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Development of a Virtual Assistant Maintenance System for Some Computer System Issues

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***Abstract*—** Virtual assistants constitute a rich history dating back to the early 1960s; however, they did not gain popularity until the 21st century. The manual maintenance of computer systems can be time-consuming, complex, and error-prone, leading to system downtime and decreased productivity. This study developed a Virtual Assistant system for some Computer System Maintenance issues. The analysis of existing applications and the design was done using Customtkinter. The design was implemented using Python. The Applications were tested for all four major functionalities (Network Test, Sort Files, Clear Bin, and Find) of the developed system. The Evaluation metrics used were CPU Utilisation, Memory Utilisation, and Response Time. The result of the evaluation shows that the Application's CPU usage had an average of 40%, memory space takes about 22.7MB, and the system takes around 1 minute to respond to users' requests. The application was deployed to the Microsoft Store. System maintenance through VAMS will pave the way for a new era of efficiency, productivity, and user satisfaction, propelling organisations toward success in the digital era.

***Keywords/Index Terms*—** Virtual Assistant, Maintenance System, Functionalities, Network Test, Clear Bin, Sort Files,

1. Introduction

Organisations' computer systems often face various issues that require timely maintenance and support to ensure optimal performance. Virtual assistant technologies can potentially revolutionise how computer system maintenance is handled by providing personalised and efficient support. The history has become wealthy since the early 1960s (Abrol and Sharma, 2020). However, it was not until the 21st century that virtual assistants gained widespread popularity with the launch of Siri by Apple in 2011. Siri introduced a more intuitive and conversational approach to interacting with technology, setting the stage for the proliferation of virtual assistants in various platforms and devices (Apple Inc., 2021). A virtual assistant is an Artificial Intelligence (AI) software program that can perform multiple tasks or services for an individual with the help of natural language processing NLP and machine learning algorithms (Hearst, 2018). Virtual assistants can be programmed to perform various tasks, such as scheduling appointments, sending emails, setting reminders, and even controlling smart home devices (Agrawal *et al.*, 2021).

A Computer system maintenance system ensures that computer hardware and software are in good working condition and that their performance is optimised for efficient and effective use (Zhou *et al.,* (2019); Abbas *et al.*, 2020). This involves regular checks, updates, and repairs to ensure the system functions smoothly and securely (Chen & Zhou, 2019). Modern computer maintenance systems have evolved to encompass various features and functionalities (Gallagher *et al*., 2021). Automated monitoring and diagnostics allow system administrators to detect potential issues and anomalies in real-time (Sharma *et al*., 2020). Integrating artificial intelligence and machine learning into computer system maintenance systems will enable more accurate predictive maintenance, reducing downtime and cost savings for organisations (Goyal *et al.,* 2018).

One of the primary challenges in computer system maintenance is the complexity of modern computing environments. The manual maintenance of computer systems can be time-consuming, complex, and error-prone, leading to system downtime and decreased productivity (Chen et al., 2019). According to a study by (Gartner 2020), businesses lose an average of 5,600 per minute during computer system downtime, emphasising the importance of efficient and effective computer system maintenance. This highlights the need for a virtual assistant to maintain computer systems Guo et al., 2020; Iyinolakan, 2023)

This will improve the performance of the system over time. The virtual assistant shall be able to perform various maintenance tasks, including disk cleanup and malware removal (Oktavianus *et al.* 2019). Hence, this study developed a virtual assistant for some Computer System issues such as recycle bin cleanup, sorting of files, network testing, etc

2. Related Works

Related work for the maintenance of the computer system includes the research and development of various software tools and frameworks that aim to automate system maintenance tasks. One example is the open-source tool Ansible, which automates software provisioning, configuration management, and application deployment. Ansible uses a simple syntax and requires no specialised coding skills, making it accessible to many users. The tool deals with

In their study, Gupta *et al.* 2018 proposed a virtual assistant to diagnose and fix computer system problems in real time. The virtual assistant used natural language processing and machine learning techniques to understand user requests and provide appropriate responses. The study

showed that the virtual assistant effectively diagnosed and fixed computer system problems, reducing the time and effort required for manual maintenance. The tool did not cover finding files, sorting files, and clearing bins.

Another study by Liu *et al*. 2019 proposed a virtual assistant for managing and monitoring computer system resources. The virtual assistant used machine learning algorithms to predict system resource usage and provide real-time feedback to users on the system's performance. The study showed that the virtual assistant effectively optimised system performance and improved user experience. The limitation is that computer system maintenance was not fully covered.

A study by Ferreira et al. (2019) explored virtual assistants' use to provide technical support for computer system users. The virtual assistant used natural language processing techniques to understand user requests and provide appropriate responses. The study showed that the virtual assistant effectively provided users with personalised and interactive technical support, improved user experience, and reduced the need for manual technical support.

Mihai Duguleană *et al*. (2020) presented a smart virtual agent that can interact with users in natural language to improve museum information accessibility. The agent interacts with humans, but it cannot fix some problems with the computer system.

In work titled "Applications of Virtual Reality in Maintenance during the Industrial Product Lifecycle: A Systematic Review", Guo *et al*. (2020) said that virtual reality (VR) is considered one of the latest technologies that are playing an essential role in helping manufacturing companies stay competitive in the international market. However, despite the achievements made in the field of VR, it is still an emerging technology that lacks deeper exploration and development in industrial application scenarios, especially in the coming fourth industrial revolution (Industry 4.0). The authors systematically investigate the applications of VR in industrial maintenance to discover evidence of its values, limitations, and future directions so that VR can be steered to do more for the industry. The results show that VR has proved its value in benefiting maintenance issues throughout the industry. However, VR is still not an indispensable element for the lifecycle management of products in terms of maintenance-related matters.

In another work, Adesoji *et al*. (2020)., here the author believe that Using Virtual Reality for Engineering Labs in Underdeveloped Countries is a Cost-Effective Substitute and will improve the quality of the education sector.

Li and Ji (2021) opined that even though industrial companies have benefited from using chatbots to communicate between humans and machines, there is a need to step up by using virtual assistants (or digital assistants) to speak human natural language in manufacturing. The authors introduced an AI-based virtual assistant, Bot-X, for the manufacturing industry to handle various complex services, including order processing and production execution. The work did not cover computer system maintenance.

Some popular virtual assistants available in the market, such as Siri, Alexa, Google Assistant, and Cortana, were examined. These virtual assistants are primarily designed for general use and do not specifically target computer system maintenance. However, they can perform basic maintenance tasks like updating software, managing files and running system checks.

In terms of their architecture, most virtual assistants use natural language processing (NLP) and machine learning algorithms to understand user requests and provide appropriate responses.

They also rely on cloud-based services to store user data and perform complex tasks.
While virtual assistants have gained widespread popularity, they still have some limitations regarding computer system maintenance. For example, they may be unable to diagnose complex system issues, and users may require additional technical knowledge to resolve them. Furthermore, virtual assistants may not always be able to access specific system settings or perform certain tasks due to security restrictions or compatibility issues.

Cortana is a virtual assistant developed by Microsoft and created in 2014. It is available on Windows 10 PCs and other devices. Cortana can run some system checks, such as checking your battery level, managing files, system checks, storage space, and network connection. However, Cortana cannot run as in-depth system checks as a dedicated system diagnostic tool.

Google Assistant is a virtual assistant developed by Google in 2012. it was the first virtual assistant to be released. It is available on Android devices, iOS devices, and other devices. Google Assistant can be used to run some system checks, such as checking your battery level, managing files, storage space, and network connection. Google Assistant can also help you troubleshoot some common problems, such as your device not turning on or not responding. However, Google Assistant cannot run as in-depth system checks as a dedicated system diagnostic tool.
Alexa is a virtual assistant developed by Amazon in 2014. It is available on Alexa-enabled devices like the Amazon Echo and the Amazon Fire TV. Alexa can be used to run some system checks, such as checking your battery level, system checks, storage space, and network connection. Alexa can also help you troubleshoot some common problems, such as your device not turning on or not responding. However, Alexa cannot run as in-depth system checks as a dedicated system diagnostic tool.

Siri is a virtual assistant developed by Apple Inc. in 2011. that is available on Apple mobile devices, including the iPhone, iPad, iPod Touch, Apple Watch, HomePod, and AirPods. Siri can perform various tasks, including Setting alarms and timers, Making phone calls and sending messages, Playing music and podcasts, Getting directions and information, Controlling smart home devices, Translating languages, and managing files.
Siri can be activated by saying "Hey Siri" or pressing and holding the Home button on an iPhone or iPad. Siri is trained on a massive dataset of text and code, which allows it to understand natural language and respond to your requests comprehensively and informally.

In conclusion, virtual assistants can perform basic computer maintenance tasks such as reviewing existing systems, managing files, updating the system, and performing system checks. However, they cannot perform more in-depth tasks, such as cleaning the recycle bin, sorting files, testing the network, or finding a missing file or folder. Despite these limitations, virtual assistants can still be a valuable tool for users who want to keep their computers running smoothly.

3. Methodology

This section describes the methodology for the study, which involves the analysis and design, development, testing, and deployment of the virtual assistant that will be used to maintain the computer system.

3.1 SYSTEM ANALYSIS AND DESIGN

The first step in developing the virtual assistant was to design the system architecture, as shown in Figure 1. This involved identifying the necessary components of the system and their interactions. The system components include the following:

- User Interface

- Knowledge-based
- Task Execution

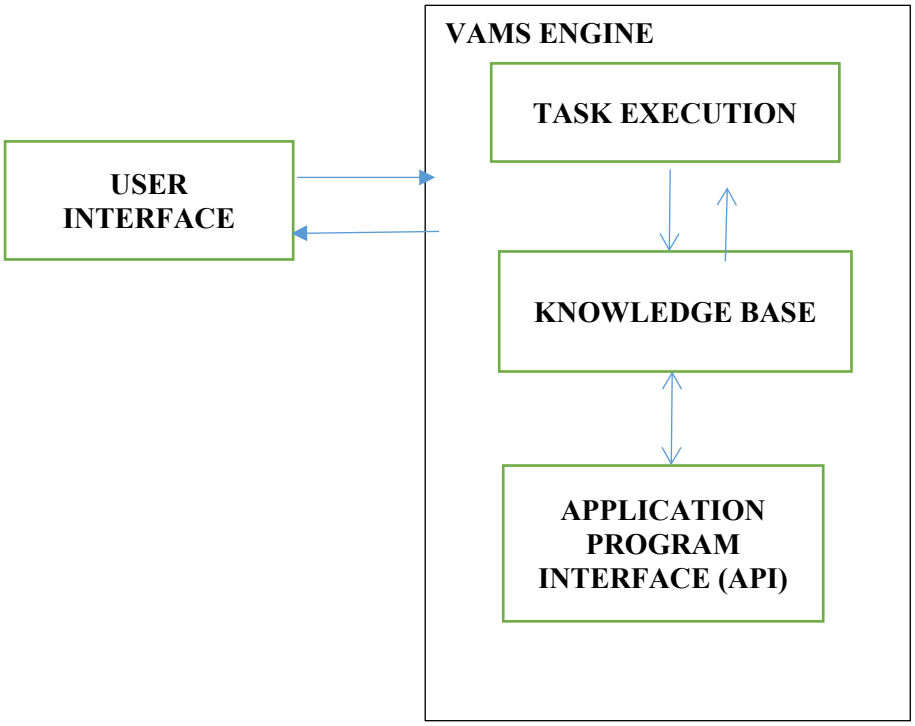

Figure 1: System Architecture

3.1.1 SYSTEM REQUIREMENT

The user interface's functionality requirement is to ensure that the functionalities are working and that users can communicate with the Virtual Assistant.

- Knowledge Base: The virtual assistant's ability to communicate, answer questions, and be smart requires using an Application Programming Interface (API) from Open AI. Building an AI module will take a lot of time. This necessitates utilising the package from Open AI using their API key (which was paid for). This made the virtual assistant smarter and could respond to the maintenance and management of the computer system.

Below is the API key used for the Virtual Assistant.

"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"

SYSTEM REQUIREMENT

This describes the minimum specification for the hardware necessary for the application to work satisfactorily on various computers.

HARDWARE REQUIREMENTS

- Windows 8.1/10/11
- 4GB ram and 1GB disk Space

SYSTEM IMPLEMENTATION

- Python and Tkinter libraries should be installed on the system. The reason for using Tkinter is that it is a Python library used to create GUI applications and other libraries that will make the developed Application work.

3.1.2 The VAMS Flowchart

The Virtual Assistant Management System (VAMS) flowchart, as displayed in Figure 2, illustrates the workflow for managing Virtual Assistants (VAs) and their tasks.

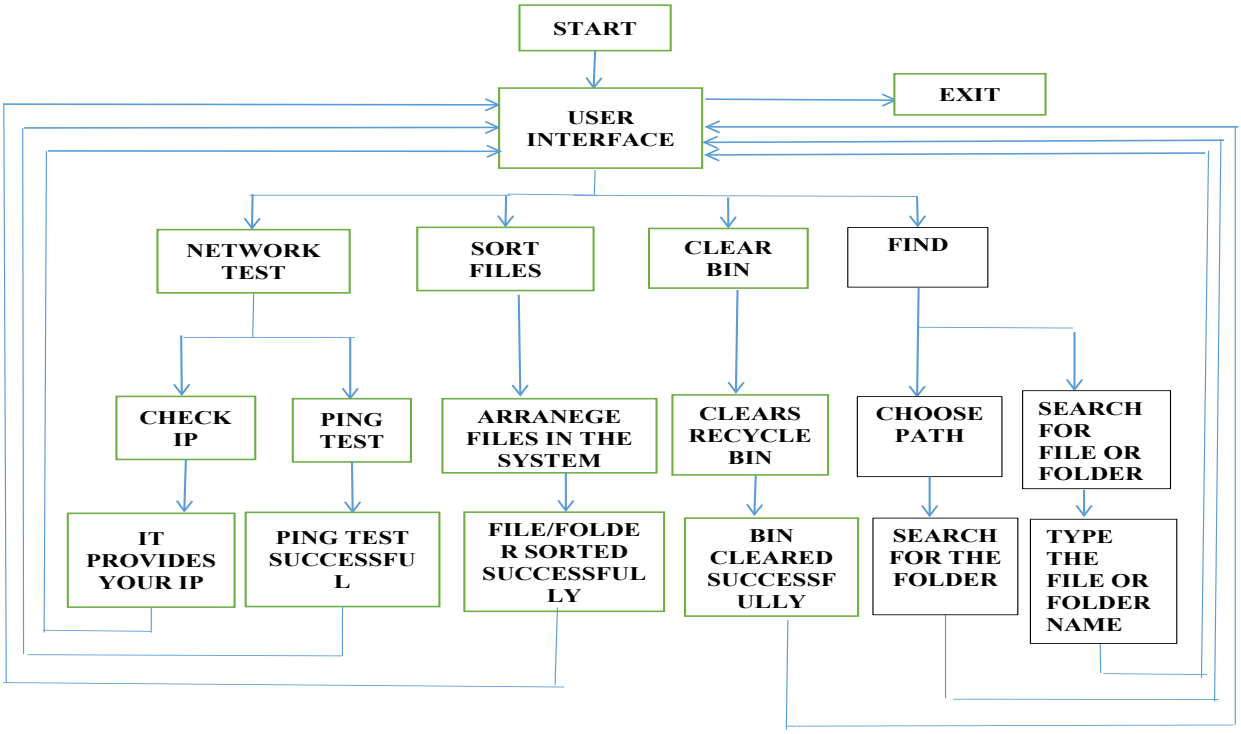

Figure 2. The VAMS Flowchart

3.2 IMPLEMENTATION

This section discusses the virtual assistant's implementation, testing, evaluation, and documentation.

3.2.1 USER INTERFACE

The user interface for the VAMS is presented in Figure 3, and it is the first window that appears when the user launches the Virtual Assistant Application.

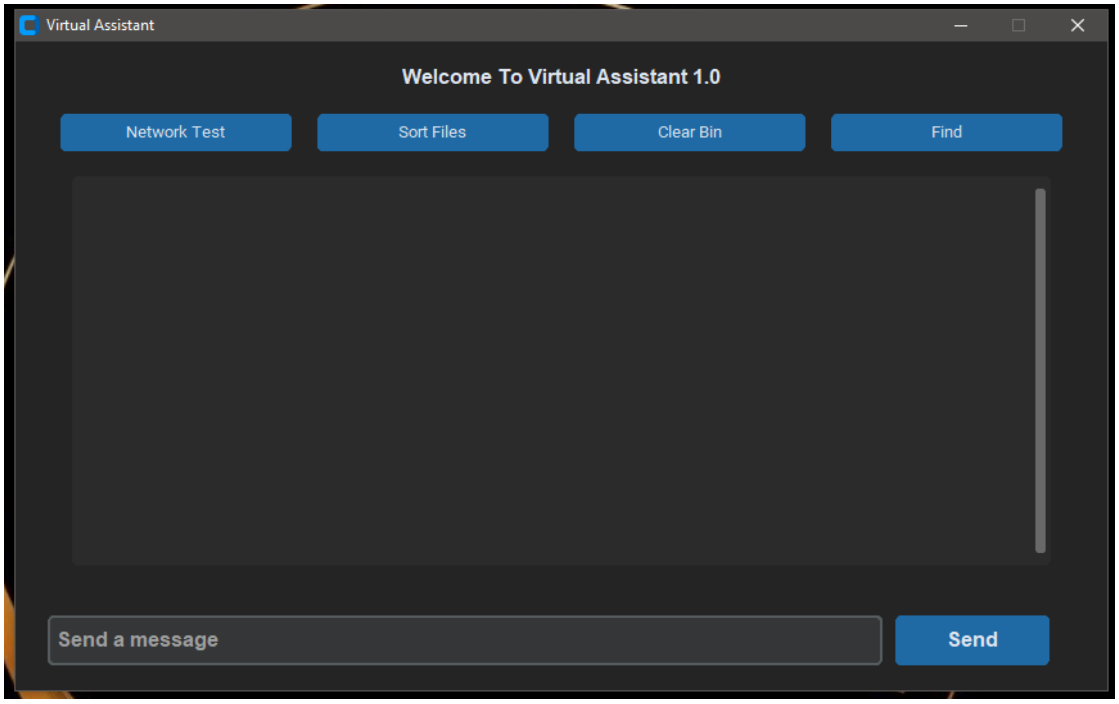

Figure 3: Screenshot of the VAMS Application User Interface

The Figure shows the user interface for the VAMS Application. It shows different functionality options that users can use to perform tasks on the application. It also has a text box section to ask the Virtual Assistant questions about Computer System Maintenance.

3.2.2 NETWORK TEST

The network testing interface of the VAMS Application is in Figure 4. Its button is the first functionality in the Virtual Assistant User Interface.

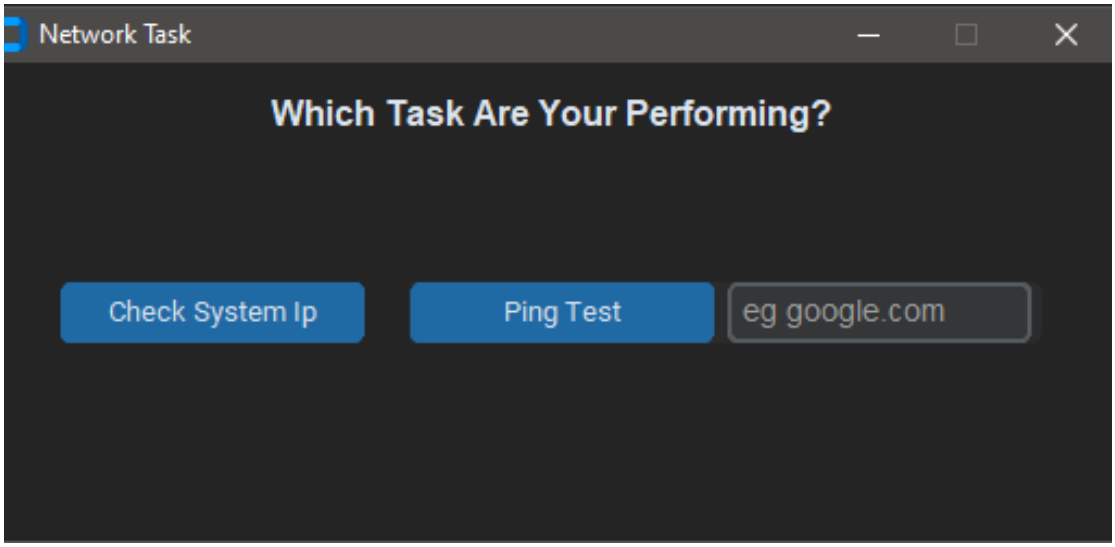

Figure 4: Screenshot of the Network Test of the VAM S Application

The Virtual Assistant Network Test interface, as in Figure 4 allows users to perform two (2) significant functions. The first one checks the system IP, while the

second one does a ping test to check website responsiveness.

The second button performs sorting functionality in the Virtual Assistant User Interface.

3.2.3 SORT FILES

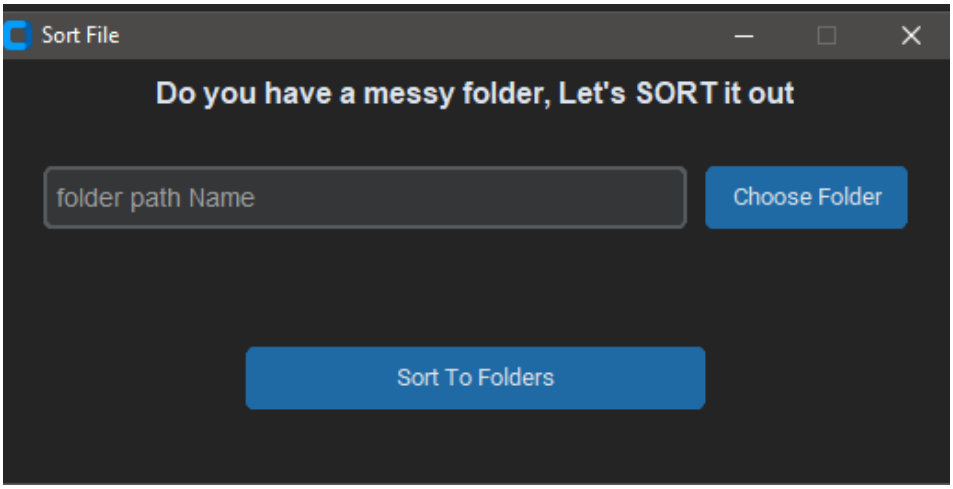

Figure 5: Screenshot of the Sort Files section of the VAMS Application

Figure 5 shows the Sort Files interface. Users can sort files scattered all over their computer system into their respective places using this interface.
Users can browse through the computer system to select the folder they want sorted using the chooser folder functionality.

3.2.4 CLEAR BIN

Clear Trash Bin is the third functionality in the VAMS User interface.

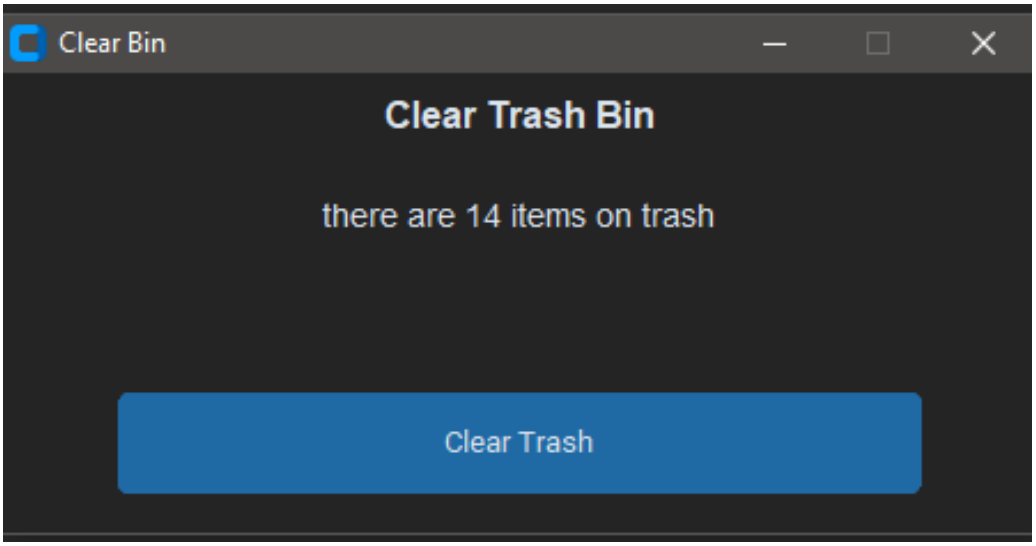

Figure 6: Screenshot of the Clear Bin interface of the VAMS Application

Figure 6 shows the Empty trash bin functionality on the interface. Using this

functionality, users can clear the recycle bin in their system giving them space in the memory.

3.2.5 FIND

Find is the fourth functionality in the Virtual Assistant application User Interface. When clicked, the presented s in Figure 7.

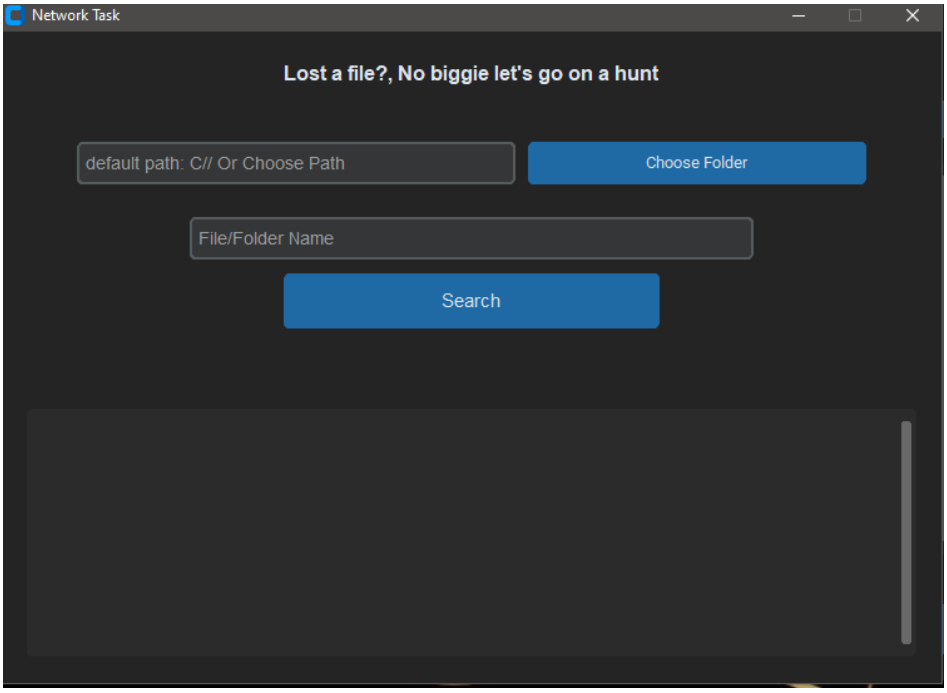

Figure 7: Screenshot of the Find interface of the VAMS Application

Figure 7 shows the Find interface of the Virtual Assistant Maintenance Application. Users can find lost folders or files in the computer system using this. The user will click on the chosen folder to select the path that they think the file or folder might be located, input the name of the file or folder, and click on search. The Virtual Assistant will search through the path name the user has selected and provide everything containing it.

3.2.6 CHATBOT

This text box is located at the user interface of the VAMS application.

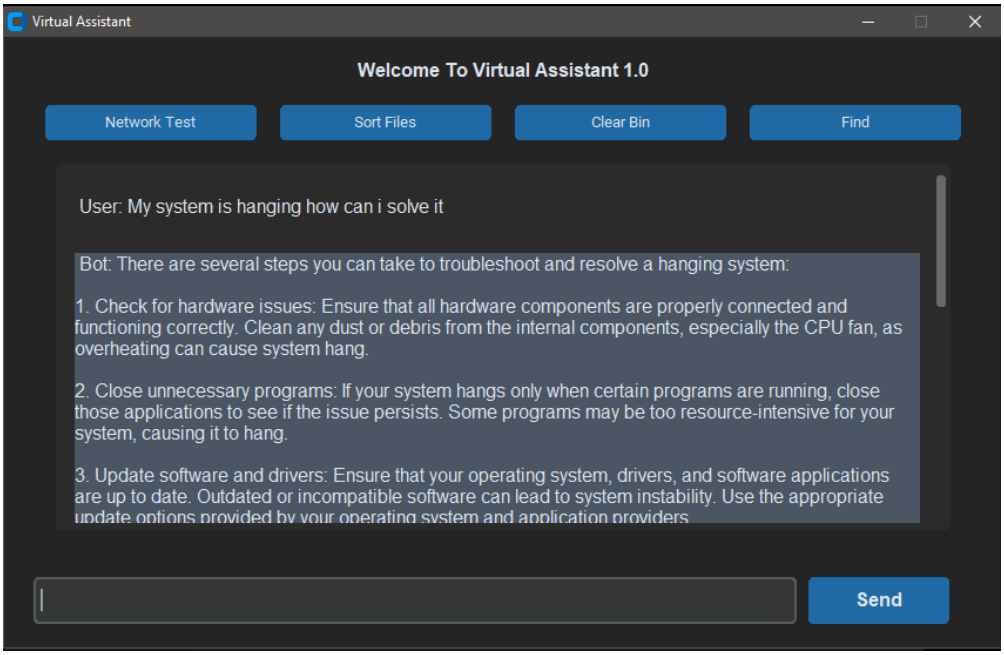

Figure 8: Screenshot of the user communicating with the Virtual Assistant

Figure 8 shows the user communicating with the Virtual Assistant and asking questions relating to Computer System Maintenance, and the Assistant is giving back a response.

4 Test and Evaluation

The VAMS Application was evaluated to show how the application will behave on different operating systems for user acceptability.

4.2 Application Installation Testing

The installation **test** was the first test carried out on VAMS; during this test, the VAMS was installed on different systems with two different operating systems, Windows OS and MacBook IOS. The installation test was successful on Windows OS systems and failed on Macbook operating systems. The details are shown in Table 1. This implies that the VAMS will work only on Windows Operating System.

Table 1: Application Installation Testing Results

OPERATING SYSTEM	**APPLICATION TEST**	RESULT
Windows 10 Operating System (8 GB core i5 CPU @ 2.20GHz 2.20 GHz)	Application Testing	Passed
Window 7 Operating System (4 GB core i3 CPU @ 2.20GHz 2.20 GHz)	Application Testing	Passed
Macbook 2016	Application Testing	Failed

4.1 NETWORK TESTING

The Network module functionality test of the VAMS was conducted. During this test, the VAMS application IP and ping functionality were tested in different systems with different versions of the

Windows operating system. As reported in Table 2, the IP and Ping Functionality work perfectly on Windows 7 Operating System and above.

Table 2: Network Test Result

OPERATING SYSTEM	NETWORK TEST	RESULTS
Windows 10 Operating System (8GB core i5 CPU @ 2.20GHz 2.20 GHz)	IP Testing Ping Testing	Passed Passed
Window 7 Operating System (4 GB core i3 CPU @2.20GHz 2.20 GHz)	IP Testing Ping Testing	Passed Passed

4.3 SORT FILES TESTING

The Sort File module functionality test of the VAMS was conducted. During this test, the VAMS application sort file functionality was tested in different systems with different versions of the Windows operating system. As reported in Table 3, the sort file Functionality will work perfectly on Windows 7 Operating System and above.

Table 3: Sort File Test Result

OPERATING SYSTEM	SORT FILES TEST	RESULTS
Windows 10 Operating System (8GB core i5 CPU @ 2.20GHz 2.20 GHz)	Sort File Testing	Passed
Window 7 Operating System (4GB core i3 CPU @ 2.20GHz 2.20 GHz)	Sort Files Testing	Passed

4.4 CLEAR BIN TESTING

The Clear Bin module functionality test of the VAMS was conducted. During this test, the VAMS application clean bin functionality was tested in different systems with different versions of the Windows operating system. As reported in Table 4, the clean bin functionality will work perfectly on Windows 7 Operating System and above.

Table 4: Clear Bin Testing Result

OPERATING SYSTEM	CLEAR BIN TEST	RESULTS
Windows 10 Operating System (8GB core i5 CPU @ 2.20GHz 2.20 GHz)	Clear Bin Testing	Passed
Window 7 Operating System (4GB core i3 CPU @ 2.20GHz 2.20 GHz)	Clear Bin Testing	Passed

4.5 FIND TESTING

The Find module functionality test of the VAMS was conducted. During this test, the VAMS application find functionality was tested in different systems with different versions of the Windows

operating system. As reported in Table 5, the Find Functionality will work perfectly on Windows 7 Operating System and above.

Table 5: Find Test Result

OPERATING SYSTEM	FIND TEST	RESULTS
Windows 10 Operating System (8GB core i5 CPU @ 2.20GHz 2.20 GHz)	Choose Path Testing	Passed
	Search Bar Testing	It passed but had a slow response time.
Window 7 Operating System (4GB core i3 CPU @2.20GHz 2.20 GHz)	Choose Path Testing	Passed
	Search Bar Testing	It passed but had a slow response time.

4.6 CHATBOT TESTING

The **CHATBOT** module functionality test of the VAMS was conducted. During this test, the VAMS application **CHATBOT** functionality was tested in different systems with different versions of the Windows operating system. As reported in Table 6, the **CHATBOT** Functionality will work perfectly on Windows 7 Operating System and above.

Table 6: ChatBot Test Result

OPERATING SYSTEM	CHATBOT TEST	RESULTS
Windows 10 Operating System (8GB core i5 CPU @ 2.20GHz 2.20 GHz)	ChatBot Testing	Passed
Window 7 Operating System (4GB core i3 CPU @ 2.20GHz 2.20 GHz)	ChatBot Testing	Passed

5 Evaluation

The VAMS application was evaluated using three (3) metrics: CPU Utilisation, Memory Utilisation, and Response Time. The results of the evaluation were as follows:

- CPU Utilisation: The Virtual Assistant had an average score of 40%
- Memory: The virtual Assistant Maintenance System requires about 22.7MB of storage space in the Computer System to function correctly.
- Response Time: It takes the VAMS Application to perform tasks around 1 minute, except for the Find functionality of the application, which takes around 5 to 10 minutes to perform the given tasks.

6 Limitations and Future Research

The work is limited to the Windows System for the features examined; future work may look into iOS systems for the same features.

7 Conclusion

The development of a virtual assistant maintenance system holds immense potential to revolutionise how computer system issues are diagnosed and resolved. The effective management and maintenance of systems through VAMS will pave the way for a new era of efficiency, productivity, and user satisfaction, propelling organisations toward success in the digital era.

8 Reference

Abbas, A., Arshad, M. R., Zareen, S., & Saba, T. (2020). Virtual assistant for computer system maintenance. *Journal*

of Ambient Intelligence and Humanized Computing, 11(9), 4083-4094.

Abrol, A., & Sharma, S. (2020). Design and Development of Intelligent Virtual Assistant: A Survey. In 2020 International Conference on Automation, Computational and Technology Management (ICACTM) (pp. 1-6). IEEE.

Adesoji, A., Misra, S., Ahuja, R. (2020). Using Virtual Reality as a Cost-Effective Substitute for Engineering Labs in Underdeveloped Countries. In: Batra, U., Roy, N., Panda, B. (eds) Data Science and Analytics. *REDSET 2019. Communications in Computer and Information Science,* vol 1229. Springer, Singapore. https://doi.org/10.1007/978-981-15-5827-6_34

Agrawal, A., Shah, R., & Sharma, R. (2021). A comprehensive review on virtual assistants. *Journal of Ambient Intelligence and Humanized Computing,* 12(2), 2157-2175.

Apple Inc. (2021). Siri: Your intelligent personal assistant. Retrieved from https://www.apple.com/siri/

Chen, L., & Zhou, Y. (2019). The role of comprehensive monitoring tools in computer system maintenance. *Journal of Information Technology Management,* 22(2), 98-107.

Gallagher, P., Murdock, V., & Bryant, K. (2021). Cybersecurity and computer maintenance systems*: A review. Journal of Computer Security,* 29(4), 617-638.

Gartner. (2020). Cost of downtime calculator. Retrieved from https://www.gartner.com/en/it-glossary/cost-of-downtime-calculator

Goyal, M., Bisht, P., & Aggarwal, A. (2018). Predictive maintenance of computer systems using machine learning. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology,* 3(1), 333-339.

Guo, Z., Zhou, D., Zhou, Q., Zhang, X., Geng, J., & Zeng, S. (2020). Applications of virtual reality in maintenance during the industrial product lifecycle : A systematic review. *Journal of Manufacturing Systems*, *56*(July), 525–538. https://doi.org/10.1016/j.jmsy.2020.07.007

Gupta, S., Singh, V., & Singh, R. (2021). Intelligent virtual assistant for computer system maintenance. *Journal of Computing and Information Science in Engineering*, 21(1), 011013.

Hearst, M. (2018). Natural language processing. In B. Liu & L. Özsu (Eds.), *Encyclopedia of database systems* (pp. 1914-1917). Springer.

Iyinolakan, O. D. (2023). Adoption of Virtual Assistants for Human-Computer Interaction among Smartphone Users in Lagos , Nigeria. Ebonyi State University *Journal of Mass Communication,* 10(1), 18–28.

Li, M., Xiong, Y., & Lyu, M. R. (2020). Software maintenance: A comprehensive survey. ACM Computing Surveys (CSUR), 53(3), 1-44.

Li, C., & Ji, H. (2021). Bot-X : An AI-based virtual assistant for intelligent manufacturing. *Multiagent and Grid Systems – An International Journal*, *17*, 1–14. https://doi.org/10.3233/MGS-210340

Li, Y., Wang, X., Zhang, B., & Liu, C. (2019). Research on predictive maintenance technology for computer systems. *Journal of Physics: Conference Series*, 1186(1), 012015.

Mihai Duguleană, Briciu, V.-A., Ionut, A. D., & Machidon, O. M. (2020). A Virtual Assistant for Natural Interactions in Museums. *Sustainability 2020, 12, 6958;*, 1–17. https://doi.org/doi:10.3390/su12176958

National Institute of Standards and Technology. (2021). Best Practices for Maintaining Information System Security. Retrieved from https://csrc.nist.gov/publications/detail/sp/800-40/rev-3/final

Oktavianus, F., Fadlil, A., & Widiastuti, Y. (2019). The Analysis of Computer Maintenance to Prevent System Failure and Improve System Performance. *Journal of Physics: Conference Series,* 1175(1), 012170. doi: 10.1088/1742-6596/1175/1/012170

Sharma, A., Kaur, J., & Singh, P. (2020). *A*n efficient computer maintenance system using IoT and cloud computing. *International Journal of Computer Applications,* 179(31), 26-30.

Zhou, Y., Chen, X., Xu, Z., Liu, Y., & Li, L. (2019). A survey on software maintenance management. In 2019 28th International Symposium on Software Reliability Engineering (ISSRE) (pp. 229-240). IEEE.