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The Application of IOT Technology in The Production Management of Baijiu

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Abstract: Driven by the rise of concepts, led by demonstration applications, significant technological progress and the gradual maturity of the industry, the Internet of things is accelerating its transformation into realistic scientific and technological productive forces, and the Internet of things has become an important driving force for a new round of global scientific and technological revolution and industrial change. This paper introduces the present situation of the research and application of the development of the Internet of things in liquor production management in the new period， and establishes a monitoring and traceability system for the whole process of liquor production around intelligent management and automatic production. The new Internet of things technology and information and network means are applied to the traditional brewing process，all kinds of information from different production links are collected and transmitted to the intelligent integrated management and control platform. Realize the processing and comprehensive application of production process information.

Keywords: Internet of Things; Intelligent management; Traceability system; Brewing process.

1. Introduction

Known as the interaction between the physical and digital worlds, the Internet of Things is enabled using sensors and further embedding computing and networking into any kind of conceivable object. In these objects, devices and installations are connected to each other to collaborate in order to perform some complex tasks that require high intelligence. In modern communication technologies, computing devices such as desktop computers, laptops, smartphones, etc. are connected to each other via the Internet in order to communicate.

The core and foundation of IoT remains the Internet, a network that extends and expands on the Internet, establishing extensive interconnection between entities within the IoT through various bearer networks, including public networks such as the Internet and telecommunication networks, but also private networks such as the power grid. The IoT can incorporate non-electronic everyday objects such as household appliances, clothing, buildings, roads, vehicles, food, etc. so that they can communicate with the Internet through the use of some embedded sensors or electronic devices [2-5].

2. Current status of IoT development

2.1. Foreign IoT development status

In 2005, the International Telecommunication Union proposed the concept of "Internet of Things", and the Internet of Things gradually became familiar to people, and the research work based on the Internet of Things also started.

The United States, the European Union, Japan and other countries attach great importance to the Internet of Things. In 2009, the United States proposed the concept of "Smart Planet”, saying that IoT is an important development area for the country, and invested tens of billions of dollars in scientific and technological research and construction of intelligent products and devices in response to the call. The aim is to exploit existing resources through technological innovation and reform in areas such as education and transportation.

In the same year, the EU formulated the "Internet of Things - European Action Plan” and formed a professional research team to plan the right way forward for the national Internet of Things. At present, the development of IoT in Europe has been very mature, and in the field of electricity, most European national grids have been fully automated.

2.2. Domestic IoT development status

China attaches great importance to the development of the Internet of Things, and related policies have been improved. 2009, Premier Wen pointed out in Wuxi that "China's sensor information center should be established as soon as possible" . The Ministry of Industry and Information Technology issued the "5G+Industrial Internet" 512 Project Promotion Plan, proposing that by 2022, five industrial public service platforms will be created, 10 key industries will be selected, and at least 20 typical industrial application scenarios will be formed. Continuously promote the Internet of Things innovation and development project, accelerate the development of modern industrial system, promote the optimization and upgrading of the economic system, and form a new trend of high-quality development.

2.3. Challenges to the development of the Internet of Things

For more than a year since the commercialization of 5G, China's industrial Internet of Things (IoT) construction has entered the fast lane, and the pace of exploration of "5G+Industrial Internet of Things" has been accelerated, and the national "5G+Industrial Internet" integration and innovation construction projects have exceeded 1,100, with pioneering development in the aviation, steel, mining, and port industries. In the aviation, iron and steel, mining, port and other industries to achieve the first development. A series of application scenarios for the integration of 5G and industrial Internet of Things, such as "flexible manufacturing" of garment production, driverless vehicles, smart ports, smart

cities, smart mines, etc., have been presented. Industrial IoT will promote fundamental changes in industrial production methods, but it is currently difficult to form a rapid, cross-industry, replicable and scalable comprehensive solution in the application promotion process. The applications of some of the industrial IoT solutions are shown in the following table.

Table 1. Industrial IoT solution application table

Country	Company	Application
The United States	FOSS Corporation	Achieve more secure, efficient and reliable operations
	PTC Corporation	Developing IoT applications for complex IT environments, quickly and cost-effectively
	Honeywell Corporation	Helps users achieve the organic integration of the Internet and industry
China	Shanghai SECCO Petrochemical Co.	Reduce downtime, lower operating costs and increase productivity
	Bergerac Industrial Automation (China) Co.	Capture production-related data from the shop floor and leverage different mapp function blocks to enable rapid software application building
	ANDRITZ (China) Co.	Development of smart sensors, big data and augmented reality

Currently, China's industrial overcapacity and the expanding economic costs required for development have given rise to an industrial production model to face a series of challenges in the new form, and along with the continuous maturation of IoT technology, the corresponding needs have become strong, such as: real-time and accurate logistics tracking; timely monitoring of production and equipment data; and safe and intelligent risk warning.

3. Application of Internet of Things in the field of Baijiu

3.1. Technology Line

In recent years, China's rapid development of the Internet of Things industry, coupled with the rapid changes in modern technology, liquor production management has also continued to integrate new science and technology, has achieved mechanized and automated production, while also promoting the upgrading of the liquor industry and promoting the restructuring of the liquor industry.

The application of IOT technology to the field of liquor, the use of sensors and detection technology, and real-time data collection and data analysis through the interconnection with terminal equipment. An efficient data sharing platform can be established, which in turn improves the safety of liquor production and ensures the quality of fermentation. Combined with the monitoring and control system, device integration with sensing, identification, driving, control, and network functions is realized. RFID technology is used to identify relevant production information to assist logistics staff in mail identification, transport vehicle location, overall environmental index, and parcel destination, which improves the quality and efficiency of logistics work and reduces staff stress.

3.2. Intelligent integration platform for Baijiu production

For current liquor enterprises, the intelligent control integration platform for liquor production including infrastructure layer, data collection layer, application service layer and comprehensive display layer is constructed from Internet, Internet of Things and big data technology thinking to realize intelligent control of liquor production management. The architecture diagram of the intelligent integration platform for liquor production is shown in Figure 1.

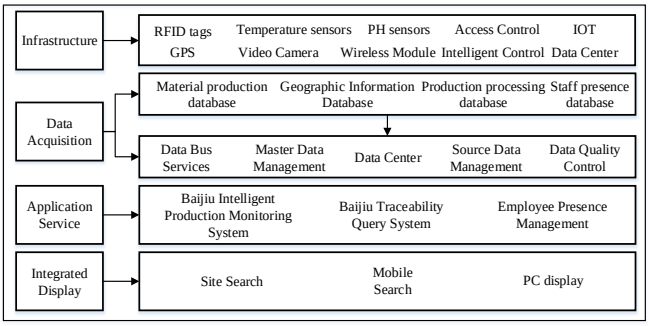

Figure 1. Architecture of intelligent integration platform for Baijiu production

(1) The infrastructure layer contains RFID electronic tags, temperature sensors, PH sensors, GPS, video cameras, wireless modules and other components. Suitable positioning is selected according to different environments, wireless module is suitable for terminal active positioning with medium cost and accuracy up to 5m; RFID positioning with lower cost and accuracy up to 3-5m is suitable for equipment asset management; GPS is widely used outdoors with lower cost and commercial grade accuracy up to 3-5m and can be applied to vehicle positioning.

(2) The data collection layer is an important carrier for database construction to realize multi-dimensional real-time data display, and the database content mainly comes from the data in the process of production and business management, and the collected contents are: production raw material information, geographic and environmental information, production and processing information, logistics and transportation information, terminal sales information, etc.

(3) The application service layer is a variety of application systems for liquor production management, mainly including intelligent production monitoring systems for liquor, liquor traceability query systems, and employee on-duty management systems. Enterprises can combine their own industry characteristics to expand the system management construction as appropriate.

(4) The integrated display layer uses a variety of devices such as PCs and smartphones to query key data such as raw material information, air quality, soil quality, temperature, and video information, thereby completing the safety monitoring and integrated display of the whole process of liquor production management.

3.3. Design of intelligent production monitoring system for Baijiu

The monitoring system in the IoT environment is realized in real time by data analysis, converting the huge database transmitted, into an easily understandable form, by realizing the monitoring of physical quantities of data, and based on the

content of the monitored data, the controller manipulates the actuators to work. The composition of the monitoring system elements is shown in Figure 2.

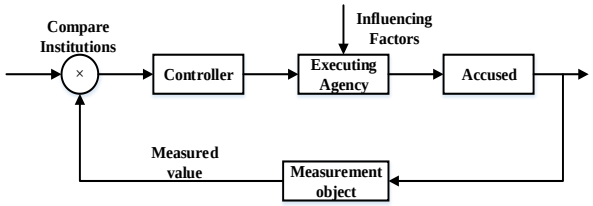

Figure 2. Monitoring system element composition diagram

The intelligent production monitoring system for Baijiu consists of sensors, data acquisition devices, enterprise production control systems, and industrial data communication networks, and is also equipped with system safety protection equipment. The role of the monitoring system includes data acquisition, real-time display, alarm management, data statistics and analysis.

(1) Data acquisition: the system has a basic information acquisition function, which enables the acquisition of real-time data on storage devices, raw materials and processing environment parameters such as temperature and PH. To ensure the accuracy of the data, the state of the measured physical quantities and the measurement environment must not be affected.

(2) Real-time display: the system has a browsing function based on real-time parameters. The processed data is transmitted to the monitoring unit, which realizes the invocation of the data, displays the parameters of the monitored object in different ways such as curves and images, and uses a uniform unit of measurement for the same measured value.

(3) Alarm management: the system has various alarm methods such as alarm threshold setting and change history, real-time data warning, and alarm point sound and light alarm. In case of real-time alarm, the monitoring equipment at the production and processing site can display the video of on-site operations and risk alarm information, and perform safety diagnosis.

(4) Data statistics and analysis: the system can count the current and historical values of various parameters at any moment, and can be printed out in graphical charts and other ways to facilitate statistical analysis. The parameters include the measured values of basic measurement physical quantities and their maximum and average values, alarm threshold information, alarm and alarm information release, etc.

3.4. Baijiu traceability system design

The liquor traceability system connects all items in the production and circulation of liquor to each other through the Internet and identification devices with the help of Internet of Things technology. It controls the safety and reliability of production, processing, and transportation more effectively and does prevent various risks of safety. The structure diagram of the liquor traceability system is shown in Figure 3.

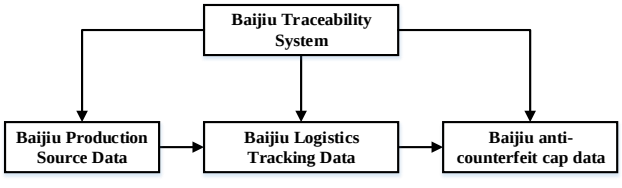

Figure 3. Structure diagram of Baijiu traceability system

The traceability inquiry system is mainly composed of the following three modules.

(1)Baijiu production module: the information of raw materials, production process information, quality inspection information and electronic bottle cap information of Baijiu is written into the electronic anti-counterfeit bottle cap through radio frequency technology, and key information such as production process and quality inspection of Baijiu is written into the RFID tag of the electronic anti-counterfeit bottle cap, and the information is synchronously and wirelessly transmitted to the quality traceability cloud platform through the mobile reading terminal .

(2) Logistics and transportation module: When leaving the warehouse, the electronic tag data in the liquor package is read and written by RFID reading and writing equipment, and this data is automatically matched with the vehicle transportation starting and ending positions and vehicle GPS data. For the vehicle driving safety, the security defense system is used, through the recognition technology of the vehicle driving personnel's face as well as body movement, real-time record whether there is abnormal and improper behavior of personnel, when there is fatigue driving, playing cell phone smoking and other behaviors, the vehicle terminal will immediately language to remind personnel to correct mistakes, and at the same time, through this kind of information, will score the safe driving of the driving personnel. This ensures the safety and consistency of the vehicle transportation process, improves the reliability of the liquor regional monopoly, and prevents the risk of liquor stringing.

(3) Terminal sales module: through a mobile reading terminal, liquor commodities are extracted in real time at the outlets, the label data in the liquor anti-counterfeiting electronic bottle cap are read, and the data are compared with the data in the quality traceability cloud platform. Thus, the authenticity and regional exclusivity of liquor goods are discriminated and processed, and the rights and interests of consumers and manufacturers are guaranteed.

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3.5. Employee Presence Management System Design

The staff on duty management system is used to manage the employees of the enterprise factory to work on time and at the right time. The specific functions include personnel management, equipment management, geographic positioning and other functions.

It identifies the information of personnel entering and leaving the production area, processing area, storage area and other areas of the enterprise, including internal staff, external staff and temporary staff, and displays real-time information on the type, quantity and area of the incoming and outgoing personnel, and provides query and statistical functions. Realize real-name entry and exit management by binding to enter personnel information. Using technologies such as access control, face recognition, and video camera, the location of staff can be accurately identified and tracked. The system flow chart is shown in Figure 4.

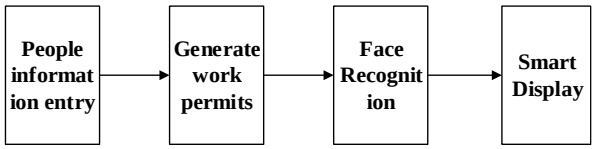

Figure 4. Flowchart of employee on-the-job management system

The system provides timely reports for personnel on duty, off duty, and crosstalk, including personnel basic information query, action route query, and action track playback, etc., to obtain information in real time. Through the construction of the system, the enterprise can effectively control the employees, improve the management effectiveness of the enterprise, and optimize the enterprise production management system.

4. Concluding remarks

With the Internet of Things as the representative of a new generation of information technology and manufacturing industry deep integration, the level of industrial production of essential safety significantly improved. With the Internet of Things, various devices in the physical world can communicate with each other through the Internet, promoting technological innovation, application innovation, integration innovation and management innovation, realizing the digitalization, networking and intelligence of manufacturing and social management, and also bringing significant improvements to all aspects of human life.

The low degree of automation and intelligence in the production of traditional liquor enterprises is highly valued by the industry, the government and relevant state departments. For the liquor industry in the new era, the penetration and integration of technology into the industry is omnipresent, from the production side, to the marketing side, and then to the management side. The cloud computing platform-based smart winemaking system replaces manual experience in the application of liquor production with the help of cloud computing, artificial intelligence, and big data. The parameters are collected to the processor using sophisticated sensors, and the corresponding knowledge base is established to form a big data system that employs professional experience and understanding to solve various complex problems. The automation and intelligence of traditional liquor brewing production is achieved, providing fundamental support for the production, management, and sales of the liquor industry.

The combination of the Internet of Things and the production management of liquor enterprises, the reasonable arrangement of Internet of Things technology in various aspects of liquor production and sales, the use of modern technology, the realization of digital management, to ensure the smooth and orderly production of safety, to better help enterprises to achieve quality, reduce costs and increase efficiency, is an important guarantee to achieve the advanced industrial base, the modernization of the industrial chain, is to eliminate the root cause of safety hazards, but also to expand the brewing It is also a necessary way to expand production.

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