Project Updates: Master Record

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Contents

Introduction

This master record collates weekly project updates to produce a thorough insight into progress within a single document. Each section consists of a week's update. Within each section are the following subsections and descriptions:

- **Supervision Meetings:**
  Consists of a listing in table format of the supervision meetings that have occurred since the last update, including dates, attendees, and a brief description of discussions and actionable items.
- **Actionable Items Recap:**
  Consists of a listing in table format of the actionable items from the previous week, briefly discussing the progress made and pending tasks.
- **Additional Project Updates:**
  Consists of updates that weren't 'actionable items' from the previous week, such as brief overviews of experiments conducted, data collected, and research findings.
- **Next Week's Agenda:**
  Consists of a listing in table format of the actionable items to complete before the next weekly update, including task descriptions, rough timelines, and success metrics.
- **Comments & Concerns:**
  Consists of a brief analysis of comments or observations about other aspects of the project, such as facilities, work environment, and any outside interest in the project. Furthermore, outlines any concerns about the project.

1 01-12-2023

1.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
-	*No meeting this week.*	-	-

1.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
Exand research and make notes.	• From the few gathered papers, I have read two and have made very in-depth notes/literature reviews in my project journal. • They were bubble detection papers for extracting bubble characteristics to monitor gas seepage from the ocean floor. • The papers used Canny edge detection, which is different to my starting point with Simple Blob Detection. • Using Canny as a starting point, one of the papers described using the Snake-method to extract the exact outlines of the bubbles. • Bubble tracking was outlined in the papers: by using a Kalman filter with the previous two captured frames, then by applying the new detection of bubbles, weighted matchings can take place using the Hungarian algorithm.	• From these papers, it is clear that there is a basic/overall standardised method for detecting bubbles (using Canny). This is a different path compared to what I was originally pursuing with image thresholding and blob detection. • I will try to experiment with the edge detection methodologies that were oulined in the reports I read - this should help me gauge the complexities involved and see the performance physically. • I need to read more literature - there was one that was cited by both the papers I read, and it should go into greater depth of how Canny was employed to detect bubbles. I will be reading this next.
Research histograms	*No progress on this.*	• Since the literature I'm reading focusses on Canny edge detection, there isn't any need for thresholding and blob detection, therefore I can temporarily pause the research on histograms. • Once I get a clear view on how the *standardised* method of bubble detection works, I can then compare it with blob detection, and when I get on to that I will resume the research on an automated thresholding method with histograms.

1.3 Additional Project Updates

Additional Update	Description
Obese Project Journal	• The Project Journal document is starting to get really big (currently just under 20MB) and the project hasn't even properly started yet. • It doesn't seem like a great idea having a singular file that is growing at this rate in a Git repository (GitHub has file size limits which I may quickly reach). • I explored a few tools I could use to help solve this: • LaTeX: I can separate one document into multiple files, which can be imported into a singular file to reder a PDF. But it's not quick enough to be able to jot down progress. • Markdown: Very simple and great for jotting progress quickly. But, features are sparse, you cannot import multiple files into a singular file to render, cannot easily create references/bibliography tables, etc. • Dendron: a Markdown based note-taking app that is a Visual Studio Code extension. Packed with useful features, but a nightmare to work with - not easy to use at all. • I need to figure out a better tool.

1.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Expand research and make notes.	• Read and make notes of currently gathered papers. • Expand literature research by reading related cited work. • Think about how real-time can be achieved.	• Make notes in project journal.	Friday
Experiement with Canny edge detection for bubble detection	• Best starting point is to use the paper that the two papers I read this week cited for the technicalities of how Canny can be employed. • Once I understand the technicalities, I can then experiment with bubble detection using Python, OpenCV, and the bubble test images that I had extracted/produced.	• Log progress in the Project Journal.	Friday

1.5 Comments & Concerns

No comments or concerns at the moment.

2 02-02-2024

2.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
30-01-2024	• Discussed information on the intial report - two main/overall aims have been identified: (a) a reliable backscatter detection program, and (b) real-time compliancy ensuring efficient and reliable processing and operation. • I will be visiting India from the 18th of March to the 5th of April and will return once Easter finishes. This means I will be working remotely from India during term time between the 18th to the 22nd of March.	• I need to research on exactly how the PREEMPT-RT Linux kernel patch works to implement real-time functionality. Especially with what pre-emption means in this context, and whether interpreted programs, such as Python scripts will continue to function, since programs may have to be compiled for real-time compliancy depending on the context of pre-emption. • There is a figure in this paper which shows the Canny edge detection detecting a bubble, the bubble is filled with white on a black background. How was the bubble region calculated and filled with white? A Python script can be written as a benchmark employing the basic methodologies explored in this paper. Try to retrieve some more of the metrics and statistics outlines in the paper to achieve a better understanding.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

Continuation 1/2			
Date	Agenda	Actionable Items	Attendees
30-01-2024	• Discussed real-time aspects, Docker/Jailhouse reserves hardware on time-basis and does not manage the scheduling and priority of tasks so jitter will still be a problem. To reduce jitter, a real-time OS needs to be looked into, however, there aren't many RTOSes with Raspberry Pi support, so a real-time kernel can be explored. • Discussed literature on using basic algorithms such as Canny and the least distance rule to detect and track underwater rising bubbles for environmental analysis. Using basic algorithms and rules such as these will form the best foundation which can act as a benchmark when comparing real-time and hardwre aspects.	• I was planning to reach out to the electronics store to enquire about the ordered components after allowing a week's time if I didn't hear anything from them, however, the components arrived surprisingly fast and I've collected them.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

Continuation 2/2			
Date	Agenda	Actionable Items	Attendees
30-01-2024	• Discussed the steps I took to get the development Raspberry Pi connected to the internet and accessible via SSH from my laptop. The uni network prevents cross-device communication, so I set up W-Fi for internet, and ethernet for SSH comms with my laptop. Easier said than done - this system took an entire evening to get working. • Ordered components on the day of the supervision meeting (new gen Pi, case and PSU for Pi, global shutter camera, HDMI cable, and USB drive to boot OS from). Components arrived on 01-02-2024.	• I need to start laying out an overall plan to how the initial report needs to be structured, I also need to plan out a schedule (with a Gantt chart for example) to create an outline of what needs to be completed and the timeframes. • Paul and Ben are happy with me working remotely from India, as long as my work output is the same quality as me working on-site, however, I do need to let the department know by emailing the Chair of the Board of Studies and my academic supervisor.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

2.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
Expand research and make notes.	• My plan to read the paper that discusses the technical aspects of using Canny to detect bubbles has been read and reviewed. • I think I've collated enough information on bubble detection, however, all the paper's I have read on this are related to the environmental analysis of quantifying bubbles released from sea-floor gas seepages. Gas escaping and rising to the surface of the ocean is very different to the backscatter experienced when recording video from a constantly moving UUV, where debris also forms backscatter alongside bubbles.	• Since I struggled to find papers on detecting and eliminating underwater backscatter, I had to assume that bubbles form most of the backscatter, and if I can build a system that effectively detects bubbles, then I can easily expand it to detect other forms of backscatter. I should develop a benchmarks script that uses the fundamental and basic technologies such as Canny to detect bubbles and the least distance method to track bubbles. This benchmark can help test how effective the bubble detection idea works with detecting other forms of backscatter such as debris.
Compare differences between hypervisors: Jailhouse and Docker.	• I have outlined the differences between the two, use-cases of the two, and their effectiveness in reducing jitter to ensure better real-time complicance in the journal. The main idea was to use one of these tools to reserve hard resources in order to ensure that task latency is as little as possible. • Unfortunately, my research showed that these tools only reserve hardware on a time-basis and cannot isolate hardware completely, furthermore, it cannot manage the scheduling or priority of the tasks, so jitter will be unchanged.	• I need to research more into the PREEMPT-RT patch to understand how it works, its benefits, drawbacks, etc. • I can use the benchmark script (that I need to write) to compare performance differences between the real-time patched kernel and the normal kernel.

Continuation 1/1		
Actionable Item	Progress Report	Pending Tasks
Compare differences between hypervisors: Jailhouse and Docker.	• Best option is to implement an RTOS, however, there aren't many that are well documented and support the family of Raspberry Pi boards that I am using for this project, so the next best thing is to apply a real-time patch to the Linux kernel (PREEMPT-RT).	
Experiment with Canny edge detection for bubble detection	• I have started writing the Python script, taking extra care into the consideration of implementing logic to calculate real-time metrics of the script.	• I need to finish this off.

2.3 Additional Project Updates

Additional Update	Description
No additional updates	-

2.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
More research into PREEMPT-RT and reading into how the bubble region was determined and filled with white from the paper.	• I have collected some literature that should be explored.	• Log details in the project journal.	Monday
Write benchmark script.	• Use basic algorithms such as Canny, least distance method to detect and track bubbles. • Prioritise fast performance over bubble detection/tracking accuracy. • Use underwater GoPro footage provided by Ben.	• Make notes in project journal. • Commit code updates to repository.	Friday
Plan initial report.	• Create an overall plan of report layout.	• Log progress in the Project Journal. • Perhaps create a new document for this report.	Friday
Plan schedule.	• Make an initial draft of the schedule, outlined by a Gantt chart.	• Show Paul and Ben, refine until perfection.	Tuesday
Email CoBoS and academic supervisor reg. India visit.	• Send email.	• If the email has been sent or not.	Monday

2.5 Comments & Concerns

No comments or concerns at the moment.

3 03-11-2023

3.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
31/10/2023	• Pinpointing project scope/objectives. • Laying out rough schedule based on project objectives. • Getting started on pre-reading/literature review. • Discussing organisational tips/workflows. • Schedule for re-occurring meetings.	• Next meeting in person to see existing lighting system. After seeing the existing system, I can decide the avenue I'd like to pursue. • Carry out some rough preliminary research for the 4 potential objectives: improving real-time computing, underwater testing, backscatter depth perception, ML-based backscatter position tracking.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

3.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks

No actionable points from the last weekly update.

3.3 Additional Project Updates

Additional Update	Description
Created project journal	• Created project-journal GitHub repository. • Consisting of Word doc outlining entire project progress.

3.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Preliminary research	• Read about each of the 4 objectives, make notes on the technical aspects that would be required for each in project journal.	• Make notes in project journal, discuss during the next supervision meeting.	Thursday
Next supervision meeting	• Next supervision meeting to take place on Thurs 9th Nov @ 2pm at the ISA (Paul Mitchell to send calendar invite). • As discussed in the last virtual supervision meeting, after seeing the lighting system it'll be easier to decide which avenue I want to research. • Since the next meeting is at the ISA I may get a tour of the facilities. I can learn about the tools I'll have at my disposal for this project.	• Not very easy to generate measurable success metrics for these items. • Decide on one of the 4 objectives. • Make notes on useful facilities for this project at the ISA in project journal.	Friday

3.5 Comments & Concerns

No comments or concerns at the moment.

4 08-12-2023

4.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
07-12-2023	• *Please refer to Project Journal for more details on each agenda item, due to formatting constraints, I couldn't put them in here - sorry.* • Discussed research finding. • Discussed hypervisor aspects. • Discussed real-time aspects. • Ordering components.	• Compare differences between hypervisors: Jailhouse and Docker. • Finish off reading literature on the technicalities of Canny for bubble detection.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

4.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
Expand research and make notes.	• There's one paper that discusses the technical aspects of using Canny to detect bubbles, this will be read next.	• I need to read more literature - there was one that was cited by both the papers I read, and it should go into greater depth of how Canny was employed to detect bubbles. I will be reading this next.
Experiement with Canny edge detection for bubble detection	*No progress on this.*	• Unfortunately, I could not find time to play around with this. • I can try to get started next time, but currently prioritising the modules that are running in this semester.

4.3 Additional Project Updates

Additional Update	Description
Obese Project Journal	• No progress on this yet as I still can't find a solution that will work well. • Will make do with MS Word, maybe will look into implementing LaTeXfor next semester.

4.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Expand research and make notes.	• Read and make notes of currently gathered papers. • Expand literature research by reading related cited work. • Think about how real-time can be achieved.	• Make notes in project journal.	Friday
Compare differences between hypervisors: Jailhouse and Docker.	• I will be using one of them to increase program priority to eliminate Jitter as much as possible.	• Log progress in the Project Journal.	Friday
Experiement with Canny edge detection for bubble detection	• *Not a priority, try to make a start if possible.* • Best starting point is to use the paper that the two papers I read this week cited for the technicalities of how Canny can be employed. • Once I understand the technicalities, I can then experiment with bubble detection using Python, OpenCV, and the bubble test images that I had extracted/produced.	• Log progress in the Project Journal.	Friday

4.5 Comments & Concerns

No comments or concerns at the moment.

5 09-02-2024

5.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
Multiple points across the week with Ben and Paul separately.	• Started to run into a lot of software-related issues: originally installed Ubuntu Server OS for it's lightweight nature (space-wise and processing-wise since it doesn't come with a lot of features built in, which is perfect for reduced power consumption and fast processing time). However, the kernel does not support the Raspberry Pi products of cameras. For that, I'd need Raspberry Pi OS (there is a 'lite' version which is also very lightweight which is what I used), unfortunately, I had to rework a lot of the set-up steps due to various process incompatibilities (mainly networking-related and Pi Camera hardware-related) with RPi OS and Ubuntu OS.	• Once everything is set up, I need to write a script to record bubble footage using the Pi and Pi global shutter camera from the underwater testing facility so that I can fine-tune my benchmarking script.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

Continuation 1/3			
Date	Agenda	Actionable Items	Attendees
	• I researched more into the theory of real-time Linux kernels with PREEMPT-RT, I realised that this kernel patch only implements real-time functionalities in the kernel logic to replace time-bound spinlocks with real-time mutexes. This 'apparently' results in a monumental reduction in general OS latency. Normal userspace tasks such as Python scripts that the user can run are usually non-real-time, however, should be more 'snappy' due to not needing to wait for kernel logic to finish before preemption.	• It is possible to write kernel-based software to harness real-time features, but it is difficult, therefore I will stick with Python and userspace code, I will compare the effects of RT with the non-RT kernel with the benchmark script.	

Continuation 2/3			
Date	Agenda	Actionable Items	Attendees
	• I have completed a basic Python script that uses the Canny edge detection algorithm to detect backscatter from the GoPro underwater footage that Ben provided. OpenCV Contour detection is used for filling the closed loop edges from the Canny output so that I can overlay black holes on a white background to drive the DLP projector to eliminate backscatter. I have added logic to track real-time metrics such as the time it takes to process each frame, etc. The test footage isn't very good since it has a lot of artifacting, this drastically reduces the Canny's performance and increases the frame processing time.	• I need to focus on perfecting Canny before working on the Contour detection logic. For this, I'd need better test footage, which is what I will be making the recording script for. After that I can look into other types of Contour detection algorithms, perhaps research into segmentation algorithms.	

Continuation 3/3			
Date	Agenda	Actionable Items	Attendees
	• I need to start work on the initial report. I have logged a lot of information in my project journal so it shouldn't be too difficult to summarise in a report.	• I will need to create a basic plan on document structure. List out section and summarise the information that will need to go in it. Bring this basic plan to the next supervision meeting and we can refine it further. Will also need to consider the tasks and timelines, can make a simple plan of the overall tasks and we can discuss breaking this down into smaller chunks and giving each an timeline. Paul mentioned to take into account of situations when things don't go to plan by adding sufficient buffers.	

5.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
More research into PREEMPT-RT and reading into how the bubble region was determined and filled with white from the paper.	• All progress complete for this item, and logged into the proejct journal. • The paper doesn't go into much detail on how the bubble region was segmented after applying Canny.	-
Write benchmark script.	• A simple script with bubble detection with Canny and segmentation with contour detection is complete, albeit very inaccurate.	• I will need to record better test footage to work with for fine-tuning the script before I can improve the bubble segmentation logic and implement bubble tracking and position predictions.
Plan initial report & plan schedule.	• No progress on this.	• Due to running to a lot of software and hardware issues, I ended up with this task in backlog. The software and hardwre problems have been mostly resolved, so I can make an effort on this next week.
Email CoBoS and academic supervisor reg. India visit.	• Done	• The department has acknowledged and approved this visit.

5.3 Additional Project Updates

Additional Update	Description
No additional updates	-

5.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Script to record footage from RPi and Pi GS camera.	• Write script, test that it works before deployment.	• Make notes in project journal if needed. • Commit code updates to GitHub repository.	Wednesday
Improve bubble segmentation performance in benchmark script	• With the better testing footage, fine-tune the Canny parameters and research into bubble segmentation.	• Log progress in the Project Journal. • Commit code updates to GitHub repository.	Friday
Plan initial report & schedule	• Summarise report sections and outline roughly what content needs to go in each.	• Log progress in the Project Journal.	Tuesday

5.5 Comments & Concerns

No comments or concerns at the moment.

6 10-11-2023

6.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
09-11-2023	• Discussed real-time software research findings. • Tour of the ISA, desk assignment. • Meetings to happen bi-weekly in person until next semester. Will be in touch with Paul & Ben with any project updates. • Discussion about hypervisors with Ben. Using Docker to package script and assign CPU/hardware, potentially solving OS scheduling issues. • I've shown interest in the 'improving real-time computing' aspects of the project. May have some aspects of underwater testing using facilities. • Rewriting software in C to reduce the overheads introduced by Python. • Paul & Ben mentioned to start simple with the software logic - with simple thresholding - then fine tuning to improve accuracy. • Ben mentioed to read older literature (e.g. 2010-era) on digital image processing - since there wont be any added complexities such as computational intelligence/ML/AI. • Work can be done to research the performance of different algorithms to detect and eliminate backscatter.	• Ben will send me some underwater footage to help me test any code without needing to implement in hardware and physically test. • I will ask Ben to send me the existing Python code so that I can get it set up on my Raspberry Pi. • With some underwater footage, I can modify the existing Python code to stream the video from file instead of from a camera, I can try to experiment with hypervisors (Docker) to see differences in performance. If there is an improvement, I will implement Docker in my final code. • I will try to research digital image processing from *older* literature. • I will try experiment with running C programs on Raspberry Pi.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

6.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
• Next meeting in person to see existing lighting system. After seeing the existing system, I can decide the avenue I'd like to pursue.	• I have shown interest to delve into the 'improving real-time computing' avenue. • I have seen the existing lighting system, and have received a tour of the ISA.	• *No pending tasks.*
• Carry out some rough preliminary research for the 4 potential objectives: improving real-time computing, underwater testing, backscatter depth perception, ML-based backscatter position tracking.	• Initial research into 'improving real-time computing' has been conducted with some reading into real-time software (documented in the Project Journal). • I have not conducted any research on the other 3 objectives since those avenues would probably not be pursued. • Underwater testing aspects may need to be researched, however, not any time soon.	• *No pending tasks.*

6.3 Additional Project Updates

Additional Update	Description
No additional updates.	-

6.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Experiment with hypervisors	• Get existing Python code and some underwater GoPro footage from Ben. • Modify the existing Python code to stream the video from file instead of from a camera. • Package the software with Docker, measure performance differences.	• Modified code should be working and containerised with Docker. • Make notes in project journal, discuss during the next supervision meeting.	Friday
Gather some digital image processing literature	• Since this is quite early on and I have other modules to focus on this semester, I won't be going into too much depth with the literature. • So this actionable item would be to simply gather a list of potential pieces of literature that I could read in depth at a later date. • I should be making some brief notes on the contents.	• Log the brief notes in the Project Journal, citing the sources of the literature.	Friday
Experiment with RPi and C programming	• Make simple scripts in C and run on Raspberry Pi. • Set up a simple-yet-efficient workflow that can speed up development time in preparation for when I start writing the project software.	• Log progress in the Project Journal, maybe even store code in a 'spike' repository on Github.	Friday

6.5 Comments & Concerns

No comments or concerns at the moment.

7 16-02-2024

7.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
13-02-2024	• Showcase of simple bubble detection script and Pi Camera recording script. • Discussed deployment of Pi Cam recording script to gather better test footage using ISA tank. • Discussed rough plan of initial report.	• The Pi Cam recording script should record in raw format without any compression to eliminate artefacting. • Better test footage is required to continue work on the simple bubble detection script. • I mentioned that I will be prioritising the initial report this week due to nearing deadline, working on hardware/software is a time sinkhole.	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

7.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
• Script to record footage from RPi and Pi GS camera.	• Script is complete, Pi Cam interfacing was successful, and I've managed to tune the lens for better focus.	• From the last supervision meeting, I need to change the code to record in raw format.
• Improve bubble segmentation performance in benchmark script.	• No progress has been made on this directly, I still need to record test footage.	• *Still pending.*
• Plan initial report & schedule.	• Rough plan has been summarised in the project journal. • An initial draft has been started.	• *Still pending.*

7.3 Additional Project Updates

Additional Update	Description
No additional updates.	-

7.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Draft of initial report.	• Full focus will be shifted towards the initial report. • I will need to finalise an initial draft for review by Ben and Paul. • Needs to be prioritised due to the nearing deadline.	• Initial draft in initial-report GitHub repository.	Friday

7.5 Comments & Concerns

No comments or concerns at the moment.

8 17-11-2023

8.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
15-11-2023	• Findings on Python performance issues research. • Discussed objectives for detecting backscatter. • Discussed objectives for predicting backscatter motion. • Discussed timing complexities for synchronising find backscatter-project holes-predict next location cycle. • Future work could be to stitch images of the seabed together to produce 'panorama'.	• Research simple blob detection algorithm. • Research object tracking algorithms, starting with linear moving on to more advanced algorithms later.	• Sidharth Shanmugam • Benjamin Henson

8.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
• Experiment with hypervisors	• Underwater GoPro footage with backscatter has been received. • Existing code has been retrieved, had to extract the files from the Pi's SD card. • Will be shifting this task for later so that I can produce software beforehand.	• *No pending tasks.*
• Gather some digital image processing literature	• I have gathered two textbooks for digital image processing. • Didn't get a chance to read through them yet, but will be doing so for next week.	• Log the different algorithms and complexities for each.
• Experiment with RPi and C programming	• I've researched that C programming would be quite difficult for this task. • Instead of C I could use C++. • A lot of the online resources suggested prototyping in Python, then translating to C++ for production.	• Set up C++ workflow to develop and deploy to Raspberry Pi.

8.3 Additional Project Updates

Additional Update	Description
No additional updates.	-

8.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Start researching on blob detection algorithms	• Use the literature for this.	• Make notes in project journal.	Friday
Gather literature for object tracking/predicting movement	• Starting with linear interpolation.	• Make notes in project journal.	Friday
Experiment with blob detection algorithms	• Extract individual frames from the underwater GoPro footage. • Or create own backscatter assets (black/grey background with white dots). • Using Python and OpenCV, experiment with blob detection algorithms.	• Log progress in the Project Journal, maybe even store code in a 'spike' repository on Github.	Friday

8.5 Comments & Concerns

No comments or concerns at the moment.

9 24-11-2023

9.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
24-11-2023	• Overview of the gathered literature for research and review. • Overview of the Python script with OpenCV simple blob detection.	• Expand research and make notes. • Think about real-time aspects along side the research. • Work on automating the fine-tuning of thresholds in the Python script with histograms.	• Sidharth Shanmugam • Benjamin Henson • Paul Mitchell

9.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
• Start researching on blob detection algorithms	• I have listed a few academic papers related to underwater bubble detection, mostly from IEEE. • The two textbooks that I'd checked out of the library don't relate much to the project, I will keep them just in case for supplementary information. • I've struggled to find textbooks that goes into detail on these aspects.	• I plan to read the papers, making notes in the Project Journals on each. • I will read any referenced papers/textbooks that are related to the project.
• Gather literature for object tracking/predicting movement	• I have gathered some papers on underwater object tracking.	• I will be making notes, and expanding my literature collection by exploring the referenced papers. • I am prioritising research on blob detection at the moment.
• Experiment with blob detection algorithms	• I have made some prototype code to help with my blob detection research in Python using OpenCV. • Using various filters, I have been successful in detecting most of the bubbles in the test image inputs. • All progress on this has been logged in the Project Journal.	• Fine tune blob detection parameters and test with non-bubble backscatter. • Maybe even apply some of the algorithms discussed in the research papers.

9.3 Additional Project Updates

Additional Update	Description
No additional updates.	-

9.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Expand research and make notes.	• Read and make notes of currently gathered papers. • Expand literature research by reading related cited work. • Think about how real-time can be achieved.	• Make notes in project journal.	Friday
Research histograms	• Research methods to automate the fine-tuning of the currently hard-coded values for the thresholding.	• Log progress in the Project Journal.	Friday

9.5 Comments & Concerns

No comments or concerns at the moment.

10 27-10-2023

10.1 Supervision Meetings

Date	Agenda	Actionable Items	Attendees
31/10/2023 (upcoming)	• Pinpointing project scope/objectives. • Laying out rough schedule based on project objectives. • Getting started on pre-reading/literature review. • Discussing organisational tips/workflows. • Schedule for re-occurring meetings. • (more to be added if I can think of anything else important)	• N/A	• Sidharth Shanmugam • Paul Mitchell • Benjamin Henson

10.2 Actionable Items Recap

Actionable Item	Progress Report	Pending Tasks
• Actionable item 1	• Progress report 1 • Progress report 2 • Progress report 3	• Pending task 1 • Pending task 2 • Pending task 3
• Actionable item 2	• Progress report 1 • Progress report 2 • Progress report 3	• Pending task 1 • Pending task 2 • Pending task 3

Since this is the first weekly report and supervision meetings haven't previously taken place, there are no actionable items to reflect on. Therefore, a boilerplate table is provided above to outline the structure for future weeks.

10.3 Additional Project Updates

Additional Update	Description
Created weekly updates automation	• Created weekly-updates GitHub repository. • Branch contains templates which I update each week. • Jenkins CI/CD to pull the templates, compile LaTeX to generate PDFs. • PDFs then downloaded and emailed accordingly.

Since this is the first weekly report and work on this project hasn't commenced yet, there are no additional updates to reflect on.

10.4 Next Week's Agenda

Actionable Item	Description	Success Metrics	Target
Actionable item 1	• Description point 1 • Description point 2 • Description point 3	• Success metrics 1 • Success metrics 2 • Success metrics 3	Thursday
Actionable item 2	• Description point 1 • Description point 2 • Description point 3	• Success metrics 1 • Success metrics 2 • Success metrics 3	Wednesday

The future week's agenda will be discussed in the upcoming supervision meeting. Above is a boilerplate table to outline the structure for future weeks.

10.5 Comments & Concerns

No comments or concerns at the moment.