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Selected Topics

Robotic Process Automation

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Introduction:

Robotic Process Automation (RPA) is a groundbreaking technology that has become a game-changer in the business world. It's like having robot helpers for repetitive jobs in different business tasks. These digital helpers copy what humans do, like entering data, processing transactions, and grabbing information. The main idea behind RPA is to make things run smoother, cut down on mistakes, and let people focus on more important stuff.

How does RPA do it? It uses bots (the digital workers), an orchestrator (like a boss for control), and a development studio (where you plan how the bots work together). The perks of RPA include getting things done faster, making fewer mistakes, saving money, and being able to handle more work. Some usual jobs for RPA are handling data entry, dealing with invoices, and taking care of HR tasks.

History For Robotic Process Automation:

RPA is the combination of several technologies, brought together under one toolkit for different automation purposes. Though the term 'RPA' emerged in the early 2000s, the initial development was started after the 1990s. 'Machine Learning (ML)' is one of those technologies that helped towards innovation, which eventually led to the creation of RPA. In 1959, 'Arthur Samuel' developed Machine Learning. Machine Learning allowed computers to perform several critical tasks, such as translation and text summarization, etc. However, there were limits on how computers could process language. It led to the development of 'Natural Language Processing (NLP),' which helped computers to understand and process human language more accurately. In 1960, NLP combined 'AI (Artificial Intelligence)' for establishing the interactions between computers and human languages. Then, the technology progressed further towards the establishment of RPA, and there were few more developments in the 1990s. Because of the continuous developments, there was an emergence of technology that most closely resembled RPA. The history of RPA says that there were three key predecessors of Robotic Process Automation.

Robotic Process Automation

Robotic Process Automation is the technology that provides tools to automate actions and processes executable at the UI level. The first-class citizen in RPA is the software robot (sometimes called also a “bot”), which can perform all the basic actions that a human also performs through the user interface of the available applications, including legacy software. More precisely, the robot can click buttons, copy data from and to various applications, but also use APIs, if necessary. The processes amenable to RPA implementations are those that are repetitive enough to justify an investment in automation, but not structured and complex enough to require a classical software development project. RPA providers offer platforms to define and operate such software robots. The mature RPA frameworks contain at least the following three components: a component to describe or model the robots (this is usually done visually), a component to execute and integrate the robots in the environment and existing applications, and, finally, a component, usually called an orchestrator, that deploys the robots, schedules and monitors their execution. On top of that, the advanced RPA solutions also offer artificial intelligence (AI) capabilities, such as natural language processing (NLP), machine learning, and computer vision, to better process the textual or visual inputs of the robot. Also, robots may be attended (requiring human input from time to time) or unattended (running independently). They can run locally, in the cloud, or in a virtual environment.

What is robotic process automation?

Robotic process automation (RPA) is a software technology that makes it easy to build, deploy, and manage software robots that emulate humans actions interacting with digital systems and software. Just like people, software robots can do things like understand what's on a screen, complete the right keystrokes, navigate systems, identify and extract data, and perform a wide range of defined actions. But software robots can do it faster and more consistently than people, without the need to get up and stretch or take a coffee break.

The Machines:

RPA bots are designed to mimic human actions, such as:

- **Data entry**: Entering data into forms, spreadsheets, and other applications.
- **Data extraction**: Extracting data from various sources, including websites, documents, and emails.
- **File management**: Moving, copying, and renaming files and folders.
- **Application interaction**: Logging into applications, navigating menus, and executing commands.
- **Reporting**: Generating reports and sending emails with relevant information.

Why is RPA transformative?

RPA technology is changing how the world gets work done.

Software robots—instead of people—do repetitive and lower-value work, like logging into applications and systems, moving files and folders, extracting, copying, and inserting data, filling in forms, and completing routine analyses and reports. Advanced robots can even perform cognitive processes, like interpreting text, engaging in chats and conversations, understanding unstructured data, and applying advanced machine learning models to make complex decisions.

When robots do these types of repetitive, high-volume tasks, humans are freed to focus on the things they do best and enjoy more: innovating, collaborating, creating, and interacting with customers. Enterprises get a boost too: higher productivity, efficiency, and resilience. It's no wonder that RPA is rewriting the story of work.

First RPA: Adopting Automation:

The late 1990s and early 2000s saw businesses increasingly embracing agile development principles. This shift played a key role in the growing adoption of RPA. Companies recognized that to remain competitive, they needed to accelerate their processes, and this included the speed and efficiency of UI testing and Quality Assurance (QA)

Banking and Insurance Automation:

Banks and insurance companies were among the first to embrace the idea.
Automation technologies still have their drawbacks.
If a company wanted to automate its processes at that time, it would likely result in building a complex IT environment. The latter required expensive engineering skills and time-consuming integrations.

The real pivotal point for the RPA technology occurred around 2012, when the technology was finally officially recognized by large-scale businesses. There was a combination of factors that made it possible,
such as:

- Due to the recent financial crisis, businesses have sought ways to reduce expenses.
- Businesses realized the need for digital transformation
- RPA was considered an easy and affordable (in corporate rates, of course) solution for going digital.

Future of Automation

As automation-as-a-service continues to be the major driver for RPA market growth, RPA will penetrate more companies of all sizes with the help of managed service providers. RPA workflows will leverage more technologies from an intelligent automation stack, such as optical character recognition and computer vision. These technologies, brought by MSPs to their clients through integrations with RPA platforms, will enable a much broader automation-as-a-service market that will outgrow and outperform RPA as we know it today, potentially including physical robotics with a robot-as-a-service model. The future of work is automation, and the future of automation is service based. Managed service providers will continue to drive the change in the market, bringing together complex technologies and skilled talent to better serve their client needs.

4 Ways to create RPA.

Record and Playback:

- Explanation: Record and Playback is a fundamental feature in many RPA tools that allows users to record their interactions with a computer system or application. The recorded actions are then played back by the RPA software to automate repetitive tasks. This approach is beneficial for automating processes where the steps are predictable and involve a series of user interactions, such as data entry or form filling.

Scripting or Programming:

- Explanation: scripting or programming involves writing custom scripts or code to define the logic and flow of the automation process. This method provides more flexibility and control over complex tasks, allowing developers to handle dynamic scenarios, conditional logic, and data manipulation. RPA tools often support scripting languages or programming environments to cater to advanced automation requirements.

AI and Machine Learning Integration:

- Explanation: Advanced RPA tools integrate Artificial Intelligence (AI) and Machine Learning (ML) capabilities. This integration enables bots to learn from data, make

decisions based on patterns, and adapt to dynamic scenarios. AI and ML in RPA can be used for tasks such as natural language processing, image recognition, and predictive analytics, making automation more intelligent and capable of handling unstructured data.

Attended vs Unattended RPA:

- *Explanation:* Attended RPA and Unattended RPA refer to different deployment models for automation bots:
    1. **Attended RPA:** Bots operate in collaboration with human users, helping in real-time. They are typically triggered by user actions or events and work alongside human workers to automate certain tasks. Attended RPA is suitable for scenarios where human decision-making or intervention is required.
    2. **Unattended RPA:** Bots operate independently without direct human involvement. They run scheduled tasks or respond to system triggers, executing end-to-end processes autonomously. Unattended RPA is ideal for automating large-scale, rule-based processes that don't require constant supervision.

How does RPA work?

Identifying Tasks for Automation: RPA begins with identifying repetitive, rule-based tasks that can be automated. These are often mundane, time-consuming, and prone to human error. Processes such as data entry, form filling, report generation, and data migration are typical candidates for automation.

Development and Configuration: Once the tasks are identified, developers use an RPA development environment or studio to create automation workflows. This involves designing the sequence of steps that the software bot will follow to perform the task. The studio provides a visual interface where developers can configure these steps without the need for extensive programming skills.

Bot Execution: After the automation workflows are created, software robots or bots are deployed to execute these predefined tasks. These bots interact with various applications, systems, or websites just like a human user would. They navigate through interfaces, extract data, perform calculations, and input information as instructed in the workflows.

Interfacing with Applications: Bots interact with applications through their user interfaces. They mimic human actions by using techniques such as screen scraping, where they read and interpret information from the screen, and APIs (Application Programming Interfaces), which allow direct interaction with applications if available.

Bot

An RPA workhorse is a bot. Typically, an RPA bot automates repetitive, rule-based tasks like filling out forms, sending invoices, or transferring data between systems. As artificial intelligence develops, the tasks the bots can accomplish become more sophisticated and may involve natural language processing and optical character recognition (OCR).

Studio/Bot designer

The Studio or Bot Designer serves as the workspace for developers and automation engineers within the RPA ecosystem. It's a platform where automation scenarios are crafted, configured, and fine-tuned to meet specific business needs. This environment enables the design and development of processes that software robots (bots) will execute.

Orchestrator

The brains behind robotic process automation are called orchestrators; they house all the tools needed for robotic process automation under one roof and provide general management and control. Apart from launching the bots, an orchestrator can also manage projects centrally, store automation scenario settings, schedule bot launches, connect multiple bots to external apps, monitor bot statuses and view logs, and more.

The orchestrator is a central hub that receives all tasks assigned to it and distributes them among the bots. It can be activated by incoming emails or newly added documents to a folder, for example. It examines the bots that are presently available, keeps track of their workload, and either assigns the task to an available bot or waits for the bot to finish its current task before assigning it to another.

Implementing RPA in Different Industries

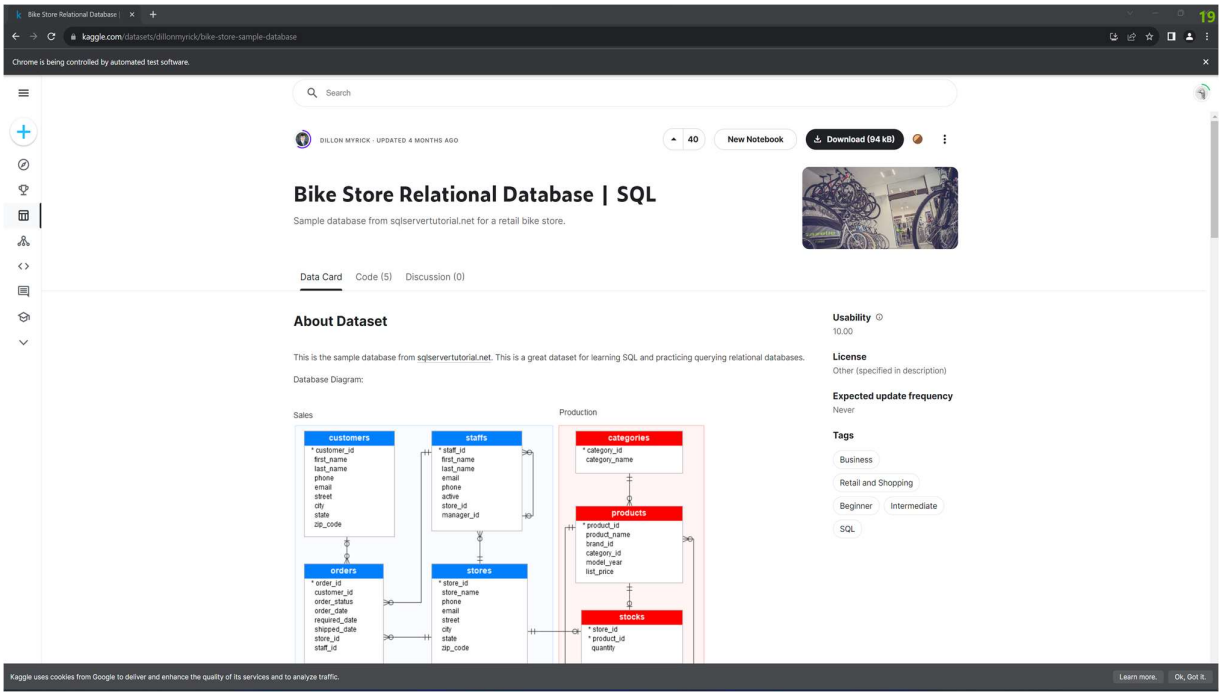
Retail: Optimize inventory management, order processing, and fulfillment.

Healthcare: Automate patient data entry, claims processing, and appointment scheduling

Manufacturing: Streamline supply chain management, production monitoring, and quality control.

Telecommunications: Automate SIM card activation, billing, and network troubleshooting processes.

```python
from selenium import webdriver
import time

# Your login credentials
email = "your_email@example.com"
password = "your_password"

# URL of the dataset
dataset_url = "https://www.kaggle.com/datasets/dillonmyrick/bike-store-sample-database"

# Path to your web driver
driver_path = "path_to_your_webdriver"

# Creating a browser session
browser = webdriver.Chrome(driver_path)

# Open Kaggle login page
browser.get("https://www.kaggle.com/account/login")

# Wait for the login elements to load
time.sleep(2)

# Fill in the email and password
browser.find_element_by_id("email").send_keys(email)
browser.find_element_by_id("password").send_keys(password)

# Submit the login form
browser.find_element_by_id("login-form").submit()

# Wait for login to complete
time.sleep(5)

# Navigate to the dataset page
browser.get(dataset_url)

# Wait for the page to load
time.sleep(5)

# Take a screenshot
browser.save_screenshot("dataset_page_screenshot.png")

# Find and click the download button
# Note: The class name of the download button can change, so it might need to be updated
download_button = browser.find_element_by_class_name("download-button")
download_button.click()

# Wait for download to start
time.sleep(5)

# Close the browser
browser.quit()
```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staffs
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stores
categories
products
stocks
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License
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Expected update frequency
Never
Tags
Business
Retail and Shopping
Beginner
Intermediate
SQL
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Learn more.
Ok, Got it.

References

Cernat, M. a. (2020). Towards Automated Testing of RPA Implementations. *Association for Computing Machinery*, 24.

Kurfess, T. (2018). *Robotics and Automation Handbook.* CRC Press, 2018.

https://www.uipath.com/rpa/robotic-process-automation
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