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Artificial Intelligence in Maintenance Planning: Optimizing Strategies and Resources

James Reyes-Picknell
Principal Consultant

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Agenda

- Planning concepts
- Plan example – *manually generated by the class*
- Generative AI - overview
- Demo of planning tool – *AI generates the plan*
- **Comparison** of the manual and the AI plans
- Live “tryout” session

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Plans

- Forward looking
- Sequence of steps
- Describes “**what**” to do with “**how**” (if it matters), and **how long**
- Include **all resources** (who, parts, tools, documents, standards, procedures, safety, permits, etc.)
- Write once, save, modify, re-use



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Planning is the first step



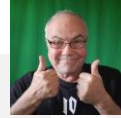
Plan

What, who, how and with what – for each job to be done



Prepare

Make sure everyone and everything needed is available before the job is “ready” to be scheduled



Schedule

Add the work that is “ready” into a time frame considering urgency (priority) and criticality

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Create a plan (building a house)

1. What is the **sequence** of steps?
2. **How long** does each step take?
3. What materials are **needed** for each step?
4. What **tools** or equipment are needed for each step?
5. What **trade skills** (and how many) are needed for each step?
6. Can some of the steps **proceed in parallel**?

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Organize the plan details

Task	Duration	Materials	Tools / equipment	Trade required	How many?	Parallel with
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Flipchart

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Standard Job Work Planning Sheet

Standard Job ID: _____
 For: Equipment # _____ Equipment Name: _____
 Information collected for Work Order #: _____
 Standard Job Title: _____
 Description of work (describe what work is being done, include steps if needed):

Trades Required:

Trade	How many?	How long? And When
Mechanic		
Welder		
Electrician		
Instrumentation		
Laborer		

Application Parts List:

Add to list:		
Part #	Part name / description	Quantity needed for job

Delete from list (not needed):

--

List any tools required that are not part of your standard tool bag / kit:

- Here's a standard job planning template that I give to clients
- It is editable and can be customized to their preferences

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What do we need to know before we can schedule the work?

Flipchart

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For scheduling ... one house

- Look at all resources.
- We have 50 trades persons available (is this the right mix?)
 - 8 electricians, 16 plumbers, 16 carpenters, 2 roofers, 8 brick layers / concrete workers
 - Do we need all of those on only one house?
- How many people do we need at any one time to build one house?
 - What trades are needed and in what sequence?
 - Can we build more than one at a time?
 - Do we need more or fewer of any trade?
- Do we have all the lumber, piping, wiring, etc. that we need?
- Do we have all the equipment we need (crane, cement truck...)?
- When will the building permits be ready?
- When will inspectors be able to visit?

This information should be in the plan

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What about the whole sub-division?

- 100 houses
 - 80 are priced the same at \$200,000 each (we make \$50,000 each)
 - 10 are priced at \$250,000 each (we make \$75,000 each)
 - 5 are priced at \$300,000 each (we make \$100,000 each)
 - 5 are priced at \$350,000 each (we make \$125,000 each)
- Each house has a contracted finish date
 - Our earnings are reduced by \$25,000 if we are late
- Goal: schedule as many as we can to achieve maximum earnings early in the project
 - Higher value houses first, if they don't cause delays to lower value houses

There are a number of incentives and constraints in scheduling in addition to your own resources and planning details

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Traditional AI

Artificial intelligence (AI) uses computer systems to mimic human intelligence and perform tasks. These systems rely on algorithms and data to make autonomous decisions, learn from previous experiences, and adapt to new situations. Traditional AI has proven useful in various domains, including problem-solving, decision-making, and automating complex processes.

All in all, traditional AI's strength lies in **analyzing and interpreting existing data**. While it can identify trends and patterns that might suggest new applications or solutions, it does not possess the ability to conceive entirely new ideas from scratch.



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Generative AI (GenAI)

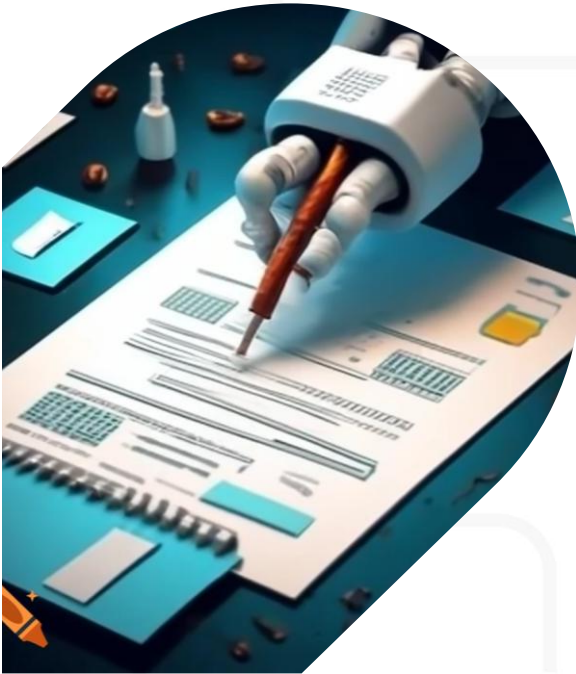
Generative AI is a branch of AI that focuses specifically on **generating new content**, such as images, text, or music in response to our prompts.

Unlike traditional AI systems, which are programmed with specific rules and algorithms, generative AI systems are trained on large datasets. They learn to form new content by identifying patterns and creating new variations based on those patterns. This allows generative AI systems to create original, creative content.

“Traditional” AI vs GenAI

Generative AI has the potential to revolutionize any field where **creation and innovation are key**. On the other hand, traditional AI continues to excel in task-specific applications. It powers our chatbots, recommendation systems, predictive analytics, and much more.

For planning we need GenAI



Let's generate a plan using an AI planning tool
(AIJobPlanner.net)

On Screen Demo

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AIJobPlanner™ - Build a World-class, Best-in-class Job Plan in 3 Easy Steps

Step 1: Input Information and Generate a Plan

1) Type in a detailed description of the work to be completed

Plan Requirements

Work Information

Description: removing, replacing, and aligning a 100-hp, 600-volt, 3-phase electric motor to a horizontal pump in a chemical plant. Include a list of parts needed and cost for parts, which trade skills and estimated hours and costs to complete, how long the steps will take, what special tools are required, and a cost estimate for each activity.

Equipment Description: ITT Gould CHG series pump and 600VAC, 3-phase electric motor

Asset Data

Asset Number	666603853	Criticality	medium
Make	ITT Gould	Model	3879
Remaining Useful Life	10	Asset Class	Transfer Pump
Volts	600	In Service Date	
		Regulatory	
		Phase	3

Nameplate

Nameplate Template

Safety Info

Lock Out / Tag Out	<input type="checkbox"/>	Confined Space	<input type="checkbox"/>
Safety Procedures	<input type="checkbox"/>	Zero Energy	<input type="checkbox"/>
Fastener Standards	<input type="checkbox"/>	Relocating Standards	<input type="checkbox"/>
Alignment Standards	<input type="checkbox"/>	Lubricant Standards	<input type="checkbox"/>

Pick or Generate a Plan (View All Plans)

Generate New Plan

Premium Template

Description: The blade is dull and needs sharpening.

Equipment Description: Zamboni SS2AC Machine

Title: Sharpen Zamboni SS2AC Blade Updated 10.0h ago

Premium Template

Description: Pippers are unnecessary.

Equipment Description: Electromechanical Petal Machine

Title: PIPER Updated 36.4m ago

Premium Template

Description: Coins are getting stuck in the slot.

Equipment Description: Snack Vending Machine

Title: Repair of Coin Mechanism in Snack VME Updated 0.0m ago

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Step 2: Edit Your Plan if Necessary

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Edit Your Plan

Visual Editor: ☐ Markdown ☒ Automatic

Title: Motor Replacement and Alignment Work Plan

Asset Number	Description	Equipment Description	Criticality
400001002	removing, replacing, and aligning a 100-hp, 600-volt, 3-phase electric motor to a horizontal pump in a chemical plant. Includes a lot of parts needed and cost for parts, which trade adds and estimated hours and costs to complete, how long the steps will take, what special tools are required, and a cost estimate for each activity.	ITT Gould CHD series pump and 600VAC, 3-phase electric motor	medium

Tasks

Title: De-Energize and Lockout System

Description	Estimated Labor Hours	Estimated Duration Of Work Hours	Estimated Production Outage Hours	Estimated Misc Duration
De-energizing the system and applying lockout/tagout devices to ensure safety during maintenance activities.	2.5	2.5	0	2.5

Activities

Description	Estimated Hours	Estimated Additional Cost	Estimated Production Outage Hours	Estimated Misc Cost	Actions
Identify and deactivate the correct breaker or switch for the motor.	1	150	0	20	

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Step 3: Export the Plan

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Export Your Plan

Visual Editor: ☐ Markdown ☒ Automatic

Title: Install New Motor

Description	Estimated Labor Hours	Estimated Duration Of Work Hours	Estimated Production Outage Hours	Estimated Misc Duration
Installation and alignment of the new motor on the pump assembly.	14	14	0	14

Activities

Description	Estimated Hours	Estimated Additional Cost	Estimated Production Outage Hours	Estimated Misc Cost	Actions
Position the new motor on the pump base and secure with mounting bolts.	2.5	200	0	75	
Reconnect electrical wiring and ensure all connections are waterproof and secure.	1.5	100	0	20	
Perform precision alignment of motor with laser alignment tools.	3	250	0	30	

Inventory

Description	Qty	Quantity	Estimated Cost	Actions
New motor mounting hardware	M8x16-0101	1	75	

Labor

Trade	People	Estimated Labor Hours	Estimated Cost	Actions
Electrician	1	7	560	
Mechanic	2	7	800	

Title: System Testing and Verification

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How does the AI plan compare with the class plan?

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Consider

Did the AI miss any steps?

Did it add any unnecessary steps?

Did it sequence the steps correctly?

Did it list the tools and materials needed?

Did it have realistic timing estimates?

Would it take long to edit it?

Which would be faster for day-to-day planning?

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Now you try it

Use your own laptop or device on wifi. If you don't have one, team up with someone else

On your device

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Getting started

- Navigate to: aijobplanner.net
- Sign up (free version)
- Click on “organization details” to see the various subscription options
- For this class we have enabled the “professional” subscription capabilities in the free version
 - Professional capability will be kept “live” for you for 2 weeks
- You can choose the language you want to work in in the upper right corner of the screen

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Enter the information you have

Work Information (mandatory)

Description of the work you want done is needed

Tell the system “what you want to do” – the more descriptive you are, the better the results

Include work details (optional)

Equipment details (mandatory)

This is “what” you are working on – again, more detail produces better results

Optional details

Can add in extra requirements

Asset Details of the equipment (nameplate info)

Safety requirements

Job site visit checks

Is work a PM, Permit requirements, Relevant Standards, Interference work items

Upload technical manuals, old work orders, procedures, standards, etc. in upper right corner

PDF format is “readable”

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Generate your plan



- You can watch the progress of the AI
- It looks at the documents you uploaded first
- Then it goes to the internet for relevant related information
- When complete, you can edit as you see fit (saves automatically)
- Export to PDF (editable)



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How did it do?

- Speed?
- Accuracy?
- Could you use the output as a draft?
- Would it make you more productive?

What needs to change?

- If you want to use it at your plant / operation, then what needs to change to get the most value from it?
- IT or other barriers?
- Business process inefficiency?
- Supervisory discipline?
- Operations discipline?
- Training (in what)?

500%

Faster

From 5 to 8 plans a week
To 40 or more.

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Typical draft plan from the tool
requires just a couple of minutes
to generate

Editing is roughly half an hour for
a moderately complicated plan

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80%+

Accuracy

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Draft plans are intended to be
edited

Planners are still needed to
review the outputs and add any
details missed

So far, we are hearing that the
plans are well in excess of 80%
accurate

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Conceptos



Speed

Minutes vs hours



Accuracy

80% plus, not perfect but excellent starting point



Productivity

Increased planner productivity
Translates into increased worker productivity

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Is this something that can help you?

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Question

If you think this could be of use in your operation, then who needs to approve it, in order to get started?



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iGracias!

James Reyes-Picknell

james@consciousasset.com

+1 705 727 7436 (Canada)

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