Drilling for Oil and Gas With Precision Using Artificial Intelligence and Machine Learning Algorithms – Oil Company Y

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Table of Contents

Revision History

10/4/2020	Draft #1: Original proposal
10/11/2020	Rev #1: Included Project organization and preliminary WBS and RACI
10/18/20	Rev #2: Added to the technical approach taking recommendations from project partners. Cost Estimate/Financial Plan
10/24/20	Risk Assessment, Mindmap, Investing stakeholders
11/1/20	Gantt Chart, PERT Chart in MS Project.
11/8/20	SWOT Analysis
11/15/20	Critical Success Factors, Assumptions
11/22/20	Monitoring and Control
11/29/20	Final: Sequence and Activity Diagram, Resource allocation, Summary

1. Purpose & Objective

The client, Oil Company Y, is looking to increase oil production and reduce the damage caused to machinery during exploration for oil and gas. This will help the company boost profits and lower costs by improving safety, minimizing risk, and cutting expenditure on repair of expensive machines while improving time-efficiency. The method found suitable to implement these aspects is to install Artificial Intelligence (AI) and Machine Learning (ML) software into the drilling equipment with the required specifications and using historical data and simulations to train the AI/ML software through a rewards-based system and reinforcement learning. The geosteerer/user/operator will input a reward or penalty function, depending on the AI/ML's choice, to help the machinery adapt to changing subsurface conditions. The specifications are that the AI/ML needs to take into account data from, pressure, temperature, and seismic surveys from the drill-bit.

2. Scope

Our team will create an AI/ML software that will take into account data from, pressure, temperature, and seismic surveys from the drill-bit on the oil drilling equipment through a rewards-based system and reinforcement learning. To train the AI/ML to perform the required analysis of the ground we will use the extensive historical data provided by Oil Company Y and then a in the deployment stage, our engineer will go on-site to setup and install the AI/ML software on-site, into the existing equipment replacing the present primitive software that the geosteerers use at the moment. After installation, the field engineer will test the AI/ML and work with the geosteerers to get them trained to operate and measure the success of the software.

3. Investing Stakeholder(s)

Oil Company Y, the short-term benefit is that the exploration operations will be safer, as the exploration sites are already high-risk areas, and save on machine repairs which are very costly (starting from approx. $100,000 per machine) and cause exploration to cease and production to slow-down and decrease. The long-term benefit is that there will be more production and added profit with more efficiency.

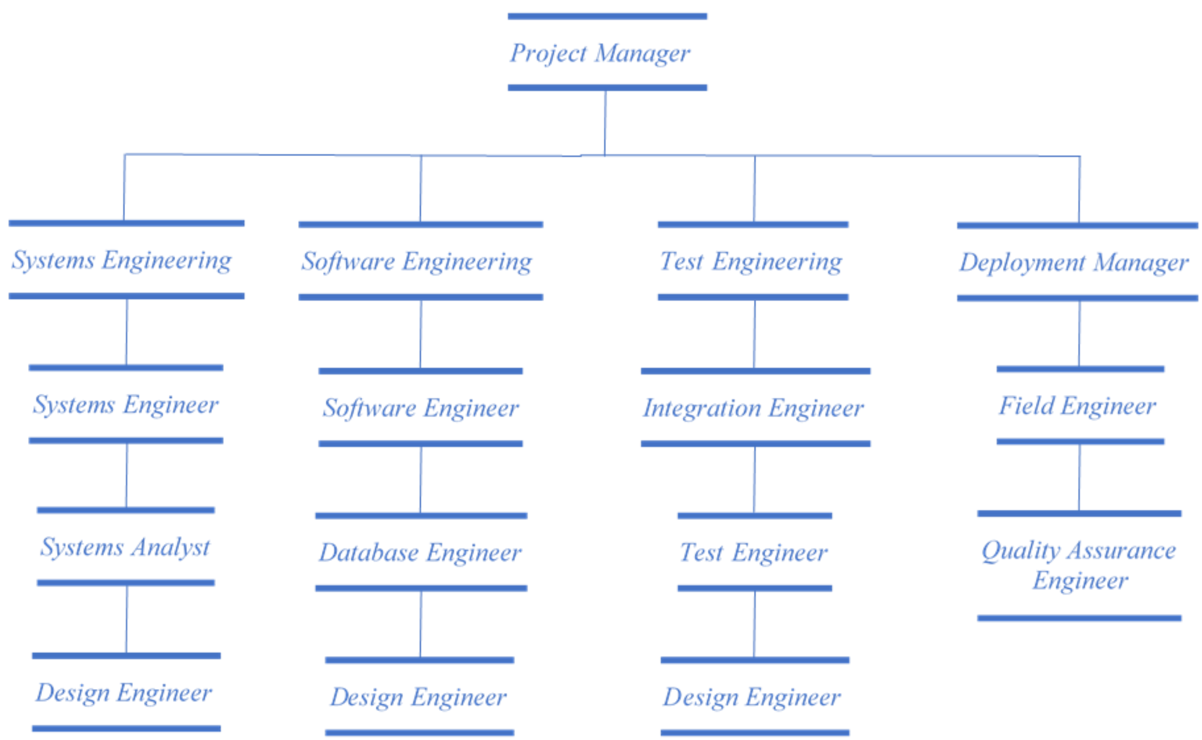
4. Critical Success Factors

Clear project mission, which will add value and has practical implications.
Participation of and support from, top executives.
Project plan and schedule.
Staying committed to the project.
Consultation and communication with the client.
Internal Communication.
Experienced Personnel
The specifications and objectives for the project are clear to everyone involved.
Geosteerers are taken into consideration in terms of end user experience and implementation of user testing.
Monitoring and Feedback
Troubleshooting
Client Acceptance

5. Assumptions

The project will follow waterfall methodology.
The scope is well-defined and covered completely.
The data provided byOil Company Y is reliable and complete.
The oil drilling machines are in good condition.
The vendors and subcontractors will make deliveries on time.
Enough resources are available for the project.
The project will use the existing test environment.
The team will code the project in Python.
The solution to the project will be located in an offsite cloud server.
The financing for the project is sufficient.

6. Project Organization



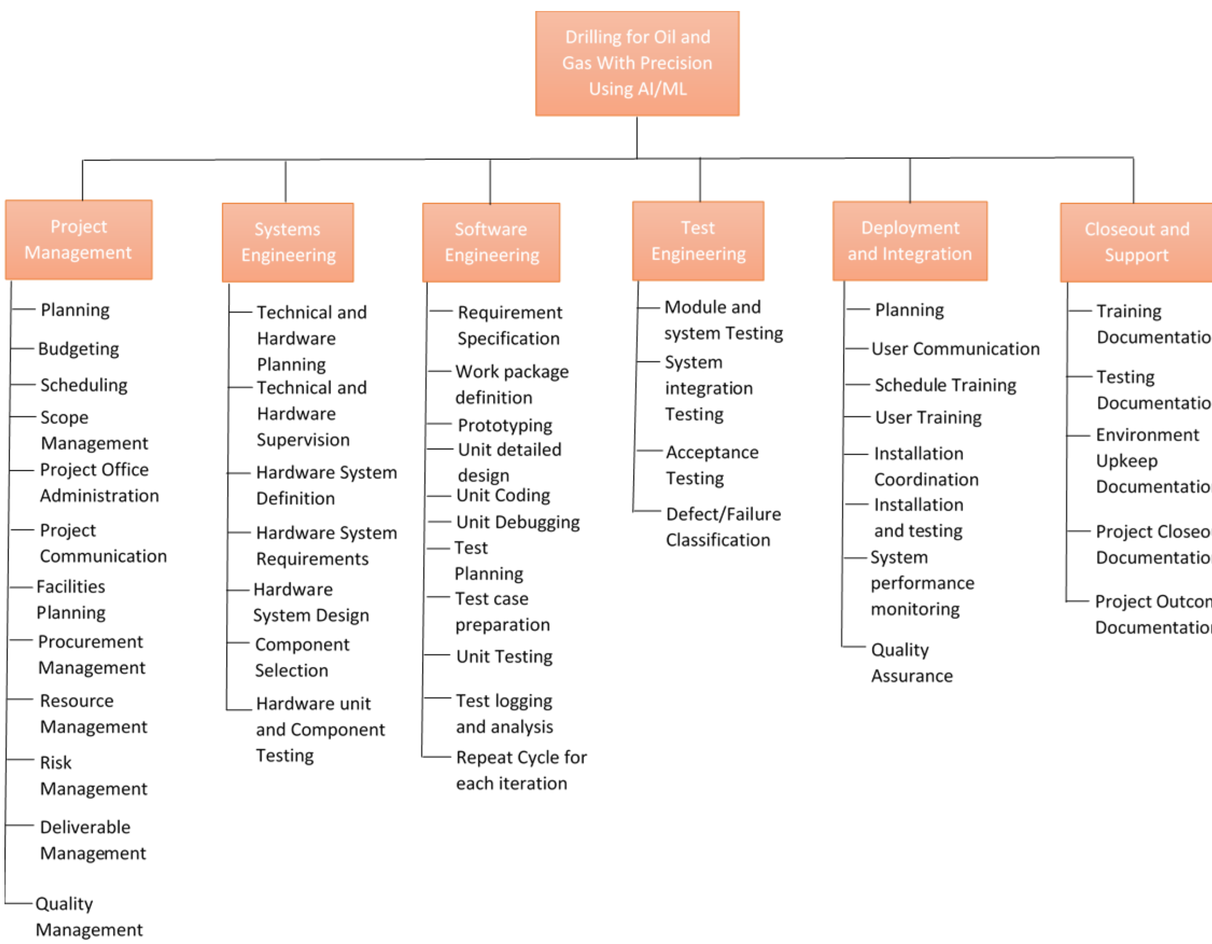
7. Implementation Plan

a. Technical Approach

The first step would be initiation which entails analysis of the objective, including meetings with the client. At this stage we will clearly define our strategic business goals and expected results from the project to select and prioritize the different stakeholder expectations, predict the key resources and steps needed, and define success metrics. Second, comes planning, for the hardware, to collect data in real-time, we will use the drilling sensor which provides measurement-while-drilling (MWD) and logging-while-drilling (LWD) features, made by Sperry Drilling Services. And for the software we will use Google Cloud Platform to program and test the AI/ML. The next thing is to scope and select the applicable use cases that the AI/ML model will be built to address. Selecting the AI/ML use cases and being able to calculate the return on investment is crucial for the success of the project. Once the relevant use cases have been determined and scoped, the next step of the project lifecycle is the design and development phase which will be an iterative process including all the steps for building the AI/ML model comprising of: research, data collection, analysis, cleaning, engineering features, testing and running sets of models to predict patterns and get data insights. The fourth stage is integration/ deployment where the field engineer will do on-site testing and train the geosteerers to use the product. The final stage will be the completion or closeout of the project.

b. WBS and RACI

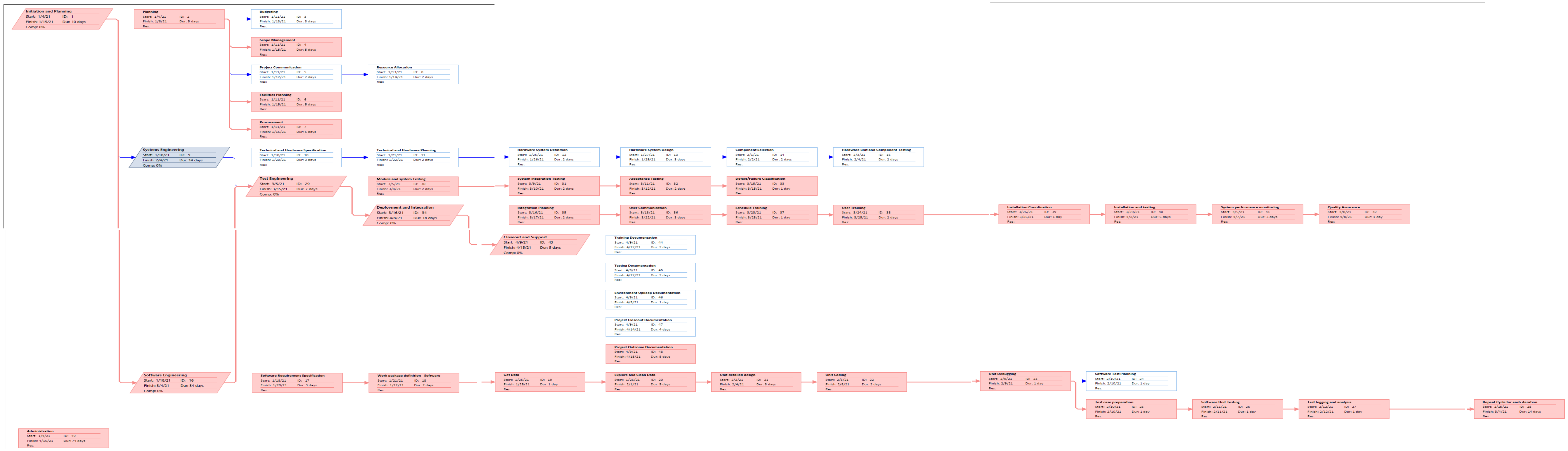
Project Work Breakdown Structure



Responsibility Assignment (RACI) Matrix

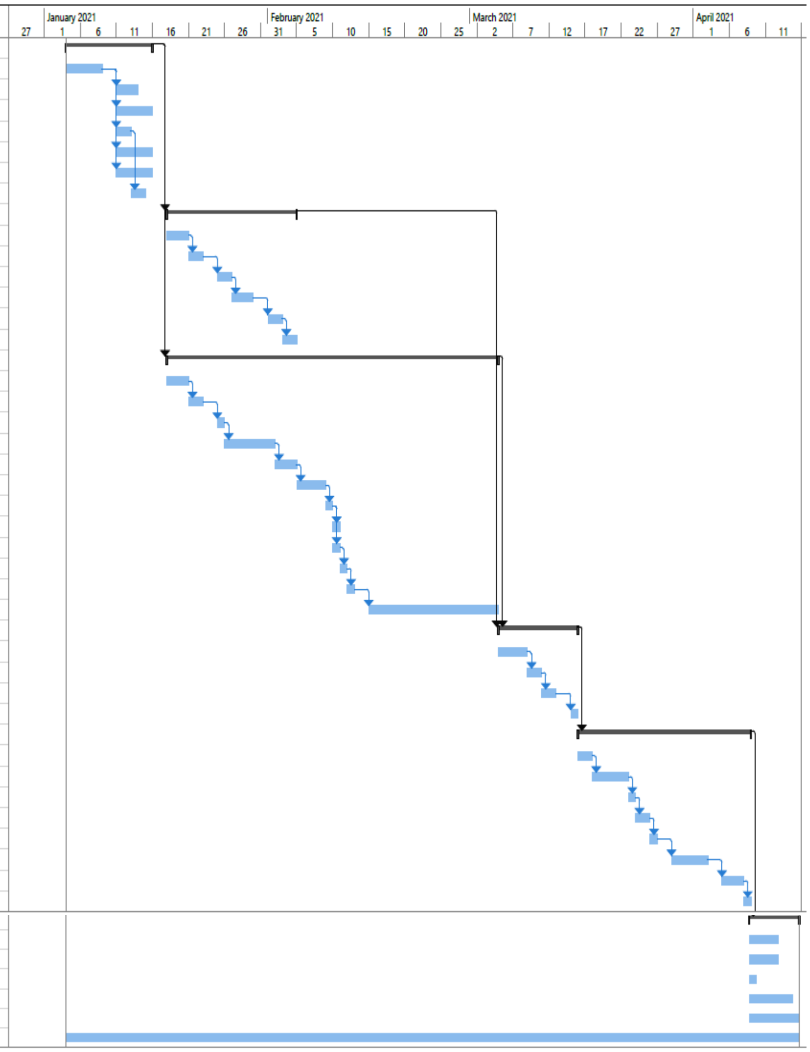
ROLES	Project Manager	Systems Engineer	Systems Analyst	System Design Engineer	Software Engineer	Database Engineer	Software Design Engineer	Integration Engineer	Test Engineer	Test Design Engineer	Field Engineer	Quality Assurance Engineer	PMO	Administrator				
ACTIVITIES	Project Management	Systems Engineering			Software Engineering			Test Engineering			Deployment		External					
Planning	R/A	C	C	C	C	C	C	C	C	C	C	C	I	I		**Legend**		
Budgeting	R/A	C	C	C	C	C	C	C	C	C	C	C	I	I		R	=	Responsible
Scope Management	R/A												C/I	I		A	=	Consult
Project Office Administration	A													R		C	=	Inform
Project Communication	R/A												I			I	=	Accountable
Facilities Planning	R/A												I					
Procurement Management	R/A	C	C	C	C	C	C	C	C	C	C	C						
Resource Management	R/A	C	C	C	C	C	C	C	C	C	C	C	I	C				
Risk Management	R/A												C/I					
Deliverable Management	R/A	C	C	C	C	C	C	C	C	C	C	C	I					
Quality Management	R/A											R/C						
Technical and Hardware Planning	A		R															
Technical and Hardware Supervision	A	R	R	R														
Hardware System Definition	A		R															
Hardware System Design	A			R														
Component Selection	A	R																
Hardware unit and Component Testing	A	R																
Software Requirement Specification	A				R	R	R											
Work package definition - Software	A				R													
Unit detailed design	A						R											
Unit Coding	A				R													
Unit Debugging	A				R													
Software Test Planning	A				R	R												
Test case preparation	A					R												
Software Unit Testing	A				R													
Test logging and analysis	A					R												
Repeat Cycle for each iteration	A				R	R	R											
Module and system Testing	A							R	R	R								
System integration Testing	A							R	R	R								
Acceptance Testing	A							R	R	R								
Defect/Failure Classification	A								R									
Integration Planning	A							R										
User Communication	R/A							C	C	C			I					
Schedule Training	R/A																	
User Training	A									C	R		I					
Installation Coordination	A							R										
Installation and testing	A							R	R		R							
System performance monitoring	A							R			R	R						
Quality Assurance	A											R						
Training Documentation	A													R				
Testing Documentation	A													R				
Environment Upkeep Documentation	A													R				
Project Closeout Documentation	A												I	R				
Project Outcome Documentation	A												I	R				

c. PERT Chart



d. Gantt Chart

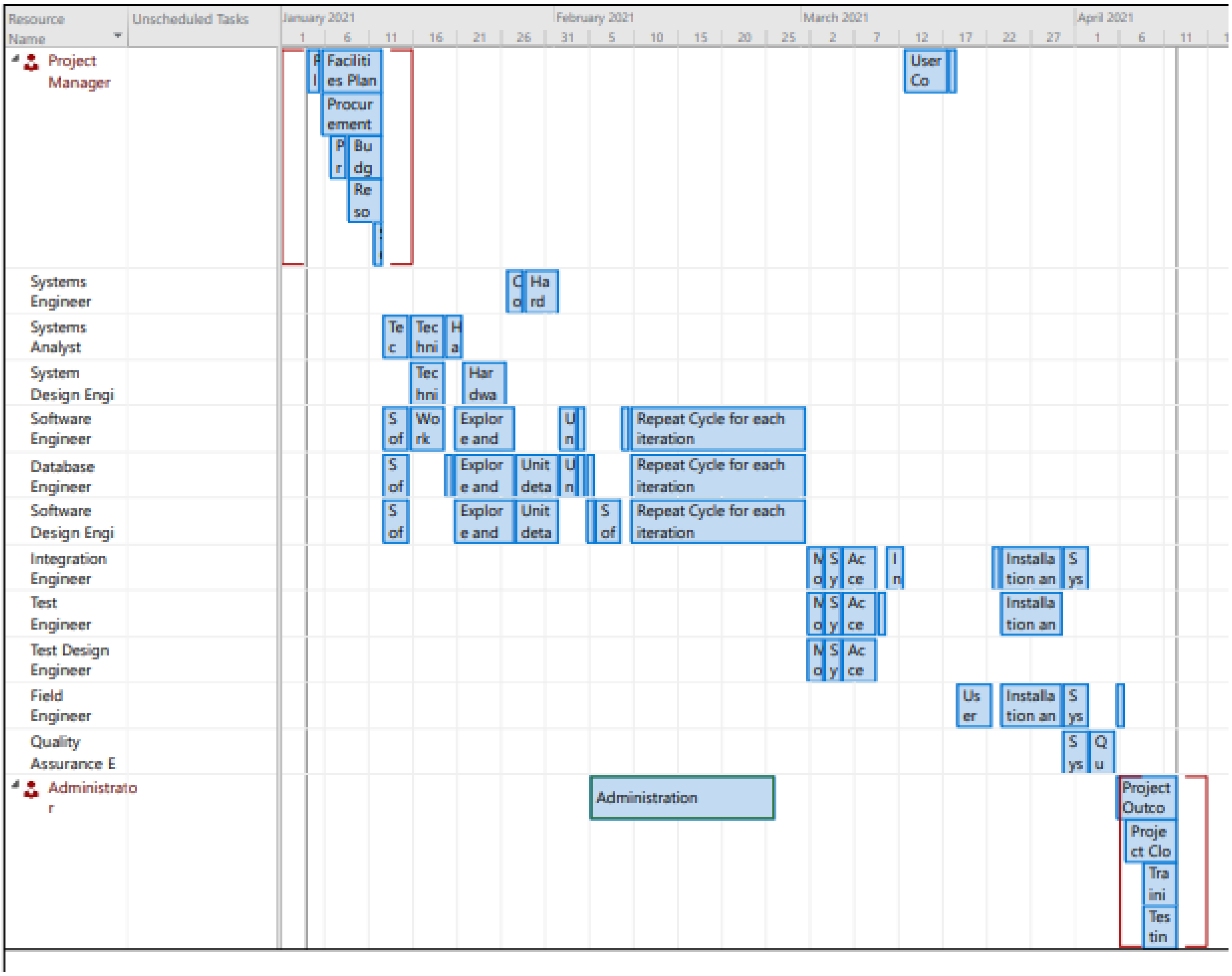
ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Initiation and Planning**	**10 days**	**1/4**	**1/15**	
2		Planning	5 days	1/4	1/8	
3		Budgeting	3 days	1/11	1/13	2
4		Scope Management	5 days	1/11	1/15	2
5		Project Communication	2 days	1/11	1/12	2
6		Facilities Planning	5 days	1/11	1/15	2
7		Procurement	5 days	1/11	1/15	2
8		Resource Allocation	2 days	1/13	1/14	5
9		**Systems Engineering**	**14 days**	**1/18**	**2/4**	**1**
10		Technical and Hardware Specificatio	3 days	1/18	1/20	
11		Technical and Hardware Planning	2 days	1/21	1/22	10
12		Hardware System Definition	2 days	1/25	1/26	11
13		Hardware System Design	3 days	1/27	1/29	12
14		Component Selection	2 days	2/1	2/2	13
15		Hardware unit and Component Testir	2 days	2/3	2/4	14
16		**Software Engineering**	**34 days**	**1/18**	**3/4**	**1**
17		Software Requirement Specification	3 days	1/18	1/20	
18		Work package definition - Software	2 days	1/21	1/22	17
19		Get Data	1 day	1/25	1/25	18
20		Explore and Clean Data	5 days	1/26	2/1	19
21		Unit detailed design	3 days	2/2	2/4	20
22		Unit Coding	2 days	2/5	2/8	21
23		Unit Debugging	1 day	2/9	2/9	22
24		Software Test Planning	1 day	2/10	2/10	23
25		Test case preparation	1 day	2/10	2/10	23
26		Software Unit Testing	1 day	2/11	2/11	25
27		Test logging and analysis	1 day	2/12	2/12	26
28		Repeat Cycle for each iteration	14 days	2/15	3/4	27
29		**Test Engineering**	**7 days**	**3/5**	**3/15**	**9,16**
30		Module and system Testing	2 days	3/5	3/8	
31		System integration Testing	2 days	3/9	3/10	30
32		Acceptance Testing	2 days	3/11	3/12	31
33		Defect/Failure Classification	1 day	3/15	3/15	32
34		**Deployment and Integration**	**18 days**	**3/16**	**4/8**	**29**
35		Integration Planning	2 days	3/16	3/17	
36		User Communication	3 days	3/18	3/22	35
37		Schedule Training	1 day	3/23	3/23	36
38		User Training	2 days	3/24	3/25	37
39		Installation Coordination	1 day	3/26	3/26	38
40		Installation and testing	5 days	3/29	4/2	39
41		System performance monitoring	3 days	4/5	4/7	40
42		Quality Assurance	1 day	4/8	4/8	41
43		**Closeout and Support**	**5 days**	**4/9**	**4/15**	**34**
44		Training Documentation	2 days	4/9	4/12	
45		Testing Documentation	2 days	4/9	4/12	
46		Environment Upkeep Documentation	1 day	4/9	4/9	
47		Project Closeout Documentation	4 days	4/9	4/14	
48		Project Outcome Documentation	5 days	4/9	4/15	
49		**Administration**	**74 days**	**1/4**	**4/15**	



Project: Gantt
Date: 11/1

Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

e. Resource Allocation



The resources are allocated using MS Project in accordance with completion of the project in 4 months.

f. Financial Plan

Top Down Estimated Cost

Project Lifecycle Cost Element	**Rate per Machine**
Project Management	$3,000
Systems Engineering	$5,000
Software Development	$30,000
Integration and Testing	$10,000
Training	$10,000
Support	$2,000
Miscellaneous	$2,000
Total per Machine	**$62,000**

As this is an unprecedented project, a top-down budget estimation has been created using data from similar previous work.

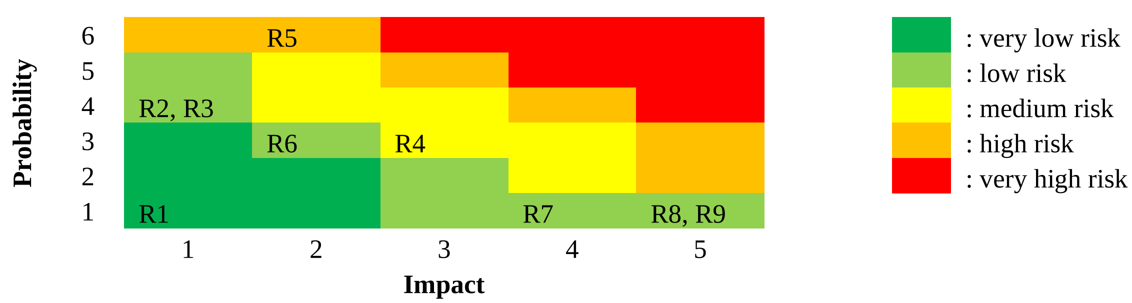
8. Monitoring and Control

The following techniques will be used to track the project:

- Project plan monitoring
- Track WBS, RACI, PERT, Gantt, Schedule
- Project budget monitoring control
- Cost estimate updates
- Track project costs
- Reporting progress at regular Intervals
- Review and status meetings to analyze problems, finding out what has been going on.

Risk Assessment

ID		Risk Event	Probability	Risk Level
R1	=	Project deliverable definition is ill-defined.	1	Very low
R2	=	Contractor delays	4	Low
R3	=	Cost Estimation errors.	4	Low
R4	=	Unplanned work that must be accommodated.	3	Medium
R5	=	Lack of communication, causing lack of clarity and confusion.	2	Very high
R6	=	Delay in earlier project phases jeopardizes ability to meet fixed date.	2	Low
R7	=	Added workload because of new direction the customer wants to take.	4	Low
R8	=	Inadequate customer testing leads to long issues list in the field.	1	Very high
R9	=	Customer rejects deliverables or milestones, delaying the project	1	Very high



SWOT Analysis

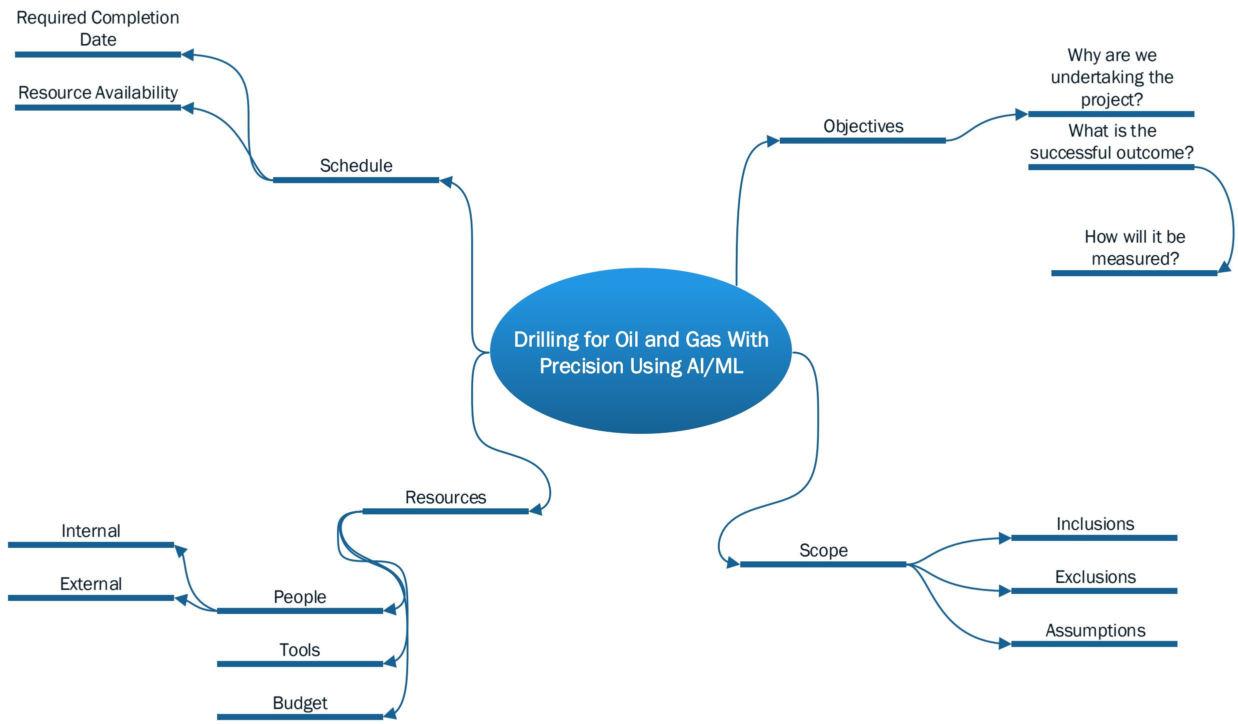
Strengths	Weaknesses
• Availability of Oil Exploration Data • Expertise in Data Science Projects • Available Experts for Oil and Gas Industry • Cost of Implementation is Low • Quality of Data is Good	• Ease of use • Communication • Outcome Unknown • Reliability in Predictive outcomes from Algorithm • Unknown Delivery Time for Reliable Outcomes • Random Errors in Available Data Due to Noise • Too Many Data Variables to Give Reliable Algorithm
Opportunities	**Threats**
• First of its Kind • Less Competitors • Reduce Cost of Exploration • Reduction in Time of Exploration • Revenue Increase	• Customer Dissatisfaction • Production Disruption • New Competitors • Decreased Demand • Risky Operations in Drilling/Irreversible • Acts of God

9. Summary

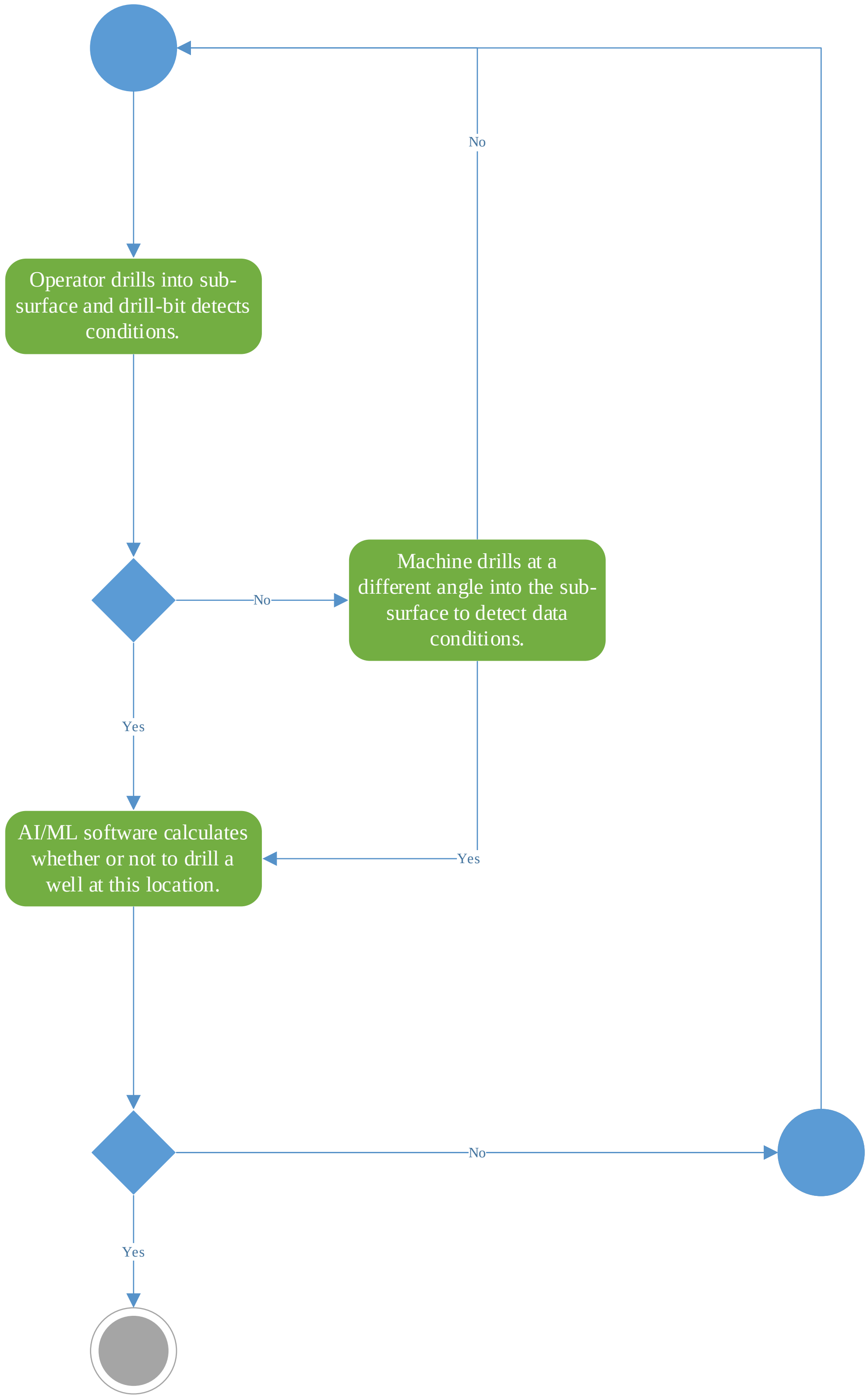
By the end of the project,Oil Company Y will have a product in regular use that will effectively compare real-time characteristic logs from wells to the repository and assess prospective of drilling at a particular location, reducing capital expenditure on repair of machines by 2%. The AI/ML software will also speed up and improve the quality of current seismic analysis while also automating it, leading to 10% reduction in dry exploration of wells which will result in a 1% increase in profit from production in the long-term.

10. Appendix

a. MindMap (in MS Visio)



b. Activity Diagram of Completed Product (MS Visio)



c. Sequence Diagram for Training and Operational Mode (MS Visio)