Automation of Hospital Patient Registration System Using Robotic Process Automation with Microsoft Power Automate Desktop

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Abstract - This paper presents the design and implementation of an automated Hospital Patient Registration System developed using Robotic Process Automation (RPA) on the Microsoft Power Automate Desktop (PAD) platform. Manual patient registration at hospital counters and health camps is repetitive, time-consuming and prone to data-entry errors, since staff must collect and cross-check multiple fields such as demographic details, contact information, disease category and payment status for every patient. The proposed system automates the complete registration life-cycle: it collects patient information through guided input dialogs, validates age, mobile number and email address using conditional logic and looping, automatically allocates a doctor based on the selected disease, generates a unique, incrementing Patient ID, stores structured records in an Excel-based patient database, manages payment status through a QR-code-based flow, and produces a patient invoice using a Word template that is converted to PDF and delivered to the patient through WhatsApp Web automation. The system was implemented and functionally verified using fifteen test cases covering input validation, doctor allocation, record storage, document generation and multi-patient registration through looping; all test cases produced the expected outcome. The results indicate that a low-code RPA workflow can reliably reproduce the behaviour of a manual registration counter while removing repetitive manual effort, reducing the likelihood of data-entry errors, and shortening the time needed to issue a registration invoice. Because the solution is built entirely on commonly available desktop applications (Power Automate Desktop, Excel, Word and a web browser) and requires no change to existing hospital software, it is well suited for deployment in small clinics, hospital OPD counters and temporary health camps.

Keywords - Robotic Process Automation, Microsoft Power Automate Desktop, Patient Registration, Healthcare Automation, Workflow Automation, Digital Invoice Generation, Low-Code Automation

I. INTRODUCTION

Healthcare organisations handle a large volume of patient information every day, and patient registration is typically the first administrative activity performed whenever a patient visits a hospital, clinic or health camp. The registration process generally involves collecting the patient's name, age, gender, contact details and information about the presenting condition, after which the patient is assigned to an appropriate doctor and the registration details, along with the applicable fee, are recorded. When this process is carried out manually, it consumes considerable staff time and is susceptible to data-entry errors, duplicate records and delays, particularly during high patient inflow such as outpatient department (OPD) hours or organised health camps.

Robotic Process Automation (RPA) offers a practical solution to this problem by automating repetitive, rule-based digital tasks without requiring changes to the underlying hospital software. RPA software "bots" interact with existing desktop and web applications in the same way a human operator would - by entering data, clicking controls and reading information - which makes it possible to introduce automation quickly and at low cost. This paper describes a Patient Registration System that has been automated end-to-end using Microsoft Power Automate Desktop (PAD), a low-code RPA platform for Windows. The automated workflow collects and validates patient data, allocates a doctor, generates a unique Patient ID, stores the record in an Excel database, manages the payment status, prepares an invoice in Word, converts it to PDF and finally delivers it to the patient over WhatsApp Web - all without manual intervention beyond the initial data entry.

II. LITERATURE SURVEY

A review of recent work on RPA in healthcare administration establishes the context for the present study:

1) Sumathi and Jeyalakshmi (2022): Studied the use of RPA to improve operational efficiency in the healthcare sector and identified patient registration as one of the strongest use cases for automation, noting that manual registration is slow and error-prone and that RPA bots can collect and consolidate patient records more consistently while reducing patient waiting time.

2) Study on RPA in Patient Registration and Onboarding (International Journal of Science and Research): Explored the application of RPA specifically to the registration and onboarding stage of the patient journey, discussing the benefits, implementation challenges and best practices for deploying RPA bots at hospital front desks to streamline administrative work and improve the overall patient experience.

3) Narrative review on AI and RPA in healthcare (PMC, 2024): Surveyed present-day applications of RPA and AI in healthcare administration - including appointment scheduling, billing and record management - and reported that these technologies can reduce operational time and human error, while stressing that successful adoption depends on adequate technical readiness and organisational adaptability.

4) Systematic literature review on RPA implementation in healthcare (ScienceDirect, 2025): Reviewed recent studies on the benefits and social impact of adopting RPA in healthcare settings and concluded that, while RPA improves administrative efficiency and data accuracy, its sustainable adoption requires attention to staff acceptance and process design, not only technical implementation.

5) Industry deployments reported by RPA vendors (ScienceSoft; UiPath-Omega Healthcare; NHS Blue Prism case studies): Document large-scale production use of RPA for registration, scheduling and revenue-cycle tasks in hospital settings, with reported reductions in processing time and administrative backlog, indicating that the approach scales beyond pilot projects to routine hospital operations.

The reviewed literature consistently identifies patient registration as a high-value target for RPA because it is repetitive, rule-based and digital, but most published work either surveys the concept at a general level or reports outcomes from large commercial RPA suites (UiPath, Blue Prism) integrated with enterprise electronic health record systems. There is comparatively little documented work on a complete, low-code, end-to-end registration workflow - covering input validation, doctor allocation, record-keeping, payment status, invoice generation and patient communication - implemented purely with Microsoft Power Automate Desktop on a single standard workstation. This gap motivates the system described in this paper, which is designed to be affordable and deployable in small clinics and health camps that cannot justify the cost of enterprise RPA or hospital information system integration.

III. EXISTING SYSTEM AND PROBLEM STATEMENT

In a conventional hospital registration counter, the patient approaches the desk and the staff member manually collects personal information, enters it into a register or a computer system, verifies the details, assigns the patient to a doctor, records the payment and prepares an invoice by hand or by editing a document template, before printing or handing it to the patient. Every step in this sequence depends on continuous human involvement.

The main limitations that motivate the proposed automation are:

- Manual data entry is time-consuming, particularly when many patients arrive within a short interval.
- Human errors can occur while typing patient details, disease category or contact information.
- Duplicate or inconsistent patient records may be created across visits.
- Validation of contact details (mobile number, email) is often skipped or performed inconsistently.
- Invoice preparation is slow when carried out manually for every patient.
- Maintaining and retrieving physical or loosely structured digital records is difficult.
- Repetitive tasks add to staff workload, especially during health camps with high patient volume.
- Communicating the registration or invoice details to the patient can be delayed.

IV. PROPOSED SYSTEM ARCHITECTURE

The proposed system replaces the manual steps described above with an automated workflow built entirely in Microsoft Power Automate Desktop. Fig. 1 shows the overall architecture of the system as a sequence of cooperating components, and Fig. 2 shows the detailed control flow, including the validation loops and the multi-patient registration loop.

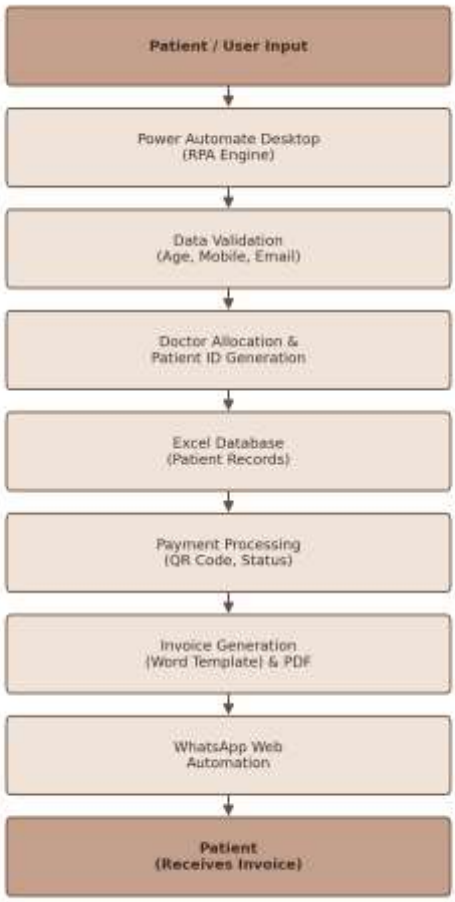


Fig. 1. Architecture of the proposed RPA-based patient registration system.

User input is captured through PAD input dialogs and passed to the automation engine as variables. The engine performs validation, computes the doctor allocation and Patient ID, writes the record to an Excel workbook that acts as the patient database, manages the payment status against a displayed QR code, populates a Word invoice template and converts it to PDF, and finally drives a browser session to deliver the PDF to the patient over WhatsApp Web. Because each stage is a self-contained PAD action group, the workflow can be modified or extended (for example, to add a database or an SMS gateway) without redesigning the entire automation.

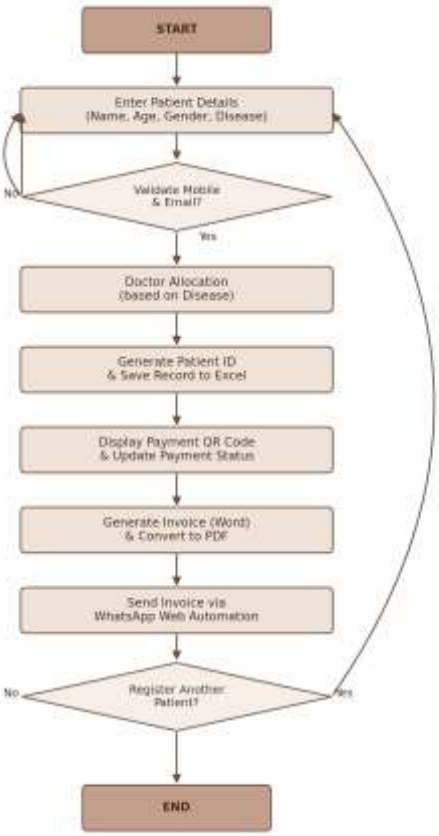


Fig. 2. Detailed control flow of the automated registration workflow, including validation and multi-patient loops.

A. Patient Information Input and Validation

The workflow begins by collecting the patient's name, age, gender and disease through guided input dialogs, followed by the mobile number and email address. Two conditional checks are applied before the record proceeds: the mobile number must contain exactly ten digits, and the email address must contain both an "@" symbol and a "." character; if either check fails, the automation displays a validation message and loops back to request the field again. The patient's age is also evaluated against a threshold of 18 years and classified as "Minor Patient" or "Adult Patient", demonstrating the use of conditional branching for automatic classification without manual calculation.

B. Doctor Allocation

Once the disease field is captured, the workflow matches it against a predefined disease-to-doctor mapping (Table I) and automatically stores the name of the allocated doctor as a variable, removing the need for a staff member to manually select a doctor from a list.

C. Patient ID Generation and Excel Database

A running counter, initialised at 1000, is used to generate a unique Patient ID in the format "PRN" followed by the counter value (e.g., PRN1000, PRN1001). After every successful registration, the counter is incremented automatically. The complete record - shown in Table II - is then appended to the next empty row of an Excel workbook that functions as the patient database, together with the date and time of registration recorded automatically in dd/MM/yyyy and hh:mm:ss format respectively.

D. Payment Processing

After the record is stored, the automation displays a payment QR code representing the registration fee (Rs. 500) and consultation fee (Rs. 100), for a total of Rs. 600. The patient scans the code using any supporting payment application,

and the operator confirms the outcome in the automation, which sets the payment status to either PAID or PENDING. This status is subsequently carried into the invoice.

E. Invoice Generation and PDF Conversion

The automation opens a predefined Microsoft Word invoice template containing placeholders for the Patient ID, name, age, gender, contact details, disease, allocated doctor, registration date and time, fee breakdown and payment status. PAD replaces each placeholder with the corresponding variable and saves the completed document, which is then converted to PDF and stored in a dedicated invoices folder using a naming convention based on the patient's name (e.g., Patient_Invoice_Rahul.pdf), so that individual invoices can be located quickly.

F. WhatsApp Web Automation

To deliver the invoice, the workflow opens Google Chrome, navigates to WhatsApp Web, searches for the patient's mobile number, opens the corresponding chat, attaches the generated PDF, sends it, and follows up with a short confirmation message. This removes the need for the staff to manually attach and send documents to each patient.

G. Multi-Patient Registration

After an invoice has been sent, the automation asks whether another patient should be registered. Selecting "Yes" restarts the registration sequence from the input stage, while selecting "No" ends the automation. This loop makes the system practical for settings such as health camps, where many patients must be processed in a single session.

TABLE I. DISEASE-TO-DOCTOR ALLOCATION (SAMPLE)

Disease	Allocated Doctor
Fever	Dr. Amit Sharma
Heart	Dr. Rajesh Mehta
Skin	Dr. Neha Patil
Eye	Dr. Priya Kulkarni
Bone	Dr. Vikram Deshmukh
Diabetes	Dr. Anjali Joshi
Asthma	Dr. Karan Singh

TABLE II. PATIENT DATABASE FIELDS (EXCEL)

Field	Description
Patient ID	Unique patient identification (e.g., PRN1000)
Patient Name	Name of patient
Age	Patient age
Gender	Patient gender
Mobile	Contact number
Email	Email address
Disease	Selected disease

Field	Description
Doctor	Assigned doctor
Date / Time	Registration date and time
Status	Payment status (PAID / PENDING)

V. TOOLS, TECHNOLOGIES AND SYSTEM REQUIREMENTS

The proposed automation was designed to run on a standard desktop workstation without any specialised hardware, using only commonly available Microsoft applications and a web browser, so that it can be deployed at low cost in small clinics and temporary health-camp settings.

TABLE III. HARDWARE AND SOFTWARE REQUIREMENTS

Category	Requirement
Hardware	Standard computer/laptop, minimum 4 GB RAM, keyboard, mouse, display monitor, internet connection
Operating System	Windows 10 or 11 (64-bit)
Automation Platform	Microsoft Power Automate Desktop
Office Applications	Microsoft Excel, Microsoft Word
Document Format	PDF
Communication	Google Chrome, WhatsApp Web
Payment	QR-code based payment display

VI. TESTING AND RESULTS

Each module of the automated workflow was tested individually and the observed behaviour was compared against the expected behaviour. The major modules verified were patient input, age classification, gender and disease selection, mobile and email validation, doctor allocation, Patient ID generation, Excel record storage, payment status handling, invoice generation, PDF creation, WhatsApp delivery and multi-patient registration through looping. Table III summarises the test cases used and the corresponding results.

TABLE IV. TEST CASES AND RESULTS

Test Case	Input / Condition	Expected Result	Observed Result
TC01	Valid patient name	Name accepted	Pass
TC02	Age below 18	"Minor Patient" displayed	Pass
TC03	Age 18 or above	"Adult Patient" displayed	Pass
TC04	10-digit mobile number	Accepted	Pass
TC05	Invalid mobile number	Error displayed, re-entry requested	Pass

Test Case	Input / Condition	Expected Result	Observed Result
TC06	Valid e-mail address	Accepted	Pass
TC07	Invalid e-mail address	Validation error, re-entry requested	Pass
TC08	Disease = Fever selected	Corresponding doctor assigned	Pass
TC09	New registration	New, incremented Patient ID generated	Pass
TC10	Payment confirmed	Status set to PAID	Pass
TC11	Payment skipped	Status set to PENDING	Pass
TC12	Registration completed	Invoice generated	Pass
TC13	Invoice completed	PDF created	Pass
TC14	PDF ready	PDF sent via WhatsApp	Pass
TC15	"Register another patient?" = Yes	Registration sequence repeats	Pass

All fifteen test cases produced the expected output during verification. The automation correctly rejects mobile numbers that do not contain exactly ten digits and email addresses missing the required characters, requesting the field again until a valid value is supplied. Patients are consistently classified by age, allocated to the correct doctor based on the selected disease, and assigned a unique, sequential Patient ID. Records are appended to the Excel database without overwriting existing rows, and the invoice generated for each patient correctly reflects the stored patient data, the applicable fee and the recorded payment status. The generated PDF is successfully delivered to the corresponding WhatsApp number, and the multi-patient loop allows registration to continue for any number of patients within a single session. These results confirm that the workflow reproduces the functional behaviour of a manual registration counter while removing the repetitive data-entry, validation and document-preparation effort that a human operator would otherwise have to perform for every patient. A limitation of the present evaluation is that it is functional rather than quantitative: formal timing measurements comparing manual and automated registration under identical patient loads were not collected in this study and are identified as future work, since actual throughput depends on factors such as computer speed, network latency and browser response time.

VII. ADVANTAGES AND LIMITATIONS

A. Advantages

- Faster, more consistent patient registration than a manual counter.
- Reduced repetitive data-entry effort for hospital staff.
- Automatic validation of mobile number and email address.
- Automatic, rule-based doctor allocation.
- Unique, traceable Patient ID for every registration.
- Digitally structured patient records maintained in Excel.
- Automatic invoice generation and PDF conversion.
- Direct delivery of the invoice to the patient over WhatsApp.
- No changes required to existing hospital software or infrastructure.

B. Limitations

- Excel is not designed for large-scale, multi-user healthcare databases and would need to be replaced by a proper database for production use.
- WhatsApp Web automation depends on an active browser session and a stable internet connection.
- User-interface changes to Excel, Word or WhatsApp Web can affect the automation and may require the workflow to be updated.
- Payment confirmation currently relies on operator input rather than a direct payment-gateway callback.
- The system automates administrative registration only and does not perform, or replace, any clinical decision-making.
- Additional authentication, access control and data-protection measures would be required before deployment with real patient data in a production hospital environment.

VIII. FUTURE SCOPE

- Integration with a relational or cloud-based database (e.g., SQL Server, Firebase) in place of the Excel workbook.
- Online, patient-facing registration through a web form or kiosk that feeds the same automation.
- Automatic appointment scheduling and doctor-availability checking.
- SMS and e-mail delivery as alternatives or supplements to WhatsApp.
- Direct integration with an online payment gateway instead of manual QR-code confirmation.
- Role-based staff login, audit logging and stronger data-security controls.
- Extension into a complete hospital management system covering appointments, billing history and patient records over multiple visits.

IX. CONCLUSION

This paper has presented the design, implementation and functional testing of a Hospital Patient Registration System automated using Microsoft Power Automate Desktop. The system collects and validates patient information, automatically allocates a doctor and a unique Patient ID, stores structured records in an Excel database, manages payment status through a QR-code-based flow, generates a Word/PDF invoice, and delivers it to the patient over WhatsApp Web, with support for registering multiple patients in a single session through looping. Functional testing across fifteen representative test cases confirmed that every stage of the workflow behaves as expected. By automating a repetitive, rule-based administrative process using only low-code tools and standard desktop applications, the proposed system offers hospitals, clinics and health camps a low-cost path to reducing manual effort, improving data consistency and speeding up patient registration, and provides a practical foundation that can be extended into a more comprehensive hospital management and patient registration automation platform in future work.

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