Robotic Process Automation (18CS745)

M1:

RPA: (Acc. to Automation Anywhere)

Defn: RPA enables you to with tools to create your own s/w robots to automate any business process.

Types of RPA approaches:

i) Attended RPA
ii) Unattended RPA
iii) Intelligent Process Automation (IPA)

1. Attended RPA:

i) It may be referred to as Robotic desktop automation (RDA).
ii) This was the first form of RPA that emerged, back in 2003 or so.
iii) Attended RPA means that the s/w provides collaboration with a person for certain tasks.
iv) Ex: A prime example would be in the call center, where a rep can have the RPA system handle looking up information while he or she talks to a customer.

2. Unattended RPA:

i) This technology was the second generation of RPA.
ii) It can automate a process without the need for human involvement - i.e the bot is triggered when certain events happen such as when a customer emails an invoice.
iii) Consider that it is generally for back-office functions.

3. IPA:

i) This may be referred to as cognitive RPA.
ii) It is the latest generation of RPA technology, which leverages AI to allow the system to learn over time.
iii) Because of this, there may be even less human intervention since the RPA s/w will use its own insights & judgements to make decisions.

Benefits of RPA:

i) The impact of small improvements
ii) Ease of implementation
iii) Compliance
iv) Customer service
v) Employee satisfaction
vi) Wide application
vii) Data quality
viii) Digital transformation
ix) Scalability

1. The impact of small improvements:

i) An employee can save 10 to 20s on a task - even something as simple as series of cut-and-paste actions.
ii) When this small task is scaled to thousands of employees across the org., the impact can certainly be significant
iii) Ex: Some companies will keep track of the metric of how many hours are saved by RPA.

2. Ease of implementation:

i) RPA is relatively easy for a person to use since there is no requirement for understanding complex coding.
ii) ∴ There is not much reliance on the IT department for support, which is certainly a win.

3. Compliance:

i) Just one violation of a govt. regulation can have a serious adverse impact on a company.
ii) It could even be a threat to its very existence.
iii) We can easily configure a bot to make sure the actions are compliant with regulatory requirements.
iv) There will be less intervention with the data from people, which lessens the possibility of fraud.

4. Customer Service:

i) RPA helps customers get quick & accurate responses from the companies.
ii) The RPA bots are programmed to make sure that all the necessary steps are taken - at scale

5. Employee Satisfaction:

i) RPA helps employee to automate tedious activities.
ii) The result may be less turnover & higher productivity.

6. Wide application:

i) RPA can be used for virtually any part of a company, such as legal, finance, HR, marketing, sales, etc
ii) It shows that the applications of RPA is very wide.

7. Data Quality:

i)

8. Digital Transformation:

i) Many companies have legacy systems that would be expensive to replace or integrate.
ii) RPA is an approach that can help with this process, which is often quicker & less costly.

9. Scalability:

i) If there is a sudden jump in demand, it can be ~~faster~~ extremely difficult to hire new employees.
ii) But using RPA, it is much cheaper & faster to ramp up new bots to meet the demand.

Downsides of RPA:

i) Cost of ownership
ii) Technical debt
iii) Enterprise scale
iv) Security
v) Expectations
vi) Preparation
vii) Limits
viii) Virtualized Environments

1. Cost of ownership:

i) The pricing of RPA s/ws depends on subscription or multiyear license or sometimes based on the no. of bots.

ii) But, in addition to that there is a need for some level of training & ongoing maintenance.

2. Technical debt:

i) This describes s/w that is not a comprehensive solution that ultimately requires ongoing reworking, updates & changes.

ii) As a company's processes change, the bots may not work properly.

3. Enterprise scale:

i) It can be extremely difficult to manage the numerous bots.

ii) There also needs to be strong collaboration among IT.

4. Security:

i) If there is a breach, then highly sensitive info could easily be obtained.

ii) As RPA gets more pervasive in manufacturing, there may even be risks of property damage & bodily harm.

5. Expectations:

i) The average time it takes to develop a quality bot was 18 months, with only 39% being deployed on time.

ii) There is a huge hype at feverish levels of RPA, this could easily lead to disappointment.

6. Preparation:

i) We need to do a deep dive in how the current tasks works.

ii) With preparing this, we may be automating bad approaches.

7. Limits:

i) RPA cannot be used whenever there is a need for judgement.

ii) Ex: To approve a payment or to verify a document, there should be a human intervention.

8. Virtualized Environments:

i) RPA system may fail, while trying to access applications remotely.

ii) The reason is that it cannot capture the text on the screen

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RPA compared to BPO, BPM & BPA:

Business Process Management (BPM):

i) It requires much more time & effort with the implementation because it is about changing entensive processes, not tasks.

ii) There also needs to be detailed documentation & training.

iii) Because of this rigorous approach, BPM is more often attractive to industries that are heavily regulated, such as financial services & healthcare.

iv) However, the risk is that there are may be too much structure, which can stifle innovation & agility.

v) Ex: Consider this analogy to self-driving cars

→ A BPM approach would require us to rip up all paved roads & install infrastructure for the new cars to move about on their own.

→ While an RPA approach seeks to operate a pre-existing car just as a human would.

Business Process Outsourcing (BPO):

i) This is when a company outsources a business service function like payroll, customer support, procurement & HR.

ii) The benefits of BPO is lower wage rates in other countries.

iii) Other pros are:

→ A company does not have to waste its attention on non-core functions.

→ By outsourcing various areas of a company, there is a benefit of having a specialist provide the service, which should mean getting better results.

BPO will have 3 types of strategies:

i) Offshore
ii) Nearshore
iii) Onshore

1. Offshore:

i) This is where the employees are in another country, usually far away.

2. Nearshore:

i) This is when the BPO is in a neighboring country.
ii) There are usually higher costs but there is the benefit of being able to conviently visit the vendor.
iii) This can greatly help with the collaboration.

3. Onshore:

i) The vendor is in the same country.
ii) Ex: There can be wide differences in wages in the U.S.

BPO disadvantages:

i) Security
ii) Costs
iii) Politics

1. Security.

i) If a BPO company is developing an app with your company's data, are there enough precautions in place so there is not a breach?
ii) Even if so, it can still be difficult to enforce & manage

2 Costs:

i) Over the years, countries like China & India have seen rising labour costs.
ii) This has resulted in companies moving to other locations, which can be disruptive & expensive.

3. Politics:

i) Instability can easily mean having to abandon a BPO operator in a particular country.

Business Process Automation (BPA)

i) This is the use of technology to automate a complete process.
ii) It can be used in onboarding.
iii) Ex: Bringing on a new employee involves many steps which are repeatable & entail lots of paperwork.
iv) For a large org., the process can be time-consuming & expensive.
v) BPA can streamline everything, allowing for the onboarding at scale.

Note: RPA is about automating a part of the ~~success~~ process, whereas BPA will take on all the steps.

On-premise computing	Cloud computing
i) On-premise computing means that a company purchases & sets up its own h/w & s/w in its own data center.	i) Cloud computing means that a company takes or uses computer resources (h/w & s/w) of other company on-demand.
ii) A company has complete control over anything. This is particularly important for regulated industries that require high levels of security & privacy.	ii) With less control of the platform, there are more vulnerabilities to security & privacy lapses.
iii) With on-premise s/w, you may have a better ability to customize the solution to your company's unique needs & IT policies.	iii) Will have to customize based on the supplier configurations. It's more restricted.
iv) It is costly to setup.	iv) Relatively less costly.
v) There is a need for maintenance, upgrades & monitoring.	v) Maintenance will be taken care by the service provider company.
vi) IT dept. will have to spend valuable time on noncore activities.	vi) IT dept. will need not worry about maintenance.
vii) While using apps. like Excel, it becomes difficult to centralize data because there are so many files spread across the org.	vii) With use of Cloud computing, a company could network all files together to enable collaboration & sharing of data & other resources.

Agile:

i) The focus of this was to allow for incremental & iterative development, which begins with a detailed plan.

ii) This also requires much communication across the teams & should involve people from the business side of the org.

Scrum:

i) This is actually a subset of Agile.

ii) But the iterations are done as quick sprints, which may last a week or two.

iii) This can help with the momentum of a project but also make a larger project more manageable.

Kanban:

i) With Kanban, there is the use of visuals to help streamline the process.

ii) The general approach is similar to Agile as there is iterative development.

Waterfall:

i) The waterfall model is about following a structured plan that goes over each step in much detail.

ii) There may be use of a project management tool, say a Gantt cha

iii) Cons:

→ It can be tough to make changes.

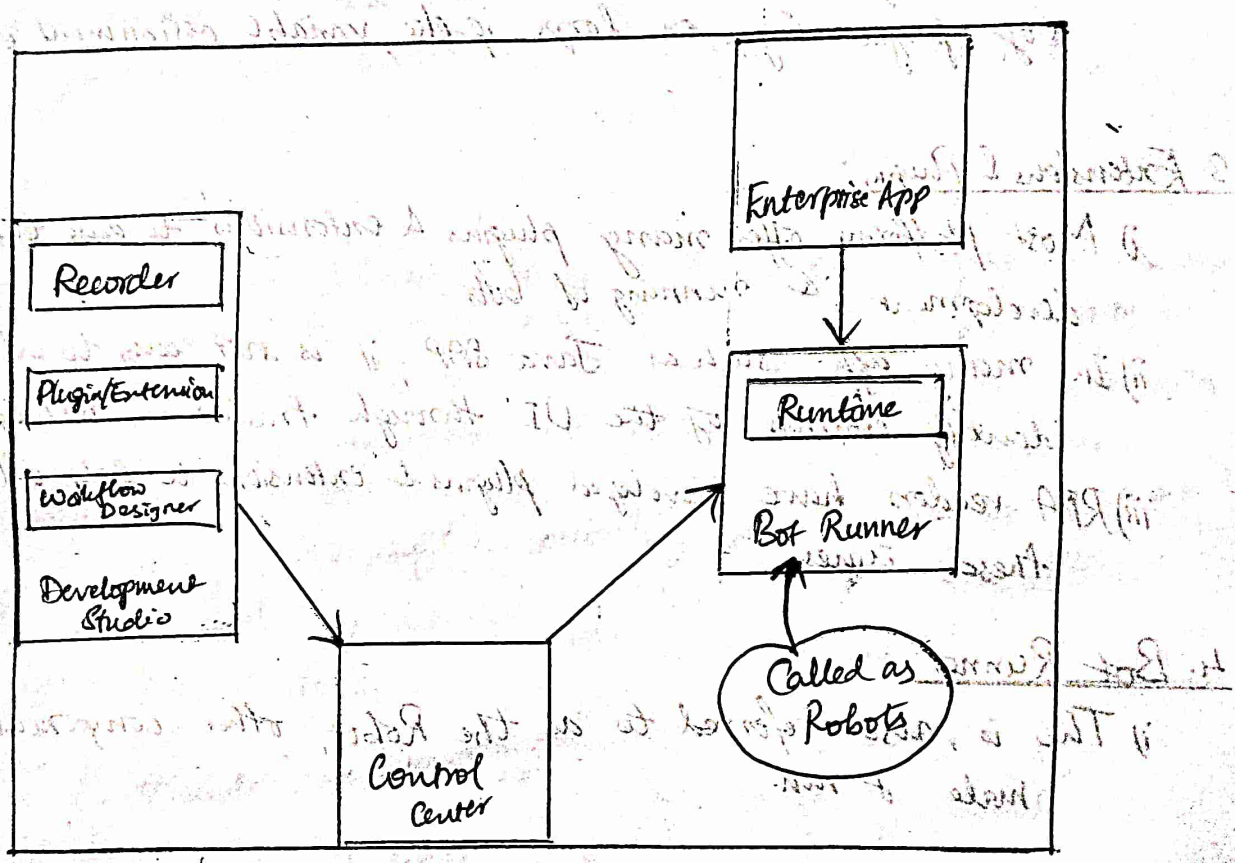
→ The process can be tedious.

→ There is often a risk of a project being late.

M2:

Components of RPA:

- The basic/core components of RPA are:
  - i) Recorder
  - ii) Development Studio
  - iii) Plugin/Extension
  - iv) Bot Runner
  - v) Control center



1. Recorder

- i) The recorder is the part of the development studio that developers use to configure the Robots.
- ii) It is like the macro recorder in Excel, the bot recorder in any platform, records steps.
- iii) It records mouse & keyboard movements on the UI & the recording can be replayed to do the same steps again & again.
- iv) This enables rapid automation.

2. Development Studio:

i) The development studio is used by developers to create Robot configuration or train the Robots.

ii) Using the development studio, a set of instructions & decision making logic is coded for Robots to execute.

iii) Some platforms provide flow-charting capabilities such as Visio, so it becomes very easy to plot steps in a process, whereas some other platforms require coding.

iv) In most studios, in order to do commercial development, developers need to have a fair amount of knowledge of programming, ex. loops, if-else, variable assignment etc.

3. Extensions & Plugins:

i) Most platforms offer many plugins & extensions to ease the development & running of bots.

ii) In many apps, such as Java SAP, it is not easy to individually identify controls of the UI through traditional techniques.

iii) RPA vendors have developed plugins & extensions to help with these issues.

4. Bot Runner:

i) This is also referred to as the Robot, other component make it run.

5. Control center:

i) The objective of the control center is to provide Robot Management capabilities.

ii) It monitors & controls a Robot's operation in a network.

iii) It can be used to start/stop Robots, make schedules for them, maintain & publish ade, redeploy Robots to different tasks & manage licenses & credentials.

UiPath Stack:

In order to make the UiPath platform fully operational at an enterprise level, there are various components that need to be in place.

There are 3 basic components in UiPath:

i) UiPath Studio

ii) UiPath Robot

1. ViPath Studio:

i) ViPath Studio is the development environment of ViPath.
ii) It is the primary tool to develop ViPath Robots.
iii) It can be used to configure steps of a ~~function~~ task or launch a full recorder to record a sequence of steps.
iv) The recording facility in the Studio is a game-changing feature for RPA tools.
v) Its simplicity lets even non-technical business users design/record steps of a process.
vi) This studio, lets the users configure Robots, i.e, develop steps to perform tasks visually.

2. ViPath Robot:

i) ViPath Robot is a Windows service that can open interactive/non-interactive windows sessions to execute processes or a set of steps, developed or recorded using ViPath Studio.
ii) It is also called an execution agent as it executes automation projects, or a runtime agent as it executes instructions generated by developing or recording processes in ViPath Studio.

Types of Robots:

i) Attended
ii) Unattended
iii) Free

1. Attended:

i) It operates on the same workstation as a human to help the user accomplish daily tasks.
ii) It is usually triggered by user events.

2. Unattended:

i) It can run unattended in virtual environments & can automate any no of processes.
ii) It addition to the Attended Robot's capabilities, this Robot is responsible for remote execution, monitoring, scheduling & providing support for work queues.

3. Free:

i) It is similar to Unattended Robots but can be used only for development & testing purposes, not in a production environment

8. UiPath Orchestrator:

i) UiPath Orchestrator is a server-based application that lets you orchestrate your Robots, hence the name Orchestrator.

ii) It runs on a server & connects to all the Robots within the network, whether Attended, Unattended, or Free.

iii) It has a browser-based interface that enables the orchestration & management of hundreds of Robots with a click.

iv) Orchestrator lets you manage the creation, monitoring & deployment of resources in your environment.

Main responsibilities of orchestrator are:

i) It helps in creating & maintaining the connection b/w Robots.

ii) It ensures the correct delivery of the packages to Robots.

iii) It helps in managing the queues.

iv) It helps in keeping track of the Robot identification.

Downloading & installing UiPath Studio:

1. To get a Community Edition of UiPath Studio, type the following link in the browser: https://www.uipath.com/commun
2. A community Edition page opens. Click on Get Community Edition
3. On the next page, you must register yourself in order to download the Community Edition. So, use the correct details & remember them because the same email will be used to activate the s/w. Fill in the following details:
   - → First Name
   - → Last Name
   - → Email

   Click on REQUEST COMMUNITY EDITION.
4. You will be directed to a page that request you to check your email for downloading the link.
   - Click on the link to download UiPath Studio.
5. Once the download is complete, open the downloaded file UiPathStudioSetup.exe

6. • The installation will then begin.
• Once the installation is complete, a welcome message will be displayed.
• Click on the Start Free option.

7. • Then, as requested, enter your email address once again & click on Activate.
• Please remember to use the same email ID that you used to download the s/w.
• This email ID is bound to the computer.
• The activation will happen online.

8. • A message will then be displayed on the screen informing you of the successful installation.
• Close this window.

Learning UiPath Studio:

The main types of projects supported by UiPath Studio are:

i) Sequence
ii) Flowchart
iii) Assistant
iv) State machine

1. Sequence:

i) This is suitable for simple actions / tasks.
ii) It enables you to go from one activity to another, without interfering with your project.
iii) It consists of various activities.
iv) Creating sequences is also useful for debugging purposes.

2. Flowchart:

i) This is suitable for dealing with more complex projects.
ii) It enables you to integrate decisions & connect activities.
iii) To start this kind of project, choose the Flowchart - Simple Process option from the new project menu.

3. Assistant:

i) This is suitable for developing attended or Front Office Robots.
ii) Sometimes these Robots are called assistants.
iii) To start this kind of projects, choose the Assistant - Agent Process Improvement option from the new project menu.

4. State Machine:

i) This is suitable for very large projects that use a finite no. of states in their execution, triggered by a condition.

ii) To start this kind of project, choose the Process-Transaction Business Process option from the new project menu:

The User Interface:

After clicking on the Blank process, the screen will be navigated to the User Interface.

i) The Ribbon
ii) Quick Access Toolbar
iii) Designer Panel
iv) Properties Panel
v) Outline Panel
vi) Arguments Panel
vii) Variable Panel
viii) Import Panel
ix) Activity Panel
x) Library Panel
xi) Project Panel
xii) Output Panel

1. The Ribbon: (File Menu/Toolbar)

This panel located at the top of the user interface & consists of 4 tabs:

i) START
ii) DESIGN
iii) EXECUTE
iv) SETUP

1. START:

→ This is used to start new projects or to open projects previously made.

2. DESIGN:

→ This is to create new Sequences, Flowcharts, or state machine or to manage variables.

3. EXECUTE:

→ This is used to run projects or to stop them, and also to debug projects.

4. SETUP:

→ This panel is for deployment & configuration options, it has 3 tools available:

i) Publish: This is used to publish a project or create a shortcut for it & schedule tasks.

ii) Setup Extensions: This is used to install extensions for Chrome, Firefox, Java etc.

iii) Reset settings: This is used to reset all settings to defaults.

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2. Quick Access Toolbar:

i) This panel gives the user a shortcut to the most used commands.

ii) One can also add new commands to this panel.

iii) This is located above the Ribbon on the user interface.

iv) The Quick Access Toolbar can be moved above or below the Ribbon.

v) By default, there are two buttons available, Save & Run, which are also available in the DESIGN tab of the Ribbon.

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3. Designer Panel:

i) This is the panel where one defines the steps & activities of the projects.

ii) It is where a dev does ~~not~~ most of the things to record activities or manually drop activities on the Canvas.

iii) When we develop a Robot, this is the window where we will be organizing various activities in a flowchart to accomplish a task.

iv) The project a user makes is clearly displayed on the Designer panel & the user has the option of making any changes to it.

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4. Properties Panel:

i) The panel located on the right-hand side of the user interface is for viewing the properties of the activities & for making any changes, if required.

ii) You need to select an activity first & then go to the Properties panel to view/change any of its properties.

5. Activities Panel:

i) Located on the left-hand side of the user interface, this panel contains all the activities that can be used in building the project.

ii) The activities can easily be used in making a project by simply dragging & dropping the required activity into the required location in the Designer Panel.

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6. Project Panel:

i) With the Project panel, you can view the details of your current project & open it in a Windows Explorer window.

ii) It is located on the extreme left-hand side of the design-panel, below the Library panel.

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7. Outline Panel:

i) This panel gives a basic outline of the project.

ii) The activities that make up the workflow are visible in this panel.

iii) You may see a high-level outline of the project & you can drill down to see deeper.

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8. Output Panel:

i) This panel displays the output of the log message or write line activities.

ii) It also displays the output during the debugging process.

iii) In addition to this, it shows errors, warnings, information & traces of the executed project.

iv) The desired level of detail can be changed in Execute / Options / Log activities.

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9. Library Panel:

i) With this panel, you can reuse automation snippets.

ii) It is located on the extreme left-hand side of the Designer Panel.

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10. Variable Panel:

i) This allows the user to create variables & make changes to them.

ii) This is located below the Designer Panel.

iii) In UiPath Studio variables are used to stored multiple types of data ranging from words, numbers, arrays, dates, times & timetables.

iv) Value of the variables can be changed.

II. Argument :

i) While variables pass data from one activity to another in a project, arguments are used for passing data from one project to another.

ii) Since arguments are used to transfer data b/w different workflows they also have an added property of direction.

There are 4 types of direction:

→ In
→ Out
→ In/Out
→ Property

Task Recorder:

i) With the task recorder, we can create basic framework for automation.

ii) The user's actions on the screen are recorded by the recorder & turned into a recording sequence in the current project.

iii) The recording is collection of execution of steps that has to be taken, on the application in the slope, in order to accomplish a task.

iv) These steps can be recorded one-by-one by pointing it on the screen or many steps in a go, i.e. automatically.

There are 4 types of recording in UiPath Studio:

i) Basic
ii) Desktop
iii) Web
iv) Citrix

1- Basic recorder:

i) It is used to record activities on the desktop.
ii) It is used for single activities & simple workflows.
iii) The actions here are self-contained & not contained in separate windows.

2. Desktop recorder:

i) It is also used to record activities on the desktop
ii) It is used to record & automate multiple actions & complex workflows.
iii) Each activity here is contained in an Attach Window component.
iv) The Attach Window component is especially important to ensure that other windows of the same application do not interfere in the workflow.

3. Web recorder:

i) The web recorder, as the name suggests, is used to record actions on web apps & browsers.

4. Citrix recorder:

i) Citrix is used to record virtual machines, VNC & Citrix environments
ii) This recording allows only keyboard, text & image automation

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Types of action recordings

i) Recordable actions
ii) Non-recordable actions

1. Recordable actions:

i) Left-click on buttons, check boxes, drop-down lists & other GUI elements
ii) Text typing is also recordable

2. Non-recordable actions:

i) Keyboard shortcuts, Mouse hover, right-click.
ii) Modifier keys such as Ctrl and Alt.

Types of Recordings:

i) Automatic recording
ii) Manual recording

1. Automatic recording:

i) This is for recording multiple actions in one go.

ii) This is a very good feature for preparing a solid foundation for automating a task.

iii) It can be invoked with the Record icon available in basic, desktop, & web recorders.

iv) A citrix recorder does not support automatic (multiple step recording.

2. Manual recording:

i) This type of recording is used to record each step one at a time & hence offers more control over the recording.

ii) It can also record all actions that cannot be recorded using Automatic recording such as keyboard shortcuts, mouse hover, right-click, modifier keys, such as Ctrl & Alt.

Functions of recording:

i) Click (Clicking a UI element: button, image, or icon)

ii) Type (Typing any value into the available text field)

iii) Copy & Paste

1. We can see a Recording icon at the top of the user-interface on the DESIGN tab of the Ribbon.

2. After clicking on this Recording icon, a list of the recording types are displayed.

3. • Clicking on each type of recording will result in the display of a recording panel with features specific to the type of recording.

• When clicking on ~~Basic~~ Basic from the recording options, ~~then the recording panel th~~

Start App:

i) This is used to start an application.

ii) When we left-click on this option we are asked to point to an application that we want to open.

iii) When we are done, we can click on the Save & Exit option.

Click:

i) Another option is Click, which is used to click on a UI element.
ii) This feature is used as a mouse input.
iii) That is, it is used for clicking, checking or selecting an item.
iv) When we click on this option, we are asked to indicate the location of the UI element we want to click.

Type:

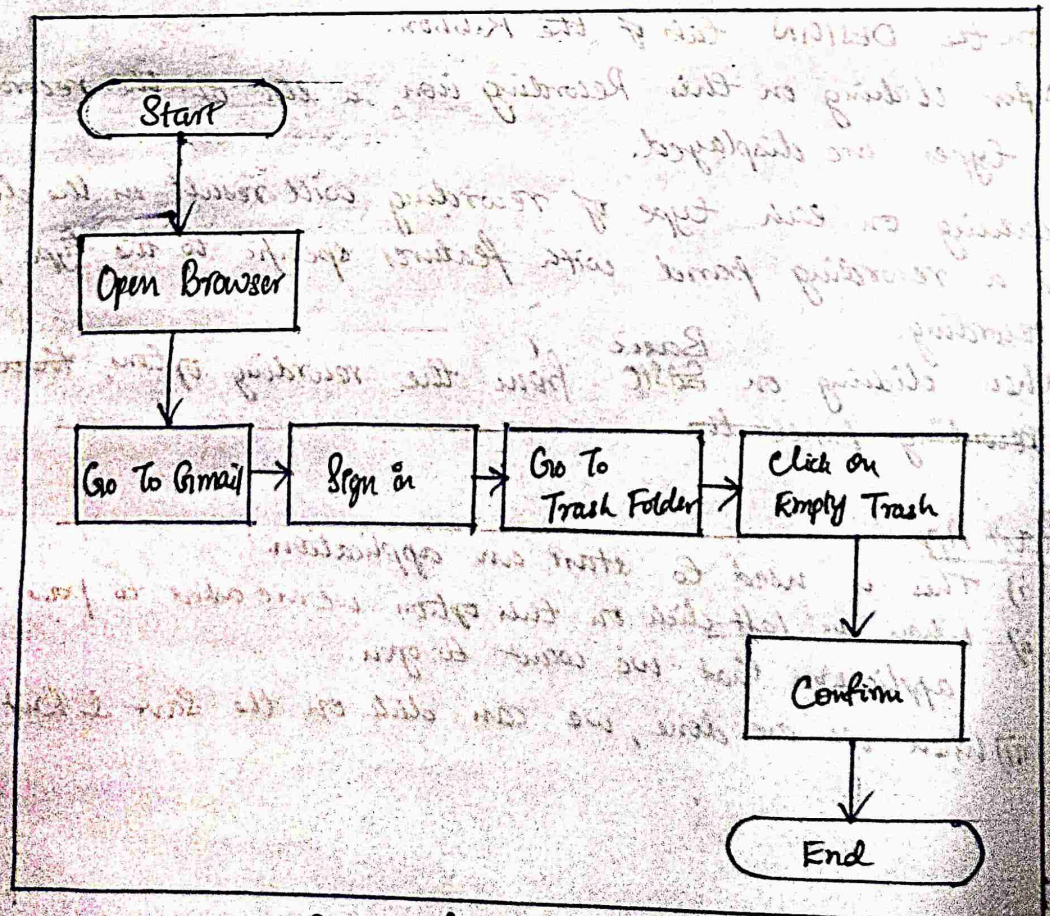
i) Another option shown in the recording panel is Type
ii) It is used for typing something inside the indicated element.

Note: There are 3 more options in recording panel:
- → Element {same as above}
- → Text
- → Image

Advanced UI Interactions:

i) Emptying the trash folder in Gmail
ii) Emptying Recycle Bin

1. Emptying trash in Gmail:



Process flow for emptying Gmail trash

Steps to be taken before starting the recorder:

i) Create a blank project in UiPath Studio & then choose Web recorder from the Recording drop-down list.

ii) Click on the Recording option & select the type of recording. Just click on Web recording & a Web Recording Panel will appear.

The following are the 6 steps in our process flow:

1) Open Browser:

i) Although we have already opened Gmail in the browser, we did not record that step.

ii) Here, we will note that step in the recorder using the Open Browser button in the recorder.

iii) A drop-down menu will appear.

iv) Again, choose Open Browser from the drop-down menu.

v) It will ask to highlight the browser, highlight the already opened browser & click on the top of the browser.

2) Go to gmail.com:

i) You will be prompted to enter the URL of the website to navigate to.

ii) Type https://gmail.com or gmail.com and press OK.

iii) Please remember the first step will merely make note of the steps in the recording but will do anything on the screen.

iv) From the next step onwards, we will use the already opened gmail.com

3) Sign in:

i) Start recording by clicking on the Record icon of the recording panel.

ii) Go to the already open Gmail & click on the Email or Phone field.

iii) UiPath will popup a prompt for typing the email.

iv) Type Gmail in the box provided by the UiPath recorder & press Enter.

v) The Gmail textbox will automatically fillup with your typed content.

vi) Click on the NEXT button of the Gmail interface; it will also get recorded.

vii) Now, you have recorded an entry in the password field.

viii) For simplicity, you may type the password in the prompt provided by UiPath.

ix) Type your password in the text field of the popup that appears.

x) Then, click NEXT to log in to your account. Clicking on the NEXT button will also get recorded.

4) Locate Trash Folder:

i) In this step, we have to click on the search box of Gmail and type in: trash in the UiPath prompt & hit Enter.

ii) Now, click on the Search button beside the search box. It will also get recorded automatically & the Trash folder will appear.

5) Click on Empty Trash Now:

i) Once you are done with clicking on the Trash action, You can see a link showing ~~Empty~~ Trash now.

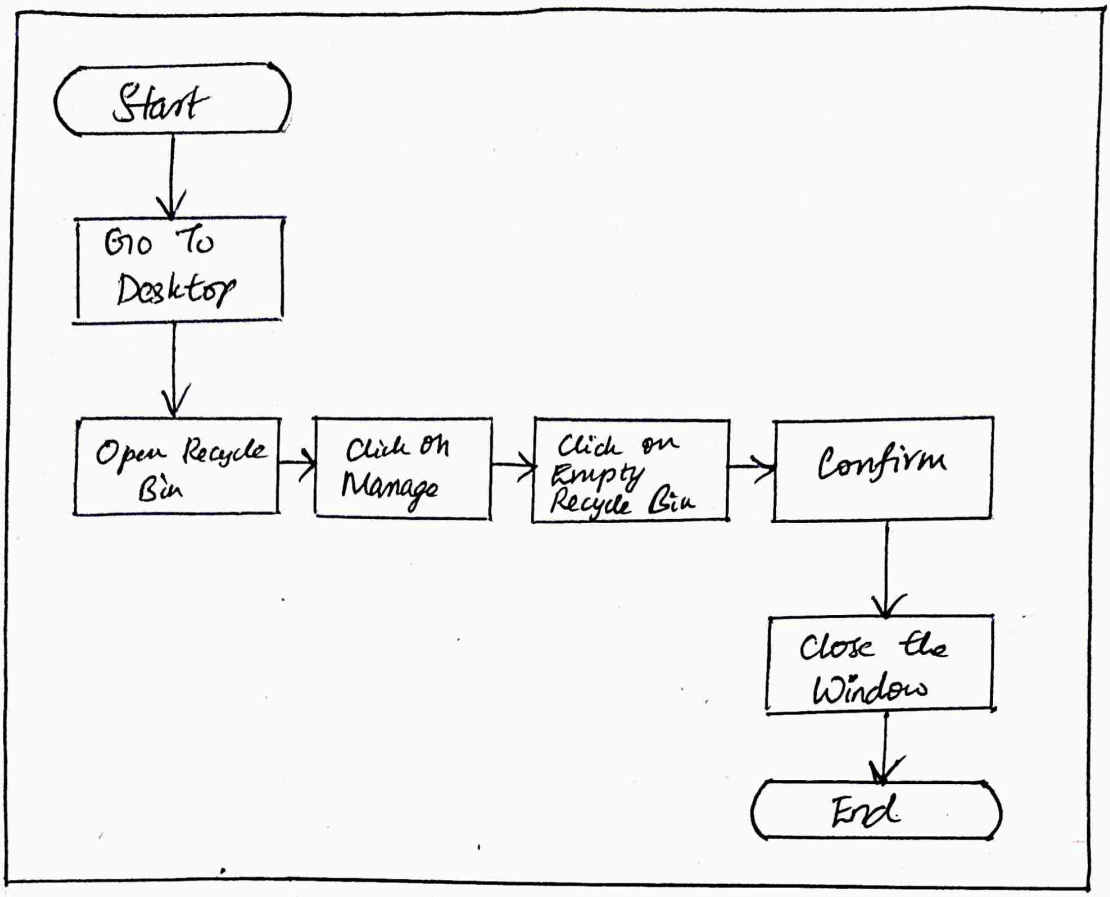
ii) Hover mouse on this link & it will get highlighted, click on it to delete all the messages in the Trash folder.

6) Confirm:

i) When you click on Empty Trash ~~now~~ now, a confirmation dialog will appear asking your permission for the action.

ii) Just confirm your action by clicking on the OK button.

2) Emptying Recycle Bin:



Process flow for empty Recycle Bin

Start the recorder & simply perform the following steps:

1. Go to the desktop by pressing the Windows+D keys.
2. Open Recycle Bin by clicking on Recycle Bin and then pressing Enter key.
3. Click on the Manage tab of the Recycle Bin folder.
4. Click on the Empty Recycle Bin button.
5. Confirm by clicking on the Yes button in the dialog box.
6. Close the Recycle Bin folder by pressing the cross button.
7. Press the Esc key & Save & Exit the recorder.

MB : Sequence, Flowchart & Control Flow :

Sequencing the Workflow

UiPath provides four types of projects :

i) Sequences
ii) Flowcharts
iii) User events
iv) State Machines

1. Sequence :

i) A sequence is a group of logical steps.
ii) Each step represents an action or piece of work.
iii) A sequence is used for processes that happen in linear succession i.e one after the other.
iv) Among the three types of projects in UiPath, Sequences are the smallest.

Ex: (We will make a simple project that asks for the name of the User & then displays the response)
(Screenshot is required)

1. Create a new project (Blank)
2. Search for Sequence in the Activities panel & drag-n-drop in the Flowchart (main.xaml)
3. Double click on the Sequence and add the steps :
   → Ask for the username in Input Dialog.
   → Display the username in a Message box.
4. Search for Input Dialog in the search panel of the Activities panel.
   Enter the ~~Title and the label~~
   → Dialog Title
   → Input Label
   → Input Type
   → Value entered
5. Drag-n-drop the message box activity into the sequence.
   Enter the Text.

[After entering all the required details, variables creation..]

6. Run the sequence

Activities:

i) An activity represents the unit of an action.
ii) Each activity performs some action.
iii) When these activities combine together it becomes a process.
iv) Each Activity resides on the Activities panel of the main Designer panel.

Flowcharts:

i) A Flowchart is generally used for complex business process.
ii) It provides decision-making facilities & can be used for both small & large projects.
iii) We can add activities in different ways.
iv) A Flowchart provides multiple branching logical operators to make decisions.
v) A Flowchart is able to run in reverse.
vi) It can also be used inside Sequences.
vii) It facilities reusability for distinct projects.

Ex: Use of Flow Diagram for checking number is +ve or -ve

Control Flow, Various types of loops, Decision making:

Control Flow:

i) It refers to the orders or the particular manner in which actions are performed in an automation.
ii) UiPath provides numerous activities for performing the decision-making process.
iii) These activities, present in the Activities panel, are put into the workflow either using the double-click method or drag-n-drop method.

Different types of control flow activities are:

i) The Assign activity.
ii) The Delay activity.
iii) The Break activity.
iv) The While activity
v) The Do While activity
vi) The For each activity.
vii) The If activity.
viii) The Switch activity.

1. The Assign activity:

i) The Assign activity is used to designate a value to the variable.

ii) The Assign activity can be used for different purposes, such as
→ incrementing the value of a variable in a loop,
→ using the results of a sum, difference, multiplication/division of variables
→ assigning it to another variable.

2. The Delay activity:

i) The Delay activity is used to delay or slow down an automation by pausing it for a defined period of time.

ii) The workflow continues after the specified period of time.

iii) It is in the hh:mm:ss format.

iv) This activity plays a significant role when we need a waiting period during automation, perhaps say, a waiting period required for a particular application to open.

Example: (Steps)

1. First, create a new Flowchart
2. Add a Write line activity from the Activities panel & connect it to the Start node.
3. Select the Write Line activity. Now, type the following text into the Text box: "Hey, what is your name?".
4. Next, add a Delay activity & connect it to the Write line activity.
5. Select the Delay activity & go to the Properties panel. In the Duration field, set 00:00:50. This is a 50-second delay between the two logged messages.
6. Take another Write line activity & connect it to the Delay activity. In the Text field, write "My name is Andrew Ng.".
7. After clicking on the Run button, the Output panel shows the message that delays it by 50 seconds.

7. The If activity:

i) The If activity consists of a statement with two conditions: true or false.
ii) If the statement is true, then the first condition is executed; if not, the second is executed.
iii) It is useful when we have to take decisions on the basis of statements.

Steps: (Example that checks whether the sum of any two nos is less than 6)

1. Add a Flowchart from the Activities Panel
2. Add two Input dialog activities. Create two integer variables, x & y.
3. In the Properties panel, change the label name & title name of both the Input dialog activities.
4. Now, specify these name of these two variables in the Result property of both the Input dialog activities.
5. Now add the If activity to the Designer panel:
6. In the condition part, $x+y<6$, check whether it is true or false. Add two Write line activities & type "True" in one & "False" in the other.
7. Click the Run button.

---

8. The Switch Activity:

i) The Switch Activity can be used to make a choice.
ii) When we have various options available & want to execute one option, we use Switch Activity.
iii) By default, it takes an integer argument.
iv) If we want to take a desired argument, then we can change it from the Properties panel, from the TypeArgument list.

Steps:

1. Add a Sequence activity
2. Add an Input dialog activity inside the Sequence
3. Now, create an integer type variable k.
4. Specify the newly created variable's name in the Result property inside the Properties panel.
5. Add the Switch activity under the Input dialog activity.
6. In the Expression field, set k mod 2 to check whether the number is divisible by 2 or not.
7. Add a Write Line activity to the Default section & type the k.ToString + " is an even number" in the text field

3 The Break Activity:

i) The Break activity is used to break/stop the loop at a particular point, & then continues to the next activity according to the requirement.
ii) It cannot be used for any other activity apart from the For each activity.
iii) It is useful when we want to break the loop to continue to the next activity in the For each activity.

Example: (Steps: The Break activity to execute only one iteration)

1. Add a Sequence activity to the Designer Panel.
2. Next, add a For each activity inside the Sequence.
3. Create two variables; an integer variable named item, and an array integer variable named x. Then set them to the text field.
4. Now, assign a default value to the integer variable x.
5. Add a Break activity inside the body of the loop.
6. Under the For each activity, add a Write Line activity.
7. In the Write Line activity, type item.ToString in the text field.
8. When we click the Run button, it will display one element, as shown in the output. This is due to Break activity.

Output:

```
Switch execution started
1
Switch execution ended
```

---

4. The While Activity

i) The While activity is used in automation to execute a statement or process based on a certain condition.
ii) If found true, the loop is executed; i.e. the process is executed repeatedly.
iii) The projects only exits from the loop when the condition does not hold true.
iv) This activity is useful while iterating through an array of elements

Example: Lets see how an integer variable will increase from 5 to 50 in increments of 5.

8. Now, create Case 1, add the one other Write Line activity to it, & type k.ToString + " is an odd number" in the text field.

Step-by-step example using Sequence and Control flow:

Ex: Find out how many of ~~them~~ (array of names) start with the letter a.

Steps:

1. Drag-n-drop a Flowchart activity from the Activities panel.
2. Drag-n-drop a Sequence activity inside the Flowchart. Connect the Sequence to the Start node by right-clicking on the Sequence activity & selecting the Set as Start node option.
3. Double click on the Sequence activity. Create a variable. Give it a name. Set the variable type to Array of [T]. When asked for the type of array, select String.
   names = {"John", "Sam", "Andrew", "Anita"}.
4. Create a variable of type integer count for storing the result. Set the variable type to Int32.
5. Drag-n-drop a For each activity inside the Sequence. Specify the array name in the expression box of the For each activity. The For each activity is used to iterate over the array.
6. Drag-n-drop the If activity from the Activities panel & place it inside the For each activity
7. Specify the expression as item.ToString.StartsWith('a').
8. Use the 'Count' variable & increment it each time a name from array starts with the letter a. We use the Assign activity.

   To: Count ← Assign activity
   Value: Count + 1

9. Drag-n-drop Message box activity inside the Sequence activity. Print the message (count) using .ToString.

Data Manipulation:

Variables and Scope:

Variable: A variable is the name given to a block of memory to hold data.

Scope: It is the region under which the data has its effect or availability.

Collections:

Types of variables:

i) Scalar
ii) Collections
iii) Tables.

1. Scalar:

i) These are variables that can only hold a single data point of a particular data type.
ii) Ex: Character, Integer, Double

2. Collections:

i) These are variables that can hold one or more data point of a particular data type.
ii) Ex: Array, List, Dictionary

3 Tables:

i) These are a tabular form of a the data structure which consist of rows & columns.

Arguments:

i) An argument is simply a variable that can store a value.
ii) It can be created in the Argument section of the main Designer And
iii) An argument has a larger scope than a variable & is used to pass values b/w different workflows.
iv) Arguments are used for interacting with different workflows by exchanging data b/w them.
v) That is why direction property is associated with Arguments
vi) We can choose the direction on the basis of our requirement - either giving the value to some workflow or receiving the value from another workflow.

The directions that can be specified for the arguments are:

i) In: When we have to receive the value from another workflow.
ii) Out: This is the current value if we have to send the value to a workflow.
iii) InOut: This specifies both, it can take or receive the value.
iv) Property: This specifies that it is not being used currently.

Data table usage:

Data table:

i) It is a tabular form of data structure.
ii) It contains rows & each row has columns.

Ex:

USN	Name
1BY18IS001	RAM
1BY18IS002	SHYAM

iii) It can be used to build a table dynamically.
iv) It can be used to store tabular data structures.
v) Also can be used in data scraping.

Building a Data table:

Initially, create an empty project.

1. Drag-n-drop a Flowchart activity on designer panel. & drag-n-drop a Sequence activity & set it as the Start node.
2. Double click on the Sequence & drag-n-drop the Build Data Table activity inside the Sequence activity.
3. Click on the Data Table button. A popup window will appear, here remove both the columns by clicking on the Remove Column icon.
4. Now, we will add three columns by simply clicking on the + symbol. Specify the column names & select the appropriate data types from the drop-down list. Click on the OK button. We will add column USN of Int32 data type, Name of String data type.

   Now enter the random values. Click on OK, & our data table is ready.
5. In order to store the Data Table created by Build Data Table activity, we have to create a data table variable MyDataTable of DataTable type & in order to store the result of the data table that we have dynamically built.

   Specify assign the Output property of the Build Data Table activity with this variable.

6. Now Drag-n-drop Output Data Table activity to the sequence, which converts the DataTable to a string data type. The output from the previous activity is fed in as the input to this activity

7. Now we can print/display the DataTable which we had created using Message box activity, we need to pass the output of the previous activity which is a string to this activity.

Building a data table using data scraping:

Ex: An example of extracting data from Amazon's website.

Steps:

1. Drag-n-drop the Flowchart activity from the Activities panel, & drag-n-drop the Sequence activity inside the Flowchart activity.
2. Double Click on the Sequence Activity.
3. Drag-n-drop the Open Browser activity inside the Sequence activity. Specify the URL in the text box.
   (URL: https://www.amazon.in/s?k=amazon+books+for+kids)
4. Click on the Data Scraping (Table Extraction) icon on the top left corner of UiPath Studio. A window will pop up. Click on the Next button.
5. Now, there will be a pointer pointing to the UI elements of the web page. Click on the name of the book.
6. Point to ~~the~~ a second ~~column~~ similar element on that web page. Specify the name that you want to give for that extracted data column. Click on the Next button.
7. A list of names will appear in a separate window.
8. It will ask you to locate the next page's button/link. If you want to extract more info about the product & it spans across multiple pages, then click Yes or No button.
9. Data scraping generates a data table.
10. Drag-n-drop the Output data table activity on the Flowchart. Set the output property of the Output data table activity as: ExtractDataTable
11. Connect the Message box activity to the Output data table activity. Specify the text property as the result variable.
12. Hit the Run button.

Clipboard Management:

i) Clipboard management involves managing the activities of the clipboard, for example, getting text from the clipboard, copying selected text from the clipboard.

Example: Getting text from the clipboard.

Steps:

1. Drag-n-drop a Flowchart activity from the Activities panel.
2. Click on the Recording icon on the top of UiPath Studio. A drop-down menu will appear with the options, Basic, Desktop, Web & Citrix, indicating the different types of recording.
   Select Desktop & click on Record.
3. Click on Notepad to open it. A Notepad window will pop up.
4. Click on the text area of Notepad. Type into the dialog box & check the empty field. Press Enter.
   Data will be written on the Notepad text area.
5. Click on the Edit button. [A popup window will appear asking you whether you want to use an anchor.]
6. Then, it will automatically start recognizing the Edit button. Choose Select all option from the drop-down list.
7. Once again, click on the Edit button. It will again ask you to indicate the anchor element. Indicate the anchor button & the Edit button will be highlighted, giving you a drop-down box. Select the copy option.
   - This copied text is now stored in the clipboard.
   - We can use the Get from clipboard & Copy selected text activities to copy the text i.e stored in the clipboard.
   - We will use the Copy selected text activity.
8. Double click on the Recording Sequence i.e generated by the recording. Drag-n-drop the Copy selected text & Message box.
9. Create a variable string to store the output value of Copy Selected text.
10. Specify the string variable in the text property of Message box activity.
4. Run button.

File Operation with Step-by-Step example:

The following are the methods (Activities) that are frequently used with an Excel file:

i) Read cell
ii) Write cell
iii) Read range
iv) Write range
v) Append range

1. Read cell:

→ This is used to read the value of a cell from an Excel file.

Suppose we have to read value of the B3 cell:

1. Drag-n-drop a Flowchart activity on the main Designer panel. Also, drag-n-drop an Excel application scope inside the Flowchart. Connect it to the Start node. Double click on Excel application scope.
2. Drag-n-drop the Read cell activity inside the Excel application scope activity. Specify the range value in the cell text box of the Read cell activity. Create a variable of type string to hold the result produced by the Read cell activity. In our case, we have created a Result variable. Specify the Output property of the Read cell activity by providing the variable's name that we have created.
3. Drag-n-drop a Message box activity inside the Excel application scope activity & specify the string variable's name in the expression box of the Message box activity.

Write cell:

→ This is used to write a value in a cell of an Excel file.

1. • Drag-n-drop a Flowchart activity on the main Designer panel.
   • Also, drag-n-drop an Excel application scope inside the Flowchart activity.
   • Connect it to the Start node.
2. • Drag-n-drop a Write cell activity inside the Excel application scope.
   • Specify the cell value in which we want to write in the Range property of the Write cell activity.
   • Specify the value of the Value property.

Read Range:

→ It is used to read the value up to the specified range.
→ If the range parameter is not specified, it will read the entire Excel file.

1. Drag-n-drop a Flowchart activity on the main Designer panel.
   - Drag-n-drop an Excel application scope inside the Flowchart activity.
   - Connect it to the Start node.
2. - Drag-n-drop a Read Range activity inside the Excel application scope activity.
   - The Read Range activity produces a data table.
   - We have to receive this data table in order to consume it.
   - We need to create a data table variable & specify it in the Output property of the Read Range activity.
3. - Drag-n-drop an Output Data table activity inside the Excel application scope activity.
4. Drag-n-drop a Message box activity inside the Excel application scope activity.

Write range:

→ It is used to write a collection of rows into the Excel sheet.
→ It writes to the Excel file in the form of a data table.

1. Drag-n-drop a Build data table activity from the Activities panel.
   - Double click on this activity.
   - Add data to the datatable (username)
2. - Create a variable of type DataTable.
   - Specify this variable in the DataTable property of the Build Data Table activity.
3. - Drag-n-drop an Excel application scope inside the main Designer panel.
   - You can either specify the Excel sheet path or manually select it.
   - Connect this activity to the Build Data Table activity.
   - Inside Excel application scope, just drag-n-drop the Write Range activity.
4. Specify the data table variable name that we created earlier & set it as a Data table property inside the Write Range activity.
5. Hit the Run.

Append range:

1. Flowchart activity, Excel applicat scope
2. Read range, data table variable
3. Append range, specify excel file path, specify the data table
4. Run

CSV/Excel to data table & vice versa:

1. Reading an Excel file & creating data table

i) Flowchart, Excel Application Scope

ii) • Specify the path of your workbook/Excel file
• Drag-n-drop the Read Range activity., Excel application scope
• data table variable should be specified in the Output property.

iii) Output Data Table → Data Table property of the Output Data Table activity is used to convert the Data Table into string.

iv) Message box

2. Creating a data table & writing all its data into Excel:

i) Build Data Table

ii) DataTable variable

iii) Excel Application Scope
→ specify the Excel sheet's path.

iv) Inside Excel Application Scope, Write Range

v) Run

Case Study: SCM (RPA in).

M4: Taking Control of the Controls

Attach Window Activity

- Attach Window Activity is generally used to attach an already opened window.

Implementing the Attach Window Activity:

→ Attach a Notepad window and then write some text into it:

i) Create a Blank project and name it.

ii) • Drag-n-Drop (D-n-D) a Flowchart activity on the Designer Panel.
• Also D-n-D a Click activity inside the Designer Panel.
• Set this Click activity as the Start node.

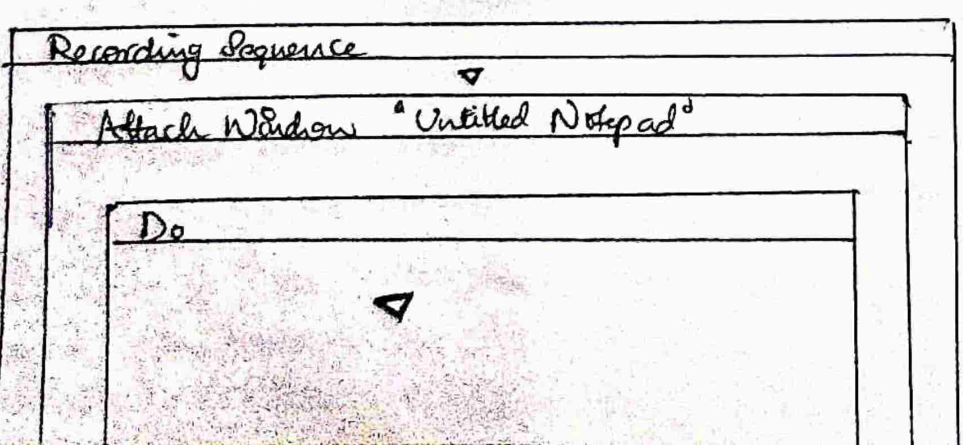
iii) • Double click on the Click activity & then click on Indicate on screen.
• Locate the Notepad icon.

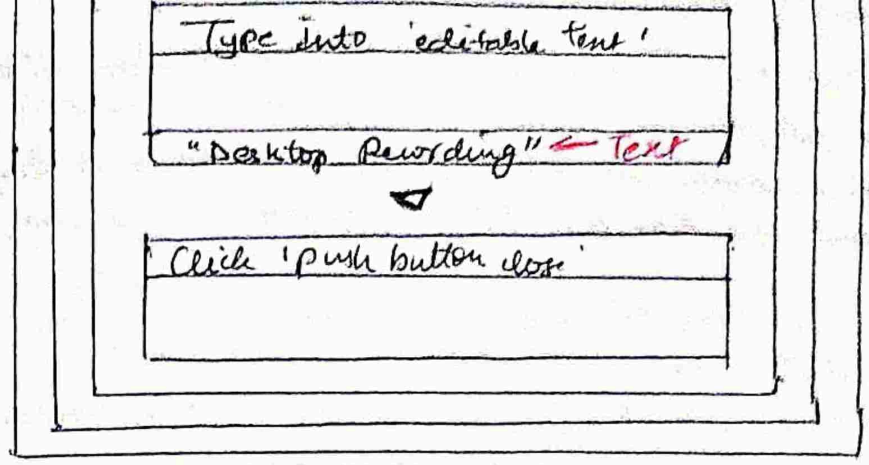
iv) • D-n-D the Attach Window activity on the main Designer panel.
• Connect the Attach Window activity to the Click activity.

v) • Double-click on the Attach Window activity.
• Click on Title Window on screen and indicate the Notepad window.
• The Notepad window is now attached to the previous activity.

vi) • For the sake of completeness, we are going to add a Type into activity.
• Just D-n-D the Type into activity, inside the Attach Window activity.
• Click on the Indicate element inside window and locate the Notepad window where you want to write the text.
• Write the text in the Text property of the Type into the activity.

vii) • Hit the Run button.





Finding the Control:

→ There are many activities which can be used to find controls on screens/applications.

→ These ~~applications~~ activities are used to find or wait for an UI element.

Finding the Control activities are:

i) Anchor Base
ii) Element Exists
iii) Element Scope
iv) Find Children
v) Find element
vi) Find relative element
vii) Get ancestor
viii) Indicate on screen

1- Element Exists:

i) This control is used to check ~~whether~~ the availability of the UI element.
ii) It checks if the UI element exists or not.
iii) It also returns a Boolean result if the UI Element exists then it returns true, otherwise, it returns false.

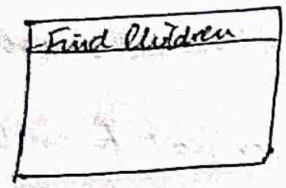
Steps:

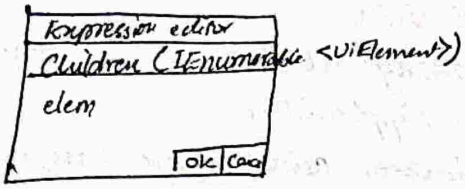
i) D-N-D the Element Exists control from the Activities panel
ii) Double-click on it. Indicate on screen option will be present.
iii) Click on it to Indicate the UI element.
iv) Provide a Boolean variable in the Exists property.
v) Hit the Run button.

2. Find Children:

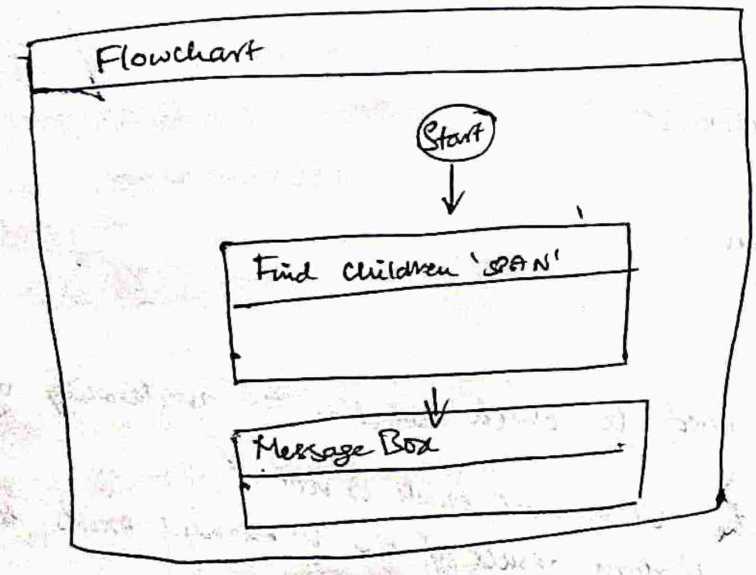
i) It is used to find all the children UI elements of a specified UI element.
ii) It also retrieves a collection of children UI elements.
iii) You can use a loop to inspect all the children UI elements or setup some filter criteria to filter out the UI elements.

Steps:
i) D-n-D the Find Children control from the Activities panel
ii) Double click on it to indicate the UI element that you want to specify. You can indicate it by clicking on Indicate on screen.





iii). You have to supply a variable of type IEnumerable<UiElement> in the children property.
- This variable is used for retrieving the UI elements



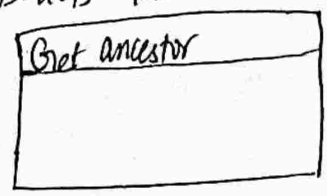
3. Find Element:

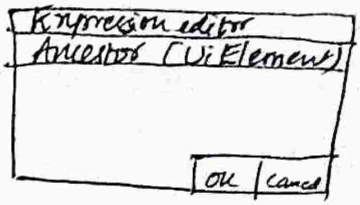
i) It is used to find a particular UI element.
ii) It waits for that UI element to appear on the screen & returns it back
iii) It can be used in the same way like other controls.

Steps:
i) D-n-D this control.
ii) Indicate the UI element by clicking on Indicate on Screen.
iii) Specify the variable of type UI element in the Found element property of the Find Element control to receive the UI element as output

4. Get Ancestor:

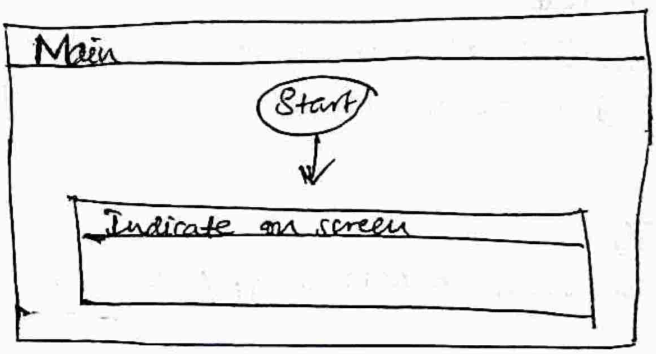
i) It is used to retrieve the ancestor of the specified UI element.
ii) Must supply a variable to receive the ancestor element as output.
iii) Specify the variable name in the Ancestor property of the Get ancestor control.
iv) After receiving the ancestor element, you can retrieve its attributes, properties, and so on for further analysis.
v) D-n-D this control & indicate the UI element by clicking on Indicate on screen.





5. Indicate on Screen:

i) It is used to indicate and select the UI element or region at runtime.
ii) It gives flexibility to indicate & select the UI element or region which running the workflow.
iii) D-n-D this control in your project



Techniques for Waiting for a Control:

→ There are 3 techniques through which we can wait for a control,
i) Wait Element Vanish
ii) Wait Image Vanish
iii) Wait Attribute

i) Wait Element Vanish:

→ This activity is used to wait for a certain element to disappear from the screen.

Example:
i) Create a Blank project & name it.
ii) • D-n-D a Flowchart activity on the Designer panel. • Also, D-n-D the Wait Element Vanish activity on the Designer panel. • Set this activity as the Start node.

iii) Double-click on the Wait Element Vanish activity, then indicate on the screen which element needs to vanish.

2. Wait Image Vanish:

i). The Wait Image Vanish activity is similar to the Wait Element Vanish activity.
- This activity is used to wait for an image to disappear from the UI element.

ii) The only diff b/w the Wait Element Vanish & the Wait Image Vanish activities is that the former is used to wait for an element to disappear, while the latter is used to wait for an image to disappear.

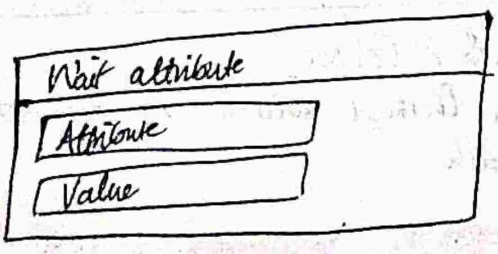
3. Wait attribute:

→ This activity is used to wait for the value of the specified element attribute to be equal to a string.
→ We have to specify the string explicitly.

i). D-n-D a Flowchart activity on the Designer panel.
- Now D-n-D the Wait attribute on the Designer panel.
- Now, right-click on the Wait attribute activity & set it as the Start node.

ii) Double-click on the Wait attribute activity.
- We have to specify three values:
  - → attribute
  - → element
  - → text property
- Specify the element on which we have to supply the value.

iii) Hit the Run button.



Act on controls - mouse & keyboard activities:

Mouse Activities
i) Click activity
ii) Double-click activity
iii) Hover activity

Keyboard activities
i) Send hotkey
ii) Type into
iii) Type secure text

Mouse activity:

→ The activity that involve interaction with mouse fall under the category of mouse activity.

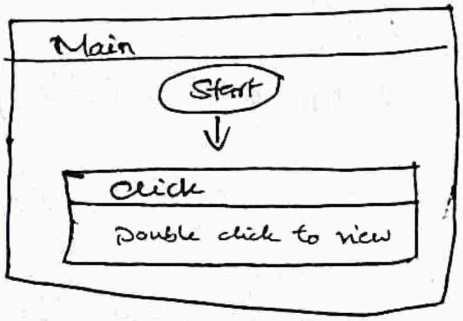
1. The Click activity:

→ When we have to click on a UI element on the screen, we use the Click activity.

Ex: i) • D-n-D a Flowchart on the Designer panel.
• Search for mouse in the search bar of the Activities panel.
• D-n-D the click activity.
• Right-click on the Click activity & select Set as Start Node.

ii) • Double-click on the Click activity.
• Click on Indicate on screen and indicate the UI element you want to click on.

iii) Hit the Run button.



2. The Double-click activity:

i) The Double-Click activity is similar to the Click activity.

ii) It performs the double-click action.

iii) Note: Explain the same (previous) example as Double-Click activity.

3. The Hover activity:

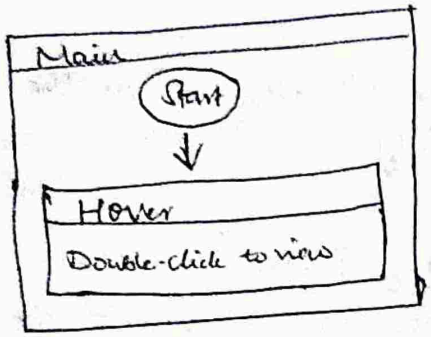
→ The Hover activity is used to hover over a UI element.

→ Sometimes, we have to hover over a UI to perform an action.

Ex: i) • D-n-D a Flowchart on the Designer panel.
• Search for mouse in the search bar of the Activities panel.
• D-n-D the Hover activity
• Right-click on the Hover activity & selects Set as Start Node.

ii) • Double-click on the Hover activity.
• Click on Indicate on screen to indicate the UI element you want to hover on.

iii) Hit the Run button.



Keyboard activities:

→ Keyboard activities generally involve an interaction with a keyboard.

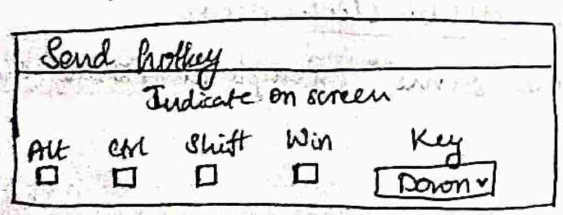
1-Send hotkey:

→ This activity is used to send keystrokes from the keyboard as an input to the screen

Ex: We will use the Send hotkey activity to scroll the Flipkart main page.

i) D-n-D a Flowchart on the Designer panel.
• Search for keyword in the Search bar of the Activities panel.
• D-n-D a Send hotkey activity
• Right-click on the Send hotkey activity & select Set as Start Node.

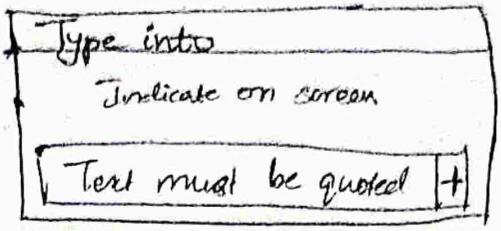
ii) • Double-click on the Send hotkey activity
• Click on the Indicate on Screen and indicate the required page (in our case, https://www.flipkart.com)
• Assign any key by marking the checkboxes.
• Also specify the key by selecting a key from the drop-down list.



iii) Hit Run button

2. Type Into:

→ This activity is used to type the text into the UI element.
→ It also supports special keys.
→ It is similar to Send hotkey activity.
→ We have to send the keystrokes along with the special keys
→ Special keys are optional.



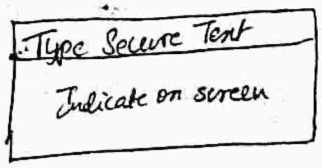
Steps:
i) D-n-D the Type Into activity.
ii) Specify the keystrokes & special keys by clicking on the + icon & choosing the key from the drop-down list
iii) You have to Indicate on screen the area where you want the text to be typed

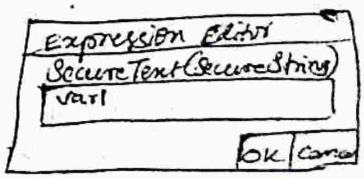
3. Type Secure Text:

→ This activity is used to send secure text to the UI element.
→ It sends the string in a secure way:

i) D-n-D a Flowchart activity on the Designer panel.
- Search for keyboard in the search bar of the Activities panel.
- D-n-D the Type Secure text activity
- Right click on the Type Secure text activity & select Set as Start Node

ii) - Create a variable of type SecureString.
- Now, double-click on the Type Secure text activity & specify the variable's name in the SecureText property of the Type Secure Text activity.
- Also indicate on screen by clicking on Indicate on screen.





Handling events:

An event occurs when some action is performed.

Different types of events are:
i) Element triggering events
ii) Image triggering events
iii) System triggering events

1. Element triggering events:

It consists of 2 types:
i) Click trigger
ii) Key press trigger

1. Click trigger:

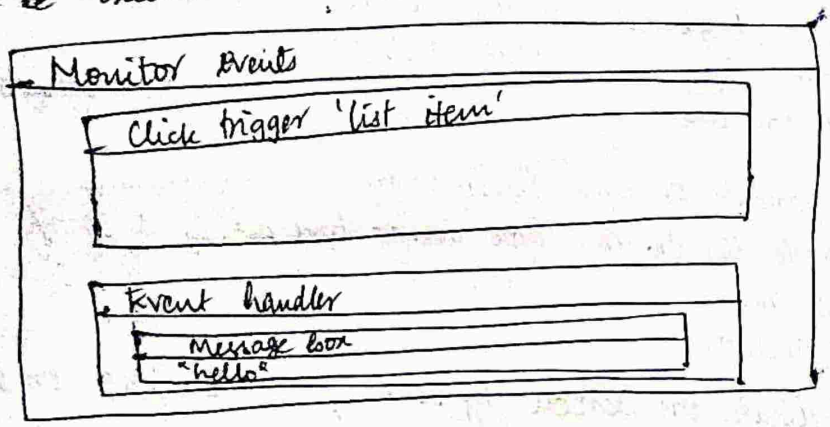
i) This event occurs when a specified UI element is clicked.

ii) Before using the Click trigger, we have to use the Monitor events activity.
- Without Monitor events, the click trigger cannot be used.

iii) Double-click on Monitor events.
- D-n-D the Click trigger inside Monitor events.
- Also, D-n-D the activity in the Event handler section of Monitor events.
- In this case, we have used the Message box activity & also specified the string value.

iv) Inside the Click trigger, you have to indicate the UI element that you want to click on.

v) When the Click action is performed on the specified button, then the event handler will be called & the activities inside the event handler will be executed.



2. Key press trigger:

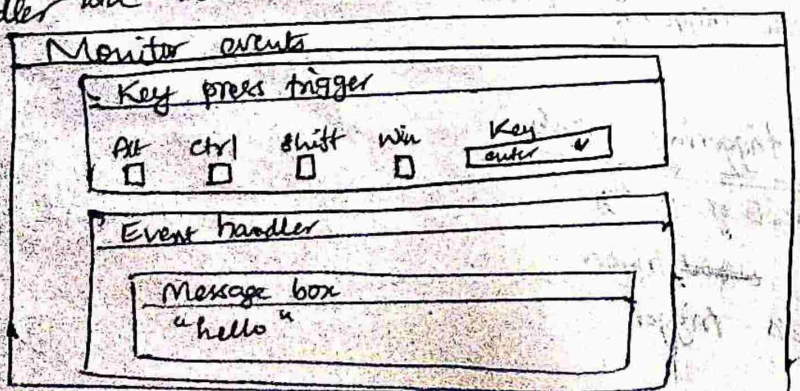
i) A key press trigger event occurs when keystrokes have been performed on some particular UI element.

ii) It calls the Event handler when it is triggered.

iii) While using key press trigger event you have to specify the key or combination of keys.

iv) Indicate the UI element on which you want to perform the action.

v) When the keys are pressed on the specified UI element, the event handler will be called.



2. Image Triggering Events:

i) The Click image trigger is an image triggering event.
ii) It is used for when we click an image.
iii) We can use Click Image trigger event inside the Monitor event & indicate the image.
iv) Upon clicking the indicated image in the Click image trigger event, the event handler will be called.

3. System Triggering events (STE)

The following are STE,

i) Hotkey trigger
ii) Mouse trigger
iii) System trigger

1. Hotkey trigger:

i) This event is raised when special keys are pressed.
ii). You can use the Hotkey trigger event on your own.
- You have to use this event inside the Monitor event.

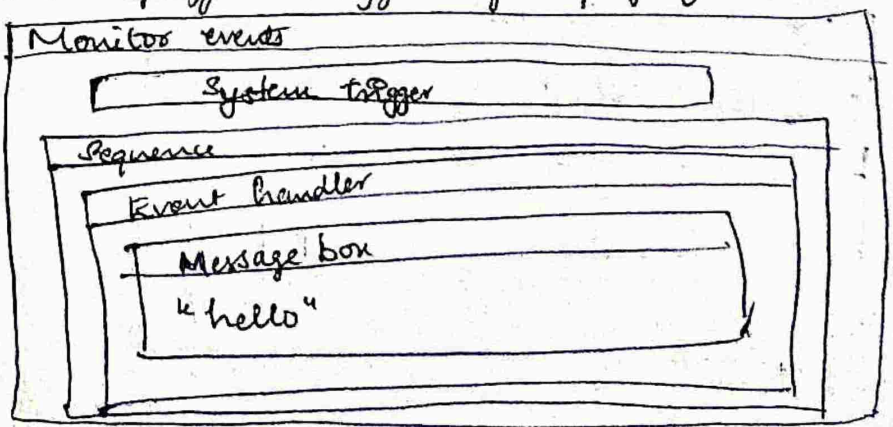
iii). Specify the special keys or combination of keys.
- Also, provide the event handler that will be called when the event occurs.

2. Mouse trigger:

i) This event is fired when the mouse button is pressed.
ii) Use this event inside the Monitor event & specify the Mouse button: Either the left mouse button (LMB), MMB, RMB.

3. System trigger:

i) This event is used when you have to use all of the keyboard events, all of the mouse events, or both.
ii) D-n-D the System trigger event into Monitor events.
iii) You can specify the trigger input property:



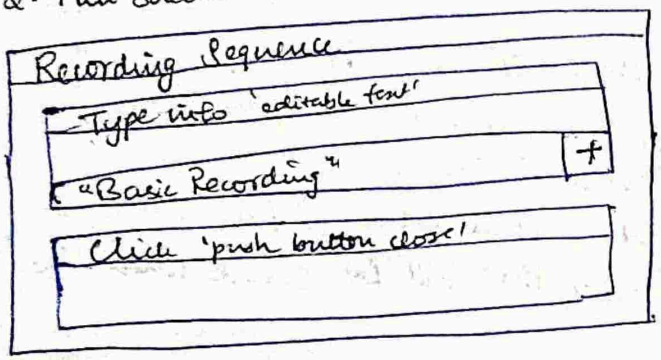
Recording:

Types of recording are:

i) Basic recording
ii) Desktop recording
iii) Web recording
iv) Citrix recording

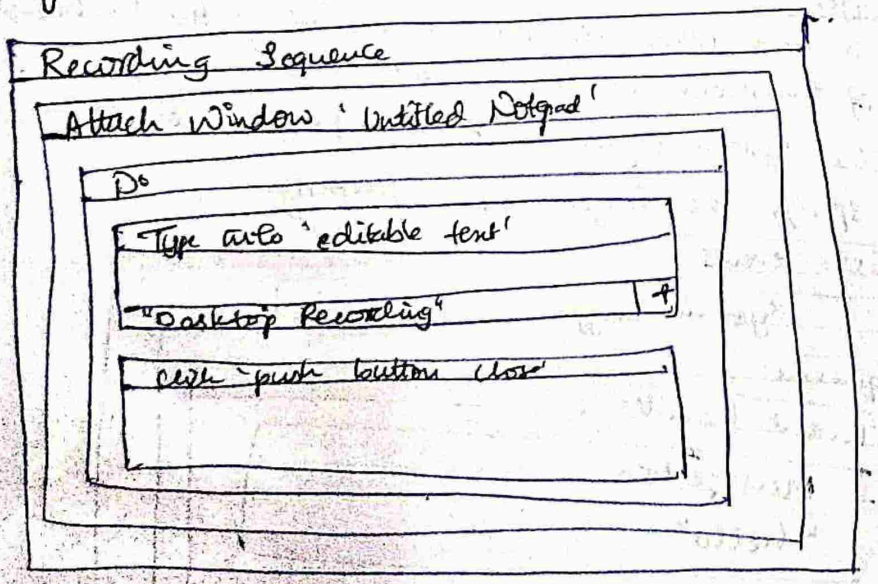
1. Basic recording (BR)

i) It is used to record the actions of applications that have a single windo
ii) BR uses a full selector
iii) It works better for applications performing a single action.
iv) It is not suitable for apps with multiple windows.
v) There are 2 types of selectors,
   1. Partial Selector
   2. Full Selector : It has all the attribute to recognize a control or application.



2. Desktop recording: (DR)

i) Similar to BR with the added advantage of working with multiple actions.
ii) Suitable for automating Desktop apps.
iii) DR generates partial selectors.
iv) Partial selectors have hierarchical structure.
v) They are split into parent child views for recognising the UI elements properly.



3. Web Recording (WR):

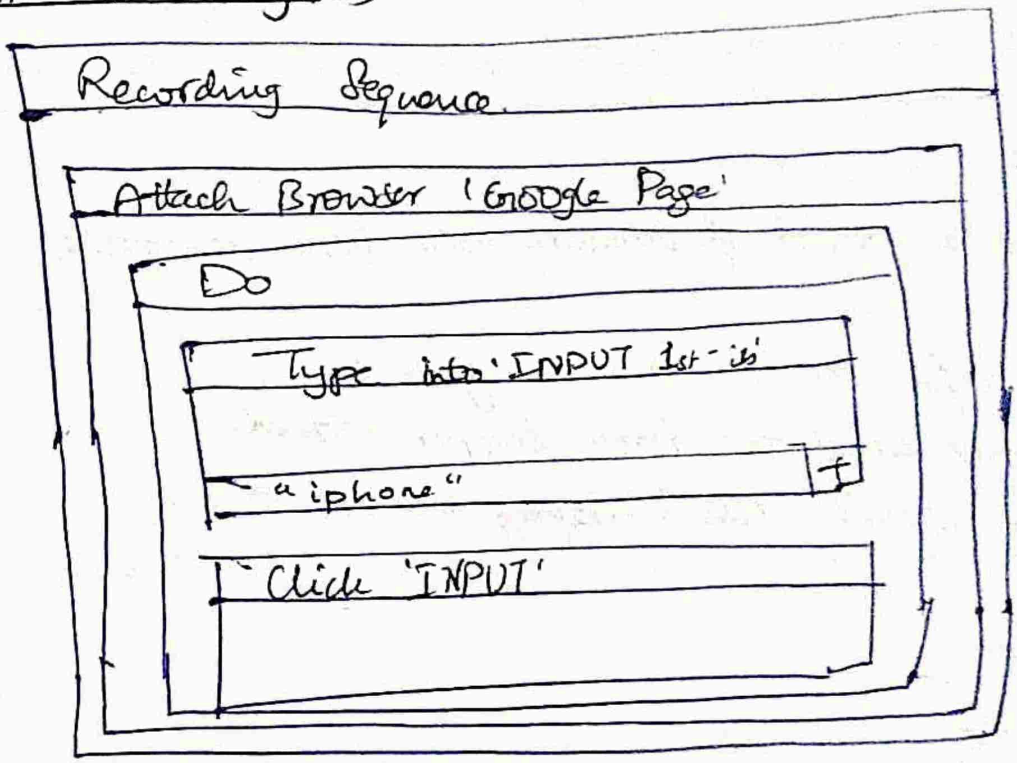
i) Web recording can be done by using the WR.

ii) For WR, the UiPath extension for that browser should be installed.

iii) Or else, you will not able to automate tasks or actions using WR.

Example: Data Scrapping example.

~~4. Citrix Recording (CR)~~



4. Citrix Recording (CR)

i) When dealing with the Remote Desktop Connections, methods such as ~~BR~~ are DR cannot be used.

ii) In an RDP environment, images will be sent from one desktop to another, & will be mapped by analyzing the position of the pointer of the mouse button.

iii) Hence, BR, DR cannot be used, as these recording techniques fail to interact with the images.

iv) In a Citrix environment, we have the Click Text & Click Image activities, using which we can work with images with ease.

y Activities that are listed in a Citrix Recording:

i) Click Image
ii) Click Text
iii) Type
iv) Select & Copy
v) Screen Scrapping
vi) Element
vii) Text
viii) Image

Screen Scrapping:

→ Screen Scrapping is a method of extracting data from documents, websites, PDFs.
→ It is a very powerful method for extracting text.
→ We can extract text using the Screen Scraper wizard.
→ The Screen Scraper wizard has 3 scrapping methods:

i) Full Text
ii) Native
iii) OCR

1. Full Text:

i) Full Text Activity (FTA) is used to extract info from various types of documents & websites.

2. Native

i) Similar to FTA, but has some diff.

3. OCR:

i) Used when the previous two methods fail to extract data.
ii) Uses OCR engines: Microsoft OCR, Google OCR.
iii) It has scale property: can choose the scale level as per your need.
iv) Changing the scale property will give best results.

Capability method	Speed	Accuracy	Background Execution	Extract text position	Extract hidden text	Support for Citrix
Full Text	10/10	100%	Yes	No	Yes	No
Native	8/10	100%	No	Yes	No	No
OCR	3/10	98%	No	Yes	No	Yes

Avoiding typical failure points:

→ There are many scenarios where the normal implementation would fail.

→ Methods to tackle failure points are:-

i) Selectors
ii) Scope of the variables
iii) Delay
iv) Element Exists
v) Try/Catch
vi) toString method

1. Selectors:

i) The problem with selectors, is when you select a UI element, it captures its properties.

ii) These properties will differ when we select the UI element of a different instance of an application with the selector.

iii) Hence, the property will differ & the selector will fail to recognize the same UI element of another instance of the app.

Solution:

i) Use wildcard characters or by attaching it to a live element.

ii) The two wildcard characters are available with UiPath are
→ The question mark symbol ?, which replaces one character
→ The asterisk symbol *, which replaces a no. of characters.

iii) Simply replace the variables with wildcard characters.

iv) Or, use Attach to Live element option from selector property window. It automatically detects the variable property & fixes them for us.

2 Scope of the variable:

i) Sometimes we create a variable inside a Sequence or Do activity.
ii) In doing so, the scope of the variable is limited to only that activity.
iii) When we try to access a variable from outside its scope, it cannot be accessed.
iv) We have to change the scope of that variable.

3 Delay Activity:

i) In some apps, we need to wait for particular action.
ii) Ex: When opening the Outlook app, it needs to connect to the server. So it takes some time to open.
iii) In the meantime, the robot's activity is waiting for the UI element to be stable so that it can perform the action.
iv) After waiting, if UI element is not stable, it results in error because the activity cannot find the UI element.
v) Thus we have to add Delay activity to ensure that UI element is stable for action.
vi) Delay will delay the process for specified time.

4 Element Exists

5 Try/Catch:

i) This is an exception handling mechanism used to tackle exceptions.
ii) Put all suspicious activity inside the Try block.
iii) If an error occurs, it can be detected by the Catch block

6 toString

i) Sometimes, we forget to use the toString method with variables & we end up with an error
ii) Ex: When outputting an integer variable inside the Message box, we have to apply the toString method.

M5: Exception Handling, Debugging & Logging

Exception Handling (EH)

i) EH is a way to handle exceptions for a process that the program or the procedure has failed to execute.

ii) Try catch activity is considered as best practice for EH.

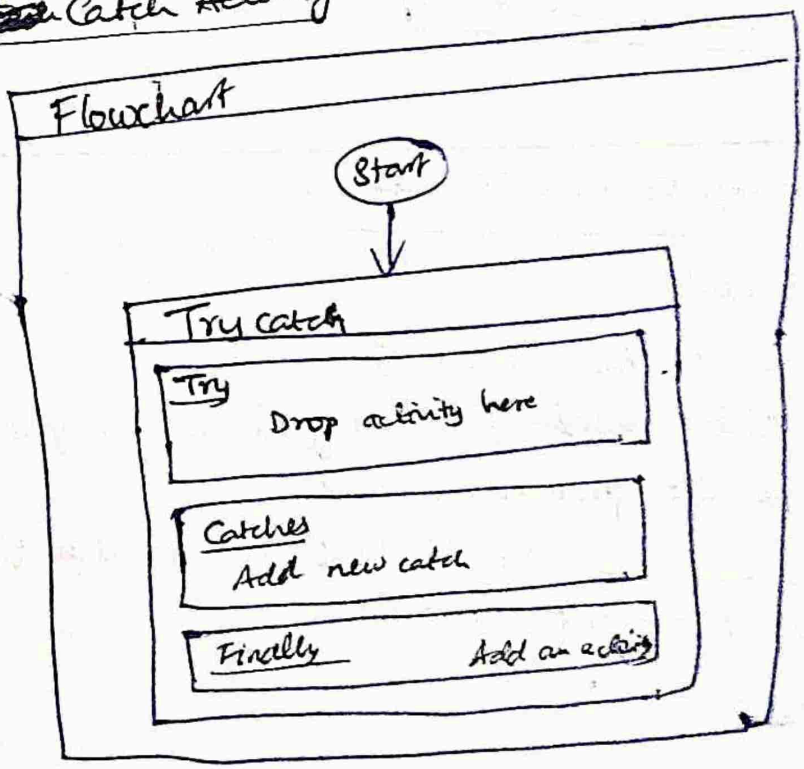
iii) Try Catch activity can be found in the Activities panel.

iv) By D-n-D the Trycatch activity, we can handle exceptions.

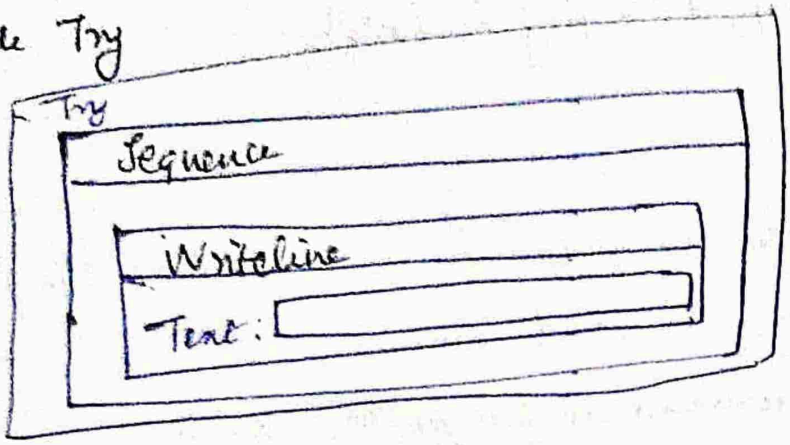
v) For handling exceptions in the Try catch block, we can divide the whole process into four parts,

1. D-n-D the Try Catch activity
2. Try block
3. Catch block
4. Finally block

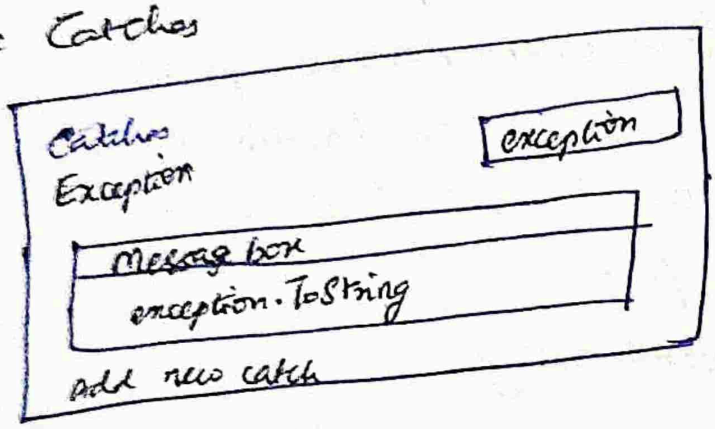
Try Catch Activity:



→ Inside Try

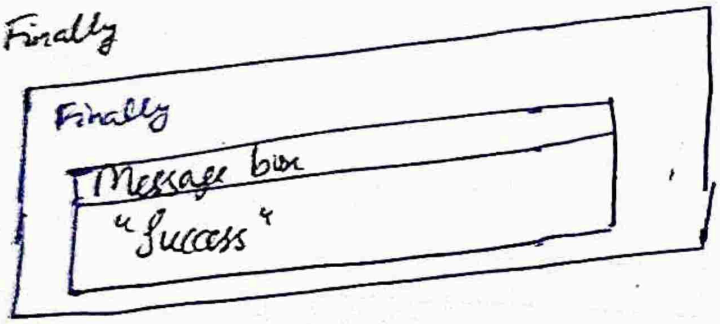


→ Inside Catches



→ Add new Catch
→ Add Exception
→ System.Exception (type of Exception) [most preferred]

→ Inside Finally



Common exceptions & ways to handle them:

i) Unavailability of UI element
ii) Orbit reference not set to the instant of an object.
iii) Index was outside the bounds of an array. Index out of the range
iv) Image not found in the provided timeout
v) Hide Generic error - cannot use UI CONTROL API on this UI node please use UI h/w ELEMENTS method.
vi) Handle runtime errors

1. Unavailability...

i) This error is occured while working on the web.

ii) Because, the UI element was not found due to the dynamic behavior of the web page

iii) To handle this exception, we have to make changes in the selector attributes or we have to add new attributes to the selector so that the UI element can be easily found.

iv) Ex: Use wildcard character, wherever there is a variable.

2. Handling...

i) We may encounte runtime errors in UPath.

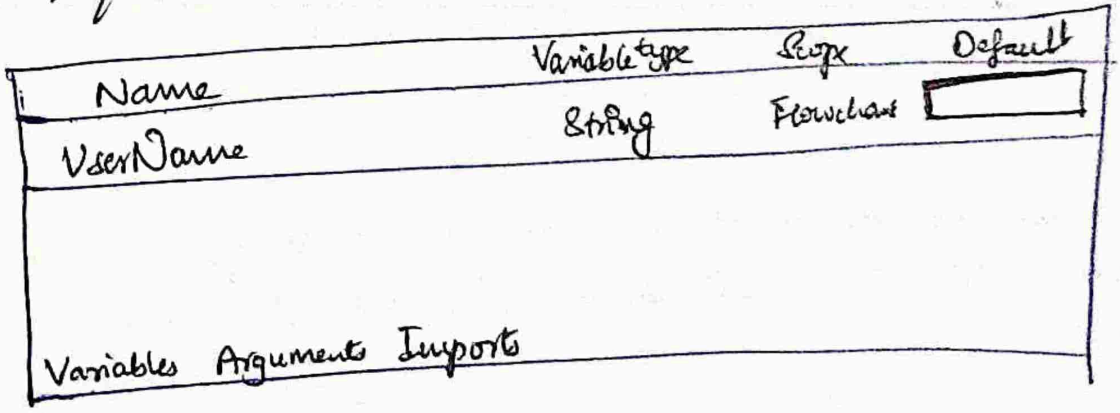
ii) To rectify, use Try catch Activity, which can handle runtime ~~errors~~ exceptions at runtime.

iii) Placing the sequence or workflow inside Try Catch Activity helps to handle runtime exceptions

3 Orbit...

i) This type of error usually occurs when the default value required for some variables is not provided.

ii) To handle, we are required to give a default value to the required variable, as shown in the following fig.



4. Index ...

i) This error occurs when we try to iterate array elements by an index which is out of range.

ii) Happens when we are not aware of the size of the array & we just randomly type the index to access the element.

iii) To resolve, check the size of the indexes of the array/list

5- Image ...

i) This type of exception is thrown because the Image was not found.

ii) This may be due to a change of environment, such as resolution or theme settings

iii) To handle, use some selector attribute or indicating an anchor.

6. Click ...

i) This type of error occurs when the environment in which we are trying to use the Click activity does not support Simulate or Send Message activity

ii) Sometimes, either SimulateClick or the SendWindowMessages may be checked.

iii) In both cases, when an exception is thrown we just have to uncheck the appropriate box.

Client Logging:

i) Client logs enable a server to record connections.

ii) These logs can be used by content providers in various scenarios, such as
   → to generate billing
   → to trace media server usage
   → to deliver suitable quality content depending on the speed of the client's server.

iii) For client logging in UiPath, we have an NLog configuration file which makes it easy and flexible to integrate with databases, servers, or any other NLog targets.

iv) Logging can be configured with the NLog.config file.

v) UiPath Studio, Robot & Workflow execution generate log messages on the client side:

vi) We can access the stored logs by clicking on Open Logs in the EXECUTE option.

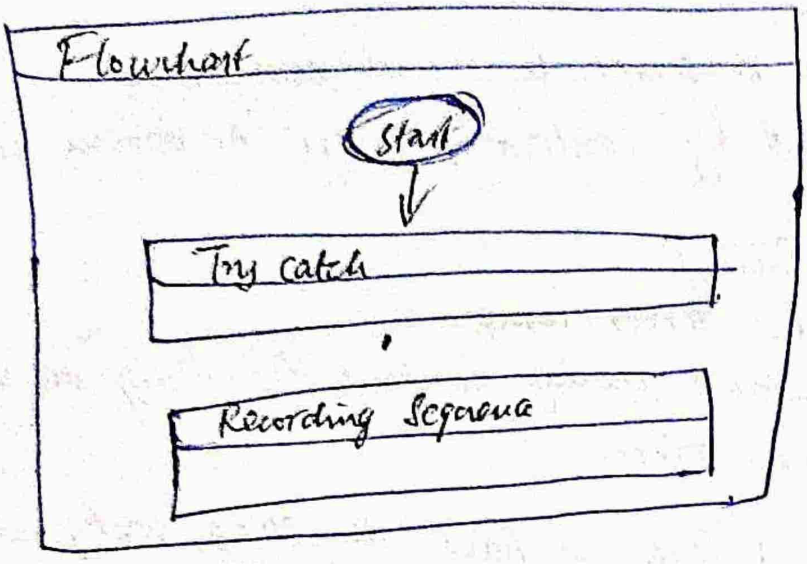
Server Logging:

i) If you have configured the UiPath server, then all logs generated by the execution are also sent to the server.

Debugging techniques:

i) There are various techniques for debugging in UiPath, inorder to check whether the workflow is running successfully or to find out errors in order to rectify them.

ii) At the top of the UiPath window, we can see various available methods of debugging inside the EXECUTE block, as shown in the following SS.



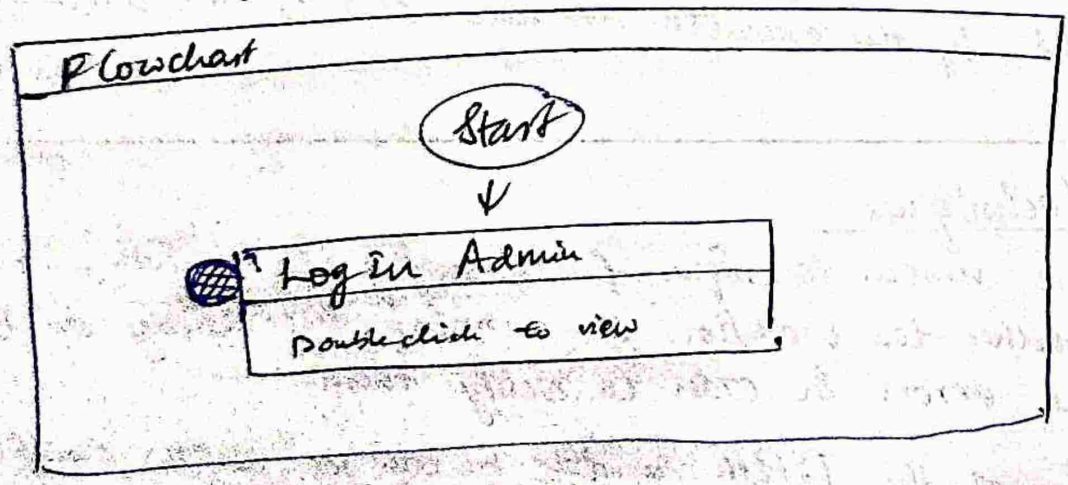
The various types of debugging are:

i) Setting breakpoints
ii) Slow step
iii) Highlighting
iv) Break

1. Setting . . .

i) While debugging we can use breakpoints in b/c if we want to run the program up to a specific location.

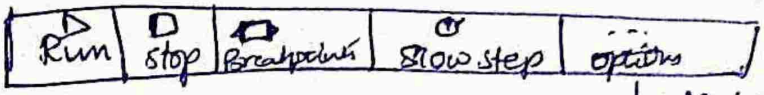
ii) This is useful when we have to stop before an activity ends completely.



2. Slow...

i) This is an activity in the EXECUTE block through which we can reduce the execution speed of a particular process or activity.

ii) We can identify each & every process & keep an eye on where to find the error.



3. Highlighting

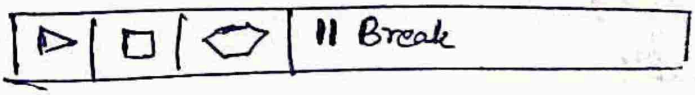
i) It is used to highlight the steps we have taken during automation & to identify each & every step in the workflow.

ii) Found in Options menu of the Execute section in the Ribbon.

4. Break:

i) It is used to break a process at a certain point.

ii) Suppose, we have a sequence performing seven activities together & we want to break the execution at a certain activity.



Enabling Crash Dumps:

i) To enable crash dumps, download the EnableFullDumps.reg file or for full dumps or the EnableMiniDumps.reg file.

ii) Double-click the file & click Yes. Administrator rights are needed to access the registry settings

iii) The dumps folder is %TEMP% whose complete path is like

C:\Users\Username\AppData\Local\TEMP

iv) When the application crashes, you will find .dmp file in the TEMP folder.

Disabling Crash Dumps:

i) Download the DisableDumps.reg file

ii) Double-click the file & click Yes to disable crash dumps. Administration rights are needed for this action.

Case Study:

Topic: RPA use cases in Banking

Use cases in the banking industry are:

i) Automatic Report Generation
ii) Customer onboarding
iii) Know your customer (KYC) & Anti-Money laundering (AML)
iv) Account opening
v) Mortgage lending
vi) Loan processing

RPA Opportunities in the Banking & Financial Sector:

i) Customer service
ii) Credit card processing
iii) Account closure process
iv)

Benefits of RPA:

i) Scalability
ii) Increased operational efficiency.
iii) Cost - effectiveness
iv) Risk & compliance reporting..
v) Availability
vi) Zero infrastructure cost
vii) Faster implementation
viii) Business growth with legacy data.

OCR: (Innovative)

Types of OCR:

i) Microsoft OCR (MODI)
ii) Google OCR (Tesseract)

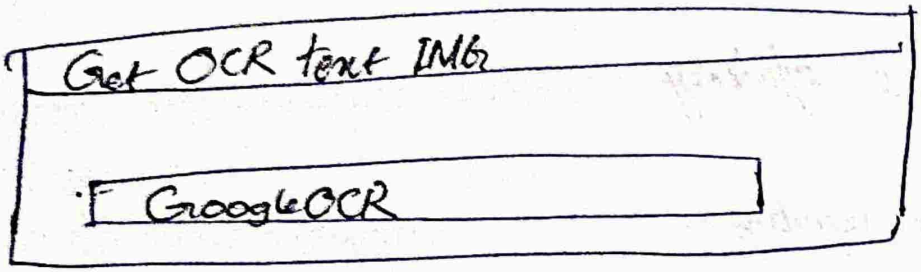
Ex: Suppose we have an image & we have to extract the text in it.

Steps

1. Open UiPath Studio. & click on Blank project.
   - Give it a name it.
   - On the Designer panel, D-n-D a Flowchart activity.
2. D-n-D a Get OCR Text activity from the Activities panel & set it as the start node.
   - Double-click on it & click on the Indicate on screen option.
   - Choose the specific area from which you want to extract the text from the image.

- In our case, we are using an image that we have searched for on Google.

3. • Now, click on the Text property of the Get OCR Text activity.
   - A window will pop up as shown in the SS.
   - Right-click inside the window & choose Create variable.
   - Give it a name, press Enter, and click on the OK button.
   - A variable will be created with that name:



4. • DnD the Message box activity.
   - Connect it to the Get OCR with text activity.
   - Double-click on the Message box activity & specify the variable name that you have created (result variable)