



SubNet

[G41_1]

[Management Track]
Project Plan Report

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REVISION HISTORY AND APPROVAL RECORD

Revision	Date	Purpose
0	dd/mm/yyyy	Document creation
1	dd/mm/yyyy	Document revision

DOCUMENT DISTRIBUTION LIST

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1. PROJECT DESCRIPTION

In response to the escalating demand for efficient underwater infrastructure, the SubNet project introduces a cutting-edge Remotely Operated Underwater Vehicle (ROUV). Adapted from a laboratory-built prototype, our team envisions an innovative ROUV designed to autonomously explore and analyze underwater environments, specifically focusing on optimizing the placement of submarine cables.

The key features of the SubNet ROUV include the integration of four essential sensors: temperature, turbidity, conductivity, and pressure. These sensors collectively provide comprehensive data, offering insights into the thermal characteristics, water quality, salinity, and depth of the underwater environment. The incorporation of autonomous navigation capabilities allows the ROUV to follow pre-established routes independently, eliminating the need for continuous remote control and enhancing the efficiency of data collection and analysis.

The primary objective of the SubNet project is to develop a sophisticated ROUV that delivers precise and comprehensive data on underwater conditions. By strategically incorporating multiple sensors and enabling autonomous navigation, the project aims to facilitate the optimization of submarine cable placement. This optimization process is crucial for enhancing the efficiency, reliability, and longevity of underwater communication infrastructure.

Beyond its immediate application in optimizing submarine cable placement, the SubNet ROUV holds potential for broader environmental monitoring and scientific research in aquatic ecosystems. Its adaptability and versatility make it a valuable tool for various industries, including marine biology, oceanography, and environmental science.

In conclusion, the SubNet project represents a significant stride towards advancing the capabilities of underwater vehicles for practical applications. Through sensor integration and autonomous navigation, our adapted ROUV promises to revolutionize the analysis of aquatic conditions, ultimately contributing to the optimal deployment of submarine cables and the broader understanding of underwater ecosystems. As we continue to refine and test our prototype, the SubNet project remains at the forefront of innovation in the field of underwater technology.

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2. CONTEXT SCREENING: MISSION & VISION

Mission:

Our mission at SubNet is to pioneer advancements in underwater technology, specifically through the development of cutting-edge Remotely Operated Underwater Vehicles (ROUVs). We are committed to designing and deploying innovative solutions that enhance our understanding of aquatic environments and optimize the deployment of underwater infrastructure, with a primary focus on submarine cable placement. Through rigorous research, engineering, and collaboration, our mission is to provide industries with a reliable and efficient tool for underwater exploration, data collection, and analysis. By pushing the boundaries of ROUV capabilities, we aim to contribute to the sustainable development of underwater ecosystems and empower various sectors with valuable insights into aquatic conditions.

Vision:

SubNet envisions a future where underwater exploration is seamlessly integrated into industries ranging from telecommunications to environmental science. Our vision is to be at the forefront of technological innovation, setting new standards for ROUV capabilities and applications.

We aspire to see our advanced ROUV technology play a pivotal role in optimizing the placement of submarine cables, thereby improving the efficiency, reliability, and longevity of underwater communication infrastructure. Beyond this, our vision extends to leveraging our adaptable ROUVs for broader environmental monitoring, scientific research, and exploration, fostering a deeper understanding of the world beneath the water's surface.

In pursuit of our vision, SubNet is dedicated to continuous improvement, research, and collaboration, driving innovation in underwater technology and contributing to a more sustainable and interconnected future.

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3. CONTEXT SCREENING: VALUES

Core values play a pivotal role in defining successful teamwork. To accomplish our collective goals, it is imperative to establish and embrace values consistently when working collaboratively. Our team is guided by the following values:

1. Innovation:

At SubNet, we embrace innovation as a cornerstone value, driving us to continually push the boundaries of technological advancement in underwater exploration. We foster a culture that encourages creativity, curiosity, and the pursuit of groundbreaking solutions. By staying at the forefront of technological trends and constantly evolving our Remotely Operated Underwater Vehicles (ROUVs), we seek to redefine industry standards and pioneer new possibilities for underwater technology.

2. Social Contribution:

Social contribution is ingrained in the fabric of SubNet's identity. We recognize the broader impact of our work beyond industry applications and are committed to leveraging our technology for the greater good. Through projects and initiatives, we aim to contribute to environmental conservation, marine research, and educational outreach programs. By aligning our goals with societal well-being, SubNet strives to be a positive force in the global community, fostering a sense of responsibility and purpose.

3. Resilience:

Resilience is a guiding principle at SubNet, defining our approach to challenges and setbacks. In the dynamic field of underwater technology, we understand the importance of adaptability and perseverance. Our commitment to resilience means embracing uncertainties as opportunities for growth, learning from experiences, and iterating on our designs and strategies. This value ensures that we remain steadfast in our pursuit of excellence, even in the face of adversity, ultimately strengthening the durability and reliability of our ROUVs.

4. Client Commitment:

At SubNet, our success is intricately linked to the satisfaction and success of our clients. Client commitment is a value that underscores our dedication to understanding and exceeding client expectations. We prioritize open communication, responsiveness, and a client-centric approach in all our interactions. By consistently delivering high-quality ROUVs and associated services, we aim to build enduring partnerships, instilling confidence in our clients and ensuring the mutual success of both SubNet and those we serve.

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4. CONTEXT SCREENING: SWOT ANALYSIS

INTERNAL	EXTERNAL
STRENGTHS	OPPORTUNITIES
<p>Innovative ROUV: The project introduces a cutting-edge Remotely Operated Underwater Vehicle (ROUV) that can autonomously explore and analyze underwater environments, using four essential sensors: temperature, turbidity, conductivity, and pressure. These sensors provide comprehensive data on the thermal characteristics, water quality, salinity, and depth of the aquatic conditions.</p>	<p>Growing demand for underwater infrastructure: The project can capitalize on the growing demand for efficient and reliable underwater infrastructure, especially in the fields of communication, energy, and security. The project can offer a unique and innovative solution for optimizing the placement of submarine cables, which are essential for transmitting data and information across the globe.</p>
<p>Optimization of submarine cable placement: The project aims to facilitate the optimization of submarine cable placement, which is crucial for enhancing the efficiency, reliability, and longevity of underwater communication infrastructure. The project uses the data collected by the ROUV to determine the best locations and routes for laying submarine cables, avoiding obstacles and hazards that could damage or disrupt the cables.</p>	<p>Advancement of underwater technology: The project can benefit from the advancement of underwater technology, which can provide new tools, methods, and techniques for improving the design and performance of the ROUV. The project can also collaborate with other researchers, experts, and organizations in the field of underwater technology, who can provide valuable feedback, guidance, and support for the project. The project can also leverage the latest trends and innovations in underwater technology, such as artificial intelligence, machine learning, to enhance the capabilities and functionalities of the ROUV.</p>

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Potential for broader applications: The project holds potential for broader environmental monitoring and scientific research in aquatic ecosystems. The ROUV can be adapted and used for various industries, such as marine biology, oceanography, and environmental science. The project can contribute to the better understanding and conservation of underwater ecosystems, as well as the discovery of new resources and opportunities.

INTERNAL	EXTERNAL
WEAKNESSES	THREATS
<p>Lack of experience: The project is based on a laboratory-built prototype that has not been tested extensively in real-world conditions. The project team may lack the experience and expertise to deal with the challenges and risks that may arise in the development and deployment of the ROUV. The project may face technical difficulties, operational failures, or unforeseen complications that could affect the quality and accuracy of the data and the optimization process.</p>	<p>Competition from other projects: The project may face competition from other projects or organizations that are working on similar or alternative solutions for optimizing the placement of submarine cables or analyzing underwater environments. The project may lose its competitive edge or market share if other projects offer more advanced, efficient, or cost-effective solutions. The project may also have to deal with the intellectual property rights, patents, or legal issues that may arise from the competition.</p>
<p>High costs: The project requires a significant amount of resources and funding to develop, test, and deploy the ROUV. The project may face</p>	<p>Environmental and ethical issues: The project may encounter environmental and ethical issues that could affect its reputation and acceptance. The</p>

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financial constraints or budget cuts that could hamper its progress and performance. The project may also have difficulty finding investors or partners who are willing to support and fund the project, especially if the project does not demonstrate clear and tangible benefits or returns on investment.

project may have to comply with the environmental regulations and standards that govern the use and impact of underwater technology on the aquatic ecosystems. The project may also have to address the ethical concerns and questions that may arise from the use and impact of underwater technology on aquatic life, such as the potential harm, disturbance, or exploitation of the marine animals and plants.

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5. CONTEXT SCREENING: MARKETING

PROJECT

SubNet project will provide an outstanding tool to all the clients interested in the study and research of subaquatic spots for underwater placement qualification, specifically, in the field of communications, energy such as electricity and security among others.

Besides the principal target of our project, it can also be used to explore and analyse the quality of water, freshness or saltwater indifferently. With all the data collected by the ROUV sensoring ie temperature, pressure, turbidity ... our customers will be able to address water quality in an unprecedented way.

TARGET MARKET

In the market of autonomous remote-operated-underwater-vehicle you can not find a ROUV with the same specs as the one we have designed. Our submarine is one of the most polyvalent you can find in the market, as it has been equipped with the most advanced and reliable sensors to outperform anything out there.

In terms of competitive benchmarking we are just the sole one provider who can offer our customers the smallest yet autonomous and multitasking ROUV, at the same time they can benefit from an unrivalled quality-price ratio.

Our company's mission is committed to sustainability and therefore we have designed a reusable ROUV. When the submarine reaches the end of its operational life, the client can trade in/return back the submarine under our BE_GREEN program designed to give a second life to the electronic components, such as the different sensors or the basic electronic components.

DISTRIBUTION

All the potential clients will be able to order the submarine directly from our own website. We will offer a face2face demonstration of the outstanding performance of our small underwater vehicle. We will also have a few demo units that can be shipped to the interested and qualified customers to check the working effectiveness of our product.

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The product can be sourced worldwide with no additional cost for international shipping. We will try, if it's possible, to choose the less expensive and pollutant way to send the product.

We will use the most renowned logistics companies such as Correos, UPS or FedEx and others.

FINAL COSTS

The final price of the product is 1.500,00 €. With our three year plan we will have a profit at the end of the third year of 375.289,40 €. If we divide this profit in the number of units sold, this brings us a profit per unit of 318,04 €.

Compared to the market, we offer an affordable product with a high quality-price ratio. This factor would position us very well in the market.

MARKETING

Our target customers include underwater installation companies and service providers. Secondary objectives are research and development entities as well as for educational purposes.

Bearing this in mind the marketing strategy will build up around branding awareness, participation in target industry exhibitions and conferences, webinars and product demonstrations.

Our website will offer permanently updated ROUV collaterals as well as customer testimonials. Industry case studies shall be developed jointly with our customers. As mentioned, we will also offer face 2 face demonstrations and free trials to qualified potential customers. Marcom budget will kept to bare minimum due to the nature of our business and target markets.

In case the company requesting a functional demo is located outside of Europe, we will offer a real-time online demo as a very valid way of showcasing the outstanding performance and unique selling points of our products.

Our marketing team is made up of 3 people, one being the marketing manager who will lead the team and bring good visibility to the company.

The Marketing manager will have a gross wage of 3.500€/month meanwhile the other team members will have a gross wage of 2.000€/month.

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6. PROJECT ANALYSIS: SCOPE

PROJECT PURPOSE

The main purpose of the project is to build up a ROUV able to measure temperature, pressure, turbidity... We will also implement an autonomous control of the submarine.

With all of these features we think we will be able to make a really great impact to the industry of underwater infrastructure and to the environment, specifically in underwater life.

PROJECT OBJECTIVES

The main objective of this project is to design, develop and deploy a Remote-Operated-Underwater-Vehicle (ROUV) equipped with some different sensors for collecting data related to water quality that can be used for other purposes besides the water quality study. The ROUV will be remotely controlled and capable of performing underwater inspections to ensure the integrity of submerged structures and monitor the quality of the surrounding water.

HIGH-LEVEL REQUIREMENTS

- Underwater Mobility: The ROUV should be capable of controlled movement in multiple directions to navigate through underwater environments. We'll be able to do this with three switches or with an arduino program (using the drivers).
- Sensor suite: The sensors have to be well integrated to the ROUV. These will send real-time data that we will have to process and plot.
- Communication System: Robust communication system to facilitate real-time data transmission between the ROUV and the PC (in our case) in underwater conditions.
- Power Supply: We need to make sure that the ROUV will have sufficient power to work. We have to ensure that the electronics parts of the submarine are well connected to avoid serious problems.

HIGH-LEVEL PROJECT DESCRIPTION

Project Deliverables:

To complete this project we have to complete and deliver certain documentation that will help us to get our goal. Some of these are the following:

- Work Packages and the implementation of each one of these.
- Weekly updated Gantt Diagram (to control the timing of each phase of the project).
- Test of the initial part of the submarine (Part A), we will check the correct functioning of the submarine outside from the water.
- Write a formal Part B proposal (adapt all the features to our business idea).
- Decide the best components that will match our project for sourcing..

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- Complete the initial version of our ROUV with all the new features and then check the correct functioning of the entire submarine.
- Write the Final Report.
- Test the finished ROUV in the water.

Project Assumptions:

The project will be carried out by a team made up of 5 students. The whole task will be divided into work packages according to the skills of each team member. This work will be completed during the three hours of class that we have each week.

Project constraints:

Along the project we will find some constraints that will risk the nominal performance during the construction of the ROUV.

- Limited time to complete each phase of the project.
- The team has just 6 weeks to complete the initial part of the project.
- The connection between the controller and the submarine is not wireless so we have a physical limitation because the cable is just 10 m long and the range of the submarine will be limited.
- We have a limited budget because we are paying for all the Part B features.

Project restrictions:

- We just have 18 hours to complete the Part A (the grade will reduce by one point every after the deadline) and 21 hours for the Part B (we will have less hours for the Part B if we start later this part).
- If we don't deliver or we deliver late the documents, there will be a grade penalty.
- We have to take into account that the components of part B may be delivered late.
- We have to consider that maybe there are some lags due to the lack of expertise and knowledge.

Acceptance criteria:

Part A:

- Create the structure of the ROUV with PVC.
- Establish all the electrical connections to have remote control on the ROUV engines with the switches.
- Add a pressure sensor to the submarine to get the real-time data of the depth.

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- Send the information gotten by the pressure sensor through a link cable using the serial port.
- Plot and save all the data acquired by the Arduino. We will process and plot all the depth measures with Matlab.

Part B:

- Add the temperature sensor to the ROUV and update the Arduino script to get data with the sensor.
- Implement the drivers to have autonomous piloting. We will update the Arduino script to control the ROUV with the computer.
- Add the Turbidity and TDS sensors to the submarine and update the Arduino script to be able to collect data with them.
- Program a script to plot all the data sent through the link cable to the computer.
- Finally we will put together the sensors and the arduino to the payload boxes and we will assemble all the components to have the final version of the submarine. Once we have it, we will test the ROUV in water.

HIGH-LEVEL RISKS

- Water leaks that can cause critical and unfixable damage to our submarine (mostly in the electrical area).
- An incorrect functioning of the arduino program can cause a non-functioning of the sensors and the autonomous mode of the motors.
- Mishandling of electronic components that can cause them to malfunction or even to break.

SUMMARY MILESTONE SCHEDULE

Milestone Part A:

- Structure of the ROUV completed.
- Assemble of the motors to the ROUV's structure and installation of the switches to the board.
- Add the pressure sensor and verify the good working condition with different measures. Verify the good functioning of the Arduino script.
- Test the Matlab script programmed to plot the data collected by the Arduino through the pressure sensor.
- Check the pressure measures at the same time of using the engines.

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Milestone Part B:

- Upgrading the electronic circuit to make possible the installation of other sensors.
- Add the temperature sensor and update the Arduino script to enable the data acquisition.
- Implement the drivers for the motors to get the autonomous driving mode. We will also need to modify the arduino script to add the new instructions.
- Modify and add some new instructions to the Matlab code to plot all the real-time data sent by the arduino through the link cable.
- Assemble all the parts and components and put it all together inside the hermetic boxes to avoid water leaks that could damage the electronic components.
- Water test to check if the submarine works well inside the water.

SUMMARY BUDGET

To see in more detail, consult the specific section in this document, called PROJECT ANALYSIS: COSTS.

To start the company we have designed a three year business plan that contemplates losses of the first year. After this three year plan, we would be generating enough profits to keep the company growing. As part of our growth plan, we will be able to reinvest some of the profits into R&D in order to expand the ROUV portfolio and to add new features.

STAKEHOLDER LIST

PROJECT APPROVAL REQUIREMENTS

- It has to meet the specifications of the product we are selling.
- All the components of the submarine have to work well together, from the electronics part to the structure.

PROJECT MANAGER AND RESPONSIBILITY

- The project manager has to take responsibility for distribution and organization of the different tasks.
- Asses that the work is done correctly and leads the team to accomplish the objectives of the product.
- Take the necessary steps to complete the project in the right timings.

SPONSORS

UPC is our main project's sponsor financing the first part of this project. We could also contact some research groups of this university to ask the right way to accomplish our main objective.

We can also contact private companies that face similar objectives to ours.

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7. PROJECT ANALYSIS: STAKEHOLDERS / COMMUNICATION PLAN

Identifying and categorizing stakeholders for a Remotely Operated Underwater Vehicle (ROUV) project is crucial for effective project management. Here's a list of specific stakeholders that we have considered:

1. Project Team:

- Project Manager
- Engineers (Software, Mechanical, Electrical)
- Designers
- Quality Assurance Professionals
- Procurement Team

2. End Users:

- Submarine Operators
- Maintenance Technicians
- Training Personnel

3. Internal Departments:

- Research and Development
- Marketing and Sales
- Legal and Compliance
- Finance and Accounting

4. Management:

- Executives and Board Members
- Senior Leadership Team

5. Customers/Clients:

- Organizations or individuals purchasing or utilizing the ROUV

6. Regulatory Authorities:

- Government agencies responsible for regulating underwater vehicles

7. Suppliers:

- Companies providing components or raw materials for the ROUV

8. Investors/Shareholders:

- Individuals or organizations financially invested in the project

9. Local Communities:

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- Communities near the manufacturing or testing sites

10. Environmental Groups:

- Organizations concerned with the environmental impact of underwater technology

11. Competitors:

- Other companies developing similar ROUV technologies

12. Media:

- Journalists and outlets covering technology, marine exploration, or related fields

13. Training and Education Institutions:

- Schools or organizations involved in training individuals to operate or maintain ROUVs

14. Insurance Providers:

- Companies providing insurance coverage for the project

15. Emergency Services:

- Search and rescue teams or other emergency response units that may use the ROUV in certain situations

16. Technology Partners:

- Companies providing complementary technologies or systems

17. Testing and Certification Bodies:

- Organizations responsible for certifying the safety and compliance of the ROUV

18. User Interface/User Experience (UI/UX) Designers:

- Professionals responsible for designing the interface used by operators

19. Intellectual Property Lawyers:

- Legal professionals ensuring that the project complies with intellectual property laws

20. Maintenance and Support Teams:

- Personnel responsible for ongoing maintenance and customer support

21. Waste Disposal Services:

- Companies handling the disposal of waste generated during the manufacturing process

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Here we will take into consideration the top 8 stakeholders registered previously.

Stakeholders	Requirement	Cause	Frequency	Channel	Responsible
Project Team	Tasks	Development	Weekly	Google chat	Project leader
End Users	Updates	Informed Personnel	Monthly	E-mail	Personnel manager
Internal Dept.	Progress and updated Roadmap	Avoid mix-ups/ mistakes	Bi-weekly	Microsoft Teams	Department representatives
Management	Progress and updated Roadmap	Inform their management strategies	Bi-weekly	Presentations	Department representatives
Clients	Features	Market our product	Monthly	Marketing strategies	Marketing Dept.
Authorities	Permissions	Allow for testing / development	When necessary	Their specified channels	Administrative Dept.
Suppliers	Specs	Avoid mix-ups/ mistakes	When necessary	E-mail	Project Team
Investors	Financials / Bottom Line	Inform on ROI and our position in the market	Quarterly	Investor relations	Investor Relations Dept.

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Stakeholders	Unaware	Resistant	Neutral	Supportive	Leading
Project Team					C
End Users			C	D	
Internal Dept.				C	D
Management					C
Clients			C	D	
Authorities			C	D	
Suppliers			C	D	
Investors				C	D

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8. PROJECT ANALYSIS: RISKS / RESPONSES AND/OR CONTINGENCY PLANS

Our company has undertaken through measures to proactively reduce any potential risks that may arise in the future. Despite these efforts, it is important to acknowledge that there are certain factors that remain, necessitating thoughtful consideration.

1- Water leak inside the system box: Unintentional water penetration into the system box, housing sensors and Arduino, may lead to damage to electronic components. To mitigate these effects, we will implement robust waterproofing measures and incorporate redundant protective layers to minimize the risk of water ingress. Regular maintenance checks should also be conducted to ensure continuous water resistance.

2-Sensors malfunction and performance degradation:

Malfunctions or a decline in sensor performance can impede the precision and dependability of data collection in our ROUV, potentially compromising the project's objectives.

Underwater environments inherently present challenges for sensor operation due to factors such as pressure, temperature variations, and corrosion.

Given the high priority of accurate data collection for the success of the project, the response strategy involves:

- Choosing sensors that have demonstrated robustness and reliability in underwater environments.
- Conducting thorough testing of sensors under diverse conditions, both simulated and in real-world underwater scenarios.

3-Communication Failure with Arduino:

Communication breakdown between sensors and Arduino, attributed to signal interference or software bugs, poses a significant risk. In this scenario, the priority is deemed high, given its direct impact on the control and data acquisition system. The response strategy to mitigate this risk involves employing robust communication protocols and conducting comprehensive testing to minimize the occurrence of communication failures.

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4- Cost Overruns: exceed the allocated budget. These overruns can arise from various factors, including unexpected development challenges, fluctuating material costs, or underestimation of project scope. To effectively manage cost overruns, a comprehensive budget plan should be implemented, regular expense monitoring should be conducted, and contingency funds should be readily available to address unforeseen expenditures.

5-Environmental Regulations:

The government's imposition of new environmental laws poses a potential challenge for our product. In response, our contingency plan involves mobilizing the engineering team to ensure all existing ROUVs comply with the new regulations. This proactive approach ensures that our clients are well-supported and assisted in meeting the requirements of the updated legislation.

6-Market competition:

Market competition poses a risk, with rival products or companies potentially affecting the success of our ROUV project. To mitigate these effects, we will:

Develop a high-quality product with a distinctive identity that sets us apart from others.

Continuously assess and enhance the capabilities and features of the ROUV to stay ahead of the competition.

Implement improved marketing campaigns to highlight the strengths of the product.

7-Limited Market Demand:

Insufficient market demand for ROUVs with the specified sensor payload is attributed to a lack of interest from potential buyers and changing market needs. To address this, we will conduct thorough market research to identify and validate market demand before making any investments. Additionally, we will explore the use of enhanced publicity techniques and revise the marketing strategy that has not met the expected goals.

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Risk prioritisation matrix

	IMPACT				
PROBABILITY	insignificant	Minor	Moderate	Big	Catastrophic
Certain					
Probable				Market competition	
Possible		Cost overruns			Water leak inside the system box
Rare			Limited Market Demand	Environmental Regulations	
Exceptional			sensors malfunction	communication failure with Arduino	

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9. PROJECT ANALYSIS: COSTS

MATERIALS LIST (REUSABLE ITEMS)

Material List	Price per unit (€)	Number of units	Total price (€)
3 motors set	69	1	69
Clamps	0,8	3	2,4
Screws	0,2	3	0,6
Washers	0,1	6	0,6
Power Supply wires	0,5	1	0,5
Link cable	9,4	1	9,4
Floater	0,8	2	1,6
Sealing gland	1,5	3	4,5
Rubber O-ring	0,3	3	0,9
DB9 Serial	0,94	2	1,88
DB9 screws & nuts	0,2	2	0,4
Fuse clip	1,02	1	1,02
Fuse	0,3	1	0,3
Payload box fixing	3,06	4	12,24
Box fixing screws	0,1	4	0,4
Electrical connector	0,7	1	0,7

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PCB jumper	0,97	1	0,97
Pressure sensor	10,98	1	10,98
Differential amplifier	2,87	1	2,87
RS232 transceiver	1,06	1	1,06
Arduino UNO	17	1	17
TOTAL			139,63

MATERIALS LIST (RECYCLABLE ITEMS)

Material List	Price per unit (€)	Number of units	Total price (€)
PVC pipe (1m)	1,65	2	3,3
PVC elbow	0,4	10	4
PVC tee	0,6	4	2,4
Floater support (50 cm)	0,1	1	0,1
Plastic net (40x30 cm)	0,3	1	0,3
Command box	5,8	1	5,8
Switches	2,3	3	6,9
Payload box	14,78	1	14,78
Silicon pipe (10 cm)	0,3	1	0,3
Pipe terminal	0,02	1	0,02

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PCB prototype board	5,78	1	5,78
PCB connector	0,5	1	0,5
Arduino prototype PCB	3	1	3
8 pins IC socket	0,3	1	0,3
16 pins IC socket	0,31	1	0,31
Capacitors	0,15	5	0,75
PCB socket strip	3,14	2	6,28
Short PCB pins strip	0,2	1	0,2
Long PCB pins strip	0,68	1	0,68
Diode	0,04	1	0,04
Plastic strip	0,02	15	0,3
Rigid connection wires	0,2	10	2
Flexible connection wires	0,15	1	0,15
TOTAL			58,19

Both Material List combined:

Material List (Reusable Items)	139,63
Material List (Recyclable Items)	58,19

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Additional engineering enhancements

Materials List (REUSABLE ITEMS):	€/unit	#	€	Materials List (RECYCLABLE ITEMS):	€/unit	#	€
- Turbidity sensor	19,77	1	19,77				
-TDS sensor	16,98	1	16,98				
-Drivers L298N	13,98	1	13,98				
TOTAL		50,73					

The final cost of the parts that we've used to build up the ROUV is 248,55€ (139,63 € + 58,19 € + 50,73 €).

BUSINESS PLAN

We have designed a 3y business plan, as detailed below.

1st YEAR	2nd YEAR	3rd YEAR	TOTAL
250 units	380 units	550 units	1180
Net Revenues	Net Revenues	Net Revenues	
375.000,00 €	570.000,00 €	825.000,00 €	1.770.000,00 €
COSTS	COSTS	COSTS	

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Material Costs	Material Costs	Material Costs	
62.137,50 €	94.449,00 €	136.702,50 €	293289,00 €
Personnel Costs	Personnel Costs	Personnel Costs	
258.000,00 €	258.000,00 €	282.000,00 €	798000,00 €
Production Costs	Production Costs	Production Costs	
9.300,00 €	14.136,00 €	20.460,00 €	43.896,00 €
Marketing Costs	Marketing Costs	Marketing Costs	
13.000,00 €	17.000,00 €	24.000,00 €	54.000,00 €
Logistics/Distribution	Logistics/Distribution	Logistics/Distribution	
7.500,00 €	11.400,00 €	16.500,00 €	35.400,00 €
Workplace/Warehousin g	Workplace/Warehousin g	Workplace/Warehousin g	
8.400,00 €	8.400,00 €	8.400,00 €	25.200,00 €
Financial Costs	Financial Costs	Financial Costs	
4.500,00 €	5.300,00 €	7.200,00 €	17.000,00 €
Office Supplies	Office Supplies	Office Supplies	
2.200,00 €	2.200,00 €	3.700,00 €	8.100,00 €
Cost of Sales	Cost of Sales	Cost of Sales	
24.000,00	27.400,00 €	32.300,00 €	83.700,00 €
Inflation	Inflation (4%)	Inflation (3,5%)	
0,00 €	17.531,40 €	18.594.20 €	36.125,60 €

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TOTAL COSTS	TOTAL COSTS	TOTAL COSTS	
389.037,50	455.816,40 €	549.856,70 €	1.394.710,60 €
GROSS PROFIT	GROSS PROFIT	GROSS PROFIT	
(14.037,50 €)	114.183,60 €	275.143,30 €	375.289,40 €

After the first year, as you can see, we wouldn't lose money and then we would start generating net profit.

Once we have passed the first three years we would have earned 375.289,40 € so we could reinvest a part of the profit to improve our designs, add more features, more staff and upgrade the quality of the materials used throughout the manufacturing process.

All these improvements would bring to our company more interested customers and these would increase our benefits throughout the years.

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10. CONCLUSIONS

This project has taught us the vital skills of meticulous task planning and meeting deadlines, proving to be both challenging and indispensable in effective project management. The practical necessity of planning and executing tasks within defined timeframes has become apparent through our collective experience.

The paramount importance of effective communication within our team has been a key takeaway. Clear and open communication has emerged as the linchpin of our collaborative efforts, facilitating smooth progress and resolving challenges efficiently.

Additionally, our collective experience of working in a team has fostered an appreciation for the diverse strengths each team member brings. Leveraging these strengths has been instrumental in achieving our shared goals. These lessons in planning, communication, and teamwork are invaluable collective takeaways that will inform our approach to future endeavors.

In conclusion, the project has been an enriching experience that has deepened our understanding of project management fundamentals. The collaboration within the team, coupled with the application of course concepts, has been instrumental in navigating the complexities of ROUV development. The lessons learned will undoubtedly shape our approach to future projects, emphasizing the importance of effective communication, adaptability, and continuous risk management.