# Robotic Process Automation for the Gaming Industry

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Abstract:     Robotic Process Automation has recently been used in many fields to automate business-oriented processes. Industries such as finance, transportation, and retail report significant return on investment (ROI) after replacing redundant, repetitive, and error-prone work performed by human workers with RPA software agents. In our research, we found that there is a great opportunity to use RPA to automate processes in the game development and support industry. In this paper, we identify some of these opportunities and propose automation domains, examples, and high-level blueprints that may be implemented and extended by both academia and the game development industry. The requirements, missing gaps, development ideas, and prototyping work were done in collaboration with local game development partners. Our empirical evaluation shows that the identified automation capabilities can play an important role in automating various processes needed by the game development industry in the future.

## 1 INTRODUCTION

Robotic Process Automation (RPA) is one of the trending technologies used today to accelerate automation in the business world (Aguirre and Rodriguez, 2017), (Leno et al., 2021b). The use of artificial intelligence (AI) and machine learning (ML) (Jha et al., 2021) has made the adoption of these technologies in many domains and business applications very attractive. In many cases, repetitive, redundant, and error-prone tasks are performed by humans, such as manually checking invoices, generating reports, collecting data needed for internal systems, and routing that data to other components, etc. All of these tasks can be replaced by RPA by having software agents perform these activities instead of humans. In this paper, we refer to these software agents as *RPA robots*, as is also common in the literature. Overall, the application of RPA in business is to free humans from unnecessary tasks by having RPA robots mimic identical human actions. In turn, the automation method ensures greater productivity and accuracy of results, and even boosts employee morale by allowing them to perform more enjoyable work.

In addition to these benefits, the adoption of RPA is highly sustainable because it is a non-invasive system, meaning it can be easily integrated into existing systems and infrastructures. RPA robot workflows are defined in the form of a graph in an authoring tool

(e.g., UiPath Studio [1]). Authoring can be done by both technical and non-technical stakeholders, which is also an important feature as these business-oriented processes can be defined and maintained on a larger scale. The operations defined in the activity nodes and links can call internal or external source code or other building blocks. Thus, the system is extensible and can reuse existing work defined by other systems. Specifically, a node in the workflow defined for an RPA robot can respond to user messages with GPT-3-based services (Brown et al., 2020) or provide resource scheduling with automated invocation of external services for a deep learning-based method with available open source code such as (Aljunid and Dh, 2020).

As we have discussed with our industry partners, the gaming industry (one of the most valuable sectors of the entertainment industry) lacks automation on several levels.

The main contribution of this paper is to research areas in the gaming industry's specific processes that can be automated through RPA technology by using intelligent robots to replace redundant human labor. The software robots used in our methods can communicate via edge and cloud operations and use AI/ML tools to achieve various proposed goals. To the authors' understanding, this is the first work that addresses the issue of combining RPA with game devel-

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[1]https://www.uipath.com/product/studio

opment and support. In short, we divide our research and proposed automation improvement into several sub-processes:

- *Development Process:* Automate the workflows performed by stakeholders in creating and deploying the product itself.

- *User satisfaction and retention background processes:* Help automate and respond to specific user needs, retain users through communication and appropriate promotions.

- *Quality Assurance:* Increase source code quality, deploy, find and mitigate bugs while incorporating more human labor.

- *Secure transactions and fraud prevention:* Prototype RPA workflows that leverage other technologies to highlight potential leaks or abnormal user behavior.

- *Scalability and dynamic infrastructure for services:* Identify how RPA robots can be used in migrating, creating, or shutting down services to smooth and optimize regional spikes in the number of users connecting online to a game while reducing unnecessary costs of keeping servers running.

At the technical level, our work also describes the prototype of the proposed areas of automation for one of the most common publicly available game engines, Unreal Engine 5 [2], with RPA and game process automation.

For this paper, we also collaborated with local industry partners to better understand the repetitive processes performed by people in developing games, deploying infrastructure, and providing ongoing post-launch support for titles, and then link this accumulated knowledge to the field of RPA and other industries that are already benefiting from it.

The remainder of the paper is organised as follows. Section 2 describes the literature that inspired us in identifying use cases and implementing prototypes. The description of the identified use cases and areas of automation used by our prototype for implementation are outlined in Section 3. Furthermore, a preliminary evaluation of the proposed methods is presented in Section 4. Finally, in the last section, our conclusions and a plan for future work are presented.

## 2 RELATED WORK

As this is, to the authors' understanding, the first work to discuss the use of RPA to automate various game development and support services, this section provides an overview of the current state of the art in applications that combine the RPA and gaming domains, as well as applications of RPA in other domains that have inspired our automation use cases and prototype development.

The work in (Andrade, 2022) focuses on using automation for continuous testing of game services in cloud platforms. We reuse and extend their work in our automation examples for game testing. In (Yokoyama et al., 2020), the authors propose using RPA to run various games with the goal of teaching students programming languages such as Python. They show that automating the playing of mini-games can increase student motivation. Another interesting application for our goals is the work in (Qasrawi et al., 2020), which automates the processes of statistical data collection and evaluation of feedback from individuals in the context of serious games and education.

One of the most common use cases of RPA combined with AI is the automatic processing of business documents without human supervision (Ling et al., 2020). Software robots are able to automatically extract data from PDF documents, credit cards, and ID photos with little or no human guidance. In addition, they can copy data into a machine-understandable format that can be visualized by humans to easily approve or update the content, rather than performing the error-prone task of manually copying each field (e.g., copying data from a PDF file into a spreadsheet format). This automated workflow can also be applied to the gaming industry, especially today where subscriptions to services are a major trend and users' personal documents can give access to special offers and discounts (e.g., as a student or from an academic institution).

RPA has also been used in human resources (HR) (Jeeva Padmini et al., 2021) to perform web crawling of resources such as LinkedIn[3] and then select potential candidates for a job. Again, a combination with AI methods, particularly NLP and sentiment analysis, is integrated into the software robot workflows. The technology and methods behind this can also be applied to the gaming industry, as users' needs and views of the products they see and what they want can be determined through external web forums that contain discussions and ratings on the topics of interest.

Applications of software robots in cybersecurity

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[2]https://www.unrealengine.com/en-US/unreal-engine-5

[3]https://linkedin.com

are discussed in (Tyagi et al., 2021). Malware detection and fraud prevention is a common problem in online gaming, so combining RPA, AI-based methods and blockchain can help the industry through simplified and reusable automation workflows.

An evaluation of chatbots for business process automation is presented in (Dan et al., 2022). The success of integrating chatbots into robotic workflows is also a valuable idea for the gaming industry, as the user is often blocked or needs general help to understand the game mechanics and systems or to continue their progress in the environment. Thus, an automated chatbot driven by tailored game-specific knowledge can reduce the effort of staff hired to respond to user messages while increasing response time to achieve greater user satisfaction.

# 3 AREAS OF AUTOMATION AND CONCEPTS

In this section, we present the ideas and proposed automation domains and concepts that we have explored and implemented as prototypes for connecting RPA, game development and support pipelines. Note that the methods used integrate or hierarchically leverage other known methods for separation of concerns, such as AI, ML, and blockchain technologies. Our proposed implementation methods are non-invasive, meaning that RPA robots can be optionally deployed in the proposed use cases and solutions in addition to the developer's existing infrastructure. This can ensure that adoption of the methods and the prototype can be a smooth process, as many developers in the gaming industry reuse components from the previous source code and infrastructure that were available in previously developed projects. We further break down this section by area of interest and present specific use cases and areas for automation, along with the concepts used to implement them as supported by our internal prototypes.

## 3.1 Quality Assurance

The quality assurance process of a game product is mainly performed by humans. This has serious implications, as literature research has shown (Politowski et al., 2021). First, this can become a costly process on the part of the developer. Second, constant updates to released products are required, and because human processes can be error-prone in the testing process, new releases can often have undiscovered problems that can lead to important data leaks or user frustration. However, there are several AI-based methods

studied in the literature that can be used in this regard to support automated product testing (Paduraru et al., 2022). In addition, developers typically create their own set of scripts for setting environments, actions, and expected results that look like typical functional tests. Using RPA software agents, products can be tested in the background without a human having to worry about different pipelines involved. As a concrete example of such a pipeline, first a specific version of the source code and data from the repository needs to be downloaded, building it on the available machines, assigning a deployment target (e.g., game console, smart TV, smartphone, PC, etc.) from the local server/cloud infrastructure resource pool, and finally automatically reporting the results to the developer's own issue tracking infrastructure, Figure 1.

Another problem addressed in other industries and solved with RPA is the concept of *know your customer* (KYC) (Vijai et al., 2020), which can also be applied to gaming products. Fraud detection with ML can be used by robots to analyze and report abnormal user behavior in the background. Then a human can further evaluate the suggestion and allow or reject it. Overall, however, this automated detection can minimize the human effort required for analysis, as today's industry mostly performs this process manually through sampling or textual reports from other users. Securing transactions also falls into this area, and robots can leverage blockchain solutions such as the work presented in (Paduraru et al., 2023). These automated processes are illustrated in the workflow shown in Figure 2.

## 3.2 Development Process

Many stakeholders intensively involved in the development of a game product must perform many redundant or repetitive operations that can be tedious, frustrating, and often error-prone (Aleem et al., 2016).

In many cases, code submitted by software engineers requires additional post-script builds to convert the code and/or assets into formats that can be used by target platforms (e.g., shader source code used in the rendering components of game consoles or smartphones). The work of artists and animators is even more tendentious: Generally, they work with third-party tools (e.g., Maya[4], Blender[5], Adobe Photoshop [6]) to create or modify existing graphical assets for the game product. However, after creating and submitting the assets in their raw format, they must re-import them or convert them to a custom format usable for

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[4]https://www.autodesk.com/products/maya

[5]https://www.blender.org
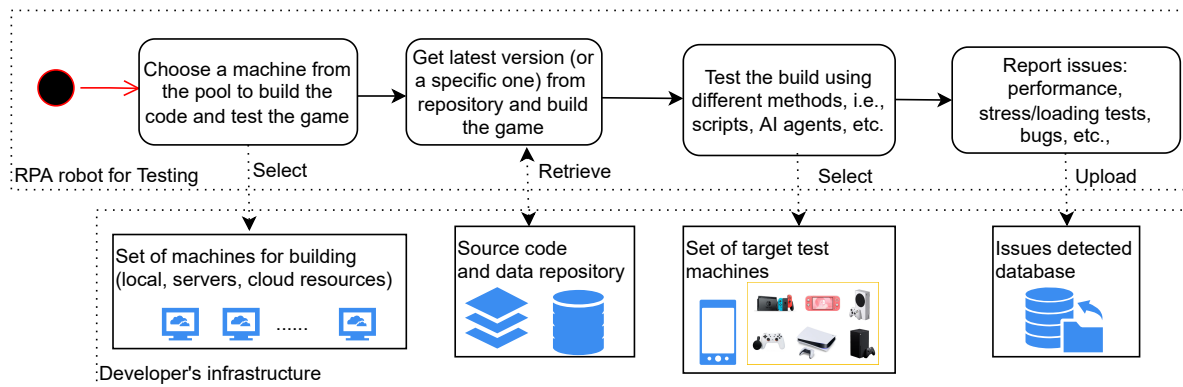
[6]https://www.adobe.com/products/photoshop.html

Figure 1: The main workflow of the RPA robot when testing a game product in the development/update phase, from start to finish. Note that the robot's work is non-invasive and decoupled from the developer's infrastructure by proxy messages. Multiple instances of this workflow would normally run in the cloud or on local servers.
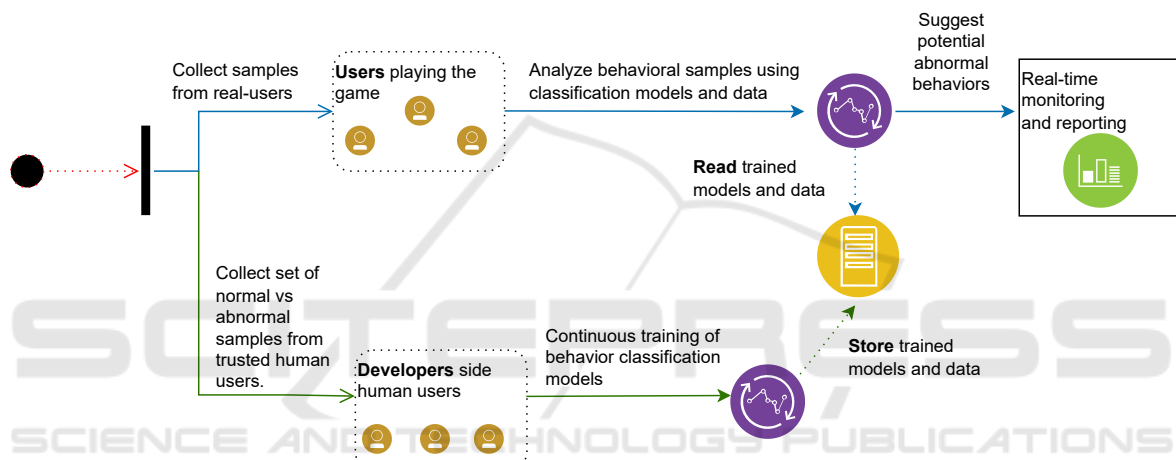


Figure 2: Two different workflows that can be automated with RPA software robots. Essentially, the first application (workflow colored in blue) shows how samples of human behavior can be collected in real time, then evaluated through trained classification methods, and finally reports generated in real time to help humans assigned to developers evaluate fraudulent or unusual transactional behavior. The second workflow (colored green) shows how training of production-ready classifiers is performed. Continuous training is required because game logic, parameters, and assets typically change constantly after the initial release.

the game and deployment target, and then resubmit the changes to the repository. At the end of these operations, all stakeholders typically need to schedule a series of evaluation processes to ensure that basic functionality is maintained.

We have found that these workflows can be automated by RPA robots, as shown in Figure 3, allowing stakeholders to focus on their assigned main task instead of manually performing the repetitive and error-prone processes observed.

## 3.3 Scalability and Infrastructure

Common games developed today are mainly played online, with a large increase in the number of users depending on external events in certain regions of the

world (e.g., World Cup events (Kim et al., 2015)) or in certain seasons (e.g., weekends, holidays, etc.). Related to this aspect, one of the main challenges in the gaming industry is the need to dynamically adapt the infrastructure to sustain these situations and provide the required quality of service (QoS) to the connected users at all times. According to our research, this work is mostly done manually by humans who analyze the number of users in relation to QoS and then set up new servers or shut down existing ones. We found that this is another potential use case for leveraging the automation capabilities of RPA software robots. A pool of available resources and the reuse of AI and ML methods to perform predictions (Martínez et al., 2022) for predicting the required resources using time series-based methods and then scheduling
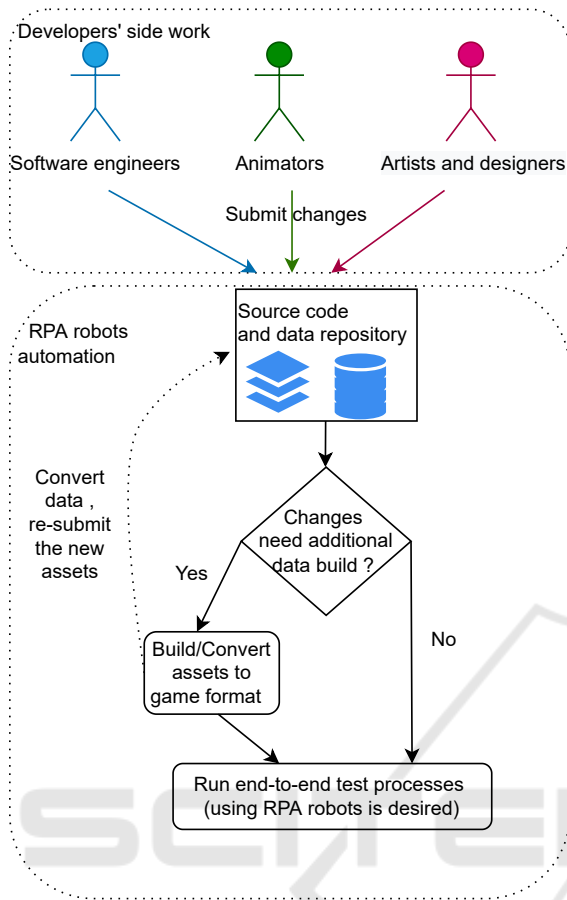
Figure 3: The diagram shows the division of effort between the developer side and the automation that can be performed by the RPA robots in the development phase with respect to code submission and the required continuous testing processes. First and foremost, RPA software robots can significantly reduce the cost of human users to deal with re-importing assets, using third-party tools, and resubmitting processes. They can also ensure that proposed changes are effectively evaluated at a predefined rate.

the required resources in advance can efficiently scale these processes automatically and with less human effort. At a minimum, RPA can be used in this context to: (a) suggest scaling up or down servers in different regions of the world, Figure 4, and (b) display contextual heatmaps of real-time usage and forecasts using continuously trained models, Figure 5. Then, human users on the developer side can correlate the suggestions made by the robots with the real-time analyzes and heatmaps, and eventually easily approve, reject, or adjust the proposed changes.

## 3.4 User Satisfaction and Retention

User satisfaction is a very important issue for business revenue in the game industry. The game product
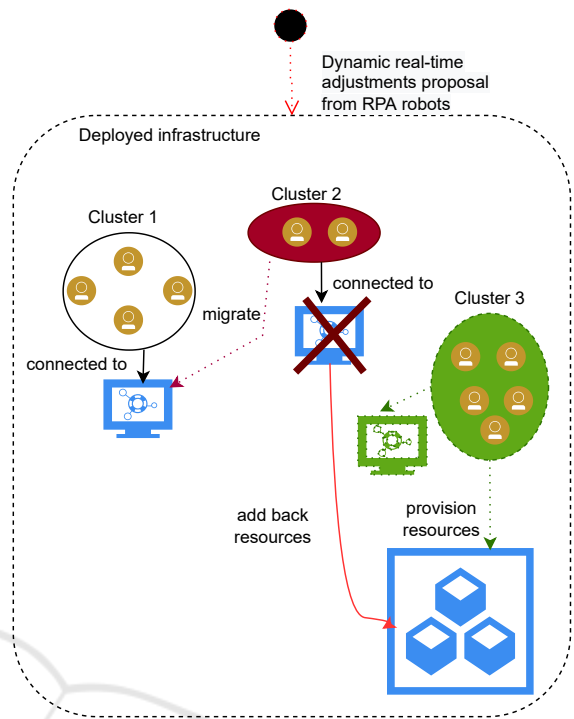


Figure 4: Examples of dynamic scaling suggestions given by an RPA robot. The agent can automatically propose or self-provision a new server to meet the promised QoS for a new group of users in an isolated area (green cluster), and simultaneously migrate a small group of users from one server to another (red cluster) if resources can be saved while still meeting the QoS.

itself must be enjoyable, rewarding, understandable, and provide live support to engage users and remove blockages (Fu et al., 2017). Typically, companies hire employees with titles known as community managers, coordinators, or community moderators to manage live support, review statistics, and provide some sort of individual reward to users (Karabinus and Atherton, 2018). Based on our findings, some of this work can be replaced by RPA robots. Overall, we conclude that aspects such as loyalty benefits, promotions, removal of live in-game blockers, and discussions with users can be fully or partially automated without human effort.

On a technical level, RPA robots can perform background data mining (Ketkar and Gawade, 2021), make decisions and provide recommendations in the background using common ML-based recommender systems such as (Ribeiro et al., 2021). These recommendations can come from different perspectives depending on the context. For example, an important issue is an RPA robot that analyses the user's activities with the environment in the background and detects when there are problems in understanding the game
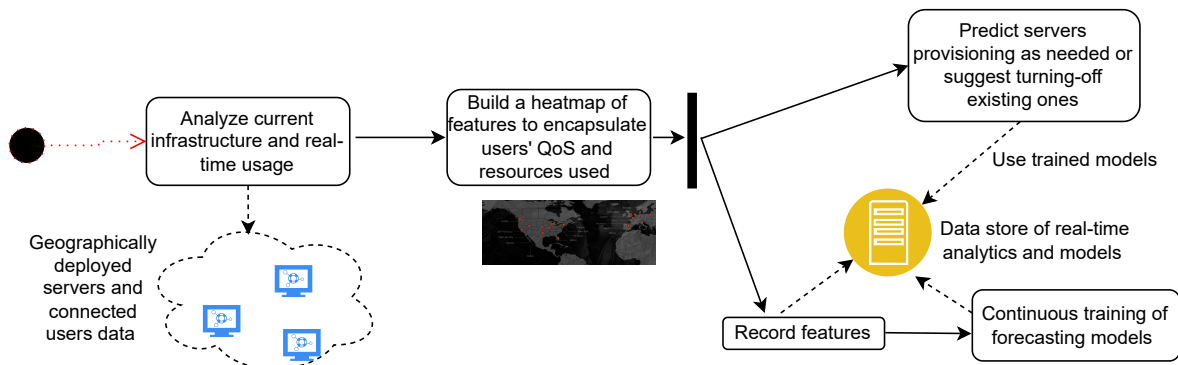
Figure 5: RPA software robots can analyze resource utilization in real time and then create a heatmap of characteristics that contain the information needed to understand the quality of services and how well they are being delivered compared to what was promised. In parallel, this heat map can be used to record, store, and re-train the predictive models while providing suggestions for scaling up or down the existing infrastructure with new servers or other types of resources.

mechanics and procedures or when the game progress is blocked. The RPA robot can then adapt to the situation and provide live feedback in the form of a tutorial (Paduraru. et al., 2022) or a chatbot (Rosmalen et al., 2012), (Ouyang et al., 2022), to help the user and keep them engaged. To keep users satisfied and feeling like they are making progress while being appropriately rewarded, robots can benefit from data collection performed in the background to award game points, items, or other game-specific objects that they enjoy interacting with. These processes are outlined in Figure 6.

One of the problems reported by users is also that the game is often constantly updated or takes too long to download due to the large amount of memory required. RPA robots can solve this problem by running on users' devices where the game is installed either on smartphones, game consoles or PCs, and then updating in the background by downloading things in advance so that the user does not have to wait for these processes to complete. Robots can be programmed to perform all of these processes to the satisfaction of the user and keep them updated at all times, Figure 7.

## 4 EVALUATION AND TECHNICAL IMPLEMENTATION

An in-depth evaluation of the implemented prototypes and automation concepts would require quantifying the adoption of RPA in the gaming industry from various perspectives such as cost savings, return on investment, morale of employees whose work has been replaced by other tasks, etc. However, this can only be done after years of implementation, which is very

difficult for an academic paper, at least when the presented topic is new. This problem of lack of theoretical basis and evaluation is also described in (Syed et al., 2020).

Instead, we first conduct an empirical (and possibly subjective) evaluation based on the collected feedback by using our prototypes in automating previously small or released projects from our industry partners. We then motivate the adoption of RPA by looking at the success of automation with RPA in the other sectors mentioned along Section 2, where the adoption is mature enough and can provide real benefit metrics. Note that our prototypes have been implemented as plugins in one of the most popular game engines, namely Unreal Engine 5, so adoption and integration is smooth or at least familiar for game developers. The interfaces of the implemented prototypes to the game products are able to call or retrieve callbacks from the RPA software robots.

**Motivation for Using RPA Instead of Previously Used Automation Methods.** After discussions with the gaming industry partners, the conclusion is that at the moment the automation methods used are based on programmed pieces of code, i.e., scripts, written by software engineers to facilitate the automation of pipelines. We sought to explore the advantages and disadvantages of custom scripts performing automation versus using RPA technology. While using our prototypes on small sized released or open sourced projects, we made a few observations by connecting the feedback received with the potential that the RPA is giving in automation related to our proposed goals.

The main disadvantage observed is the time required for stakeholders to become familiar with RPA technology and the lack of confidence in integrating new technologies alongside existing projects. However, the benefits observed appear to outweigh these
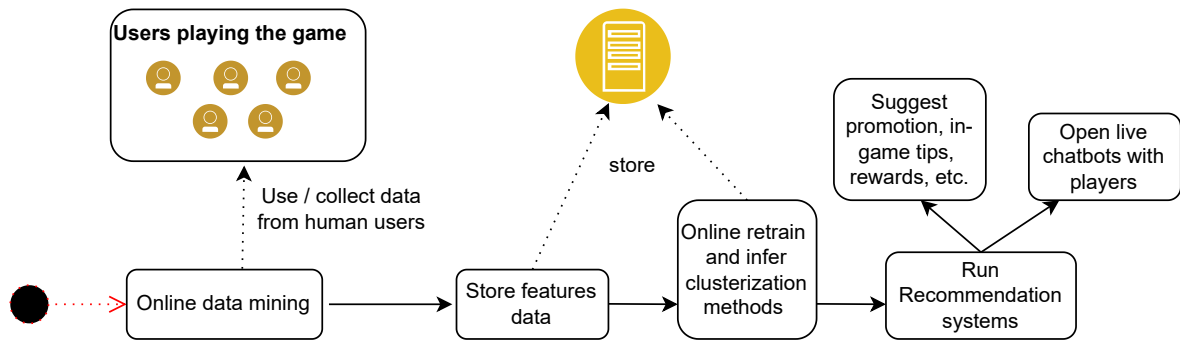
Figure 6: Workflow of an RPA software robot that performs continuous data evaluation of features collected from players. These features can be customized by developers, but generally relate to connections between the context of the game, gameplay, previous rewards, and objects of interest to the user. These features are processed, aggregated, and stored in a data store for later use, which is then used to update existing clustering models commonly used for recommender systems. At the end of the workflow, suggestions can be made automatically for other rewards, product promotions, or even using chatbots with users to unlock their progress.
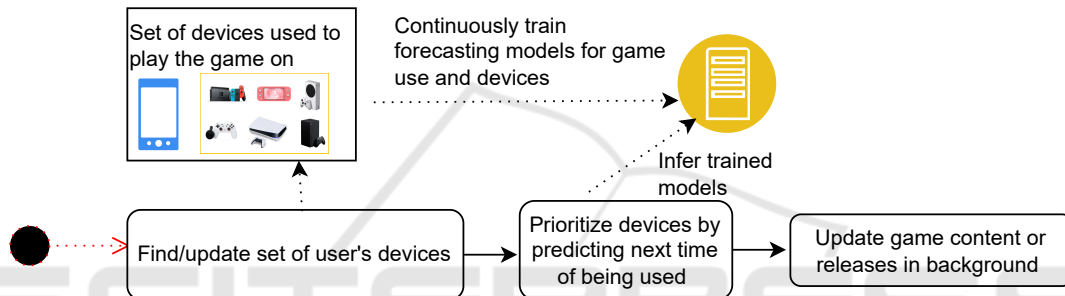


Figure 7: An RPA robot that takes care of updating users' devices in the background so that they can immediately play on the predicted devices. Algorithms for predicting the devices on which the user will play the game (e.g., smartphones, consoles) are continuously trained based on user data that takes into account, for example, time of day or seasonal data.

problems:

- The RPA workflows (or a portion of them, i.e., a subset of the activity nodes) may be shared among projects within the same organisation (Neifer et al., 2022). There is even a marketplace (e.g., UiPath Marketplace[7] for components that can be reused between organisations or communities. As we work with game industry partners on our project to gather requirements and find missing gaps for automation processes in today's workflows, we believe that providing a set of reusable components would accelerate the adoption of automation in video games and reduce costs, as the lack of expertise in many nice/unrelated technologies is a major problem in the industry.

- The graphical interface for creating RPA workflows can be used by non-technical stakeholders too, thus providing better scale in developing and maintaining automation services (Chakraborti et al., 2022).

- Workflows and activity nodes can be created to

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[7]https://marketplace.uipath.com

execute external, existing source code. In addition, the RPA robots can be triggered by the code as needed. This makes the method non-invasive to existing projects and can be replaced or added at any time during the project. Our empirical testing in Unreal Engine 5 has also shown that there is no significant performance penalty when calling or registering callbacks for operations performed by the robots, as the languages used can vary as needed, e.g., C#/Visual Basic, Python, C++, etc.

- Process and Task Mining (Leno et al., 2021a) can help in creating a first draft of workflow definitions by simply observing patterns in existing redundant human work through AI-based methods. According to studies, this can significantly reduce the cost of implementing the technology in the first phase. Communication mining can also be used to understand communication channels, capture messages and manually performed work, and then automate these processes to improve operations and their efficiency.

Compared to the above benefits, the problem with using custom, project-specific automation scripts is

often that it is difficult to reuse these scripts within the organisation or in a follow-on project. The first problem is that the source code is written only by software engineers and the automation services cannot scale in terms of development and maintenance. In addition, the source code is closely related to the project code itself, making it difficult to transfer it to a new project. In addition, engineers from the different teams were found to have different skills and a lack of knowledge about related technologies. All of this made it difficult to reuse the previous automation scripts. In comparison, when using RPA workflows, there is a separation of concerns, with decoupled and implementation, as our preliminary prototypes show.

## 5 CONCLUSION

This paper presents a set of areas that can be automated in the game development pipeline through the use of RPA software robots, along with proposed concepts and implementation details. The presented methods are non-invasive and can be integrated into existing projects and infrastructures, as workflows written in graphical editors can call both internal and external libraries and third-party tools. We believe that the adoption of RPA can help the gaming industry in the future by providing automation processes that can be shared between projects, can be easily defined by non-technical personnel, and have a high level of maintenance. Our requirements, ideas and prototypes have also been discussed and validated with our local gaming industry partners. We are also exploring further collaborations to incorporate the prototypes into real projects and conduct an in-depth evaluation of their benefits. Last but not least, we plan to opensource our prototypes, so that the interested developers may use or extend them.

## ACKNOWLEDGEMENTS

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