



Automating Test Procedures Using Robot Software

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Nomenclature

<i>IR</i>	=	Image Recognition Software
<i>LCS</i>	=	Launch Control System
<i>NASA</i>	=	National Aeronautics and Space Administration
<i>NIFS</i>	=	NASA Interns, Fellows, and Scholars
<i>OS</i>	=	Operating System
<i>SCCS</i>	=	Spaceport Command and Control System
<i>SRPS</i>	=	Self-writing Record and Playback Software
<i>STEM</i>	=	Science, Technology, Engineering and Mathematics
<i>TW</i>	=	Test Writing Software
<i>UER</i>	=	User Emulating Robotics

I. Abstract

This paper will discuss the project I was assigned during the 2018 Spring semester NIFS internship, what the project does for NASA, and what I contributed to the project. It will begin with a broad analysis of the types of software I worked on and how they were used to complete the project. Then, it will narrow in scope to concentrate on the group and parts of NASA assigned the project. Next, it will pay attention to the project itself and how it worked. After that, it will focus on my direct contributions to the project. Lastly, a few personal experiences I encountered to make my internship relatable. The initial points discussed will be an introduction to the basics of automated testing and the types of software used. Next, I will briefly discuss why these tools were chosen and whether or not they can be improved. Then, a look at where my group fits into the hierarchy of NASA, what the group working on my project did for NASA, and who were the entities working together for this project. Afterwards, a review of my involvement in the program, my development as an individual, and my new skills and abilities. Finally, a sense of involvement with the community through personal development will be demonstrated using unique experiences only available to me through this internship.

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II. Introduction to Automated Testing

Automated testing is accomplished by turning a test procedure, which is otherwise performed by humans, into code designed to be executed by a computer. This is done by creating software that enters text as if keyboard keys were pressed, activates buttons by impersonating mouse clicks, and performs tasks to meet pass or fail criteria. Automating tests allows people more time to focus on other tasks, rather than repeating the same time consuming tests. This reduces the workhours spent on testing, increases productivity, and allows for more research and development.

For this project, TW² and IR² were paired with a UER² software designed to run the tests by operating outside of any currently running programs while operating in the same environment on the OS². The code was developed in a general text editor available for use with the current OS. The code was constructed in the TW. The TW used keywords created in the UER and IR to keep the language of the code as high-level and close to spoken English as possible. The UER was used to simulate the keyboard key presses and to initiate mouse movement and clicks. The IR was tasked with finding the correct text fields and appropriate button locations on the screen and relaying the information to the UER to ensure proper behavior.

Utilizing the preexisting program, the IR and UER could interact with the program in the same way as a human, but faster and with fewer errors. Throughout the entirety of the project, other options and modes of improvement were always under consideration and the submission of new ideas or considerations was always welcomed. Some of these ideas were to use SICS² instead of the IR, complete environment changes replacing both the IR and UER with SRPS², and enhancing the current software with more tools designed specifically for it.

III. Working with NASA

For my internship, I was assigned to the SCCS/LCS (Spaceport Command and Control System/ Launch Control System) project. I worked with one other intern very heavily for one of the SCCS/LCS sub-teams that were focused on the programs and interfaces used mainly to display the current measurements and readings occurring of a space craft up to the point of launch and possibly shortly thereafter. Those systems handled the interactions of when a user wanted to interface with the system by changing values, sending commands, and transferring files.

When using this team's software, a unique environment would be loaded on to the screen. From the point that the environment is loaded until it stops, system performance information and error occurrence is under constant observation by the software. This information is also being recorded so a user can search the history of any problems that happen to see why they occurred in order to fix them. Using the environment provided, the user can navigate to any system they want to monitor or with which they want to interact. Next, the appropriate user interface would appear on screen. The user can change values, affect alarms, view process history, and many other things. It is the team's job, along with the assistance of many other sub-teams, to ensure the user can interface with the system in a meaningful manner. The interfaces are customized to meet the requested specifications provided by the other teams based on their needs. An example of this customization is that some interfaces were designed with conversion capability able to turn decimal input into hexadecimal or octal outputs and vice versa.

The SCCS/LCS project has many teams that collaborate with each other very well to meet the needs of NASA. The sub-team on which I worked had many tasks and required its team members to be very well versed in their jobs as well as being able to assist other teams with testing or making changes to the software and systems. These tasks varied widely from developing the physical tests and checking by hand that they worked, to troubleshooting any problems in the entire system that could have affected their software, and more. This constant collaboration helped to ensure the teams maintained a positive and cooperative demeanor.

The sub-team I was assigned to had members from many different fields and backgrounds. It provided a rare opportunity for me to meet people who had worked on multiple spaceflight programs and to ask the advice of the people who came before me about any issues, concerns, or general ideas I may have had.

IV. Code writing challenges

The project given to me to work on for the duration of my internship was to follow a spreadsheet with step-by-step instructions for several physical tests and to develop automated procedures capable of being run by robotic software for them. The systems interact with each other by having the environment and the robotic software on the same system, but functioning as individual entities. The order in which they were started does not matter. As the two programs are running, the environment simulates a real-time launch, or at least attempts to return acceptable or expected responses.

² Switched proper names for generic terminology

During operation, independently running both programs while still maintaining full functionality would require the IR to be able to identify the interfaces provided by the sub-team's environment, the UER to be programmed and timed correctly so that the appropriate actions occurred in the right places, and that interference from outside the test environment was minimized as much as possible. This last part meant that if a procedure existed to press keys for navigation and activation, the proper convention was to use the key pressing procedure, rather than moving and clicking the mouse. There were several other constraints and requirements that required my code to follow similar behavior. The special requirements for this program are what helped to improve and increase the confidence in my code by removing the possibility of improper mouse movements.

The main code for the tests is written in the TW and ran as the controlling entity for the IR and UER. To make the TW, the IR, and the UER capable of communicating, keywords inside of multiple libraries were created by my predecessors. I had to ensure proper coding etiquette was followed and maintained anytime I made changes. I managed to automate full test cases to the furthest extent available on my individual station and ran the test cases on real systems and hardware.

Using a least-interference-prone approach was one of the harder challenges presented mainly because the robust functionality of the IR and UER was always tempting to use but would not provide the needed confidence. Part of the solution to reduce improper behavior of the IR was to increase the accuracy of the matches. Some other solutions were to utilize hotkey combinations, develop my own scripts or functions to use, and alter the existing code to use more accurate matching requirements.

V. Unexpected and unique benefits

My time spent working at NASA was one of the best experiences of my life. NASA works closely with many companies. During my internship, telling the difference between who the contractors and employees were was at times almost impossible, because of how cooperative everyone was. Working together with one another permeates throughout NASA from the top director down to the newest intern. As part of the inviting nature of NASA, several meet and greet style conferences were held where I had the opportunity to meet many of the influential people at Kennedy Space Center.

During my internship, I seized the opportunity to witness several rocket launches. These launches highlight some of the greatest creations of the human species so far, and they inspired me to always work towards improving myself. The internship also afforded me with outreach events to build rapport with my fellow interns. One of the events was a competition which led to my having a luncheon with the director of Kennedy Space Center, Mr. Robert Cabana.

To give back to the community, several volunteer events were opened and one of the ones I participated in was a promotion of women in STEM programs. To better myself intellectually, I attended many training events and even participated in a space conference discussing the use of super conductors as radiation shields. NASA also hosted a run/walk event on-property where I was able to complete the 5K option.

VI. Summation

In conclusion, my life has been enriched by accepting the internship to Kennedy Space Center much more than I had ever imagined. The program that was assigned to me was challenging and demanding without being impossible, instilling in me confidence and providing me with new problem-solving techniques. The teams and interns that created my social network have demonstrated what a positive and motivating work environment can produce. My personal understanding of my profession has grown, and lastly, I have been inspired to strive for greatness by those around me and to help others to do the same.

VII. Acknowledgements

I was only able to accomplish my tasks with the help of the other members of my team and the NIFS internship program. I would like to thank Jamie Szafran, Jill Giles, and Caylyne Shelton who were my mentors in the NIFS internship, the Education Office for making this opportunity possible, the Engineering Directorate for providing me with purpose, and my loving family who supported my decision to take an internship that would relocate me for 16 weeks.

VIII. References

<https://drawingninja.com/resoure/213775/central-new-mexico-community-college.png>