Application Analysis of Infrared thermal imaging Technology in Intelligent Manufacturing Field

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Abstract: With the continuous development of science and technology, traditional manufacturing technology has also been developed. It has gradually developed in the direction of intelligent manufacturing technology through continuous integration with the advantages of machinery, energy, materials and other technologies. Intelligent manufacturing technology has been widely used by virtue of its own advantages such as high quality, high efficiency and energy saving. At present, in order to better improve the efficiency of intelligent manufacturing technology, relevant personnel have begun to apply infrared thermal imaging technology to the manufacturing field.

1. Introduction
Infrared thermal imaging technology was first applied to some darker areas of the working environment, such as the photosensitive chemical industry, seabed resource exploration and ocean fishing operations. With the continuous maturity of infrared thermal imaging technology, it is gradually applied to the field of intelligent manufacturing.

2. A brief analysis of the concept of intelligent manufacturing
The intelligent manufacturing industry belongs to a relatively special category in the manufacturing industry. The fundamental purpose of adopting intelligent manufacturing technology is to optimize the production and transaction. Different from traditional manufacturing technology, intelligent manufacturing technology mostly uses computer and the more popular artificial intelligence technology to control the manufacturing. In addition, technical employees engaged also undergo systematic and professional training to ensure the superiority of intelligent manufacturing technology. In the past two years, with the continuous maturity of smart manufacturing technology, a number of smart factories have been derived. Smart factories can achieve the same output as the traditional manufacturing industry with less human resources. And the production technology adopted by the intelligent manufacturing industry is mostly pollution-free technology, which not only greatly saves production costs but also not causes damage to the surrounding.

3. Key technologies in the field of intelligent manufacturing

3.1 Computer technology
Computer technology in intelligent manufacturing mainly refers to communication and computer technology as the core. In the field of smart manufacturing, computers in different geographical environments can be connected wireless by signing agreements. With the help of computer technology, enterprises engaged in smart manufacturing can quickly obtain the production and data. In addition,
computers must have efficient and stable transmission performance. With the help of transmission performance, it can not only ensure the normal operation but also improve production efficiency.

3.2 Automatic control technology
Under normal circumstances, automatic control technology can be divided into closed and open loop. The automatic control technology used in the field of intelligent manufacturing is mostly closed loop control structure. The closed loop control structure is equipped with a feedback loop device, and technicians can set corresponding output and positioning actions on the feedback loop device according to actual needs to control the production line.

3.3 Communication technology
In the field of intelligent manufacturing, communication is also one of the core technologies. The essential purpose of communication technology applied to the field of intelligent manufacturing is to collect and obtain information. Under normal circumstances, designers will install a central control system on production equipment, and a corresponding integration system is added to the control system. On the one hand, the system can help manufacturers quickly obtain the required production data. On the other hand, it can help manufacturers quickly deal with some of the problems in the production, thereby improving manufacturing efficiency.

| Item No. | Key words                                      | Item No. | Key words                                      |
|----------|-----------------------------------------------|----------|-----------------------------------------------|
| G06F19/00 | Digital calculation / data processing         | G06F9/46 | Multi-program device                          |
| G06F17/50 | Computer aided design                         | G05B19/4093 | NC machine/control information               |
| B01B     | Measure                                       | G05B23/02 | Electrical inspection /monitoring control     |
| G06N     | Specific calculation model                    | G05B19/4069 | Simulation/program control                    |
| G01N     | Test and analyze materials                    | F16H     | Gearing                                       |
| G06F17/00 | Digital calculation/data processing           | G05B19/4097 | NC machine control                           |
| H04W     | Wireless communication network                 | G05B19/408 | Data processing/format                        |
| G06F17/60 | Data processing system                        | G01J     | Photometry                                     |
| G06K     | Data identification/representation/recording  | G11B     | Information storage                           |
| G05B19/418 | Full factory control                     | G23C     | Milling                                       |
| G06F17/30 | Information retrieval/database structure      | B23Q1/25 | Movable and adjustable machine parts          |
| G02F     | Light control/optical simulation              | G05B19/404 | Control unit/compensation                    |
| G06F15/18 | Machine learning/adaptive control system      | G06G7/48 | Analog computer                               |
| B21D5/01 | No cutting or processing                     | G06T17/00 | 3D model                                      |
| B25J9/16 | Program control/robot                        | G06F11/30 | Monitor                                       |
| H04L     | Transmission of digital information           | G06F3/00 | Interface unit                                |
| E21B47/00 | Pressure or flow monitoring                   | E21B33/13 | A method or device for cementing              |
| B23Q3/155 | Machine/profiling or control                  | G06F11/00 | Error detection / correction/monitoring      |
4. **A brief analysis of the concept of infrared thermal imaging**

In 1800, when British astronomers used a spectroscopic prism to study sunlight, they stumbled upon a hot line that was indistinguishable to the naked eye. The hot line was later known as infrared rays. Infrared, also known as infrared radiation, is ubiquitous in the material world. Scientists have found through analysis that as long as the temperature exceeds zero Kelvin, a certain amount of infrared radiation will be emitted, even ice cubes with zero degrees. (The zero Kelvin temperature mentioned here is -273.16°C). With the development of this research, the application of infrared thermal imaging technology was born. Scientific researchers have developed a detection instrument for infrared radiation by using internal photoelectric effect semiconductor components and equipment. The instrument can effectively distinguish the difference between ordinary and infrared radiation temperature based on the principle of spectrum, and produce different images based on the intensity of infrared radiation. At present, infrared thermal imaging components can be divided into two types and they are uncooled and cooled thermal imager. Although there are certain differences in the operating modes of the two components, the equipment composition of the two is similar mainly composed of detector components, optical lenses, signal processing equipment and display devices. In the infrared thermal imaging detection instrument, the two most are the infrared detector and the optical lens. However, due to the late introduction of infrared thermal imaging technology, most manufacturers currently come from the United States, Japan, France, Britain and other countries.

Infrared thermal imaging technology was only used in the field of military strategy at first, and it was very expensive imaging technology. In 1940, the first photon infrared detector appeared. The technology was derived from the heat-seeking missile technology. In the Second World War, the German army used the first modern infrared detector PbS for the first time. In the Gulf War in the 20th century, the US military also used a large number of infrared thermal imaging equipment.

5. **Application analysis of infrared thermal imaging technology in China**

At present, with the continuous development of science and technology, the capabilities of infrared thermal imaging technology have also been greatly improved. The acceleration of economic globalization has broadened the application scope of infrared thermal imaging technology. It is no longer an isolated product in the military field and widely used in fields such as optical microelectronics manufacturing technology, material physics technology, and mechanical design technology. With the rise of the intelligent manufacturing, it is also closely integrated with intelligent manufacturing technology. In recent years, many manufacturers engaged in smart manufacturing have begun to apply infrared imaging technology to their daily production and manufacturing. For example, some smart manufacturing factories use infrared thermal imaging detectors to detect the temperature of mechanical equipment. Technicians can use the data returned to adjust the operating mode of smart machinery and equipment in time, thereby saving energy for the enterprise cost.
5.1 Application of infrared thermal imaging technology in intelligent video surveillance

In nature, temperature is higher than the absolute temperature of zero degrees will radiate red energy. The higher the temperature, the stronger the red energy radiated will be. Infrared thermal imaging technology can be carried out by receiving the red radiation emitted by various objects. In view of the advantages of thermal imaging technology, researchers use infrared thermal imaging technology in intelligent video surveillance to realize image recognition and object analysis.

For example, an infrared thermal imaging security monitoring system is used in a factory engaged in the research and development of smart phone. Different from ordinary surveillance security technology, infrared thermal imaging security surveillance technology has a good imaging transmission effect, and it can also carry out wide-angle monitoring. In the process of using infrared imaging intelligent surveillance video, the monitoring personnel only need to set a certain monitoring temperature value for the intelligent surveillance video. If the temperature of the production workshop at night is higher than the specified value, the monitoring will issue an early warning and automatically store the video. Under this monitoring technology, not only can it effectively deter the occurrence of illegal crimes at night, but it can also monitor the temperature in the production to avoid potential fire risks.

5.2 Application of infrared thermal imaging technology in equipment damage monitoring and maintenance

Infrared thermal imaging technology can be used not only in the field of security monitoring, but also in some portable devices in intelligent manufacturing. Due to the high cost of infrared thermal imaging equipment, few enterprises will use infrared thermal imaging monitoring equipment in large areas. In the traditional manufacturing industry, monitor and maintenance personnel may not be for a few small parts, most people can only use the traditional tools. In order to avoid material damage, managers should be in intelligent manufacturing by communication and computer technology. For example, managers can make monitor and maintenance equipment by using computer, communication and infrared thermal imaging technology. The instrument equipment mainly uses infrared thermal imaging technology to study some micro-damage on the surface of composite materials, and then uses ultrasonic conduction technology to analyze the damage. If the composite material shows no damage, the ultrasonic wave will not be altered. If the composite material is damaged, the ultrasonic wave will change.

5.3 Application of infrared thermal imaging technology in the erection of intelligent manufacturing engineering

With the continuous development of science and technology, the cost of infrared thermal imaging technology detectors has also been relatively reduced. In addition to being used in portable and security equipment, it can also be used in engineering. For example, infrared thermal imaging technology can be applied to exterior wall construction and power online detection. The use of infrared thermal imaging technology can not only visually monitor power supply equipment, but also use it to monitor power equipment in real time.

| Yearly representative of infrared thermal imaging technology development |
|---------------------------------------------------------------|
| 5.1 Application of infrared thermal imaging technology in intelligent video surveillance |
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6. Conclusion
In summary, with the continuous development of technology, the application range of infrared thermal imaging is gradually expanding. Currently, infrared thermal imaging technology can be organically integrated with intelligent manufacturing production. Although infrared thermal imaging technology is not perfect and mature enough, combined with a large amount of data, it can be seen that the market demand for infrared thermal imaging technology is still expanding. According to incomplete statistics, the current potential market demand for infrared thermal imaging technology is still as high as 60 billion yuan. From the current market situation, infrared thermal imaging technology market is still in infancy.

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