Business Process Improvement

Contents

Story: Arrival

When a patient arrives at the clinic, they are typically greeted by a receptionist or front desk staff member.

The receptionist will ask the patient for their name and possibly some form of identification, such as an insurance card or photo ID.

Improved:

The patient produces the same and the Staff scans it over a scanner. The scanned Image is archived and important fields are read into the DB generating the Unique ID or matching the Unique ID to fetch the Past entries if exists.

Story: Arrival Time

The patient's arrival time is noted

Improved:

The Above entry is saved with current timestamp

Story: Additional Information

They are asked to fill out any necessary forms if they are a new patient or if their information has changed.

Improved:

The receptionist types in the data in the form, or filled the paper form. In case of Paper form, The form is scanned over the same system as in previous step, and as per session, necessary information is fed into the system DB along with the image of the form.

Story: Patient Identification

The receptionist will verify the patient's identity and insurance information, ensuring that all details are up to date and accurate.

Improved:

The system accesses the insurance company through available facilities and verifies the insurance details against its identity.

Story: Appointment Confirmation

If the patient has an appointment, the receptionist will confirm the appointment time and provider.

Improved

System verifies the above details as per system calendar against that patient or the doctor. If it's a patient with pre-booked appointment, the appointment status is updated with assigned doctor or alternative doctor if required. If it's a new patient, then a new appointment is generated with available doctor with matching specialty as required by the patient

Story: Verify Insurance

If the patient has insurance coverage, the receptionist will verify the patient's insurance information and coverage eligibility.

This may involve contacting the insurance company to confirm coverage and benefits.

Improved

The provided APIs are used to do the same

Story: Payment Options

If the patient has a co-pay or owes for previous visits, the receptionist may collect payment at this time.

improved

As per system response. This is human activity. System provides payment receiving and adjustment options with necessary notifications for the patients and insurance companies etc

Story: Educate Patient

The receptionist may also explain the clinic's billing and payment policies to the patient.

Improved

Human Activity. A text can be sent over WhatsApp, email etc.

Story: Update EMR

The receptionist may update the patient's electronic health record or Electronic Medical Record (HER | EMR) with any new information or changes in medical history.

Improved

API Call specific to the EMR involved

Story: Patient Flow

After completing the registration and verification process, the receptionist will direct the patient to the waiting area.

Improvement

A text can be generated for the patient or a printed Page with details of previous steps and further instructions can be made available for the patient.

Story: Get Additional Information

The patient may be given a clipboard with forms to fill out or asked to wait until they are called by a nurse or healthcare provider.

Improvement

The forms later can be scanned to hence DB can be populated with the input data.

Story: Queue Management

The clinic receptionist helps manage the flow of patients, ensuring that appointments are running on schedule. They may notify healthcare providers when their next patient is ready.

Improvement

Usual queue management tools with support on WhatsApp and app notifications and before time interval setup

Story: Addressing Patient Inquiries:

Receptionists often handle patient inquiries, including questions about appointments, billing, referrals, and general clinic information.

Improvement

Chatbot, Kiosk, App

Story: Follow-Up Appointments and Check-Out:

After the patient's appointment, the receptionist may schedule any necessary follow-up appointments.

Improvement

Scheduler working with availability of Facilities, Doctors and time slots

Story: Greeting and Verification:

When a returning patient arrives at the clinic, they are greeted by a receptionist or front desk staff member.

The receptionist will ask for the patient's name and possibly request identification or their date of birth to confirm their identity.

Improved

The patient produces the same and the Staff scans it over a scanner. The scanned Image is archived and important fields are read into the DB generating the Unique ID or matching the Unique ID to fetch the Past entries if exists. Or using the facial recognition and speculated other fields the ID is retrieved OR the patient can handover previous prescription/receipts where ID is available

Story: Appointment Confirmation:

If the patient has a scheduled appointment, the receptionist confirms the appointment details, including the date and time, as well as the healthcare provider they are scheduled to see.

Improved

The system helps in fetching the current appointment and displays relevant information, also the previous appointments. If the appointment is not available, the system generates a new appointment with available doctor of matching specialty and availability

Story: Updating Patient Information:

The receptionist may ask the patient if there have been any changes to their contact information, insurance, or medical history since their last visit.

Any updates to the patient's information are recorded in the EHR.

Improved

(The system updates it. If the receptionist wants, these updates can be scanned directly into the system as before by using combination of techniques to update the DB)

Story: Insurance Verification

If applicable, the receptionist verifies the patient's insurance information to ensure it is current and that coverage is still in effect.

Any changes in insurance or payment information are noted and processed accordingly.

Improved

The provided APIs are used to do the same

Story: Follow-Up Appointments and Check-Out:

After the patient's revisit and consultation with the healthcare provider, the receptionist may schedule any necessary follow-up appointments.

Improved

As before, kiosk or app or chatbot can be used for this. Chatbot is a good option for scheduling the same

They may also handle check-out procedures, including additional payments or providing receipts.

Story: Age Verification

The patient's age is confirmed to ensure that the appropriate procedures and vital sign reference ranges are used.

Improved

Computer Vision trained system can be used to identify gender and age

Story: Blood Pressure Measurement (BP)

- A healthcare provider, nurse, or medical assistant typically measures the patient's blood pressure using a sphygmomanometer.

- The systolic (pressure during heartbeats) and diastolic (pressure between heartbeats) values are recorded.

Improved

Computer Vision/sensor/IoT based device to measure the BP or written page can be used to identify the same as in form filling

Story: Temperature Measurement

- Body temperature is often measured using a digital thermometer placed under the patient's tongue (oral), in the ear (tympanic), on the forehead (temporal artery), or via other methods.

- The recorded temperature is typically in degrees Fahrenheit (°F) or degrees Celsius (°C).

Improved

(CV/sensor/Programmable IoT based device to measure the temperature or written page can be used to identify the same as in form filling)

Story: Weight and Height Measurement

- The patient's weight is measured using a scale, while their height is measured with a stadiometer.

- These measurements are often taken in kilograms (kg) and centimeters (cm) or pounds (lb) and feet/inches (ft/in).

Improved

CV/sensor/Programmable Meter rod and weighing machines to measure the BP or written page can be used to identify the same as in form filling, a person may be asked to stand against a graded wall. Weighing machine can be updated to send feed to the system

Story: Eye Color Detection

- While eye color is not typically considered a vital sign, it may be recorded as part of the patient's demographic information for identification purposes.

Improved

CV/sensor/IoT based device to measure the record the eye color or written page can be used to identify the same as in form filling

Story: Pulse Rate Measurement

- The healthcare provider or medical assistant measures the patient's pulse rate by palpating the pulse at a specific location (e.g., radial artery at the wrist) or using an electronic device like a pulse oximeter.

- The pulse rate is recorded in beats per minute (bpm).

Improved

CV/sensor/IoT based device to measure the Pulse Rate or written page can be used to identify the same as in form filling

Story: Respiration Rate Measurement

- The patient's respiration rate, or the number of breaths per minute (bpm), is measured by counting chest or abdominal movements over a specific time period.

- Respiratory rate is recorded.

Improved

CV/sensor/IoT based device to measure the Respiration Rate or written page can be used to identify the same as in form filling

Story: Clinical Assessment

- The healthcare provider reviews the recorded vitals and assesses the patient's overall health and any specific concerns based on the vitals and other clinical information.

Improved

Chicory presents data to the doctor

Story: Treatment and Care Planning

- The healthcare provider uses the vital sign data, along with the patient's medical history and any reported symptoms, to determine a diagnosis and treatment plan.

- Medications, referrals, or further tests may be ordered based on this assessment.

Improved

Treatment plan is recorded on a prescribed piece of paper with special marks and camera scans and inputs this record in the DB

Story: Prescribing Patient Labs

Self explanatory

Improved

Names and results of Labs are given on a prescribed sheet which scans and hence gets recorded in the Database

Story: Patient Checkup

Improved

Vitals, conversation and hand gesture and other hints capture the details

Story: Patient Prescription

Self Explanatory

Improved

Prescription is recorded on a prescribed piece of paper with special marks and camera scans and inputs this record in the DB

Story: Patient Treatment (Medication, Intravenous, Dressing, …)

Self Explanatory

Improved

Computer Vision records it or the operator punches in or gives special gestures to record it

Patient Financials

Patient History (Family, Vitals, Treatment, Financials)

Sensors Required

Sensor	Purpose	Scenario	Input	Output	Exceptions	Considerations
Camera	Capture and transmit videos of patient and doctor interactions	• Patient Arrival • Vitals • Treatment • Lab • Prescription • Activity Recognition • Gestures • Scanning • Eye Color detection • Emotions detection • Medicine confirmation	• Videos	Videos into Medical Computer Vision System (MCVS)		
Microphone	Capture spoken words from physician to extract words/sentences to help decide what is going on by learning	• Patient Arrival • Vitals • Treatment • Lab • Prescription • Activity Recognition •	• Audio Stream	Audio in the voice processing system which works in coordination with MCVS		
Programmable Thermometer	Capture Patient's temperature					
Programmable BP Apparatus						
Programmable Weighing machine						
Programmable Meter Rod						
Programmable Respirator						

Interface to non-digital devices						
Programmable Pulse Rater						
SuperMedDevice	This device					
Kiosk/Chatbot/robotceptionist/self service counter						

Apps Required

Patient App

Doctor's App

Manager's App

Facility / owner's app

Services Required

Object Recognition, Activity Recognition, Speech to Text, Text to Speech, Hand Writing Recognition, OCR, Gestures recognition, Form field Identification,

APIs Required

YTD

CPUs Required

For AI, for Storage, for application,

System and Software Required

Important Links

https://azure.microsoft.com/en-us/products/ai-services/ai-vision/

https://www.sciencedirect.com/science/article/pii/S2468067221000122

https://www.instructables.com/IOT-Based-Patient-Monitoring-Kit/

https://github.com/armaanpriyadarshan/Training-a-Custom-TensorFlow-2.X-Object-Detector

https://www.google.com/search?q=github+custom+object+detector&oq=github+custom+object+detector&gs_lcrp=EgZjaHJvbWUyBggAEEUYOTIKCAEQABgIGA0YHjIKCAIQABgIGA0YHjIKCAMQABgIGA0YHjIKCAQQABgIGA0YHjIKCAUQABgIGA0YHjIGCAYQRRhA0gEJMTA0NTRqMGo3qAIAsAIA&sourceid=chrome&ie=UTF-8

Consider

https://www.wellbeingpeople.com/products/interactive-health-kiosk/interactive-health-kiosk/

Thermometer

https://drive.google.com/drive/u/0/folders/1_kRWF-tbCUtzO8u3xE5hDnUMS-1PZAf0

BP Apparatus

https://www.instructables.com/Blood-Pressure-Monitor/

Weighing Machie

https://www.instructables.com/DIY-Weighing-Machine/

Glucometer

https://www.instructables.com/How-To-Customized-Glucometer/

this device is compound many in one machine with many devices available under one body.

List of these devices

The machine has its own controller, internet connectivity, security protocols, strong body, monitoring unit and so on.

This device can be connected to the portal and relay live readings to the portal or other connected device. after proper authorization, it can be used connect over lan, BT or Infrared. Every reading taken is recorded with time stamp and internally stored. Records can be fetched over communication links. A small touch screen is available for admin purposes.

Sourcing of components (Lets discuss)

Smart Table Lamp

The lamp provides illumination for the doctor writing a prescription. It also has a mounted camera to take image of the prescription and upload to the image to the system. The boundary of paper need to be marked, options are:

Specific contrasting color of paper

Specially printed paper

Focused light + or dots symbol (visible or infra)

Wired, BT or WiFi connectivity for the camera.

https://randomnerdtutorials.com/esp32-cam-video-streaming-face-recognition-arduino-ide/

https://github.com/Gowresh7/V380_Python