

Computed Tomography (CT) circulation phantom to assess hyperdynamic contrast flow rates

Client: Dr. Giuseppe Toia

Advisor: Professor Chris Brace

Team Members: Sawyer Bussey, Alec Shabowsky, Charlotte Thomas, Shashandra Suresh, Shreya Venkatesh

Name	Email	Role
Sawyer Bussey	bussey2@wisc.edu	Team Leader
Charlotte Thomas	csthomas5@wisc.edu	BSAC
Alec Schabowsky	schabowsky@wisc.edu	Communication
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Shreya Venkatesh	svenkatesh9@wisc.edu	BPAG

Reporting Period: September 4th, 2024 - September 13th, 2024

Problem Statement:

Computed tomography (CT) is an imaging technique that uses rotating X-rays to obtain images of the human body. These images are used by medical specialists to diagnose issues within the body. Since the COVID-19 pandemic, respiratory and heart conditions have been more common, resulting in increased use of treatments such as ECMO (Extracorporeal Membrane Oxygenation). This device assists the heart and lungs by pumping blood outside of the body and oxygenating it before returning it to the bloodstream. CT machines are often calibrated by a CT phantom. These phantoms are meant to replicate normal bodily blood flow. Therefore, in the case of using CT scanners on an individual who is undergoing ECMO treatment, the rate at which the Iodinated Contrast medium should be injected into the bloodstream is unclear due to the variability of blood flow during ECMO. Previous groups have been successful in creating a prototype for simulating blood flow through a 3D-printed artery using a dynamic flow pumping system. However, there is still a necessity for a pulsatile pump to simulate the opposing flow created by the heart during an ECMO treatment.

Brief Status Update: The team is currently investigating the previous projects, as well as conducting research in literature, to gather a comprehensive background to the project. Additionally, we are preparing information and questions for our client meeting Monday, 09/16.

Summary of Weekly Team Member Design Accomplishments:

- Team: Met briefly after initial project selection, collectively doing research to establish a baseline on the project.
- Sawyer Bussey (Team Leader):
 - Researching ECMO and CT scan relationship as well as motivation for project and necessity of project.
 - Created problem statement
 - Researched previous teams' work to figure out what they accomplished and what they determined to be future work to get an idea of what we need to do this semester.
- Charlotte Thomas (BSAC):
 - Reviewed the Fall 2023 and Spring 2024 projects to get familiar with what has been done/what needs to be done
 - Through those notes, found topics that I need to learn more about and have begun doing research on those
 - Began generating ideas and questions to talk about with Dr. Toia at our meeting on Monday (9/16)
 - Brought our beginning work to the BSAC meeting and talked with other BSAC representatives
- Alec Schabowsky (Communicator):
 - Set up client meeting
 - Conducted research into previous projects
 - Helped draft the problem statement
- Shashandra Suresh (BWIG):
 - Uploaded team roles and team picture to project webpage

- Looked at Fall 2023 and Spring 2024 projects to look at the previous renditions of the project to gain a better understanding of how it could be developed further.
- Researched VA-ECMO to gain more knowledge that would be useful while making this project
- Shreya Venkatesh (BPAG):
 - Researched previous 2023 project
 - Generated questions for discussion with Dr.Toia for Monday's meeting
 - Outlined methods to improve on previous designs

Activities:

Date	Name	Task	Time (hours)	Weekly Total	Semester Total
09/11/2024	Team	Met briefly during initial project selection	1	1	1
9/10/2024 9/11/2024	Sawyer	- Communication with team - Researching - Meeting team member/ writing problem statement	0.25 2 2	4.25	
09/11/2024	Alec	- Research - communicated with client	4	4	4
	Shashandra	- Uploaded information to website - Looked at previous projects - Researched VA-ECMO	0.5 0.5 0.5	1.5	1.5
9/11/2024 9/12/2024	Charlotte	-Summarizing the previous two semesters projects to get familiar	3 2	5.5	5.5

		-Began research on topics I don't know much about -Curating questions for Dr. Toia	0.5		
09/11/2024	Shreya	-Research on past projects -Outlined questions for Dr. Toia	1 0.5	1.5	1.5

Weekly/Ongoing Difficulties:

There are no difficulties experienced by the team at this point in time.

Upcoming Team and Individual Goals

- Team: Research design criteria and create PDS. Create a list of questions to ask the client during Monday's meeting
- Sawyer Bussey:
 - Create a list of questions for the client
- Shashandra Suresh:
 - Continue researching on CT scans and other information relating to the project
 - Finalize a list of questions for the client meeting on Monday
- Charlotte Thomas:
 - Continue researching on what I need to learn more about, and what needs to be done next
 - Researching all about CT machines, learning about materials and what is being used today
 - Figure out what we have access to, what we would need to buy/what is provided
- Shreya Venkatesh: Research VA-ECMO machine, understand the basic mechanism of CT scans specifically CT Phantom, importance of pulsatile pump in relation to past projects
- Alec Schabowsky: Review the spring 2024 team's LabArchives and research into the VA-ECMO machine, including the types of pumps used, and the function of the VA-ECMO machine within the heart. Understand the "opposite flow" that occurs.

Project Schedule/Timeline:

Project Goal	Deadline	Team Assigned	Progress	Completed
Product Design Specifications	9/20	All	0%	No

Design Matrix	9/27	All	0%	No
Preliminary Presentations	10/4	All	0%	No
Preliminary Deliverables	10/9	All	0%	No
Show and Tell	11/1	All	0%	No
Poster Presentations	12/6	All	0%	No
Final Deliverables	12/11	All	0%	No

Expenses: No expenses to report.