December 14th, 2019
Dr. Mark Lanthier
Computer Science Apartment
Carleton University

Dear Mark Lanthier,

From September 3, 2019, to December 20, 2019, I had my first CO-OP term as Test automation student in part of the test automation development team at Ford. My Coop course number is COMP3999A. My supervisor is Danny Yang who is the Test Automation and Tooling supervisor

The following full CO-OP work term report follows the guidelines set from the Co-op Work Term Report Guidelines. The report is my own original work and has not been previously submitted for credit

Sincerely,
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COOP 3999A

Ford- Test Automation Co-op Position - 5
First work term report
Full report
Employer: Ford
Supervisor: Danny Yang
Department: Test Automation Tools

CO-OP Work Term Report

Executive summary

From September 3, 2019, to December 20, 2019, I had my first CO-OP term as an automation test in part of the test automation development team at Ford

I worked on a range of test stations containing both single ECU's (Electronic Control Units) and sub-systems of different ECU's in a Test Automation Development team. My main responsibilities are setting up workstations, executing tests, analyzing test results, tracing bugs, distinguish actual error and environment error or setup issues, and developing new functionalities in test scripts.

By the end of this CO-OP term, I have found and solved many environmental issues and several actual bugs during test runs, experienced using different systems and tools such as build system (Jenkins) and defect tracking system (JIRA), developed a new functionality that can read signal strength data from one of the ECU every time after a test is finished. These valuable experiences allow me to develop my aptitude for troubleshooting and the ability to work in a team environment.

Acknowledgments

None of my achievements is possible without my supervisor's trust and colleagues' support. I want to express my sincerest gratitude for their help.

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1. Introduction

1.1 Organizational context

Ford is the second-largest U.S.-based automaker, and it is well known as selling automobiles and commercial vehicles under the Ford brand and most luxury cars under the Lincoln brand. In recent years, Ford decided to expand the organization in a different way since Henry Ford put the world on wheels in 1903 to make a better future with new connectivity technologies and automotive infotainment.

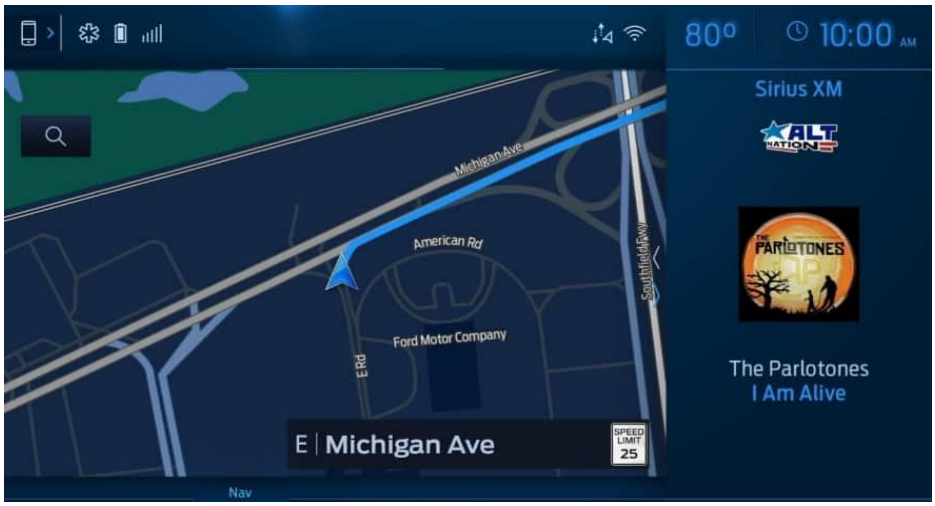
To achieve this, Ford recruited thousands of employees with advanced computing, analyzing, and technical skills to help transform the company from a traditional vehicle company to a company that manufactures vehicles with advanced techniques.

I am a part of the Test Automation Development team, and my team is responsible for one of the most important requirements of the products, stability. The job for my team is developing and maintaining automated test framework, test scripts, and related tools, while also manage automated test execution to help measure the quality and stability of the software.

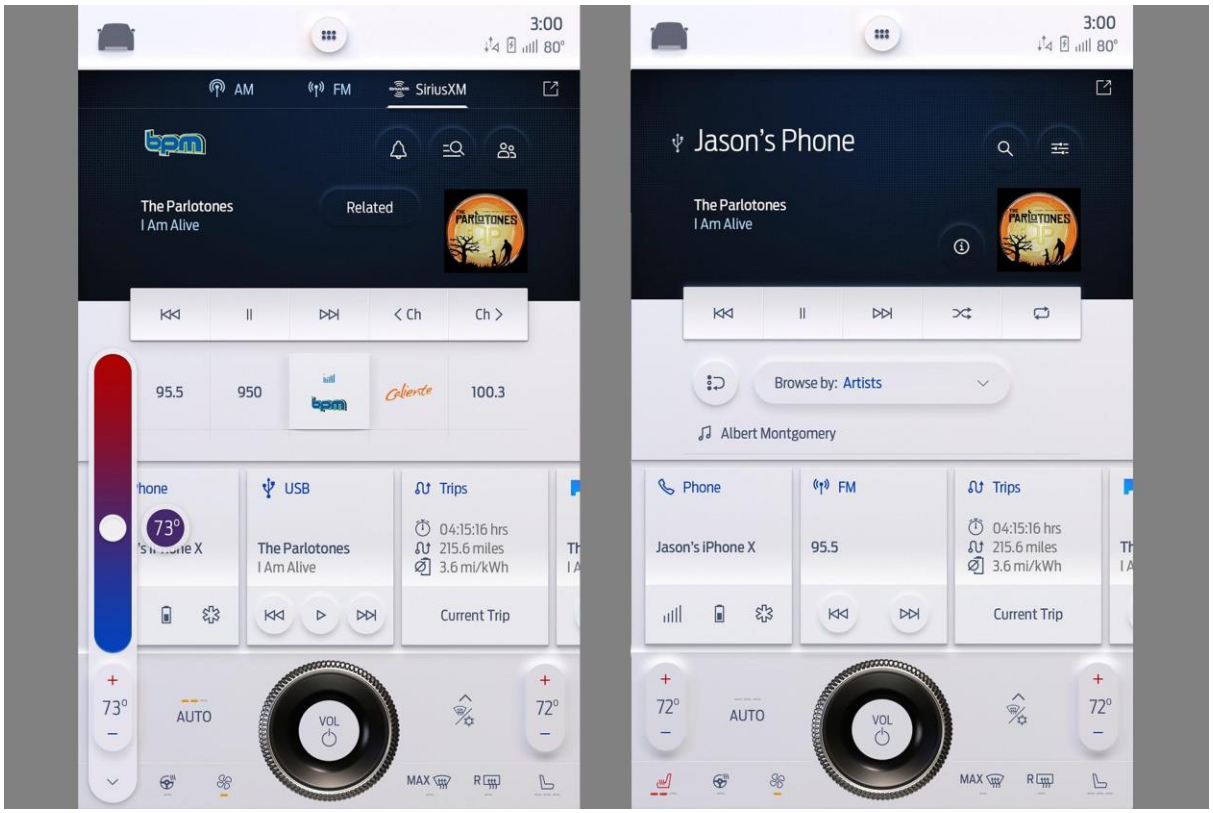
2. Work experience

2.1 Nature of work

The project that my team is working on is executing and triaging test runs on Ford's SYNC 4 communications and entertainment system which is set to arrive on vehicles in 2020. SYNC 4 is one of the ECUs, and it has cloud-based connectivity and conversational voice recognition. To ensure the product will successfully arrive next year. There are lots of new features and upgrades for this system, which means my team has plenty of test plans that need to be tested.



Map on SYNC 4



User interface on SYNC 4 with 15.5 inches screen

As an automation tester, the final goal is to ensure that there is no error in the product. To achieve that, we have a lab that has 73 stations, and each station has a complete system in it so that every member of the automation team is responsible for at least five stations. The regular job for me is to executing different daily stability test plans and triaging them. Before executing stability test plans, I need to ensure that local configure files and the stations which contain three ECUs on each of them are set correctly. All the bundles that are loaded on ECUs and VMCU need to be updated to the corresponding versions that the team leader assigns to me. After setup a stability environment, picking a few tests from the test plan for pre-execute is necessary. If the test reports contain lots of environment error the report will be invaluable. So I need to exclude those environment errors as early as possible.

Most of the stability test runs will take 24 hours to 36 hours (if there is no crash during the runs) because every single test repeatedly runs many times to prove the stability of the product.

When the test runs start, the test report will be saved on the stability dashboard, by analyzing and comparing test errors, there are two ways to manage them. The first way is to cache an existed Jira and map that defect to the corresponding error. In the second situation, I need to raise a new because I cannot find any Jira to map to the error.

Communication also plays an important role at work. Since new functionalities, test scripts, even hardware are updated frequently, it is impossible for every member to be proficient with different parts of the test scripts or ECUs. Be flexible at communication is

significant. For example, I was assigned to assemble a station on with Rad Moon Fire 2. It is a powerful intrepid media converter for automotive Ethernet applications. All the other stations in the lab are set with old ran moons. To communicate with one of my colleagues who has the experience to deal with new rad moons is necessary to complete that Jira.

As a conclusion for my nature of work, I would update new bundles, execute stability runs, triage errors, develop new test scripts, and solve unseen problems by communicating actively with my collogues.

2.2 Experience

Since all of Ford's product is related to Ford's vehicle, and all the Python test scripts are developed to be used for testing different situations for driving and users' daily operations. Although I learn Python in one of my first-year courses, the knowledge of coding only helps me be able to have a basic understanding of the test scripts. My experience for the ECUs is very limited before I came to Ford.

Most of the time, I spent on my work in the first few weeks was on setting up my own lab computer and be familiar with concepts and useful commands for three different ECUs which are the main components for the SYNC 4 system. I can only talk about sync here. It is the name of one of the ECUs. The same name with Ford's project. Sync is the ECUs that directly connect to the monitor. In the first month of my work term, I started with executing test runs for a single ECU which has a simple setup. All the commands that I need to know were very basic, like updating requirements for test repo, make ECUs goes into fastboot mode and normal mode, etc… Then I learned how to use these similar functionalities in the other two ECUs which include sync.

After these tedious processes, I started to be able to work on stations where all three ECUs are connected to each other. Those processes are necessary for me to deal with any potential issue on any single ECUs.

ECU stations are the place that my work begins. Run stability test runs in the test repository and triage the test reports or just run a single test manually to dig in the test scripts. Being able to verify the local test configure files and started to investigate problems that conflict the station and test scripts

2.3 Challenge and solutions

The reasons that cause the test errors are various. It can be environment issues likes virtual environment uses Python 2.7 instead of using 3.6.8, setup issues, like ECUs, are not connected properly.

In October, I was assigned a Jira that cellular data connectivity that causes test errors. The cellular data connectivity had been seen to drop within the lab during prolonged test executions. Video tests on the last build also failed with the "No Connectivity" error, and

one of my colleges also provided recent logs that shown one of ECUs' network was going down in between the runs. So my leader wanted me to find a way to poll signal quality at the end of each test and/ or loop, and consider retries in the test if the signal drops below a certain threshold.

Building the script was one of the challenges that I faced during the CO-OP term. I spent a few hours to briefly understand the concept that how the test scripts by manually execute test cases. Contrast and compare the logs and the test scripts were helpful for understanding. After two days of working, I figured out how to get the signal strength manually from the ECUs through the diagnostic engineer tool (DET). However, polling the signal strength value manually is different from polling it through scripts.

One of my colleagues also sent the sample code that worked before. Although the sample code did not even have the right implementation it still gave me the right Python files that I should investigate. However, when I roughly had done my code, it could not be executed with "slash run <Python file>" command. I have to learn the slash command myself. It is from the Python slash test (slash is testing framework written in Python). After struggling for a few hours of Python slash documentation I succeeded to test my scripts. My function worked, but the signal strength value that it polled is quite different from the value from DET. The value I actually got was near 65440 but the right value was near -95 dBm. I trace the code in Pycharm and found out the value 65440 came from the right place, which means the DET must perform some unknown calculation for users so that we could get -95. After calculation and another colleague's help. We figured out the 65440 need to be deleted by FFFF (This is a hex value and it equals to 65535). I also executed my test twenty times so that I could ensure that the value is the correct one.

After that, I decided to add my function to all the tests that related to VLAN (virtual local area network), such as bug report test, video test, and recovery test, etc. I also reached an agreement with my leader that we do not need to make the tests run again since the test already run hundreds a day in test plans. Finally, my pull request is verified and my code was pushed to the master branch.

3. Reflections on Work Experience

3.1 Contributions

The responsibility for a member of the test automation development team contains both testing and developing. For testing, I executed test runs and triaged errors that develop team made when they are developing new features or functionalities. I also report the errors by raising serval new Jiras. For developing, I wrote a functionality that can poll the signal strength from ECUs that will help my colleagues to check the value easily instead of manually using DET.

I also convert three develop secured SYNC to product secured. It was a high priority Jira when I time I was working on the signal strength Jira. I will explain the detail in 3.3 Career development.

3.2 Relation to academic studies

I started my CO-OP term when I was in third-year. The material that I learn from school does help me in a direct way. However, the one that helps more is the learning habits that I have though the time that I spent in Carleton. In Carleton, I discover the most effective way for me to learn new knowledge. In my first year, I spent all the time to read the material from the professor and take every lecture. However, I found myself that I lose concentration when I just stay in class and just listen to lectures. So when I always stuck by different problems when I read the documentation. It was extremely ineffectively. In the second year, every time I stuck in any problems. I would ask the professor without any hesitation after I tried by myself. Then I would practice the problem and I found I can memorize the knowledge from the problem for a much longer time.

In the work term, I just kept the same study habit that made me work and learn effectively. The experience that I learned at university gave me good learning habit, it plays an important role in my work term as well.

3.3 Career development

I do not have a specific career goal for now since I just started my third-year study at university. So I would like to try different fields in computer science. For my first work term, I did a lot of bug tracking and also developed new functionality for my team. My debugging skill definitely gets practiced and improved. Debugging skills also relate to the developing field.

The experience of working in a multi-site team environment is also significant for the rest of my CO-OP term. The experience makes me be self-driven and self-motivated capabilities which are key capabilities that working in a large company. I am developing another developing Jira about “reboot ECUs when connecting to phone” when I am writing the work term report in the last two weeks of the work term. I am much more familiar with the script than the last time. All the scripts that I will work on in other companies will be unfamiliar code that I never look before. This was a valuable experience to use existing API and develop new functionalities.

The experience in Ford also developed my capability to deal with multi-task. There is an interlude when I was dealing with my signal strength Jira. My team was required to convert develop secured SYNC to product secured. So expect my daily responsibility which is executing daily stability test plans I have to investigate my code and convert the SYNC. Since most of the steps for converting sync and loading bundles on ECUs both requires

approximately five to ten minutes of waiting. I remoted to different stations at the same time, and process the steps alternatively I wrote the steps that I currently finished so that I did not ruin any of the work and I clearly knew the processes for all the four stations that I was working on. I saved a lot of time for my developing project.

4. Summary

This is my first-time work in a tech team. For most of the time in office or lab, I learned the knowledge that I cannot learn from elsewhere except Ford. Before I came to Ford, I only have a brief understanding of Python since I only learned Python in COMP 1405. Through experience at Ford and self-learning, I have a better understanding of Python, slash test and debugging which enhanced my coding ability in general.

I spent a lot of time when I was developing the signal strength project. It gave me the experience to deal with code that I did not familiar at all. And that is the situation when I work in a tech company. The experience for the first work term at ford is valuable for me. I feel accomplished for the contribution that I did at Ford.

5. References

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