

# IMPLEMENTING THE INTELLIGENT AUTOMATION SYSTEM ON PRODUCTION LINES

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How to make the best use of the work force at a factory and to enhance the production efficiency are the topics which all manufacturing enterprise need to continuously think so as to maintain their high competitiveness. Under the non-stop progress of technology, there is also a new wave of changes at the factory working environment while integrating the professional technologies in all fields.

This article introduces a real case that a professional fitness manufacturer has established a no-manual-delivery and intelligent system with automatic inspections on the assemble line of fitness equipment, which indicates the importance of factory automation.

## **The background to implement the intelligent automation system**

Taking the production of commercial treadmills as an example, the total weight of a treadmill's

parts is about 50 kilograms. On the assembling process, the responsible person has to carry out the function tests and write down the results on the manufacturing control sheets. After delivery, the manufacturing sheets shall be filed. And after the assembling, the whole treadmill weights around 300 kilograms. Then, the treadmills will be moved to the packaging line to be dismantled and packaged. At last, they will be piled upon the pallets for shipments.

The manufacturing problems which a factory encounters can be attributed into the following 3 points, which shall be treated as priorities of problem solving.

1. The treadmill packaging personnel needs to take charge of all the parts and final products deliveries. The weight is not light at all. There is a possibility of industrial safety accident on the delivering process. In order to reduce the happenings of accidents, the manufacturing

company hopes to replace the manual delivery with automatic guided vehicle.

2. During the assembling process, the assembling personnel has to inspect the functions of the product; also they have to write down the test results on the manufacturing control sheets. After the treadmills are sent out, the sheets shall be filed and stored. The function inspections and result judgements are done by humans; therefore, there might be different operations and different test results. And there might also human errors in writing the test results. This company plans to implement an intelligent automation system which is able to collect test results and put into the database via communication programs and to decrease manual work steps so that they can get objective and accurate test results by comparisons.
3. When the products are shipped to the end users, if there are functional problems, the logistics of customer complaint service shall be done as followed: (1) Usually the clients in the fitness equipment industry requests to receive replies within 24 hours. Even so, the problems cannot be directly judged. It is vital to track

the manufacturing process and the records on the manufacturing test sheet. However, the problem and the paper manufacturing test sheet can be only reported to the quality control department the next working day; (2) the staff at the quality control department find the manufacturing information on the manufacturing test sheet based on the product number; (3) the staff at the quality control department, the production department, and at the research and development will discuss the problem, the reason and the solution; further, they can reply their client within 24 hours; (4) within 3 days, they post new parts to the client to replace the broken ones. Due to the manufacturing test sheets are made of paper, there is a chance to get lost and uneasy to find it. Thus, it is indeed a challenge to reply clients within 24 hours. Additionally, because the problematic parts are provided by subcontractors. The parts of the same patch are possibly used in the treadmills with other serial numbers. Based on the paper records, it is not an easy job to trace back the relevant information.



## Solutions of the intelligent automation system

In views of the above-mentioned demands, we provide the following methods to make improvements at the factories.

1. The assemble line of treadmills shall be installed with no-manual delivery system. To plan a reasonable and smooth delivery route from the assemble line, the factory can simply reduce the happenings of industrial safety accident by installing automatic guided vehicles made in Taiwan.
2. To implement the automatic checks of treadmill functions and signal captures. According to check items, treadmills can be installed with optical vision and laser sensor equipment which can export the test results and the signals of speed and strength;

moreover, they can automatically capture the test statistics and make judgements if they can meet the product specifications made by the company.

3. To build the treadmill production information database and the traceability system. By using the computer system, we connect the inspection information of important parts with the product information, the database can directly answer the questions from customers very promptly from the traceability system.

## Benefits created by the intelligent automation system

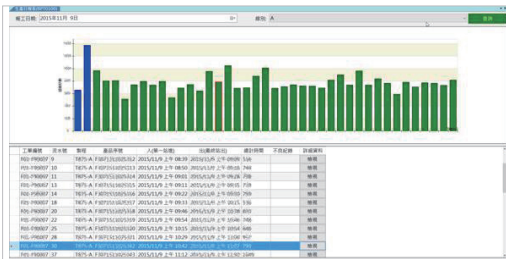
To implement an intelligent automation system is not meant to directly deny the efforts of the production-line personnel. They are very diligent to make contributions. The consideration is that when there is a manual factor, things would become comparatively uncertain. Therefore, the manufacturer hopes to solve industrial problems by installing an intelligent factory environment. Besides, the implementation of the intelligent system is not to replace the human work or to reduce the operation staff at the

factory. In the contrary, with the assistance of the smart equipment and system, the work of the original personnel are elevated to inspections and confirmation. And the heavy delivery work problem would be solved; the chance of industrial safety accidents would be also lowered. Besides, due to the re-confirming act of the working staff, product quality and yield could be much improved. In general, the system can bring the benefits as followed:

1. Optimization of the manufacturing efficiency: The no-manual delivery system has the materials from the storage or the second process production line. The delivery quantity of the assemble parts relies on the demands. When the production line needs to be changed, the system can save time to deliver the materials in and out of the production line. In addition, the automatic guided vehicle carry all the assemble parts of a treadmill. When the final product is assembled, it is supposed that all the parts shall be installed into the product. If there is any left part, it shows there must be a problem on the certain part of the production line.
2. Flexibility of production: Once the production information database is installed, the producing process of all products can be managed efficiently. All production information will be on the intelligent system. Therefore, if there is a request to produce different products, we only need to read the barcode on the manufacturing test sheet and then we can directly change and schedule the assemble content to carry out the requested production. Besides, if suddenly the staff forgets how to produces the new products, they can use the online documents on the system and watch the video lessons and quality abnormality, etc. By direct browsing, the production-line personnel would be reminded with precautions.
3. To establish an intelligent management system of inspection information: via signal automatic collection, the captured inspection results are recorded in the database and build a connection with the product serial number of treadmill for the future tracing. If the measure results do not meet the regulations, the system will pump up an error screen to remind the staff on the production line. Meanwhile, there are also color management. OK is green; NG is red. In addition, if there is an important data which is not given, the system will also show up a reminded the missing information and forbid the producing flow to the next working station.
4. Information collection: collecting and recording all the mechanical signals of assembled parts during the assembling process on the major production line which includes the frame processing, base assembling, motor assembling, roller assembling, running plate assembling, running belt assembling,



Picture 1 Through scanning the barcode of parts to collect information and reduce human errors in copying.



Picture 2 Statistics of daily production sheet

日期	数量	其他信息
2015/11/15	100	...
2015/11/16	120	...
2015/11/17	110	...
2015/11/18	130	...
2015/11/19	140	...
2015/11/20	150	...
2015/11/21	160	...
2015/11/22	170	...
2015/11/23	180	...
2015/11/24	190	...
2015/11/25	200	...
2015/11/26	210	...
2015/11/27	220	...
2015/11/28	230	...
2015/11/29	240	...
2015/11/30	250	...

Picture 3 Query about the production information and inspection records

monitor assembling, and tests, the serial number of final products and the relevant patches information of key parts and other messages on the production line. All the information will be the important references for the following production progress and reminders, quality control inspections, yield statistics and other analysis tasks.

- Information inquiry: This system contains a complete database of production information. Just with the product serial number of treadmill, the customer-service staff can quickly get all the production information and quality control check records and answer the questions raised by customers. At the first moment, they can pass the relevant information to the quality control and R&D colleagues to follow up and avoid the similar problems. The query interface is shown in the Picture 3.
- To build a quick-replying mechanism to serve customers: Through the production management system, the company can store the manufacturing information of all-shipped treadmills and make the connections between the serial numbers of treadmills and the patch numbers of key parts:
  - When the product is delivered to the end user and the function does not work, the staff use the inquiry function of this system according to the product serial number and the traceability management to find out the production records so as to know the problem and reply the customer.
  - If the problem has something to do with a certain patch of parts with problems, the staff also can use the connection

management between products and key parts to find out the parts in the same patch and the applied products. Before the problems of other products happen, the staff can replace the parts with normal ones. Thus, it can lift the quality image which the company initiates and also reduce the cost to handle customer complaints.

7. 7.Instant information display system: to instantly control the latest information of production lines through production information database, the personnel can estimate the production quantity that day, completed production quantity and abnormal quantity. Also they can check all the ongoing production lines and the instant information, including product names, manufacture order numbers, assembling timing, operator personnel information and so on as shown in the Picture 4.



Picture 4 Instant information display system

Taiwanese manufacturers are embracing the fierce global competitions. They do not have the price advantages to get orders like before. It is essential to develop toward manufacturing servitization and provide clients with better value-added services so that a long-term partnership could be well-established. In this article, the intelligent automation system is to implement the production traceability management system in combination with automatic inspection technologies of manufacturing and production information management system. When a certain product has a problem, the company can use the electronic management method to instantly reply customers and provide solutions. Also with the product traceability management, the company finds out the products which might share the same problems. Such as the car industry to take call-back actions and handle the problems in advance so that in the end the customer satisfaction level and the quality product image of the company can be both enhanced.