



# Latest Development to the Mass Tracking System (MTG)

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*Changing the World's Energy Future*

Shreeya Pradhan



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# **Latest Development to the Mass Tracking System (MTG)**

**Shreeya Pradhan**

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**Idaho National Laboratory  
Idaho Falls, Idaho 83415**

**<http://www.inl.gov>**

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# Latest Development to the Mass Tracking System (MTG) for Fuel Conditioning Facility at Material and Fuel Complex(MFC)

Shreeya Pradhan | University of Idaho-Moscow | U601 | Greg G. Galbreth

## Introduction

The Fuel Conditioning Facility (FCF), located in the Material and Fuels Complex at Idaho National Laboratory (INL), is a hot-cell facility that provides for the electro-metallurgical treatment of fuel elements from Experimental Breeder Reactor II (EBR-II) and other fuels as approved by the Department of Energy (DOE). In this facility, a wide range of remote operations involving fissionable material is performed and it is essential to keep track of the material for desired outcome in safe and effective manner while still following the procedure and the rules set by the Technical Safety Requirement (TSR).

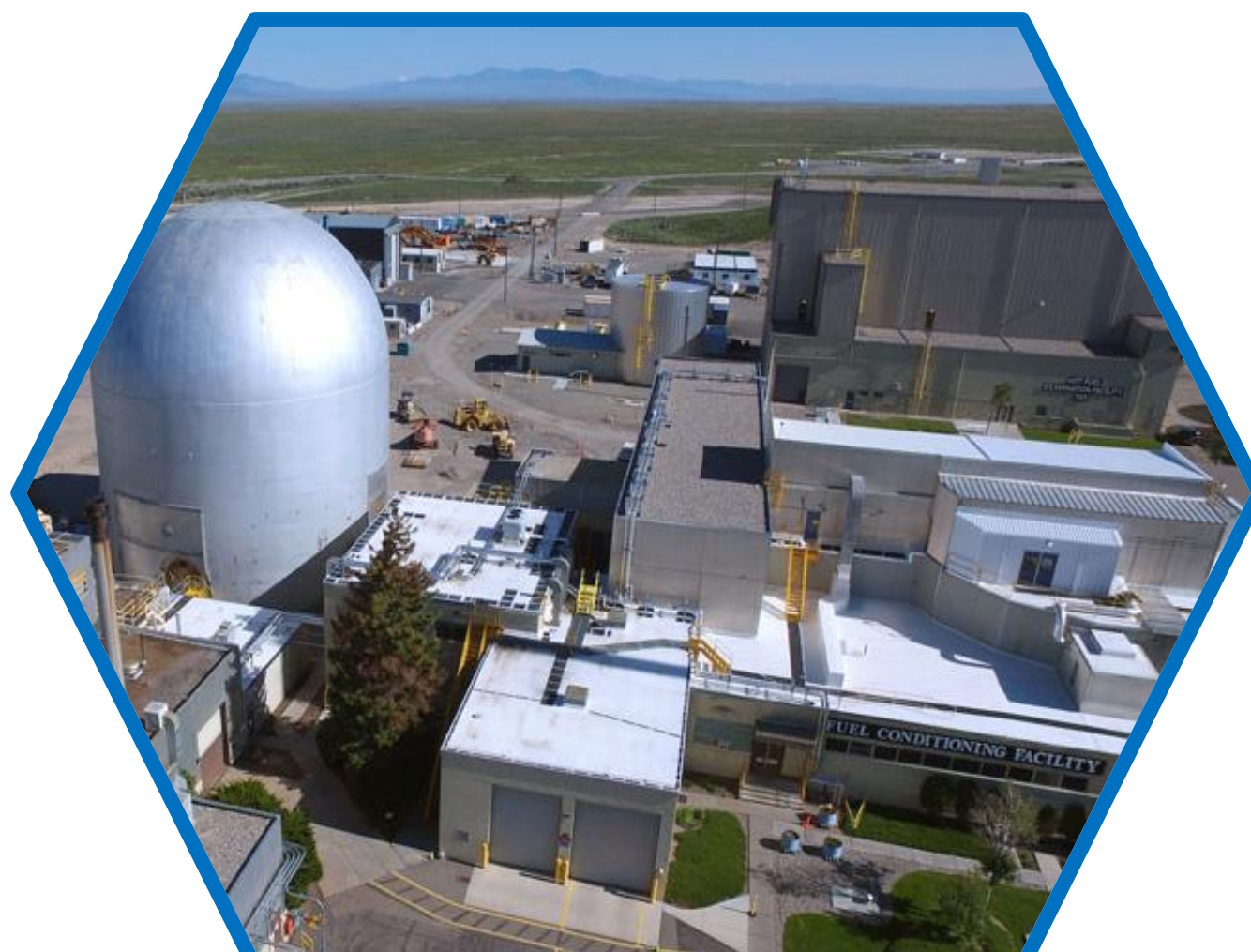


Figure 1: Fuel Conditioning Facility (FCF)<sup>1</sup>

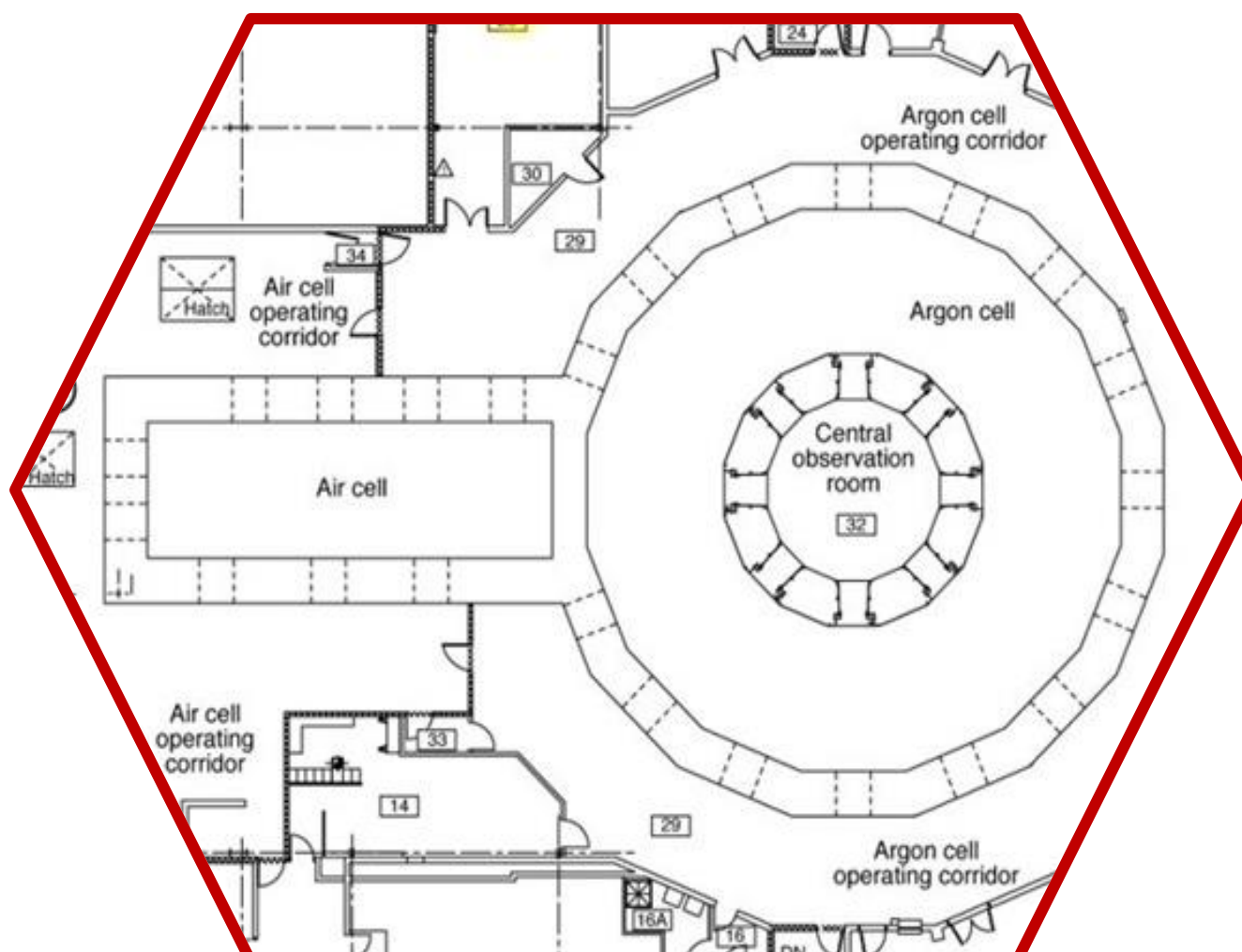


Figure 2: Air Cell and Argon Cell at FCF

For this very purpose, FCF uses the Mass Tracking System (MTG), a system that tracks the location and composition of the material. Originated at Argonne National Laboratory (ANL), this system has been operating since 1996 to track, control, and record all forms and types of the material in the Air cell and Argon cell (Figure 2) within the facility, providing an additional barrier to an inadvertent mass event during container and material transfers.

## Issues

"The MTG user interface is a multi-component interface based on a Fortran generated HTML web interface Operator Control Station (OCSMTG) and command line UNIX terminal service."<sup>2</sup> The OCS allows user to interact with the MTG via a communication file while the UNIX terminal session allows the MTG utility run case to generate the input communication file.

The current OCSMTG has been a successful platform for many years, yet there are limited functions provided for developing the system. Moreover, the web interface needs enhanced user organization with multiple crews to reduce user errors. Similarly, the UNIX terminal runs on Oracle Solaris 10 operating system, an OS that is on extended support with no plans from Oracle to be updated and improved anytime soon. It gives the software technical team scarce resources such as no Pro-Fortran modules and limited choices of programming languages to further develop the MTG in an efficient manner.

Overall, the main issues with the current system are the operating system that will become unsupported in 2027 and need for organized web interface.

## Solution

This project resolves the two main issues by migrating the Solaris UNIX environment to LINUX environment and developing the front-end development. To migrate the Solaris UNIX environment to LINUX environment, all the Pro\*Fortran need to be updated to Pro\*C. This is initialized in the back-end part of the system with Fortran programming language, C programming language, and ORACLE. Once the migration is successful, the focus of the project will be front end development in JavaScript, PHP, and Python.

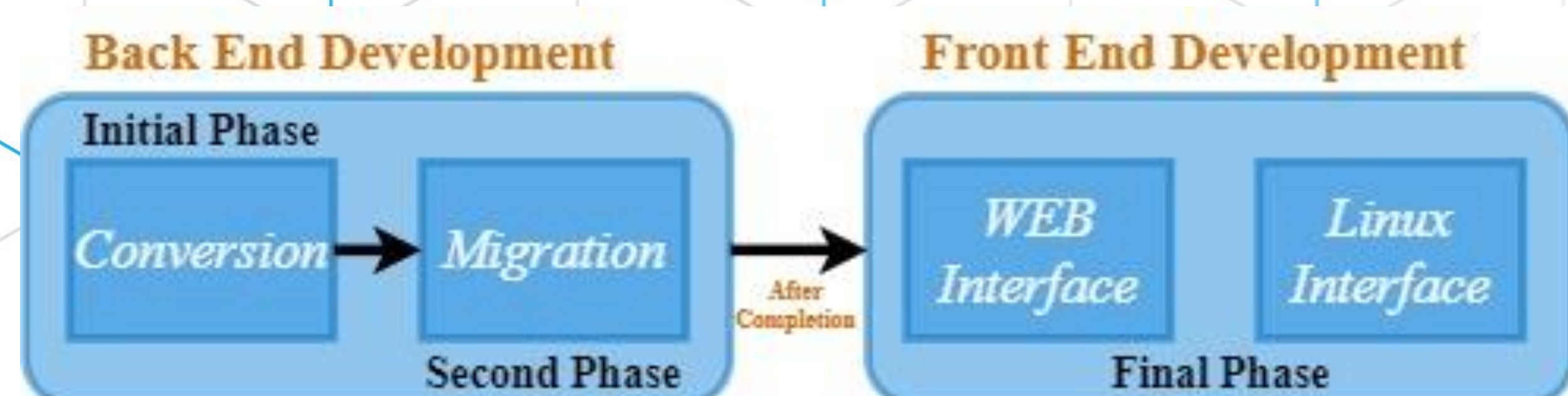


Figure 3: Phases of the Proposed Project

## Progress and Plans

The migration began with education on Fortran and Oracle SQL command in Fortran to have better understanding on how these languages work in the system. Moreover, there existed many C programming functions not utilized in the Fortran-77 world. So, the development of Fortran-95 modules started to let Fortran-77 use dynamic memory and call the existing C-functions. This has sped up the process of converting the Pro\*Fortran codes to Pro\*C codes. In addition, each file that is a part of the MTG requires testing once converted. This initial phase is a big part of the project which then supports setting up a new operating system, Linux, with the MTG.

Consequently, a large volume of validation and testing is the next phase to make sure everything is working both individually and collectively. Since the MTG is Nuclear Quality Assurance of 1 (NQA-1), it must go through nuclear software configuration, assurance and validation and testing.

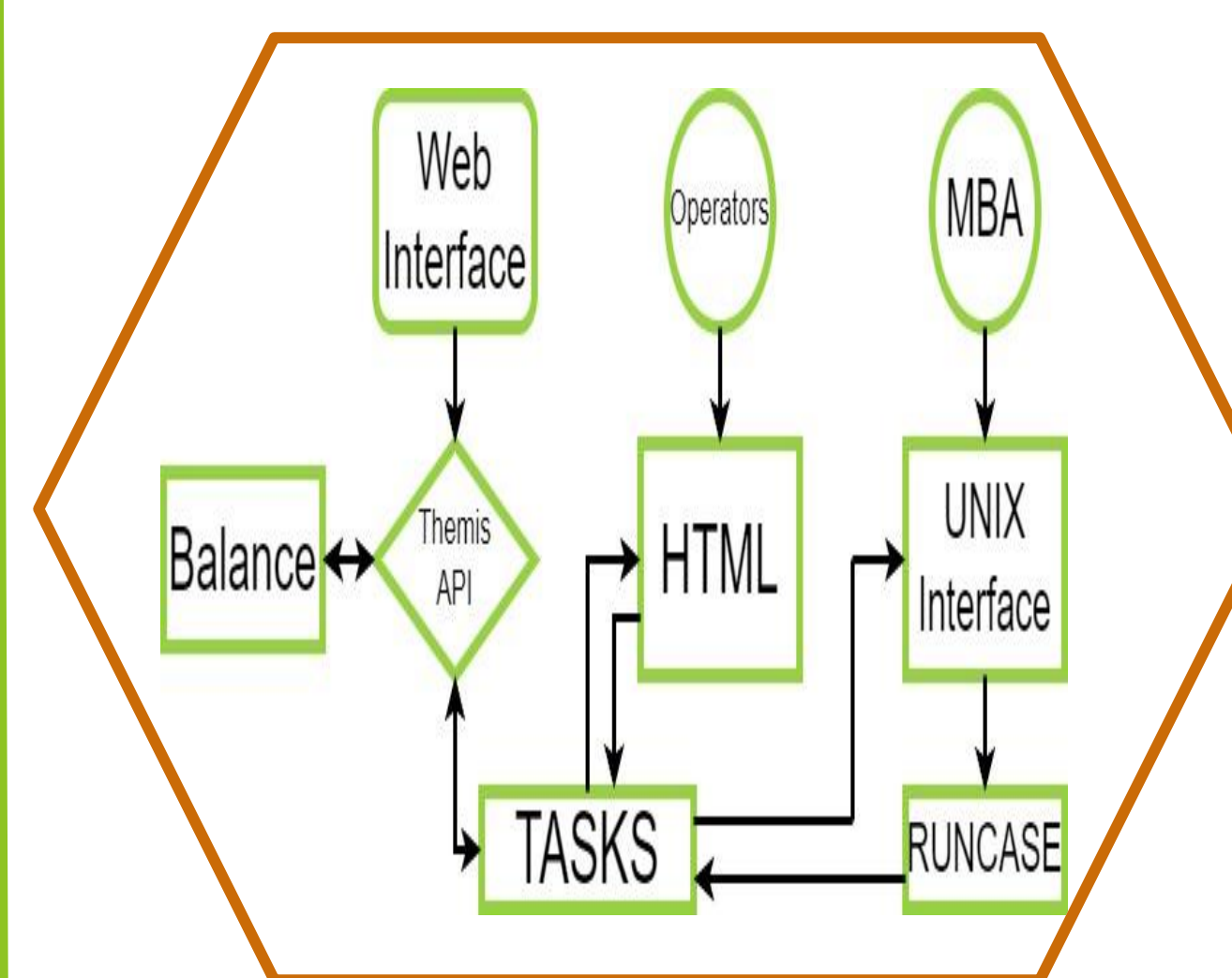


Figure 4: Current MTG Flowchart

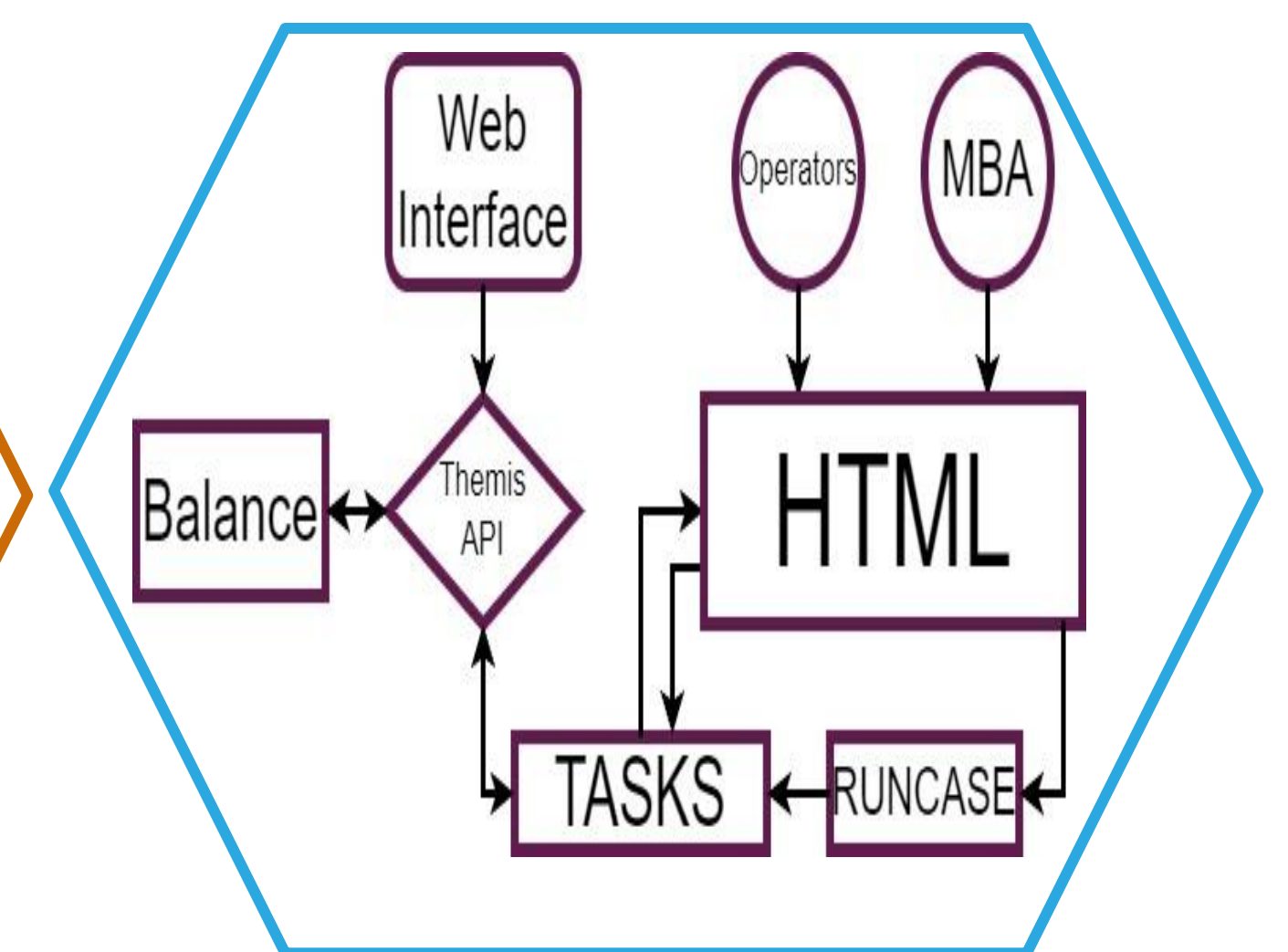


Figure 5: Proposed MTG Flowchart

Similarly, the front-end development is the final phase of this project. The current webpages in use will need modifications in accordance with the new Linux OS. The improved user interface is aimed to be adaptive and customizable by the user with little programming. In brief, the core of this improvement is the new webpage interface and the RUNCASE API.

## Conclusion

After the completion of the project, the Mass Tracking System (MTG) will perform as a versatile and efficient system where the users can easily make the changes they need. The back end will easily get access to large number of resources for development and new functions. Similarly, replacing the UNIX interface, the MBA users can easily operate the webpage as line command functionality is no longer needed. In conclusion, the workflow of the MTG will remain unaffected despite the upcoming lack of support for the operating system, and the operations in FCF will perform optimally in a better, secure, and efficient environment.

## Acknowledgement

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