Towards Performing Customized cryo-EM/SEM/TEM Image Processing Applications by Combining [QuPath + ImageJ/ Fiji+JikesRVM/RVM-Research Virtual Machine] via Groovy- a JVM Language in the Context of [IoT/HPC- High Performance Computing/JI Prolog/Linux OS] Heterogeneous Environments.

[Exploring Novel Algorithms Using Java/Groovy/RVM – for Advanced Electron Microscopy Image Processing Frameworks]

Nirmal Tej Kumar

Independent Consultant   **Informatics/AI/Photonics/Nanotechnology/HPC R&D.**
R&D Collaborator   **USA/UK/Israel/BRICS Group of Nations.**
Current Member   **ante Inst,UTD,Dallas,TX,USA.**
email id   **hmfg2014@gmail.com**

[I] Inspiration + Introduction :

" Structural analysis of drug-target interactions is a valuable tool to optimize new drugs for efficiency and safety. For decades, the required level of detail could only be obtained through X-ray crystallography or NMR – unfortunately, methods not applicable to many relevant targets. Nobel-prize winning cryo-electron microscopy (cryo-EM) has emerged as an exciting alternative. "
[Source : *https://labiotech.eu/sponsored/cryo-em-structure-drug-design-evotec* **]**

https://imagej.nih.gov/ij – **Java based Image Processing Software**
https://imagej.net/Fiji – **Java based Image Processing Software**

"QuPath is developed at the <u>University of Edinburgh</u>. The software was originally created at the <u>Centre for Cancer Research & Cell Biology</u> at <u>Queen's University Belfast</u>, as part of research projects funded by <u>Invest Northern Ireland</u> and <u>Cancer Research UK</u>.**"**

<u>https://qupath.github.io/</u> – *QuPath* **is an open, powerful, flexible, extensible software platform for whole slide image analysis.**

Bankhead, P. et al. QuPath: Open source software for digital pathology image analysis. *Scientific Reports* **(2017). <u>https://doi.org/10.1038/s41598-017-17204-5</u>** .

<u>https://petebankhead.github.io/qupath/scripting/2018/03/08/script-imagej-to-qupath.html</u>

Groovy – *www.groovy-lang.org*
https://javabeat.net/introduction-to-groovy-scripting-language

<u>http://gaelyk.appspot.com/</u>
<u>https://cloud.google.com/appengine/</u>

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3855844
www.icmr.ucsb.edu/programs/3DWorkshop/Uchic-2015_FIJI_Tutorial.pdf
https://www.stressmarq.com/5-free-image-analysis-software-tools-for-microscopy

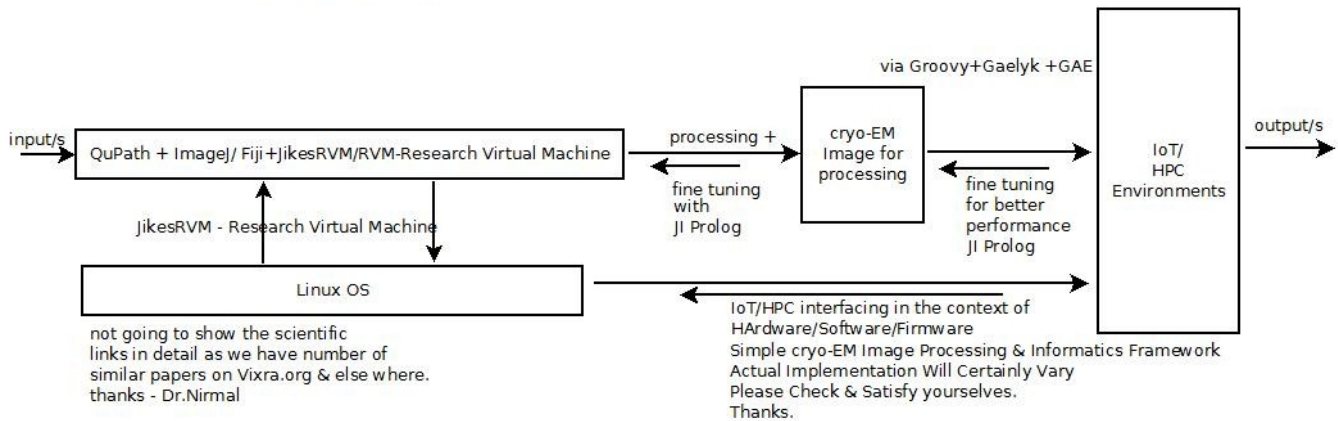**[II] R&D Algorithm for Image Processing Framework Implementation** :

R&D Algorithm Illustrating - cryo-EM Image Processing for IoT/HPC/GAE Heterogeneous Environments
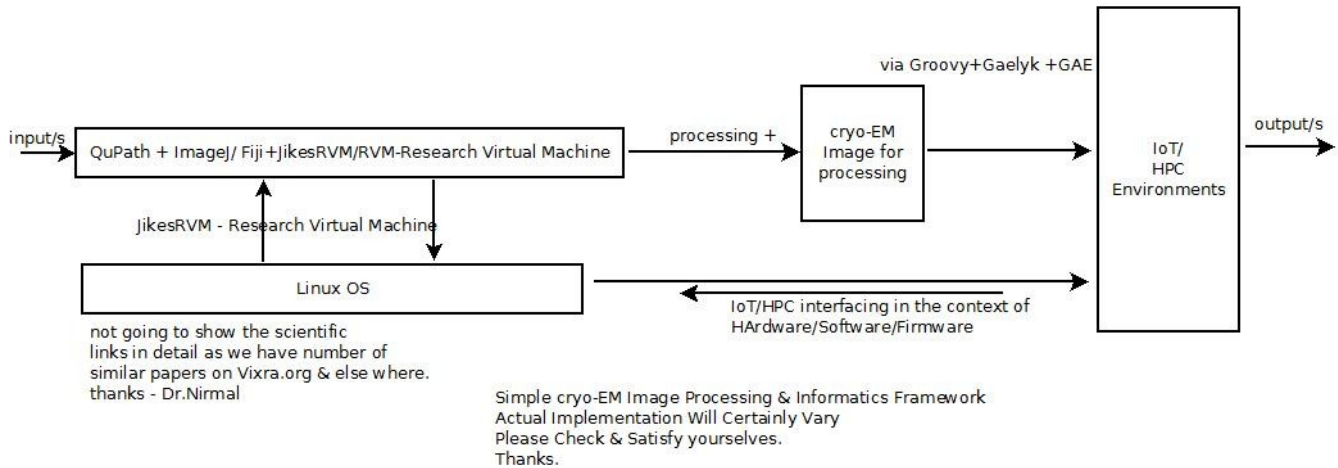
[Figure I – Algorithm I – A Simple Approach to Designing cryo-EM Image Processing & Informatics Framework]

R&D Algorithm Illustrating - cryo-EM Image Processing for IoT/HPC/GAE Heterogeneous Environments
Fine Tuning the Entire Java based Image Processing Using JI Prolog Option
General Layout for Advanced Image Processing Algorithms
for Improving efficiency of Machine Vision Automation

[Figure II – Algorithm II – A Simple JI Prolog Approach to Designing cryo-EM Image Processing & Informatics Framework]

" **JikesRVM is a bleeding-edge research project**. "

https://www.jikesrvm.org/ – "Jikes RVM (Research Virtual Machine) provides a flexible open testbed to prototype virtual machine technologies and experiment with a large variety of design alternatives. The system is licensed under an OSI approved license. Jikes RVM runs on many platforms and advances the state-of-the-art of virtual machine technologies for dynamic compilation, adaptive optimization, garbage collection, thread scheduling, and synchronization. A distinguishing characteristic of Jikes RVM is that it is implemented in the Java™ programming language and is self-hosted i.e., its **Java code runs on itself without requiring a second virtual machine**."

"Google App Engine is Google's platform as a service offering that allows developers and businesses to build and run applications using Google's advanced infrastructure. These applications are required to be written in one of a few supported languages, namely: Java, Python, PHP and Go. It also requires the use of Google query language and that the database used is Google Big Table. Applications must abide by these standards, so applications either must be developed with GAE in mind or else modified to meet the requirements. " Ref [g]

"GAE is a platform, so it provides all of the required elements to run and host Web applications, be it on mobile or Web. Without this all-in feature, developers would have to source their own servers, database software and the APIs that would make all of them work properly together, not to mention the entire configuration that must be done. GAE takes this burden off the developers so they can concentrate on the app front end and functionality, driving better user experience. " Ref [g]

"Advantages of GAE include :

> [a] Readily available servers with no configuration requirement
> [b] Power scaling function all the way down to "free" when resource usage is minimal
> [c] Automated cloud computing tools ".Ref[g]

[III] Related R&D Information on Mathematics + Software Used ((((via)))) Vixra.org :

[a] *www.vixra.org/author/nirmal_tej_kumar*

[b] http://www.vixra.org/pdf/1803.0124v1.pdf

[c] *www.vixra.org/author/n_t_kumar*

[d] *www.vixra.org/author/d_n_t_kumar*

[e] https://www.semanticscholar.org/author/Nirmal-Tej-Kumar/123554503/suggest

[f] http://vixra.org/pdf/1709.0412v1.pdf – Formalizing Image Processing Using HOL.

[g] http://www.vixra.org/pdf/1909.0548v1.pdf

[IV] Acknowledgment/s :

Special Thanks to all WHO made this happen in my LIFE. Non-Profit R&D.

[V] References :

[a] *https://**en.wikipedia.org**/wiki/Cryo-electron_microscopy*

[b] ***cryoem**.berkeley.edu/**cryoem***

[c] *www.tau.ac.il/~saharon/BigData2018/Yoel.pdf*

[d] *https://www.fei.com/**cryo-em***

[e] *https://sciencehill-**cryoem**.yale.edu/**images**-o*

[f] *https://**cryoem**.ucsf.edu/software*

[g] https://www.techopedia.com/definition/31267/google-app-engine-gae – GAE & Related Information.

[THE END]