Preliminary report

Development of a C^{++} based user-interface for a plasma simulation tool

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Department of Electrical Engineering and Electronics

14 October 2016

Declaration of academic integrity

I confirm that I have read and understood the University's Academic Integrity Policy.

I confirm that I have acted honestly, ethically and professionally in conduct leading to assessment for the programme of study.

I confirm that I have not copied material from another source nor committed plagiarism nor fabricated, falsified or embellished data when completing the attached piece of work. I confirm that I have not copied material from another source, nor colluded with any other student in the preparation and production of this work.

SIGNATURE.....Jianming Zhang.....

DATE .....14/12/2016.....

Abstract

An existing microplasmas simulation tool which developed by the technological plasma team will generate numerous output data in various formats. Thus a user-friendly-interface is needed by relevant researchers and industry users.

This report is aimed to describe the preliminary development procedures of this user-friendly-interface and it will be divided into 6 parts which are project description, methodology, project plan, project rationale with industrial relevance, literature review and the working result in the first three weeks.

The future work of this project will in terms of the project plan in continuing research.

Contents

1. Introduction

This preliminary report will be divided into 6 main parts:

First is the project description. The overview, aims and objectives of this project will be mentioned and then the general ways to realize these aims will be described.

Second part is the methodology. The specific tools and technological processes of this project will be explained.

Third part is project plan and Gantt chart. This project is combined from a large amounts of specific tasks with duty cycle and then it will be used to generate the Gantt chart for managing the task progress.

After that is project rationale and industrial relevance. The evaluation of this project and the research interests of project supervisor will be used to analysis this project and the relationship with industry.

And then is the literature review. The relevant research results of other people will be browsed and displayed as reference list.

Last part is the result. Preliminary research result of this project in the first three weeks will be introduced.

2. Project Description

2.1 Problem statements

The Technological Plasma Group has developed a simulation too for microplasmas which called Plasimo. Large amount of output files will be generated through simulated these models of plasma.

Plasimo 5.0 developer version and the Micro Discharge 2D (md2d) model of plasma will be applied on this project. The running process of this simulated tool is shown as Figure 1.

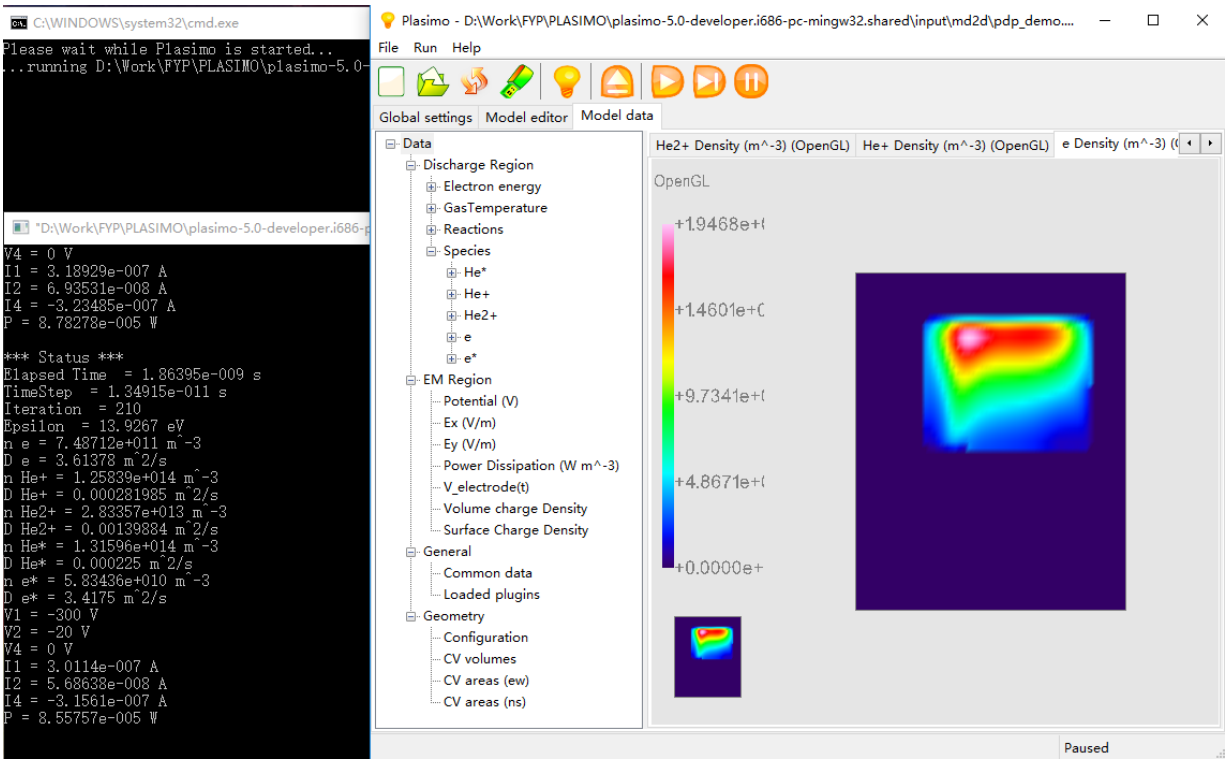


Figure 1. Running process of Plasimo 5.0 with md2d model

After finished the simulated process, large amount of output files will be generated as text and out formats which is shown as Figure 2.

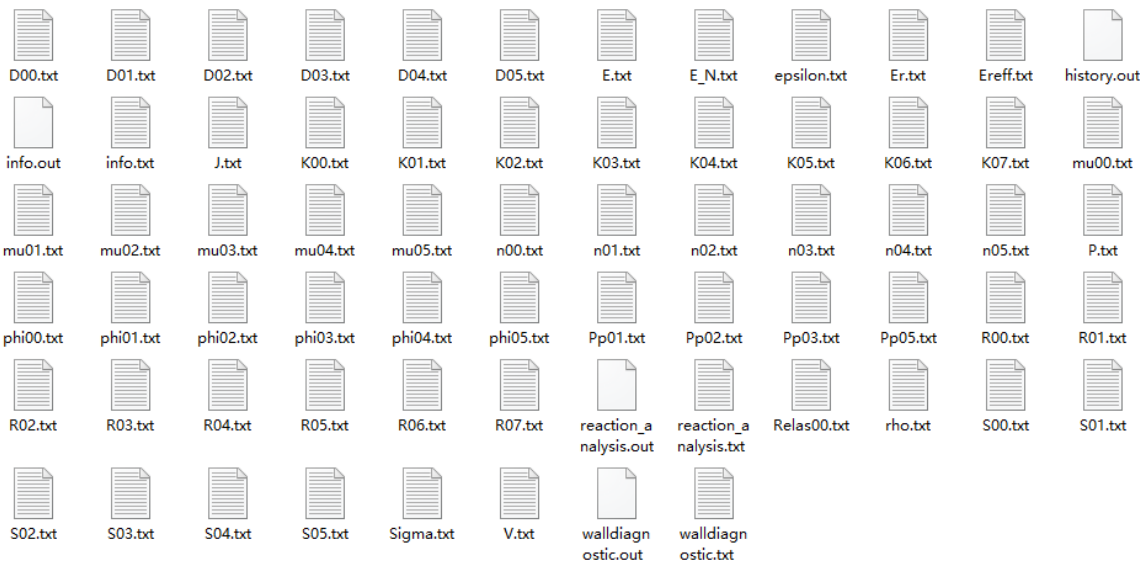


Figure 2. Output files of md2d model simulation

Lots of information of simulated plasma are stored as specified in these files. The explanation of each files will be shown in Table 1[1].

n00.txt	electron energy density [J m^{-3}]
phi00.txt	electron energy flux density [W m^{-2}]
S00.txt	electron energy source [W m^{-3}]
D00.txt	electron energy diffusion coefficient [W m^{2}]
mu00.txt	electron energy mobility coefficient [J m2 V^{-1} s^{-1}]
Relas00.txt	rate of electron energy loss from elastic collisions [W m^{-3}]
epsilon.txt	mean electron energy [J]
n01.txt	density for species 1 [m^{-3}]
S01.txt	source for species 1 [m^{-3} s^{-1}]
D01.txt	diffusion for species 1 [m^{2} s^{-1}]
mu01.txt	mobility for species 1 [m^{2} V^{-1} s^{-1}]
phi01.txt	flux for species 1 [m^{-2} s^{-1}]
R00.txt	reaction rate for reaction 1 [m^{-3} s^{-1}]
K00.txt	reaction rate coefficient for reaction 1 [m^{3} s^{-1}]
Pp01.txt	power dissipation for species 1 [W m^{-3}]
P.txt	dissipated power density [W m^{-3}]
J.txt	current density [C s^{-1} m^{-3}]
V.txt	potential [V]
E.txt	electric field [V m^{-1}]
Er.txt	reduced electric field E/p [V m^{-1} Pa^{-1}]
E_N.txt	reduced electric field E/N [V m^{2}]
rho.txt	volume charge density [C m^{-3}]
sigma.txt	surface charge density [C m^{-2}]
info.txt	the averaged values written with the user-specified frequency
info.out	the averaged values
history.out	gives the calculated variables as a function of time

Table 1. The explanation of each simulated output files from plasimo user guild

For plasma model md2d, a long simulated time is needed to run the md2d model in the plasimo. In addition, there are total 68 output files with 32.9 MB data, different files represent different data of plasma as shown in Table 1, thus researchers and industry users are complicated read these data, moreover, a number of these data are useless to them.

2.2 Project overview

According to the problem statements, a software with user-friendly-interface is needed to developing. Therefore, the aim of this project is to develop a practical C^{++} based user-interface to help researchers and industry users obtain significant output data effectively.

This project could be divided into 2 main objectives:

- First is research of plasma to select useful data from numerous output data because the significant data are needed to pick at the beginning to reduce the workload of programming. Thus, background reading and research for plasma discharges will be involved as an initial phase of this project.
- Second and the key aspect of this project is develop the widely accessible user-interface to help researchers and industry users. The skill of developing interface by using C^{++} based tools should be trained.

In order to achieve this project within 20 weeks, it need developer working by combined research work and programming skill together. At the meanwhile, the report and presentation of this project should be prepared. More detail about how to realize this project will be discussed in the Methodology part.

3. Methodology

3.1 Tools

3.1.1 C++ based software developing tools

The requirement of this project is under C++ developing environment. 3 main tools will be used to build this user-interface.

3.1.1.1 Microsoft Visual Studio Community 2013

Visual Studio is the most popular integrated development environment on Windows. It will be used for the main developing tool in this project.

3.1.1.2 Qt 5.7.0

Qt is a framework of cross-platform C++ graphical user interface (GUI) application development. it contains the fundamental technology of GUI which is used to render the interface [2].

3.1.1.3 openGL

Open Graphics Library (OpenGL) is the most widely 2D and 3D Application Program Interface (API). It could applicate in lots of platforms such like Window, Linux and MacOS.

3.2 Software Development Process

3.2.1 Software requirements

This program is used to display required data by processing large amount of text files and it should be used to select significant data of plasma to researchers and industry users.

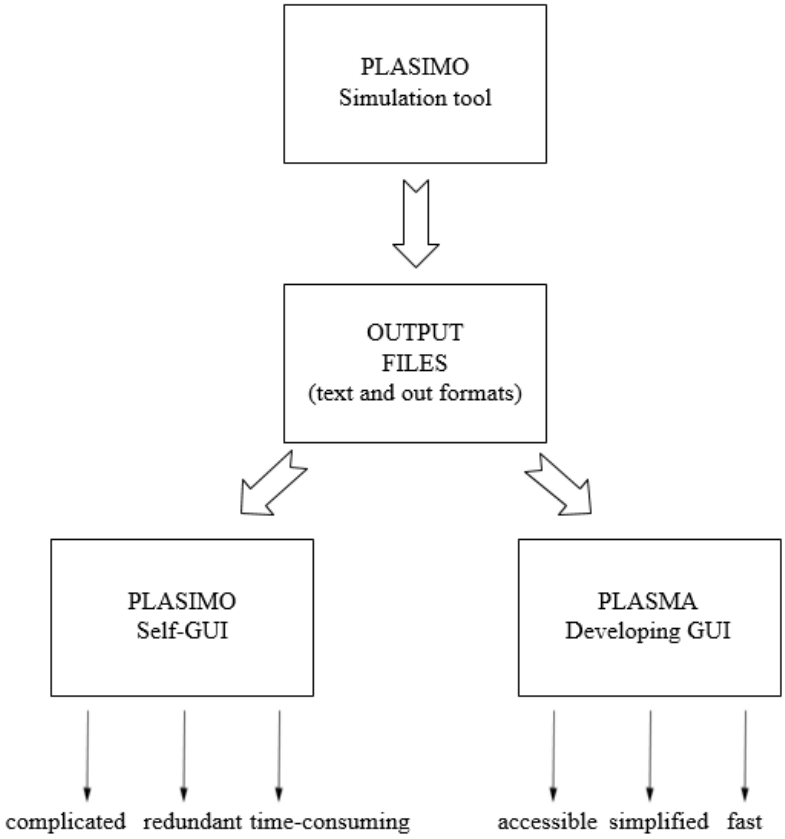


Figure 3. The general analysis of this project

According to analysis the characters of this original GUI in Plasimo, it could find it is complicated because new users are hard to run this software without handbook. At the same time, redundant output data will be generated through the simulated process, researchers and users cannot find useful data efficient. For m2de model, it cost 10 minutes to run simulation. However, there still has other models of plasma are more time-consuming.

In order to solve these problems, it could find the software requirements are an accessible, simplified and fast GUI to support useful data to users. This analysis process is shown as Figure 3 and the design process of this project will follow this analysis.

3.2.2 Design

In order to realize requirements of this software, accessible, simplified and fast will be consider as the key points of the design process.

3.2.2.1 User-interface building

In order to develop an accessible user-interface, the key aspect is it should obey the Eight Golden Rules of Interface design [3].

- Strive for consistency
- Cater to universal usability
- Offer informative feedback
- Design dialogs to yield closure
- Prevent errors
- Permit easy reversal of actions
- Support internal locus of control
- Reduce short-term memory load

In addition, research interfaces of different software especially research-based software are significant.

The soul of this project is user-interface, thus it needs to spend more time to compare advantages and disadvantages of different interfaces in continuing research.

3.2.2.2 3D graphical display function

For technology users, the output simulated data of plasma should be displayed intuitionistic. Therefore, 3D graphical model could be treated as a simplified and intuitionistic way to research plasma. Users could observe the changing process of particular plasma model.

3.2.2.3 Rapid loading text files function

Excellent reasoned time of a software should be considered as an important standard. Numerous output data will be generated by md2d plasma simulation and other models of plasmas may spend longer time to obtain results. In addition, there are 68 output files of one simulated plasma, thus the rapid text files loading function is needed to researching and developing fast interface.

4. Project Plan

4.1 FYP

4.1.1) Preparatory Work

4.1.1.1) Obtain plasma simulation tool and relevant reading materials

4.1.2) Research Work

4.1.2.1) Weekly background reading for plasma discharges.

4.1.2.2) Investigating significant data in numerous output file.

4.1.2.3) Investigating Interface of learning, researching and factory software.

4.1.2.4) Literature review.

4.1.2.4) Learning of corresponding software include C^{++} based visual studio, openGL and Qt.

4.1.3) Developing Work

4.1.3.1) Write software requirements

4.1.3.1.1) software specifications

4.1.3.1.2) software analysis

4.1.3.2) Design

4.1.3.2.1) Rapid loading text files function developing.

4.1.3.2.2) 3D graphical model displayed function developing.

4.1.3.2.3) Intuitive user-interface developing.

4.1.3.3) Testing and improving

4.1.3.3.1) Program test and debug.

4.1.3.3.2) Development methodology.

4.1.4) Report Work

4.1.4.1) Writing project specification report form.

4.1.4.2) Writing Preliminary report.

4.1.4.3) Weekly virtual log book.

4.1.4.4) Preparing presentation.

4.1.4.5) Creating poster.

4.1.4.6) Writing final report.

The complicated project plan will be shown in Appendix 2 with the Gantt chart.

5. Project Rationale and Industrial Relevance

In this project, the major areas related are computer science and physical, which are both significant branches of human scientific and technological development. In addition, the relationship of these two areas and EEE are not closely. Therefore, this is a more challenging opportunity to test the learning ability of new areas as a EEE undergraduate.

For the continuing development, high value of this project could be created because there are many applications on plasma.
For example, microplasmas for biomedical is an important application. The plasma needle could be used to product reactive species such as excited molecules, radicals and ions [4]. In this case, the properties of the plasma needle can be displayed and investigated in simulation tool which is shown as Figure 4.

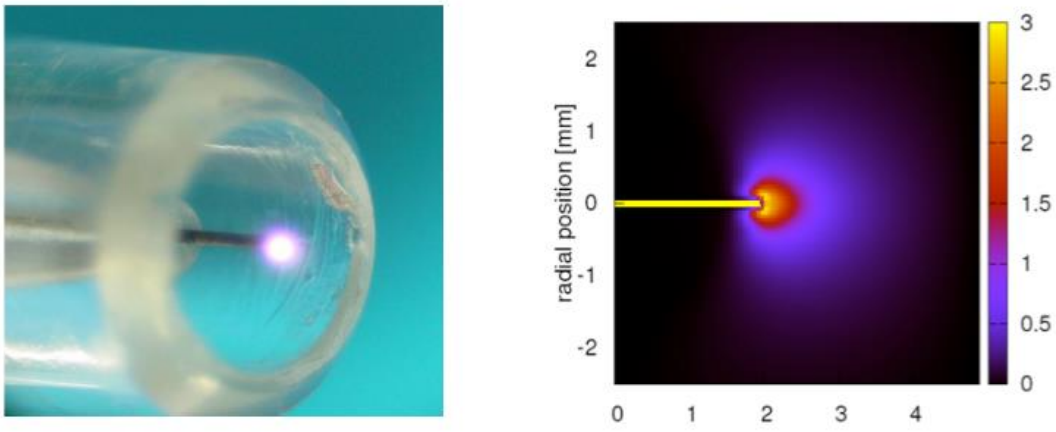


Figure 4. Simulation of the plasma needle

Source: Numerical description of discharge characteristics of the plasma needle

6. Literature Review

At the preliminary stage, 3 literatures related to this project has been found through the university library database. Two of them are related to web-based user-interface and the remaining one is related to software interface developing of plasma tools.

To better understand the characters of user-interface design, R.R. Zhang, B.J. Xiao, Q.P. Yuan, F. Yang, Y. Zhang, R.D. Johnson, B.G. Penaflor (2014) illustrates the clearly design process of GUI, they have excellent workflow to deliver their ideas. However, the completed interface is not adequate quality as their design process. M. Emoto, S. Murakami, M. Yoshida, H. Funaba and Y. Nagayama (2007) developed neat interface which could display the data of plasma into formulas and line charts. S. Anett, L. Heike, S. Jörg (2007) described the detailed design process of GUI and the most impressive idea is give the user specialized tools for specific tasks within the control system.

For summarizing these 3 literatures, web-based interfaces are developed by JavaScript, but the concept of GUI design process is worth to study, both clear

explanations and flow charts are needed to display the interface. Moreover, thinking more of users is the most important factor to develop a wonderful GUI.

Literature reviews appendix

- M. Emoto, S. Murakami, M. Yoshida, H. Funaba and Y. Nagayama., " Web interface for plasma analysis codes", *J. Appl. Phys.* vol. 83, no.2-3, pp. 453-457, April 2008, DOI: 10.1016/j.fusengdes.2007.10.008

- S. Anett, L. Heike, S. Jörg, " User control interface for W7-X plasma operation", *J. Appl. Phys.* 2007, DOI: 10.1016/j.fusengdes.2007.05.052

- R.R. Zhang, B.J. Xiao, Q.P. Yuan, F. Yang, Y. Zhang, R.D. Johnson, B.G. Penaflor, " The web-based user interface for EAST plasma control system", *J. Appl. Phys.* February 2014, DOI: 10.1016/j.fusengdes.2014.02.070

7. Results

Plasma is a new area of EEE student, thus this project contains two main parts which are deep learning about plasma and user-interface developing.
At the preliminary stage, research basic properties of plasma and develop specific function are two main result in the first 3 weeks.

7.1 Preliminary research of plasma

7.1.1 Plasma and Micro Discharge 2D(md2d) model

7.1.1.1 Plasma definition

Plasma is one of the four fundamental states of matter, it is part of ionized gas which consists of electron, ion, free radical, neutral ion and photon.

The general type of plasma will be applied at this project which is shown in Figure 5.

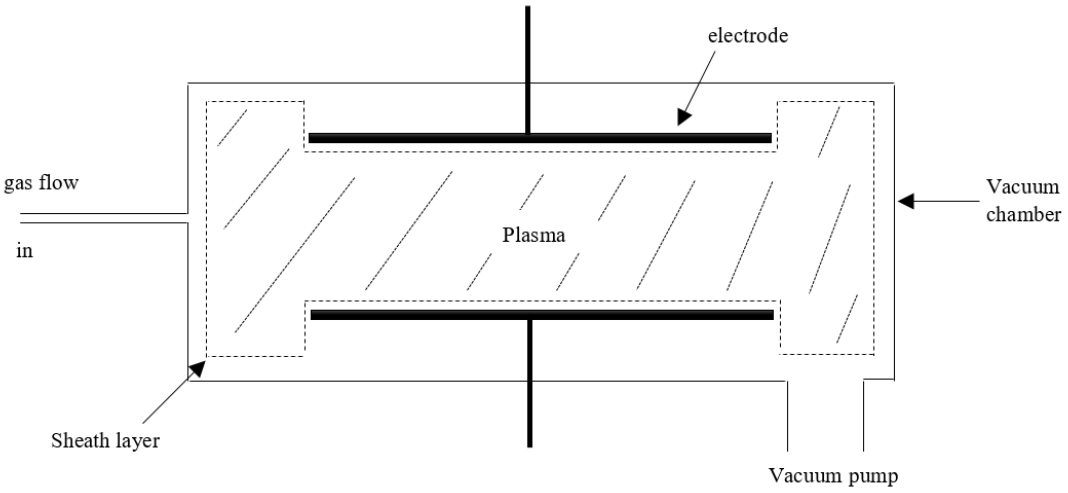


Figure 5. The general image of a plasma

According to figure 5, it could be observed that the general plasma has a vacuum chamber, pump, a gas flow system and electrodes.

In addition, the plasma has various significant features which are:

- Sheath layer
- Different types of particles
- Reactions in the plasma
- Power input and loss of the plasma
- Gas flow into and out of the chamber.

A large amount of output files is generated through the Plasimo simulation tool and the explanation of each output files is shown in Table 1. It described 24 properties of plasma. However, the most basic plasma properties are:

- Gas Density and pressure
- Neutral particle density
- Electron density
- Electron energy and electron temperature

- Ion density
- Plasma potential
- Ionization ratio

7.1.1.2 md2d model definition

Micro Discharge 2D (md2d) is the target model in this project. It is a time dependent model and the function of it is solve particle transport problem in conjunction [5].

7.2 Preliminary developing of software

7.2.1 Rapid loading text files function

There are 68 text files with 32.9 MB data of simulated md2d model. Moreover, other models of plasma may generate more data, thus to improve the response speed of this software, the stable and fast text load command should be chosen.

For searching on the internet, there are four commands to load data of text file in C^{++} environment.

In order to test these command, it need to generate a text file with 10000000 random number first, and the different loading command will be used to test the loading time of this files.

Scanf is the normal loading command in C^{++}.

```
#include <ctime>
#include <iostream>
int main()
{
    int start = clock();
    printf("%.3lf\n", double(clock() - start) / CLOCKS_PER_SEC);
    const int MAXN = 10000000;

    int numbers[MAXN];
    void scanf_read();
    {
        freopen("data.txt", "r", stdin);
        for (int i = 0; i<MAXN; i++)
            scanf("%d", &numbers[i]);
    }
```

Figure 6. Code of testing scanf command

cin is the most common loading command in C++.

```
#include <ctime>
#include <iostream>

const int MAXN = 10000000;

int numbers[MAXN];

void cin_read()
{
    freopen("data.txt", "r", stdin);
    for (int i = 0; i<MAXN; i++)
        std::cin >> numbers[i];
}
```

Figure 7. Code of testing cin command

Fread command is used to load all data into one string

```
#include <ctime>
#include <iostream>

const int MAXN = 10000000;
const int MAXS = 60 * 1024 * 1024;

int numbers[MAXN];
char buf[MAXS];

void analyse(char *buf, int len = MAXS)
{
    int i;
    numbers[i = 0] = 0;
    for (char *p = buf; *p && p - buf<len; p++)
        if (*p == ' ')
            numbers[++i] = 0;
        else
            numbers[i] = numbers[i] * 10 + *p - '0';
}

void fread_analyse()
{
    freopen("data.txt", "rb", stdin);
    int len = fread(buf, 1, MAXS, stdin);
    buf[len] = '\0';
    analyse(buf, len);
}
```

Figure 10. Code of testing fread command

Visual Studio 2013 command	Time (s)
scanf	3.8
cin	21.6
fread	0.42

Table 2. Testing result of loading command.

According to analysis these result, it could find command fread has the most efficient speed to load files, thus this command will be used as the first choose to loading data.

However, this is only the preliminary test of this function. All test focused on one text file, but there are 68 text files of the simulated output. Thus, the rapid loading text files function still need further development.

8. Conclusion

In general, this preliminary report is the initial guild of the Final Year Project which is development of a C^{++} based user-interface for a plasma simulation tool. It can be divided into six parts include project description, methodology, relevant plan, project rationale, literature review and the result. The aim and objective are developing a user-friendly-interface to help researchers and industry users to investigate plasma effective.

The ability of formulate a project plan and preliminary work are trained through this process. After finish this report, the understanding of the project will be increased, so that it will support convenience to the future development. However, it is still the beginning of this FPY, the details about interface design and relevant programming need more time to investigate.

References List

[1] The Plasimo Team. (2014 April) IEEE Citation Reference [online]. Available: https://plasimo.phys.tue.nl/generated-docs/plasimo-5.0.0/misc-docs/user_guide.pdf (accessed 14th October 2016)

[2] D. Molkentin, "*The Book of Qt 4: The Art of Building Qt Applications*". San Francisco, USA: No Starch Press, 2007, ISBN-13 978-1593271473

[3] B. Shneiderman. (2010) IEEE Citation Reference [online]. Available: https://www.cs.umd.edu/users/ben/goldenrules.html (accessed 14th October 2016)

[4] W.J.M. Brok, M.D. Bowden, J. van Dijk, J.J.A.M. van der Mullen and G.M.W. Kroesen., " Numerical description of discharge characteristics of the plasma needle", *J. Appl. Phys.* vol. 98, 2005, DOI: 10.1063/1.1944218

[5] The Plasimo Team. IEEE Citation Reference [online]. Available: https://plasimo.phys.tue.nl/physics/md2d/index.html (accessed 14th October 2016)

Appendices

Appendix 1. The specification report form

UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

Project Specification Form 2016-2017
*Final Year BEng (***ELEC340***) and Year 3 MEng (***ELEC440***)*

Student Name: Junming Zhang Module: ELEC340

Supervisor: Mark Bowden Student ID No: 201138928

Project Title: Development of a C++ based user-interface for a plasma simulation tool

Project Specification

A. Project Description and Methodology:
(Overall view of the project with proposed route to realization i.e. what are the project aims and objectives and how you are going to do it?)

This project develops a practical C++ based user-interface to help researchers and industry users obtain the output of plasma simulation effectively.

The existing simulation tool of plasma will generate large amounts of output data in various formats. Thus, the main objectives of this project contain research of plasma to select numerous output data and deep learning of C++developing tool to build the user-interface. Specifically, it requires leaning of C++ based tools which contain Visual Studio (C++ fundamental), Qt (develop GUI) and OpenGL (build 3D graphics).

In order to achieve them within 20 weeks, background reading and research for plasma discharges should be the first objective, at the meanwhile, the skill of C++ developing tools should be practiced. Next, the developing of this software should be proceeded. Finally, the report and presentation of this project should be prepared.

B. Project Tasks and Milestones: (indicate the tasks and milestones that should be achieved and their expected dates e.g. understanding of theory, designs of circuits, construction of circuits, software specifications, working demonstrations etc.)

Tasks: (a task is a package of work that should be completed during a particular time period)

Preparatory Work Week 1 ~ Week 2
- Obtaining plasma simulation tool and relevant reading materials.

Research Work Week 3 ~ Week 15
-Weekly background reading for plasma discharges.
- Investigating and selecting significant data in numerous output files from plasma simulation tool.
- Investigating and comparing different interface of learning, researching and factory software.

Developing work Week 4 ~ Week 15
- Learning of corresponding C^{++} based software include openGL, visual studio and Qt.

- 3D graphical model display function developing.
- Write relevant report.

- Rapid loading text function developing.
- Write relevant report.

- Intuitive user-interface developing and combine all functions together.
- Write relevant report

-Software testing and optimization.

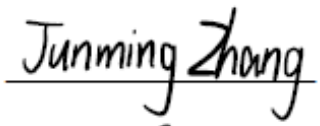
Report working Week 1 ~ Week 20
- Project specification report form writing.
- Preliminary report writing.
- Preparation for first presentation
- Creating poster.
- Preparation for bench inspection.
- Final report writing.
- Weekly virtual log book

Milestones: (an objective that should be achieved by a particular date e.g. the completion of a task)
Semester 1
Week 3 Completion of preparatory work, project specification and preliminary report writing. **Week 11** Completion of first presentation preparation. Completion of rapid loading text function and 3D graphical model display function developing as necessary elements of user-interface.
Semester 2
Week 15 Completion of user-interface developing and whole system testing. Completion of virtual log book. **Week 20** Completion of poster, bench inspection presentation and final report writing.

C. Project Deliverables: (Indicate what should be completed at the end of the project e.g. this list should indicate what will be presented / demonstrated at the final bench inspections)

- The completed software of plasma simulation user-interface with detailed software handbook. - The poster with significant achievements of this project. - The software demonstration and presentation. - The main functions will be displayed and introduced with the software and codes. - The final report and relevant documents of this project.

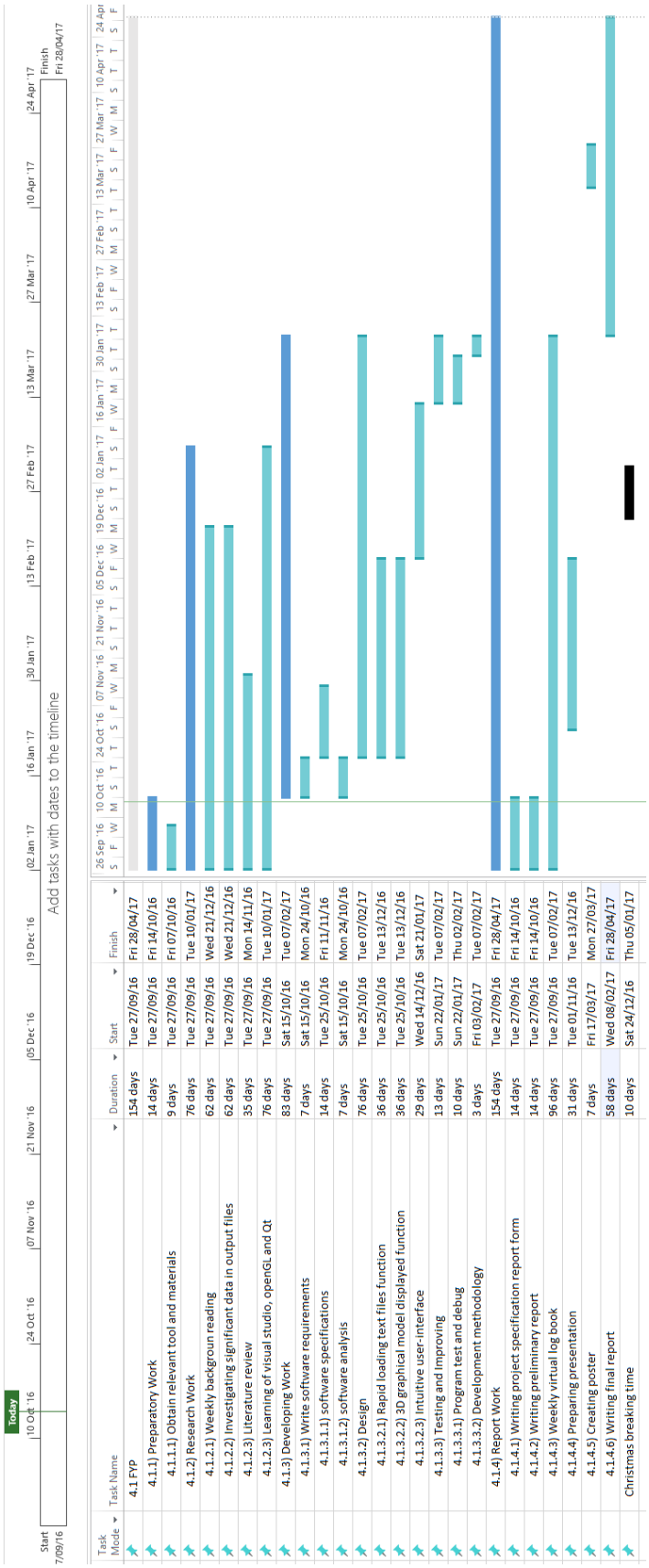
D. A section on Project Rationale and Industrial Relevance must be included in the preliminary report (deadline midnight Friday 14th October 2016). This should explain how and why the project was devised, e.g. it may be a project sponsored by a company or linked to a research project.

Student Signature:  Date: 11/10/2016

Supervisor's Signature:  Date: 11/10/2016

By signing this form, the supervisor and student are confirming that the project is of a sufficiently demanding nature that it is suitable for the individual project component of an accredited engineering degree and that a student, who is capable of producing a first class performance, will be able to demonstrate his/her capabilities in this project.

Appendix 2. A Gantt chart preferable produced by MS project



Task Mode	Task Name	Duration	Start	Finish
	4.1 FYP	154 days	Tue 27/09/16	Fri 28/04/17
	4.1.1) Preparatory Work	14 days	Tue 27/09/16	Fri 14/10/16
	4.1.1.1) Obtain relevant tool and materials	9 days	Tue 27/09/16	Fri 07/10/16
	4.1.2) Research Work	76 days	Tue 27/09/16	Tue 10/01/17
	4.1.2.1) Weekly backgroun reading	62 days	Tue 27/09/16	Wed 21/12/16
	4.1.2.2) Investigating significant data in output files	62 days	Tue 27/09/16	Wed 21/12/16
	4.1.2.3) Literature review	35 days	Tue 27/09/16	Mon 14/11/16
	4.1.2.3) Learning of visual studio, openGL and Qt	76 days	Tue 27/09/16	Tue 10/01/17
	4.1.3) Developing Work	83 days	Sat 15/10/16	Tue 07/02/17
	4.1.3.1) Write software requirements	7 days	Sat 15/10/16	Mon 24/10/16
	4.1.3.1.1) software specifications	14 days	Tue 25/10/16	Fri 11/11/16
	4.1.3.1.2) software analysis	7 days	Sat 15/10/16	Mon 24/10/16
	4.1.3.2) Design	76 days	Tue 25/10/16	Tue 07/02/17
	4.1.3.2.1) Rapid loading text files function	36 days	Tue 25/10/16	Tue 13/12/16
	4.1.3.2.2) 3D graphical model displayed function	36 days	Tue 25/10/16	Tue 13/12/16
	4.1.3.2.3) Intuitive user-interface	29 days	Wed 14/12/16	Sat 21/01/17
	4.1.3.3) Testing and Improving	13 days	Sun 22/01/17	Tue 07/02/17
	4.1.3.3.1) Program test and debug	10 days	Sun 22/01/17	Thu 02/02/17
	4.1.3.3.2) Development methodology	3 days	Fri 03/02/17	Tue 07/02/17
	4.1.4) Report Work	154 days	Tue 27/09/16	Fri 28/04/17
	4.1.4.1) Writing project specification report form	14 days	Tue 27/09/16	Fri 14/10/16
	4.1.4.2) Writing preliminary report	14 days	Tue 27/09/16	Fri 14/10/16
	4.1.4.3) Weekly virtual log book	96 days	Tue 27/09/16	Tue 07/02/17
	4.1.4.4) Preparing presentation	31 days	Tue 01/11/16	Tue 13/12/16
	4.1.4.5) Creating poster	7 days	Fri 17/03/17	Mon 27/03/17
	4.1.4.6) Writing final report	58 days	Wed 08/02/17	Fri 28/04/17
	Christmas breaking time	10 days	Sat 24/12/16	Thu 05/01/17

Appendix 3. The risk assessment form

UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

YEAR 3 BENG/MENG Project Safety Risk Assessment 2015/16

The Management of Health and Safety at Work Regulations require that a risk assessment is carried out before work starts. For guidance on risk assessment see Safety Circular SC42/3.

STUDENT NAME: Junming ZHANG ID No: 201138928

LOCATION WHERE WORK IS TO BE UNDERTAKEN: Computer lab. SUPERVISOR Mark Bowdea

TITLE OF PROJECT: Development of a C++ - based user- interface for a plasma simulation tool

Description of Work Undertaken

Familiar with the properties and background of gas discharge. Using PLASIMO which is the plasma simulation software to obtain a series of output data. Then using C++ software to develop a user-friendly interface to pick up the significant output data and display them to user intuitively.

Main hazards of the work/project *(Consider: people who can be affected, equipment used, materials handled and environment hazards)*	**Controls required** *(Consider: appropriate physical, procedural and behavioural controls).*
- standards of prolonged Komputer use.	- standard controls for computer use - regular break. - appropriate workspace

Page 1 of 2

All boxes must be ticked in the following section to indicate either YES or NO.			
	NO	**YES**	**If you have ticked YES please follow the hyperlinks in the attached document, complete and return supplementary paperwork and/or implement and adhere to the guidance given.**
Will work require the lifting of weights (heavier than 15kg)	✓		SC44-5 Manual Handling
Use lasers of any kind?	✓		Laser Risk assessment Laser Local rules Laser Registration form Read CoP & AURPO
Use gas cylinders or compressed gas?	✓		Gas Cylinder safety
Use Chemicals?	✓		COSHH SCR18 – COSHH assessment
Use voltages over 30V DC/AC	✓		Electrical Safety Electricity at work
Use Power tools or rotating motors and machines	✓		SCR15-4 PUWER
Use Cryogenic Liquids/gases	✓		Cryogenic liquids and solids
Use Vacuum Systems and pressurised vessels	✓		Vacuum Systems and Pressure vessels
Use Radiation (UV, x-rays, microwaves)	✓		Control of artificial optical radiation at work Radiation safety code of practice Local rules – UV Code of Practice – UV Microwave registration

LEVEL of Supervision?	**A** = Work May not be started without direct supervision
	B = Work may not start without Supervisor advice or approval
	C = No specific extra supervision requirements
Other relevant specific assessments (Local rules) none.	
I can confirm that Hazards identified and precautions specified are appropriate for the task :- Academic supervisor Signature M Bond Date 5/5/2016 Student Signature Junming Zhang	

- **A new assessment must be completed whenever there is a change that affects safety**

A copy of this assessment must be dated and signed by the student and supervisor. Please scan this form and submit online on VITAL within one week of selecting the project with your supervisor. Also submit the paper copy to the Student Support Office. If you fail to return the form within one week, your project may be reallocated to another student.

DSE WORKSTATION AND USER RISK ASSESSMENT

NB – if self-assessing, please remember to return your completed form to your DSC who will check and authorise it. Users of laptops and similar devices do not need to complete this form. They should follow the guidance in the relevant generic risk assessment.

Department: Electrical and Electronic Eng	**Assessment date:** 05 / 10 / 2016
Individual: Junming Zhang	**Date of Birth/staff No.:** 01 / 06 / 1994

NB – Section A: texts in bold italics are minimum requirements. Other issues are best practice.

SECTION A – WORKSTATION ASSESSMENT	YES	NO	N/A
Are screen characters appropriate (i.e. clear, of suitable size and stable)?	✓		
Have the monitor brightness/contrast controls been explained?	✓		
Is the screen fully adjustable (i.e. is height adjustable and can swivel/tilt)?	✓		
Is the screen free from reflective glare that may cause discomfort?	✓		
Is the screen size the most suitable for the workstation?	✓		
Is the screen in front of the operator so that twisting is minimised?	✓		
Is the top of the screen at about eye level?	✓		
Is there good colour contrast between screen characters and the background?	✓		
Is the keyboard tiltable and separate from the screen?	✓		
Is there sufficient space in front of the keyboard to rest hands/arms?	✓		
Is the mouse, trackball, etc suitable for the task?	✓		
Is it positioned correctly near to the keyboard?	✓		
Is the desk large enough to allow flexibility in positioning of equipment?	✓		
Is the area under the desk free from obstruction and/or clutter?	✓		
If a document holder is used is it stable and set at the right height?	✓		
Is it possible to arrange the equipment to find a comfortable position?	✓		
Is the work chair stable and does it have five feet?	✓		
Is the chair adjustable in height?	✓		
Is the chair back adjustable in height and tilt?	✓		
Has the individual been shown how to use the controls?	✓		
Where required, is the footrest suitable for the task?	✓		
Can the user change position and move around when seated at the workstation?	✓		
Has excessive contrast between the screen and background been reduced?	✓		
Is the workstation layout positioned correctly to reduce glare problems?	✓		
Are windows fitted with suitable blinds to reduce glare problems?	✓		
Is the general workstation environment suitable for the task?	✓		
Is the software used suitable for the task?	✓		
SECTION B – USER ASSESSMENT			
Is the individual a User i.e. uses the DSE for significant periods on a regular basis?	✓		
Have any bodily aches or pains been experienced when using DSE?		✓	
Does the User have specific problems/impairments that make DSE work difficult? *(NB - this does not refer to a medical diagnosis but rather to a loss of function, or a symptom such as pain, aches, stiffness, or a perception such as "eye strain")*		✓	
Is there control over the speed of DSE work?	✓		
Are other tasks and/or short breaks taken at least every hour?	✓		
Has the individual been informed about DSE risks?	✓		
Has the individual been trained in how to use the software?	✓		
Has the individual been informed about eye/eyesight tests?	✓		
Are problems associated with DSE work reported to the DSC?			✓

Copies to User and Departmental file

SECTION C -ADDITIONAL COMMENTS

Workstation assessment based on PC in EEE 3rd Floor computer laboratory.

RECOMMENDATIONS	Responsible person	Timescale
Recommendations should address any issues identified in Parts A, B or C of this form		

Assessors name (print) MARK BOWDEN Signature M Bond

Date for review 05 / 10 / 2016

Copies to User and Departmental file

Appendix 4. Ethical approval questionnaire

UNIVERSITY OF LIVERPOOL

DEPARTMENT OF ELECTRICAL ENGINEERING AND ELECTRONICS

Ethical Approval Questionnaire 2016-2017

Final Year BEng (ELEC340) and Year 3 MEng (ELEC440)

Student Name: Junming Zhang Module: ELEC340 / ~~ELEC440~~ (delete one)

Supervisor: Mark Bowden Student ID No: 201138928

Project Title: Development of a C++ - based user - interface for plasma simulation tool

Formal ethical approval must be obtained for all research projects *'involving research on human subjects or human tissues or databases of personal information to be carried out by University staff or students on University premises, or at any location, where there is no other acceptable provision for ethical consideration'*. Final year projects (ELEC340) and year 3 MEng projects (ELEC440) involving human participation must be undertaken in a way that safeguards the dignity, rights, health, safety, and privacy of those involved.

It should be noted that this policy covers **all** research methodologies including such activities as informal interviews, accessing personal files in an archive, or on-line data gathering. The requirement to obtain ethical review applies with equal force to projects undertaken by undergraduate students. For these projects, it is the responsibility of the supervisor to ensure that the ethical issues of the research are fully assessed and that formal ethical approval is obtained before the project commences.

Does your project involve any human participants (including situations where you are a participant as well as the investigator)?	~~YES~~	(NO)
Does your project involve any human tissues (including your own)?	~~YES~~	(NO)
Does your project involve any databases of personal information (including your own personal information)?	~~YES~~	(NO)
Does your project involve experiments using animals?	~~YES~~	(NO)

Delete either YES or NO on each line above

If any of the answers given above are YES then you, along with your project supervisor, must investigate the requirement to apply for ethical approval. Details of how to apply for ethical approval can be found at www.liv.ac.uk/intranet/research-support-office/research-ethics/ (for human participation) and at https://www.liv.ac.uk/research-integrity/biomedical-research/ (for use of animals).

Student Signature: Junming Zhang Date: 05/05/2016

Supervisor's Signature: MBowden Date: 5/5/2016