PREPROJECT - REPORT

BACHELOR THESIS

NTNU

Department of ICT and Natural Sciences

TITLE:
Integration of Aquaculture inspection platform

CANDIDATES(NAMES):			
Lars Even Sætre, Sigurd Olav Liavåg, Ole Morken			
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PRINCIPALS/SUPERVISORS:
Ottar L. Osen, Houxiang Zhang

SUMMARY:

Postadresse
Høgskolen i Ålesund
N-6025 Ålesund
Norway

Besøksadresse
Larsgårdsvegen 2
Internett
www.hials.no

Telefon
70 16 12 00
Epostadresse
postmottak@hials.no

Telefax
70 16 13 00

Bankkonto
7694 05 00636
Foretaksregisteret
NO 971 572 140

This task is an exam report done by students at NTNU Ålesund

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1 INTRODUCTION

In maritime industry, inspection and maintenance is an important task to keep equipment in good condition in order to reduce downtime in the production and prevent losses due to construction damage.

Underwater inspection is a demanding process due to rough conditions at sea. Traditionally the industry used divers to inspect equipment underwater, but this is both dangerous for the divers and it is ineffective. Divers can't work for a long period of time and need rest before they can work again.

The use of ROV technology to do inspection and maintenance is widely used today, but the size of the ROV and the equipment needed to operate it is expensive. Traditionally the ROV is launched and operated from a large offshore vessel. Because of this the use of ROVs are mostly limited to the offshore industry.

This project aims to make a system that can bring advanced ROV technology that personnel can use without much training. By making an easy to use automatic ROV system which can move and operate in rough conditions.

The ROV will be carried by a platform which will navigate around in the work area by using GPS, and laser sensors (lidar). The platform can deploy the ROV using a winch when it reaches the correct working position.

The platform and ROV will be remotely controlled by an operator on a work station that will display live camera feed and sensor data.

2 NOTION

DP – Dynamic Positioning
ROV – Remotely Operated Vehicle

3 PROJECT ORGANIZATION

3.1 Project members

Studentnummer(e)
Ole Grytdal Morken
Lars Even Sætre
Sigurd Olav Liavåg

3.1.1 Project tasks – organization

Members

Lars Even Sætre – Project leader
Ole Grytdal Morken - Secretary
Sigurd Olav Liavåg – Group member

Platform

- Check condition - Test Software/Hardware
- Electrical Wiring
- Buoyancy
- Stabilization
- DP - Dynamic Positioning
- Autonomous System
- Lider, Scanse Sweep
- Camera
- Integrate with control system

ROV

- Check condition - Test Software/Hardware
- Integrate with control system

WINCH

- Check condition - Test Software/Hardware
- DockingHead
- Integrate with control system
- Fix broken parts, 3D-Print?

Common Control Unit

- Design Common Control Unit
- Integrate with all three systems (Platform, ROV, Winch)

3.1.2 Project leader responsibilities

Keep the project plan up to date with progress on the ongoing tasks.

3.1.3 Secretary responsibilities

Write weekly reports on the progress of ongoing task and the progress.
Write a short report from each meeting with supervisors.

3.1.4 Other group members responsibilities

All group members will regularly update the progress of their task and assist the secretary on the weekly reports.

3.2 Supervisors (veileder og kontaktperson oppdragsgiver)

- Ottar L. Osen
- Houxiang Zhang

4 AGREEMENT

4.1 Agreement with supervisors

In the first meeting with the supervisors we agreed on some terms for the project.

- We will write a weekly report of what we have done in the week, and what we will do the following week. Also, we will show how we are progressing according to the project plan.
- If we have problems and needed help, we will contact the supervisors and set up a meeting.
- Every second week on Thursdays at 10 am, we will have a meeting with the supervisors, were we discuss progress and planning of the project. The meeting is set to last 30 minutes.
- If we need to buy any equipment or parts, we will contact the supervisors and get founds, within a reasonable limit.

4.2 Workplace and resources

During the beginning of the project the platform is located at "plastlab".

We have access to plastlab Mondays- Fridays between 08:00-16:00. The plan is to move the platform to "tunglab" later in the project, this is because we have more access to tools there and we have access to the room for longer periods of the day. Tunglab is also closer to the water tank, which we are using for testing.

We have also been granted access to L167 project room Tuesdays – Fridays the whole project period. This room will we use for project planning, and computer work. This room is equipped with monitors, mouse and keyboard.

4.3 Group Norms – Agreement on cooperation – Attitudes

To reach the goal of the bachelor we have agreed upon some rules. The workdays will be from 08:00 to 16:00. Location is NTNU Aalesund. If a group member cannot meet, he must notify the remaining group members accordingly, and update the members on the status of the work he's been working on.

There will be set of at least one hour in the end of the week to write weekly report.

All group members will treat each other with respect and listen to each member opinions on project maters.

All group members shall have insight in each other's work. This way it is easier for the rest of the group to help if a member is stuck in its work.

We should follow the progress plan, if we can see that we are not able to finish what we set out to do, we need to come together and select which parts of the project we should make a priority.

All members in the group are dependent of each other.

5 PROJECT DESCRIPTION|

5.1 Problem - goal – purpose

This project is based on and a continuation of a bachelor thesis done in 2017 called "Sea farm platform" done by graduates at NTNU Ålesund. Their project contained a platform which could maneuver around using GPS, and remote control from a tablet.

Since then, the platform has been upgraded with a winch which was built in mechatronics course in 2017, and a ROV which was built in mechatronics course in 2016. These components are driven by separate control systems, and they are not integrated to the control system of the platform.

The goal of this project is to integrate all the component into one system, that can be monitored and controlled from a remote location. And improve the current systems with more functionality.

The purpose of this project is to make a cheap and easy to use autonomous platform that can be used in the industry for underwater inspections.

5.2 Solution requirements or project results – specification

The finished results of this project will be a complete system integration of the previous systems. This includes the sea platform, the winch and the ROV. The system will have a common control unit with options to view the different video

streams, remote manual control of winch, ROV and platform, autonomous mode and DP for the platform.

A new GUI will be implemented for video stream, to show sensor data and to switch between different operational modes for the platform, ROV and winch.

Make the electronics on the platform sea worthy by waterproofing some of the connection boxes. Also fix some of the cable wiring to make it look more presentable.

For the autonomous mode to work properly for the platform a 360-degree laser sensor will be fitted, and a collision avoidance system will be implemented to the system.

For the dynamic positioning (DP) mode a GPS signal that provides its real time position will be used so the platform can hold its position while the ROV is in operation.

When the ROV is not in operation mode it will be secured in a docking head mounted on the platform. The already implemented solution will be upgraded to handle the weight of the ROV and withstand corrosion from seawater.

5.3 Scheduled progress for development - method(s)

5.4 Information gathering

Since this project is a continuation of earlier projects, we have gathered reports and documentations from the Platform, ROV, and the Winch.

- Bachelor sea farm project. 02.06.2017
- Simple winch for seafarm. 23.11.2017
- Aquafarm inspection – ROV. 30.11.16
- A Novel Low Cost ROV for Aquaculture Application. *OTTAR L. OSEN*

We have also acquired the source code from these projects.

5.5 Risk analysis

There is allot that can go wrong when doing a group project, we are confident that all the group members will work hard to finish the project in time. But working hard will not help if we are not efficient or prioritizing the right tasks.

Another issue we must make sure that we are aware of is the time it takes for parts to arrive after we order them, if we are missing a crucial part it could halt the progress of the project, therefore it is important to order parts that we know we need as early as possible.

Everyone gets sick, sickness is very hard to predict. If a member is away for days due to sickness, it will have huge impact on the weekly goal of the project since we are only three students. If a member is sick, he must ask himself if he is able to work from home or do different work that he may be able to do even if he is sick.

Research before starting the work. We must do research to make sure that the plan we set is even possible. If we use weeks to make software for a controller, it could be complete waste if it shows that the hardware is not able to run the software, or support the other components in the system.

5.6 Main activities

- Beskrivelser av planlagte hovedaktiviteter og viktigste delaktiviteter for gjennomføring av prosjektet.

Nr	Hovedaktivitet	Ansvar	Kostnad	Tid/omfang
A1	Platform	Ole		1 uke
A2	ROV	Sigurd		1 uke
A3	Winch	Sigurd		1 uke
A4	Common Control Unit	Lars		1 uke

5.7 Progress management

5.7.1 Master plan

Report

- Weeklys update from all group members.

Platform

- **Test the software for the platform**
  Check the software

  Start date: 10.01.2019
  Estimated date of completion: 25.01.2019

- **Check hardware functionality and fix problems**
  Check hardware (Thrusters, IMU, Pumps)

  Start date: 10.01.2019
  Estimated date of completion: 25.01.2019

- **Replace batteries?**

  Replace batteries with new.

  Start date:
  Estimated date of completion:

  Make electrical wiring more water-resistant
  Replace wiring.

  Start date:25.01.2019
  Estimated date of completion: 06.03.2019

- **Design new Control system**
- The new control system will be using PLC and Raspberry pi 3B+.
- Start date: 28.01.2019
  Estimated date of completion: 06.03.2019

- **Bouyancy**

  Start date: 07.03.2019
  Estimated date of completion: 07.03.2019

- **Stabilisation**

  Start date: 08.03.2019
  Estimated date of completion: 15.03.2019

- **Continue development of the DP system**

  Start date: 18.03.2019
  Estimated date of completion: 05.04.2019

- **Autonomonus System**

  Start date: 05.04.2019
  Estimated date of completion: 26.04.2019

- **Implement laser sensor (Lidar) for collision avoidance in autonomous mode**

  Start date: 05.04.2019
  Estimated date of completion: 26.04.2019

- **Install a better camera solution.**

  Start date: 29.04.2019
  Estimated date of completion: 03.05.2019

- **Integrate with common control system**

  Start date: 29.04.2019
  Estimated date of completion: 06.05.2019

- **Testing/Tuning**

  Start date: 29.04.2019
  Estimated date of completion: 10.05.2019

ROV

- **Test existing software.**

  Start date: 10.01.2019
  Estimated date of completion: 25.01.2019

- **Replace old Raspberry pi with new one (Raspeberry pi 3B+)**

  Start date: 28.01.2019
  Estimated date of completion: 31.01.2019

- **Make changes to the software so it can be implemented in to the main system.**

  Start date: 01.02.2019
  Estimated date of completion: 05.02.2019

Winch

- **Check condition - Test Software/HardwareStart date:**
  Start date: 03.01.2019
  Estimated date of completion: 17.01.2019

- **Fix DockingHead, 3D-Print**

  Start date: 17.01.2019
  Estimated date of completion: 04.02.2019

- **Fix broken parts on winch, 3D-Print**

  Start date: 17.01.2019
  Estimated date of completion: 04.02.2019

- **Integrate with common control system**

  Start date: 15.04.2019
  Estimated date of completion: 18.04.2019

Common Control Unit

- **Design a common controller for all systems**
  Design a good solution that is portable and easy to use. Portable.

  Start date: 04.02.2019
  Estimated date of completion: 15.02.2019

- **GUI with video feed from ROV and Platform, and display relevant sensor data**

  Start date: 04.02.2019
  Estimated date of completion: 15.02.2019

- **Manual control for winch, ROV and platform**

  Start date: 04.02.2019
  Estimated date of completion: 15.02.2019

5.7.2 Project management tools

To keep an overview and a plan schedule, we will use a Gantt chart. This will show the dependency relationships between activities and current schedule status.

5.7.3 Development tool

- Netbeans IDE to develop java software.
- Arduino IDE to develop Arduino code.
- 3D drawing software.
- E!cockpit
- Python
-

5.7.4 Internal control – evaluation

Progress will be updates continuously, this will be done by all group members.

A progress is completed when the given task fulfils its requirement.

5.8 Decision-making process

Decisions will be made by all group members.

6 DOCUMENTATION

6.1 Reports and technical documents

Weekly report updates on how the progress of the week went.

7 PLANNED MEETINGSR AND REPORTS

7.1 Meetings

7.1.1 Meeting with supervisor

Meetings with supervisors are scheduled to every Thursday morning. There the progress report will be presented. And also, if there are some issues that has to be solved will be presented.

7.1.2 Project meetings

Project meeting every Monday morning and Friday afternoon. On Monday morning short recap on last week progress, and the goal for the week. On Friday afternoon it will be a meeting about how the week went.

7.2 Periodic reports

7.2.1 Progress reports (incl. milestones)

A short progress report will be written every week, this report will be shared with supervisors. Every two weeks when the group have a meeting with the supervisors the report will be more detailed.

8 TREATMENT OF NONCONFORMANCE

Each group member is responsible for their own tasks, if a group member has issues completing the task in due time he will ask for assistance from the group.

The group can decide to do changes to the overall plan while still maintaining the goal of the project.

9 EQUIPMENT REQUIREMENTS / CONDITIONS FOR IMPLEMENTATION

Testing the platform in water:

- Access to the water tank at NTNU
- Transport to sea trial
- Crane for moving the platform during sea trial
- Boat for accessing and monitoring the platform during sea trial.