December 2022

SELECTIVE PRINTHEADS SERVICING BASED ON PRINTMODE AND DROP DETECTION ANALYSIS

HP INC

Selective Printheads Servicing based on Printmode and Drop Detection analysis

Abstract

Current disclosure will present a method to improve the efficiency and the effectiveness of Drop Detection (DD) functionality and related servicing. This improvement is based on a predictive approach using as reference the printmode nozzle usage strategy. It is very common, in large format printers (middle and low volume) for the printheads (PHs) to have a fixed position in the carriage. Thus, depending on the printmode selected, the printer uses just a small part of the available nozzles of the printhead(s). It is also usual that before printing a plot, the printer performs a drop detection to record which nozzles are not firing and based on that program an error hiding strategy or a cleaning servicing. There are some printmodes that only use a 10% of the available nozzles but normally the machine performs a detection to the entire pen and takes decision based on that information. This means that even if we need just the 10% of the nozzles, we are taking into account if a not used nozzle is firing and even triggering an additional cleaning servicing in case that the number of nozzles is higher than the threshold, even if those nozzles will not be used never. In addition, there is not information used about these nozzles out are located so, even if they are less than the threshold they could be clustered in a used zone, compromising the final IQ of the plot. For fixing this we propose a different solution where we detect the entire performance of the pen, but we just use the information about the nozzles used in the next plot printmode to trigger (or not) a recovery routine, being more specific, increasing IQ, saving time and ink from recoveries. This approach leads to many advantages, first of all, the improvement in IQ performance due to the specific recovery of the area of the PHs used, avoiding unnecessary recoveries over the rest of the nozzles and at the same time giving the opportunity of removing clusters of nozzles out that will compromise the final results.

Problems Solved

- IQ defect fixed avoiding servicing triggered in inefficient way
- Reduce until 90% of unnecessary servicing
- Improve click to print time
- Improve ink efficiency
- Improve printheads life for less mechanical stresses
- Improve IQ for specific decision of servicing based on the number and location of the used nozzle, avoiding possible little clusters of nozzles out

Prior Solutions

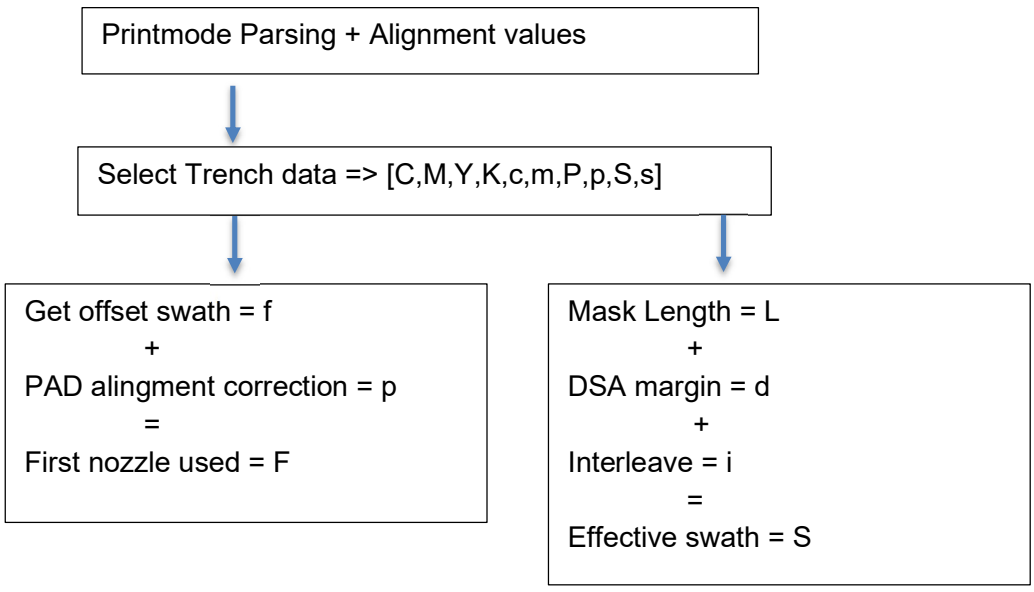
There is no specific prior solution known to face this kind of problems of unnecessary servicing and no specific diagnostic of nozzle out. It is in use the workflow of detect and evaluate all the printheads nozzles, in a blind way respect the programmed future plots. This strategy will not ensure a perfect IQ for all the printmodes to be used and normally lead to a waste of time and ink.

Description

In order to give a solution of the explained problems we are proposing and implementing a novel solution, using and combining the information already stored in the printer CPU. The strategy is summarized in the following steps:

- Get the information of the used nozzles for the next job
- Get the information of the nozzles health of the used PHs. For this step we need the information of the drop detector analysis. This component is already installed in the printers and the routines of DD are normally triggered in many recovery routines or PH replacement routines.
- Cross the information and compare the nozzles health of the used PHs (or their parts) with the specific thresholds for each printmodes
- If necessary, trigger the specific recoveries routines

As an example let's consider the following printmode, and relative PHs usage.



With the information described above the system will know which effective nozzles are used for printing and the exact position fitting within the printhead. All nozzles residing outside this range will not be used at all for printing.

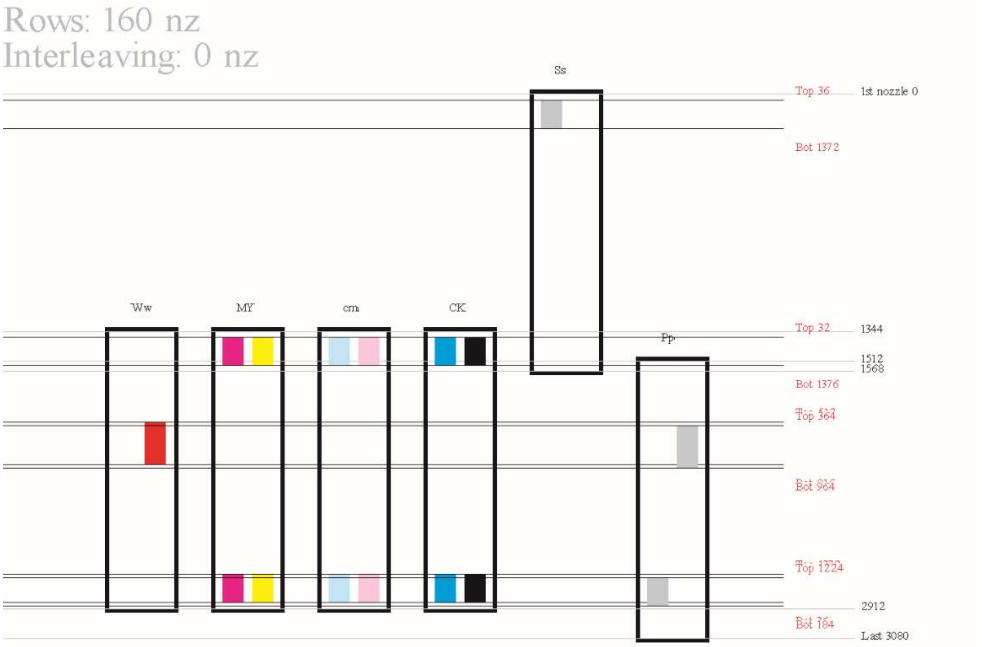


Figure 1: Printhead usage in a white ink printmode strategy

In this case is easy to see that just a little parts of the PHs are used. Specifically for the white PH (Ww) only 160 nozzles for a total of 1568 are used (approx.10%) . Normally in our technology, we are using as threshold of acceptability 70 or 100 nozzles out for triggering a recovery routine.

Taking for simplifying as threshold 100 nozzles out we could face these 2 main problems:

- We have more than 100 nozzles out and they are located outside the used area. This fact will trigger an unnecessary recovery, wasting time, ink and consumables.
- We have a cluster of less than 100 in the used zone. Due to the little amount of used nozzles (160) if we face with a cluster of 99 or even 20 nozzle out in the interesting zone, we will have an high percentage of nozzle out that they will be used. Even if we should mitigate that with the error hiding we could lead with an expansion of the problem (crusting) and a poor IQ due to a no triggered recovery routine.

Our new strategy will allow to fix these problems allowing ad hoc solution for each printmode and situation of printing. As shown in Figure 1, this information is available after a first stage of printmode processing. This is executed at the bginning of the printing process and can be parallelized with a ligh begin of job servicing or the warm up in case of having heaters in the printer. After this first light servicinga drop detection is executed to update the status of all nozzles. At this point the status of the specific nozzles that should print can be checked. With this status servicing can evaluate their condition an stablish a recovery level (if required). If the

nozzles selected are in good status this recovery can be skipped. Information about the slected nozzles is also transferred to be used at the spit level inside the recovery routines.

This way spits can focused on these nozzles reducing the overall waste of the routine. Afterwards, a final health check is executed with a new drop detection that finally updates the nozzle database returning the final results of nozzles out so they can be processes and if required, hidden.

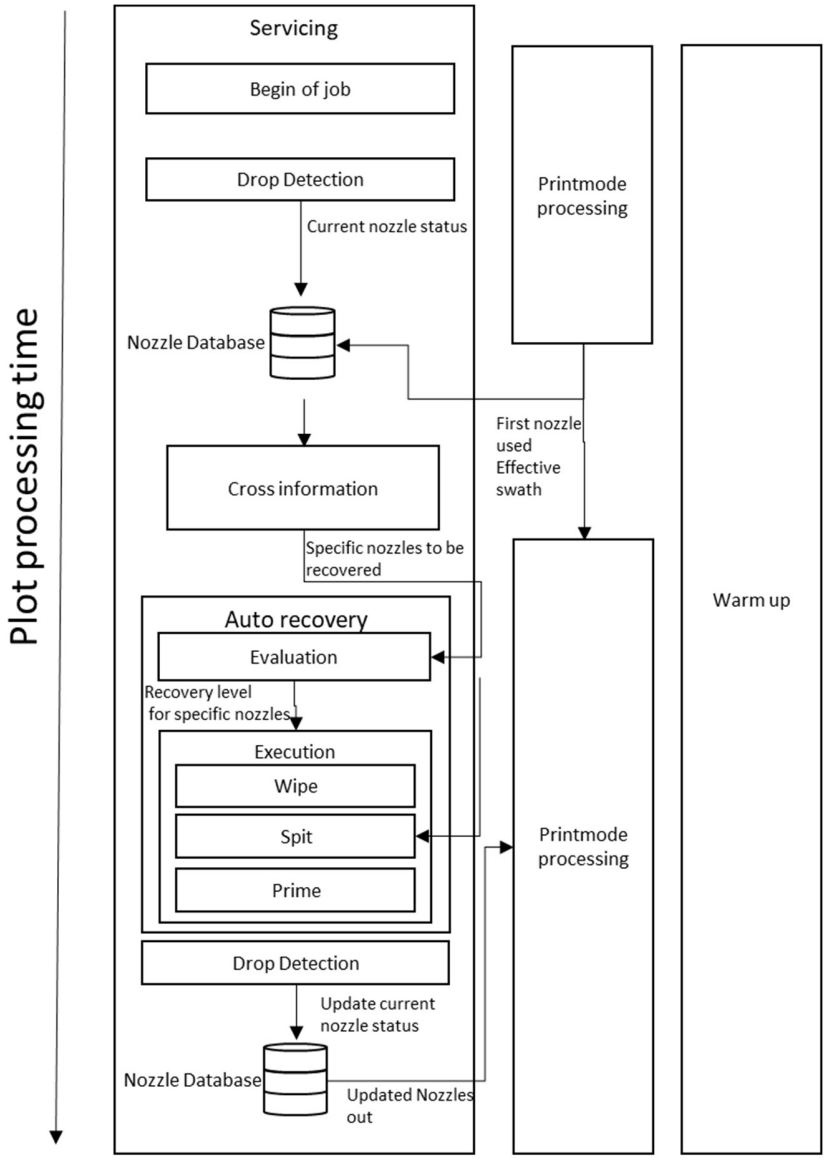


Figure 2: Overall workflow

Advantages

Improve customer satisfaction in several ways:

- Consumable cost reduction (ink, web roll, pen, wipers, spittoons etc)
- More specific and accurate control of printing time
- Specific nozzle recovery algorithm servicing, centered in efficiency and increasing provided quality
- Improves energy efficiency rate: good plots vs energy consumption, enabling more eco and sustainable printers for less material consumption and waste of unused parts
- Speed up of printer production due to elimination of unnecessary stops or checks for change parts by operator
- Speed up of printer productivity for shorter and fewer stops due to maximization of usage
- Optimization of ink efficiency.
- Easy implementation and zero cost: the innovation doesn’t need extra sensors or hardware: it was born in a cost-reduction environment so this is also applicable to any other printer that use this kind of technology
- Improve IQ for specific decision of servicing based on the number and location of the used nozzle, avoiding possible little clusters of nozzles out

Disclosed by Pau Costal, Estefania Serrano and Maurizio Bordone, HP Inc.