System

Voice recognition functionality enables users to fill forms through speech. The system integrates speech processing libraries to convert spoken input into text data, improving accessibility for users with limited typing ability.

E. Database Management

• All user data, profiles, and form submissions are stored in an SQLite database. The database contains tables for:
• User authentication
• User profile data
• Form submissions
• Password reset OTPs
• This structured database design ensures efficient data retrieval and history tracking.

F. PDF Generation Module

Once the form is completed, users can export the filled form as a PDF document. The system uses the ReportLab library to generate formatted documents containing all form fields and values.

III. IMPLEMENTATION

The system is implemented using Python programming language with multiple libraries and frameworks.
[1] Technologies Used

Component	Technology
Programming Language	Python
GUI Framework	PySide6

OCR Engine	Tesseract
Voice Recognition	VOSK / SpeechRecognition
Database	SQLite
Password Security	bcrypt
PDF Generation	ReportLab

• The graphical user interface is built using PySide6, which allows the creation of interactive forms, dashboards, and navigation menus.
• The application architecture includes multiple threads for:
• OCR processing
• Voice recognition
• PDF generation
• This multithreading design improves system performance and responsiveness.

1. Use Case Diagram
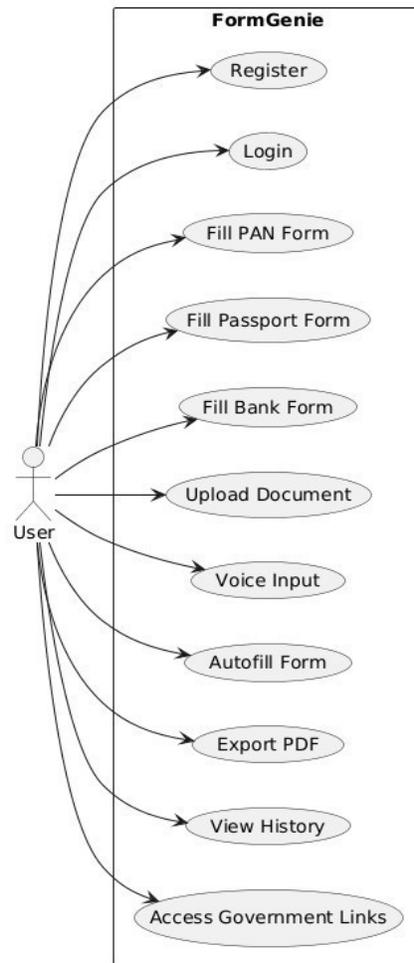
Fig. 1 Use Case Diagram of FormGenie

The use case diagram illustrates the interaction between the user and the FormGenie system. The primary actor is the user who performs operations such as registration, login, filling forms, uploading documents, using voice input, exporting forms to PDF, and viewing history. The system processes these requests through various internal modules such as OCR processing, voice recognition, and database management.
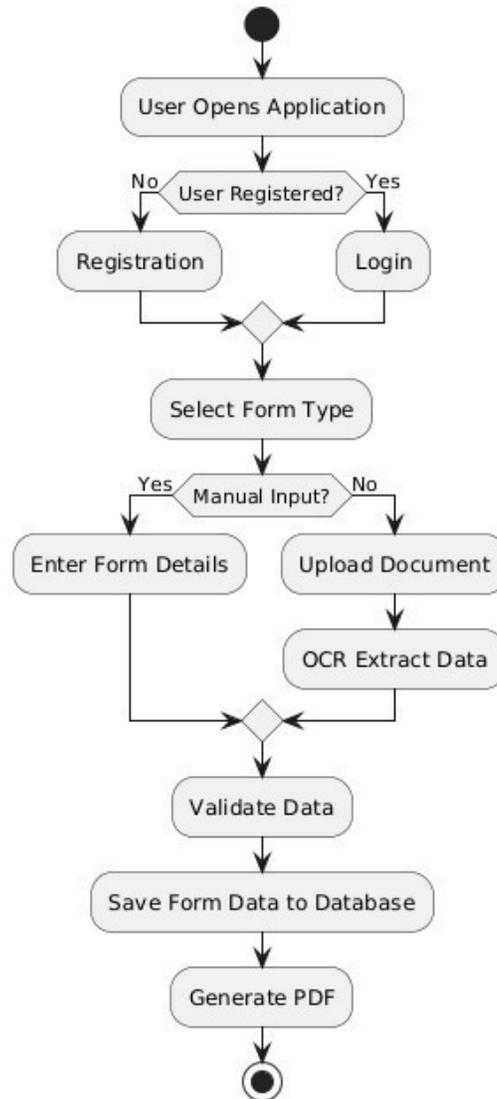
2. Activity Diagram

Fig. 2 Activity Diagram of FormGenie Workflow

The activity diagram represents the workflow of the FormGenie system. The process begins with user authentication through login or registration. After successful login, the user selects the required form type. The user may manually enter data, upload documents for OCR extraction, or use voice input. The system processes and validates the data before storing it in the database. Finally, the user can export the completed form as a PDF document.
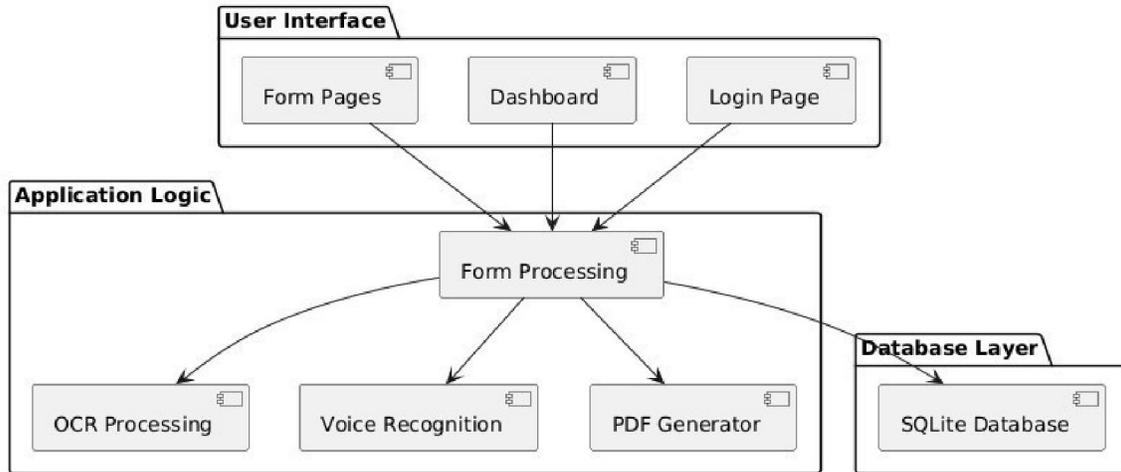
3. System Architecture Diagram

Fig. 3 System Architecture of FormGenie

The system architecture of FormGenie consists of multiple integrated modules including the User Interface Layer, Application Logic Layer, and Data Storage Layer. The user interacts with the system through a graphical interface built using PySide6. The application logic processes form inputs, voice commands, and OCR data extraction. The OCR module extracts information from uploaded images using Tesseract OCR, while the voice recognition module processes speech input. All processed data is securely stored in an SQLite database, and the ReportLab library generates final PDF documents.
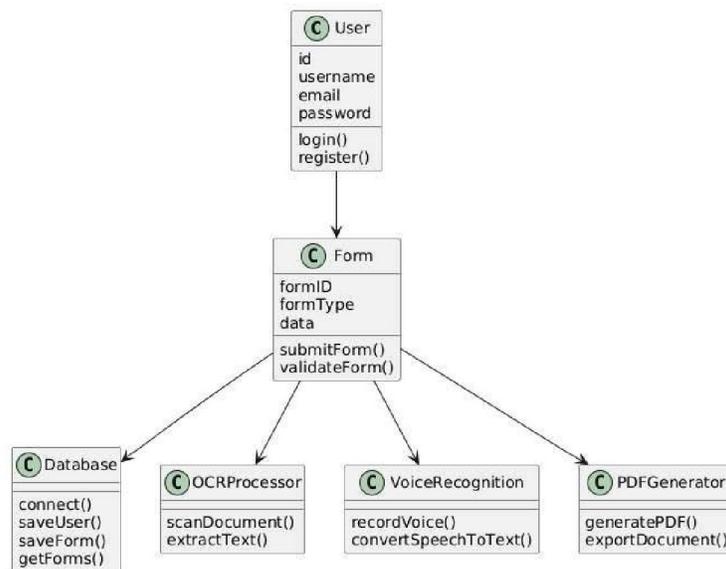
4. Class Diagram

Fig. 4 Class Diagram of FormGenie

The class diagram illustrates the structural design of the FormGenie application. The main classes include User, Database, FormManager, OCRProcessor, VoiceRecognition, and PDFGenerator. The User class handles authentication and profile management. The Database class manages data storage operations using SQLite. The OCRProcessor

extracts information from uploaded images, while the VoiceRecognition module processes speech input. The PDFGenerator class generates formatted PDF documents for completed forms.
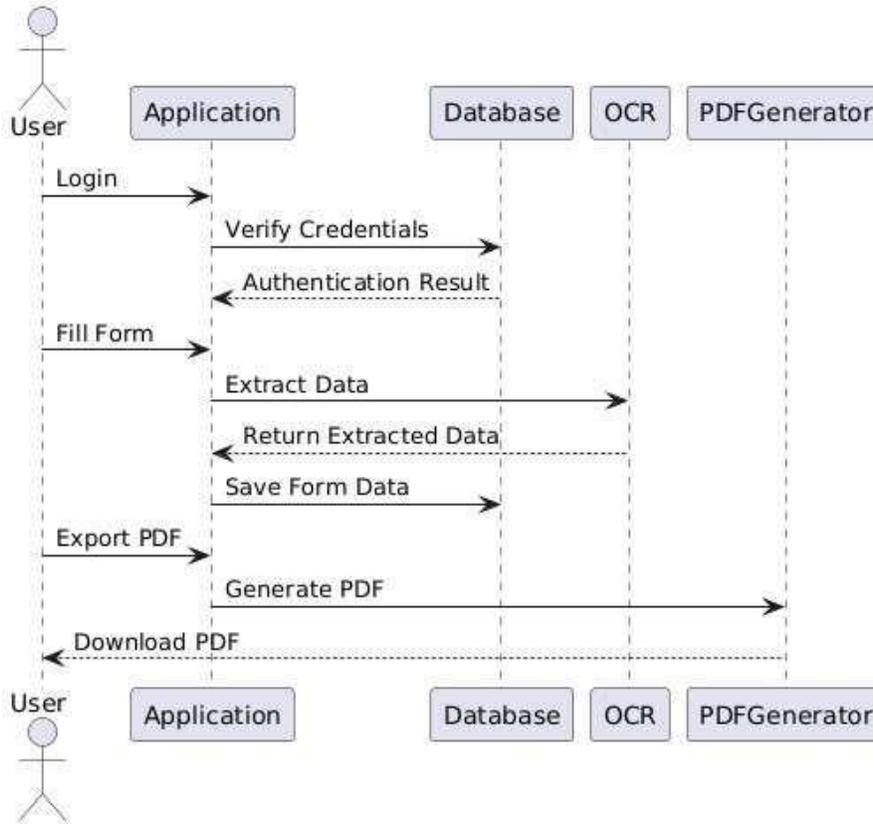
5. Sequence Diagram

Fig. 5 Sequence Diagram of Form Submission

The sequence diagram shows the interaction between the user and different system components during form submission. The user submits form data through the interface, which is processed by the application logic layer. If OCR or voice input is used, the respective modules process the data before it is stored in the database. After validation, the system generates a PDF document and provides the output to the user.

IV. FEATURES OF FORMGENIE

• The FormGenie application provides several advanced features:

[2] 1. Automated Form Filling

• The system automatically fills form fields using extracted document data.

[3] 2. OCR-Based Document Scanning

• Users can upload scanned images, and the system extracts relevant information.

[4] 3. Voice-Based Input

• Speech recognition enables hands-free data entry.

[5] 4. Secure Authentication

• User accounts are protected with encrypted passwords and OTP verification.

[6] S5. Multi-Language Support

• The interface supports multiple languages including:

• English

• Hindi

• Marathi

[7] 6. PDF Export

Completed forms can be exported as official PDF documents.

[8] 7. Government Resource Links

The system provides quick access to official government websites for PAN, Passport, Aadhaar, and ration card services.

V. RESULTS AND DISCUSSION

• Testing of the FormGenie system demonstrated significant improvements in efficiency compared to manual form filling. OCR extraction successfully detected key information fields such as names, phone numbers, and identification numbers from uploaded images.

• Voice input functionality enabled faster form entry and improved accessibility. Database storage allowed users to view submission history and manage previously filled forms.

• The integration of multiple modules created a seamless workflow from data input to document generation.

VI. CONCLUSION

• This research presented the development of FormGenie, an intelligent form automation system designed to simplify document processing tasks. By integrating OCR technology, voice recognition, database storage, and PDF generation, the system provides a comprehensive solution for automated form management.

• The system reduces manual effort, improves accuracy, and enhances accessibility through multilingual support. Future improvements may include cloud integration, mobile application support, and machine learning models for more advanced document recognition.

• FormGenie demonstrates how intelligent automation can improve the efficiency of digital administrative services.

ACKNOWLEDGMENT

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