

Yamaha Pitches Advanced M2M Connectivity Concept

The 1 STOP SOLUTION method links the company's smart production machines and software to overcome limitation in information sharing in an advanced M2M environment.

In recent years, the proliferation of high-speed communications infrastructure and the reduction of communications and storage costs have been advancing rapidly. Against this backdrop, the trend of the fourth industrial revolution, typified by Industrie 4.0, has spread explosively, and the momentum of investments in related technologies has been building globally.

Yamaha Motor Co., Ltd. has taken this trend in a timely manner, and developed "Intelligent Factory," an Internet of Things (IoT)/machine-to-machine (M2M) integration system (Fig. 1) using the latest technologies. For the introduction of Intelligent Factory, Yamaha Motor is proposing a practical four-step process (Fig. 2). First, in Steps 1 and 2, the company focuses on and actively proposes the automation and labor saving of the surface-mount technology (SMT) line based on the M2M connectivity.

In this process, Yamaha has made possible mutual cooperation, not only among Yamaha's SMT machines, but also with other companies' machines. In fact the company already has a track record of installing that kind of numerous production lines.

As a practical problem involving M2M linkages among machines of different manufacturers with various development concepts and business scales, there is a significant amount of proprietary information that cannot be mutually disclosed. Therefore, information sharing is virtually limited to standard basic information, such as board IDs

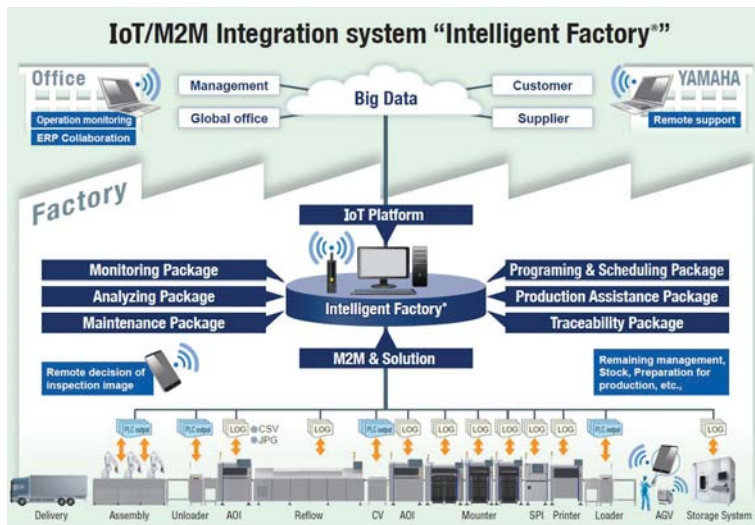


Fig. 1: Intelligent Factory outline

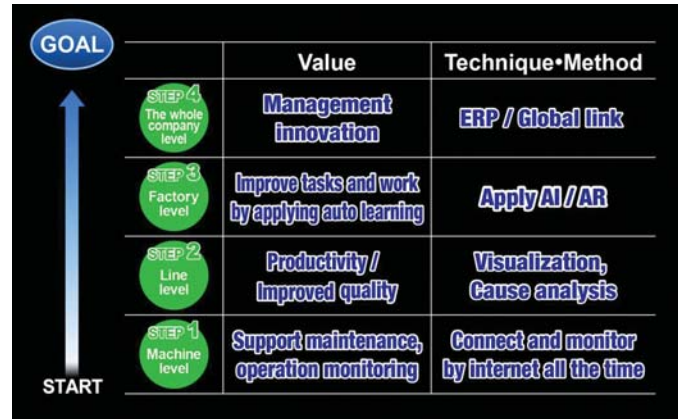


Fig. 2: Steps to the introduction of Intelligent Factory

and bad marks. In addition, it is considerably difficult for manufacturers with different resources and situations to simultaneously develop software for mutual cooperation. Hence, naturally, there is a limit to the synergetic effects that can be attained through cooperation.

1 STOP SOLUTION

To achieve advanced M2M connectivity that overcomes the said limits, Yamaha Motor vigorously promotes "1 STOP SOLUTION," the company's original concept. It solely uses Yamaha products to link intelligent SMT machines and software to maximize synergetic effects.

Yamaha Motor already has a full lineup of main machines on a mounting line: surface mount device (SMD) storage systems, printers, dispensers, screen printing inspection (SPI) machines, mounters, and automated optical inspection (AOI) systems. Connecting each machine on a mounting line comprising of these Yamaha products through advanced M2M connectivity without a black box in an "Intelligent Factory" maximizes the effects of mutual cooperation of machines and software. Thus, it becomes possible to achieve a highly efficient mounting line through true total management.

Figure 3 shows an example of a full Yamaha SMT line through "1 STOP SOLUTION." Some functions through M2M connectivity between machines, include 1) Transfer of instructions from the production plan, or board ID information read by the machine at the start, among machines enables production switchover and automatic setup changes on the total line without requiring special skills; 2) Upon the receipt of information on production switchover, components are delivered from the SMD storage system and transferred to arbitrary setup change-over locations specified through the linkage using the automated guided vehicle (AGV) to reduce the burden on the worker (Photo 1); 3) Feedback of print position from SPI to solder paste printer ensures stable print position accuracy (Fig. 4); 4) Feed-forward of bad mark from SPI to mounter reduces takt time loss (Fig. 5); 5) Components



Fig. 3: An example of 1 STOP SOLUTION Yamaha line



Photo 1: Delivery of components from the SMD storage system and transfer using AGV

that are needed to be supplied are notified from the mounter to the SMD storage system at the necessary timing in order of precedence to automatically deliver the necessary amounts of components and supply them at a time; 6) Feedback of defect information and instruction of stop command from AOI to mounter prevents the mounter from continuing to produce defective PCBs (Fig. 6); 7) SPI image of mounting defect found by AOI is instantaneously displayed, and at the same time, all related images, such as those of printer and mounter are shown to speedily determine the cause of defect (Fig. 7).

Future Efforts

Based on the examples given above,

advanced M2M through “1 STOP SOLUTION” enables a variety of mutual cooperation functions, and results to reductions of work time, labor and human errors and improvement of quality through speedy implementation of defect countermeasures, thereby bringing out potential capabilities of the whole mounting line and improving efficiency as a whole.

Aside from the above-described examples, Yamaha Motor also provides various mutual cooperation functions unique to Yamaha machines connectivity. In addition, Yamaha is determined to develop further advanced connectivity functions in stages to improve overall efficiency of SMT factories. □

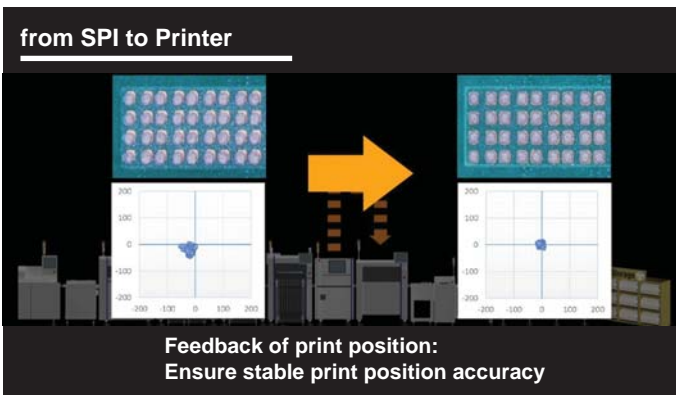


Fig. 4: Feedback of print position from SPI to printer

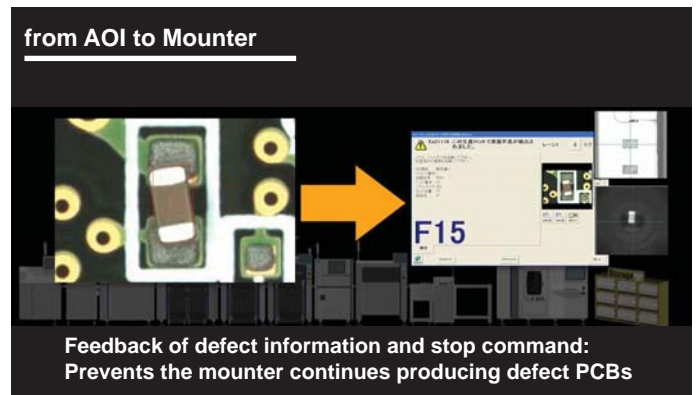


Fig. 6: Feedback of defect information and instruction of stop command from AOI to mounter

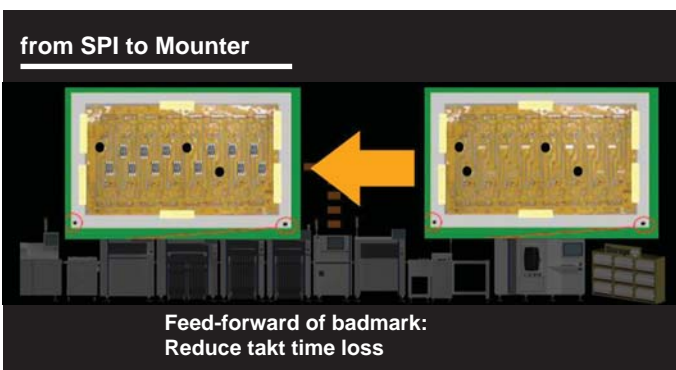


Fig. 5: Feed-forward of bad mark from SPI to mounter

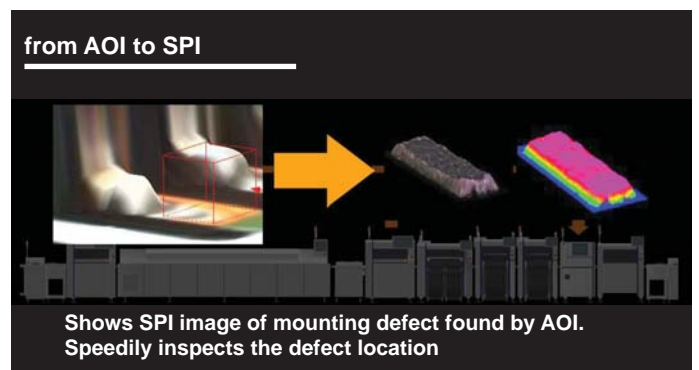


Fig. 7: Display of SPI image found by AOI