The Fourth Industrial Revolution in the Wood Products Industry

Improve your company's decision-making, your productivity and your troubleshooting capabilities

SAWQUIP   **CARDINAL**

The fourth industrial revolution

By Francois Tremblay, Automation and Control Director at Sawquip

For some time now, we have been inundated with information about a new industrial age. *Industry 4.0*, *Big Data*, *Smart Factory* and *4IR* are some of the names commonly used to describe it. Simply put, it refers to the rise of data, connectivity, analytics, and human-machine interaction in industrial processes. While the concept of analysing data from the production floor to improve performances and quality is as old as the industrial world, recent technology is a game-changer. This paper examines how this revolution can be efficiently used in the wood products industry.

The challenges faced by wood products manufacturing

Data gathering is broadly deployed in process industries such as oil and gas, food and beverage, pulp and paper and mining. Most of these processes are relatively slow. The data fluctuates at a low rate, generally expressed in seconds, minutes and even hours.

In contrast, a wood products production line operates at a very high speed. Many of the process values that need to be gathered for analysis have a change rate expressed in milliseconds. This poses a unique challenge for wood products manufacturers.

Understanding high-speed processes

Things are indeed happening very quickly on a wood products production line. Cutting tools are moving from one position to the next in a matter of few hundreds of milliseconds; logs enter machine centers at a speed of over 700 feet per minute; motors current peaks last for under a tenth of a second; board optimizers compute cutting solutions in half a second or less. These events are way too fast for any human being to grasp and analyse. For instance, a damaged chipping head positioner that takes 100 milliseconds more to complete a 6-inch move will never be noticed by the operator. It may be weeks before the condition degrades to a point where the problem becomes obvious. Do the math! At 700 feet per minute, a 100-millisecond delay requires a 14-inch gap increase between logs. For a production line running 13500 logs per shift, it represents up to 21 minutes of production loss. On a single sawline, there are dozens of key indicators like this that can be fetched and analysed in real-time. Here are a few examples.

- Gap Control Inaccuracies
- Axis Positioning Time and Error
- Cutting Tools Deviation
- Optimizer Solution Computing Time
- Pneumatic and Hydraulic Pressure
- Vibration Sensors

Figure 1. Historical data displayed on various devices (Laptop, tablet, iPhone, TV)

A few definitions

Before we move on to our subject, let us examine three important definitions.

KPI (Key Performance Indicator)

A KPI is a measurable value that evaluates how well an equipment or a production line if performing. A KPI is a piece of information that is meaningful to establish the efficiency of a system. KPIs are the ultimate tools to improve the productivity of your machines and the quality of your products.

Historian

A historian is a software package used to store data collected from the process. The data can be stored for any amount of time and later retrieved for long-term analysis. A historian allows us to go back in time and often predict the future. A historian is a powerful tool for predictive maintenance.

Analytics

In the industrial world, analytics is defined as a methodical analysis of live and historical production data. Analytics falls into four pillars.

- Descriptive : What happened?
- Diagnostic : Why did it happened?
- Predictive : What is likely to happen next?
- Prescriptive : What action should we take?

Real-time data, also referred as live data, will partially satisfy the first of the four pillars of analytics. The last three pillars will require historical data, provided by a historian.

Contextual data

One of the most common mistakes we encounter when dealing with KPIs is failing to take into consideration the notion of context. Most KPIs are useless if they are analysed out of context. A good analogy is when a few words or sentences extracted from one's speech are used out of context to make the author say something different.

Let me give you an example. Asked to evaluate the performance of a log loading equipment, we configure an historian to record the number of logs per minute fed by the loader, along with the gap between each log. The production line is designed to run 32 logs per minute with a requested gap of 64 inches. The result shows a log count of 24 logs per minute with an average gap of 96 inches. Based on the data, we conclude that the machine is not performing in accordance with the specifications. Now, let's ask a few questions to add some context to our testing.

- Was the infeed deck constantly full of logs during the test?
- What was the length of those logs?
- What was the diameter of the logs?
- Were all the logs about the same length and diameter?
- What was the species in production?
- Did the operator switch to manual control at any time?
- Did an external interlock hold the loader during the test?

Any of these factors has an influence on productivity. Larger logs will run slower; diameter variations require a longer gap in the machine; an infeed deck that cannot keep up with the loader will decrease the log count while increasing the gap. These factors must be considered to get an accurate indicator. Here are a few more examples of the relationship between various indicators to provide accurate KPIs.

- Hydraulic positioners efficiency vs oil pressure/temperature
- Logs per minute vs logs length and diameter
- Stacker cycles per minutes vs type of boards
- Wood recovery vs debarking efficiency

Remember this! Inaccurate KPIs are likely to take you down the wrong path. They will make you lose precious time by looking for solutions to a problem that doesn't exist, or they will blind your eyes to real issues.

KPIs visualization tools

Fetching and recording KPIs in a historian database represents only the first half of the process. The second part requires that the information be formatted and presented in accordance with the four pillars of analytics.

Figure 2. Bright colors are used to draw attention on abnormal events.

Presenting the KPIs

Staring at a computer monitor for hours, trying to find information that indicates a problem or a decrease in performance can be boring and counter-productive. For that reason, analytics tools are build in a way that a KPI showing an abnormal situation, such as a decrease in productivity or an equipement failure, will stand out.

Most of us in the wood products industry are well acquainted with high-visibility safety vests. What is the color of yours? Probably bright red, orange or yellow. There's an obvious reason for the choice of color. These vests make you stand out aga250 most backgrounds. Stop traffic lights are red for the exact same reason.

When you think of it, a green traffic light is not asking you to do anything. It simply tells you that you can continue on your route. A red light, on the other hand, asks you to perform an action, it orders you to stop! A well-designed KPIs visualisation tool works the same. Values that are within the normal operating parameters appear in a subdued color such as grey, blue or green. Abnormal values or conditions appear in yellow, red, orange or purple. Same as a red traffic light, a KPI showing up in red is asking you to do something.

In Sawquip's high-perfromance systems, a light blue color is used to show KPIs that are within the optimal range of operation. Green is used when a KPI shows a performance better than expected, which can be a great motivation for operators and managers. Bright colors indicate problems, failures or drastically degraded performance.

Let the data come to you!

As I said before, no one wants to sit in front of a computer day in, day out, looking at KPIs. You and I have better things to do! Our solution allows us to access the information from anywhere, on practically any device. Mobile phones, tablets, iPads, laptops and desktop computers, television screens, you name it! Any device that can open a Web browser will work, even obsolete devices.

Right! But do we still have to be looking at the device to quickly react when a problem occurs? Absolutely not! We can configure email alerts for any event occurring in the system. Alerts can be sent to a specific user or several users at once. For instance, a low oil level condition can automatically send an email to the mechanical department, while a decrease in productivity can alert the shift supervisor.
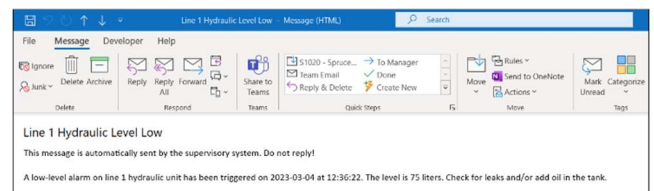

Figure 3. E-mail sent automatically to specific users.

Key features of our historian solution

An exhaustive review of all the functionalities we use is beyond the scope of this document. Here are just a few of the most useful features.

Contextual analysis

When a recurrent problem occurs, it is often necessary to look at various parameters at the same time to establish a causal relationship. In such a case, it is useful to create a specific trend that will show several variables. On the image on the right, the red portion of the blue and green lines show an overcurrent situation on two chipper heads. To help find the cause, we add three variables showing the log diameter, the feed speed, and the cant width. Looking at the trends, we can easily determine that the volume of chips was way too high for the speed of the machine. Other variables could now be added to the trend to narrow the search.
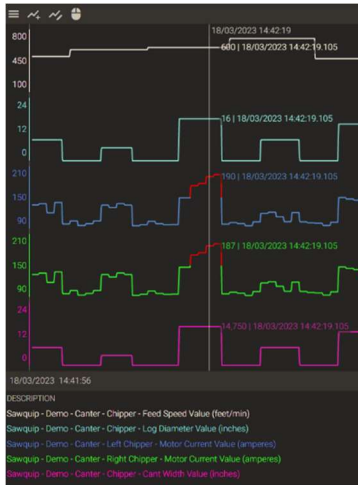
Playback
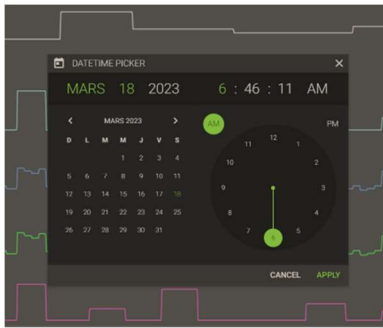
Playback allows us to go back in time and replay an event that happened anytime in the past. This is particularly useful when a problem occurred on the night shift, when no technical personal is on site. Playback can be run at various speeds, which is very handy when looking for a problem that we do not know exactly when it occurred.

Notes

Notes can be added to specific events. For instance, the technician investigating an overcurrent situation wrote a note on the event to indicate the source of the problem and the action taken. Notes are kept in the database along with the trend data. When the problem shows up again, another technician will have access to those notes and may be able to solve the problem much quicker, making use of others' knowledge.

Historical comparisons

Another nice feature is the ability to compare various KPIs from different points in time. For instance, we can create a trend comparing data from the night shift and the day shift. A very helpful tool for troubleshooting and training purposes.

Reports

Automatic reports can be generated at regular intervals and sent to email addresses.

How much does it cost?

This is the big question! My answer to this question is this: it cost nothing! Ok, let me explain. A complete system will require some licensing for the historian and the communication drivers. You will probably want to get a new dedicated computer or even a server for larger applications. Add to that some basic training and some support for the initial configuration. The price tag primarily depends on the volume of data your will want to get from your production lines.

Now, if you purchased this system only to analyse the temperature and chlorine concentration of the water in your swimming pool, the cost would be prohibitive. Similarly, if you paid that much for a system that nobody ever uses or maintains, it would be a waste of money.

However, a well-maintained and accurately configured historian will save thousands of dollars monthly if the results of the analysis lead to action. The payback can be extreme, especially within the first months. Believe me, after a month or two, you may very well agree that the solution costs nothing! Here are some of the improvements you will notice.

- Increased efficiency and productivity
- Superior product quality
- Better predictive maintenance
- Decrease in parts failure and replacements
- Crew more motivated to perform

Configuration and deployment

The solution we propose is powered by the powerful Canary Labs historian engine. The software package installs itself in just a few minutes. No software needs to be installed on the clients. A simple Web browser is used to monitor and configure the system. In merely a few hours, a user can learn how to create new screens from the data available.

One important note though! The notion of context on a production line running at high speed means that some of the KPIs will have to be preformatted and contextualized within the control system (PLC) before the data can be sent to the historian. A good practice when designing control systems for production lines and machines is to use a control library that already provides the functionalities for this task. This is the path we have taken at Sawquip. Our control library is equipped with various built-in tools dedicated to the task.

More question?

Please don't hesitate to contact us if you have any questions. Have a look at the following page for answers to most frequent questions we get from our clients.

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Does Sawquip use a proprietary software?

Sawquip uses the well-known Canary Labs historian engine. Have a look at Canary's Web Site @ https://www.canarylabs.com/. Canary Labs has been around since 1985, with over 20,000 installations in over 65 countries. However, Sawquip uses its own powerful control library dedicated to the wood products manufacturing industry to precondition the data in the programmable controllers (PLC).

Do I need to pay a monthly fee?

You have the option of a one-time purchase or a quarterly subscription. You decide what is best for you.

Will I need a highly skilled programmer to maintain the system?

Absolutely not! The Canary Labs historian engine is very easy to use and configure. A single-day training is all that is needed to learn how to use it and create new screens and reports. You may need a control specialist to help you find the data needed in the controllers (PLC) or to add logic to put the data in context. Other than that, the limit is your imagination.

Will I need expensive hardware to install the historian package?

Not at all! We are running the full package on a simple laptop with 16 Go of memory. In most cases, KPIs don't need to be logged for years, so there's no need for large storage. In our industry, most KPIs will have a useful life of a few days.

What specific KPIs will I get?

You are the only one that can answer that question! While we can suggest some basic KPIs for a wood products manufacturing line, your process engineers and production supervisors are the ones who fully understand your needs. Therefore, they are the ones who know.

Can I collect data from any type of controllers?

As long as you can find a specific communication tool that is OPC compatible, you will be able to get data from your controller. For instance, you can use *RSLinx* to access data from Rockwell Automation controllers. All manufacturers of industrial controllers that we see in the wood products industry have one or several OPC communication tools available. Licensing might be required.

How will it improve my productivity?

There is no doubt that your productivity will improve. By how much really depends on the state of your system and the dedication you put in analysing KPIs. We have seen over 20% increase in productivity on some production lines in just a matter of days.

As a production supervisor, can I create my own analytic screen?

Of course! With minimal training, you will be able to build your own screens and reports. You will be able to publish them for anyone to see or to keep them private.

Can I monitor the data on my iPad?

The client tool runs on any device that can open a Web browser. Mac, iPad, Android, Linux, Windows, iPhone… you name it! It is important to note that there's no fees for the clients. The price of the package allows you to run any number of clients for free.

Can I configure an e-mail alert only for one specific user?

Each E-mail message can be configured to deliver to a specific person or multiple people.