

Research Article

The Design of Food Storage Guided Vehicle System Based on RFID Technology

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Abstract: According to the characteristics of the food transport system, RFID technology is integrated in the AGV automatic guided vehicle system in the food warehousing. The node RFID oriented method is chosen and the RFID note positioning function is used to realize more types and over horizon identification loading, handling and automatic storage function that improves the system flexibility through the design of tag oriented system.

Keywords: Electronic tags, food storage guided vehicle system, RFID technology

INTRODUCTION

With the development of the AGV, it has become an integral part of the logistics and distribution system of logistics equipment, which can play a strong function in food production and transport, logistics and distribution systems and therefore this device can be further developed and applied (Fuguang *et al.*, 2014). AGV (Automated Guided Vehicle) is a flexible and intelligent as one of an efficient load handling equipment, through the built-in automatic guidance system can be automatically loaded in the case of manual handling of non-intervention. It works by using the communication between the AGV and the host server, thus enabling the system to accept the task instructions issued by the host computer, the execution so that equipment running from the origin to the end, the use of the characteristics of the device itself to complete the assigned agency goods transportation and handling (Pan, 2013). Paper, food production through automation, intelligent transportation research, the use of RFID technology (Mengru, 2013; Huagui, 2014), the entire food handling system overall design and planning, thereby reducing the use of human and material resources and the working efficiency of the system is increase.

MATERIALS AND METHODS

System overview: Herein food storage guide system consists of a power supply system, the vehicle body, a drive system, wireless communication device, the control center, the positioning module and other components. AGV PC to receive a corresponding path planning, through execution of the corresponding command control center, enabling the efficient movement of the system. The three functional objectives are completed in design, control and

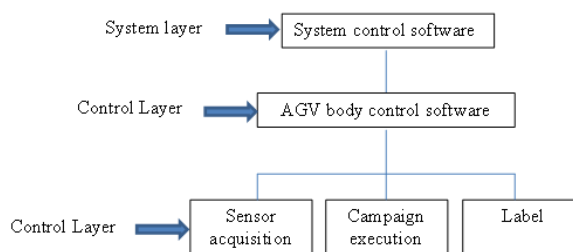


Fig. 1: Hierarchy of a schematic diagram of the system

implementing agencies. The guidance system is mainly composed of the AGV host computer control system, the vehicle control systems, sensor module, motion systems, RFID readers, tags and wireless communication module cargo and other components. System hierarchy is shown in Fig. 1.

Hardware components: The system hardware consists of many different sub-modules, specifically for wireless local area networks, computer systems, motor, electronic code disk, automatic guided vehicle power supply, various sensors, control center. Composed of hardware modules is shown in Fig. 2.

The entire hardware system is the most important device for the computer, which uses a standard server, equipped with the software system, whose duty is to give instructions AGV system. Information in this system the top intermediate layer and the transfer of information over the wireless local area network, different wireless local area network comprises a different communication protocol, which requires communication in the corresponding communication protocol. Work DC motor play a role in the motion control system, the driver is determined primarily by the H-bridge PWM wave to control speed. AGV is responsible for driving the encoder speed feedback, the feedback that the running speed and distance

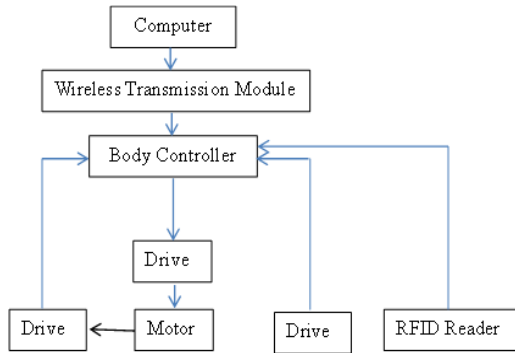


Fig. 2: Hardware system architecture diagram

information systems, two DC motors makes the AGV's attitude is adjusted by adjusting the speed. The design of the sensor system uses paper are: avoidance of ultrasonic sensors, infrared sensors, these sensors collect information about the environment is used to control the AGV sport, attitude adjustment data basis (Shaoping, 2011).

Software components: Food storage automated guided vehicle system software and software from the top of the middle layer of the MCU system PC control software. AGV core software components of the system is the top of the PC control system, which has a remote control command for automatic guided vehicles, issued function commands and tasks. While AGV and storage corresponding status information is real-time custody, the AGV path is planned by PC control system (Yongding and Jiapeng, 2011).

AGV main body of software running on the microcontroller to control the implementation of its responsibilities for the information of the PC control system integration translation, thus providing control instructions for each actuator and feedback to the PC control software to collect relevant information (Beisi *et al.*, 2010).

RFID technology principle and composition: RFID (Radio Frequency Identification) refers to the radio

frequency identification, is a more advanced wireless identification technology. The technology RFID reader for RFID-related information on the RFID read, thus completing the application and implementation of the guidance system, through user-defined label information, allowing the system to achieve efficient guiding effect.

RFID system includes RFID readers and RFID electronic tags usually (Lei, 2012). Target information is required by the system, the reader reads the electronic tag after the target information, the information corresponding data processing. Process required by the RFID reader connected to the computer serial port corresponding to the data obtained by the feedback to the operator via a computer interface, so, RFID system is a necessary part with RFID technology is matched.

RFID systems integration and AGV: By integrating RFID systems and AGV, such that the guide effect of the system is improved. Figure 3 shows a schematic diagram of an integrated system composed of communication in the serial RFID reader and AGV control system implemented in the corresponding communication protocol to transfer the collected data reader to AGV control systems, real-time control system to upload data to PC, PC to analyze data in order to achieve the integration of the whole process of AGV and RFID systems.

Integrated system driven design: LPC2210 microprocessor-driven control system is an integrated control unit with the core, which is mainly used for each interface data processing, data storage and connection system, the system control functions. The control unit includes the following major components: the microcontroller LPC2210, Serial and Modem port, debug interface. Si4133 is the system used in drive control chip, which consists mainly of startup programs: detect lock bit function Si4133_Locked, Si4133_SendData function to send data to the Si4133. The flowchart Si4133_Locked function is shown in Fig. 4.

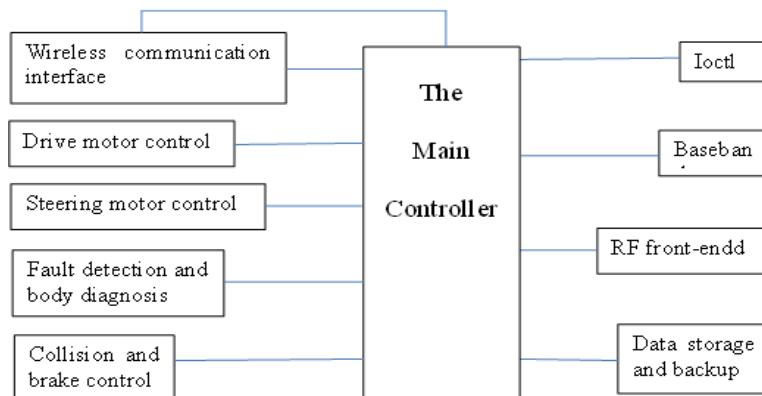


Fig. 3: Schematic of system integration

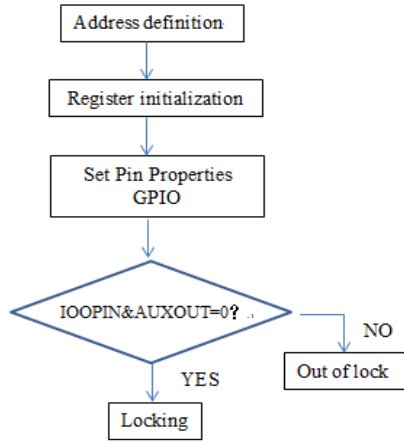


Fig. 4: Si4133_locked function flowchart

RESULTS AND DISCUSSION

RFID standards: Currently, more authoritative electronic tag has two major research institutions, which can represent an electronic tag force to the development of standards. One was established in 1999 and headquartered in Massachusetts Institute of Technology and the other in the afternoon in March 2003 was established in Japan, the two centers introduced standardized specifications are some differences.

In China, RFID technology has been the use and development of industry standards or only in some independent research and development of various RFID tag products. In terms of capacity and information format, the technology contains inconsistencies and incompatibilities. Therefore, China needs some independent research as soon as the appropriate standard for my label standard.

Front-end circuit: Systems electronic tags by the RFID circuit and antenna, divided into two types: active and passive type. Passive tags do not need to work in the power, low cost, high reliability teach; active tags require a power supply work process, when not energized in "standby" state, when excited by the reader into the normal working communication state. The study found that active tags for location and information processing advantage, therefore, greater stability. Front-end circuitry is shown in Fig. 5.

Label software design: For the reception and transmission, RF transceiver chip function data play a key role, in which the software configuration register can achieve a lot of features (Finkenzeller, 2003), including: a transceiver frequency, receiving address, CRC checksum length, wireless receive mode. Packet consists of a preamble, address, packet label, valid data and CRC check of five parts. Coordination of work between the hardware for efficient transmission and reception of data packets have a great impact, for example, the preamble information can be done automatically sending and receiving under hardware control. Data packets are labels, can be effectively prevented repeatedly received data controller.

When the system receives a command packet (address match, CRC correct), the received data is stored in the status register RX_FIFO. Position level control IRQ status register is valid. When the instruction so that the system automatically valid, acceptable response signal will be returned. CE micro-program controller is low, the control system will enter a low-power mode, this time, the system will carry out, such as the instruction fetch and store at low current. Transmitting and receiving the flowchart described herein tag

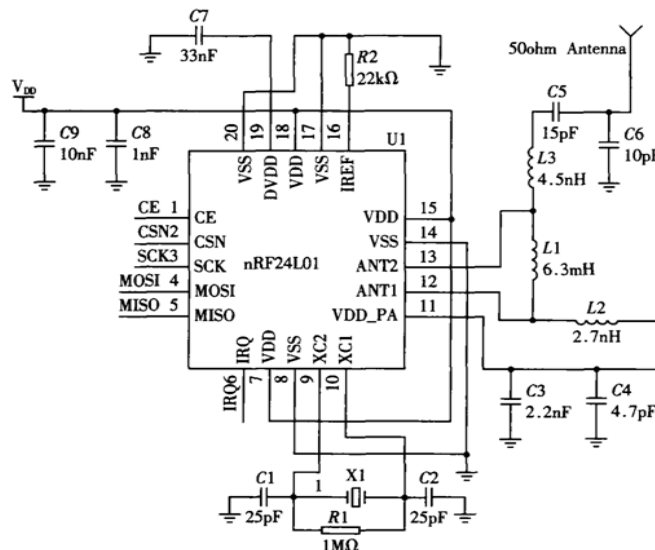


Fig. 5: Front-end circuitry

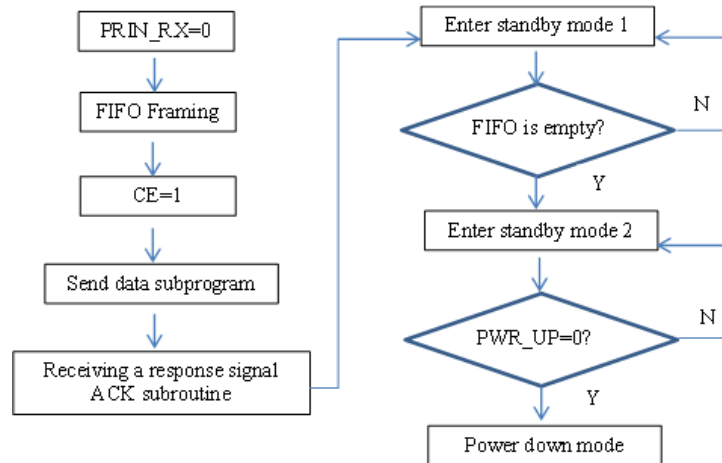


Fig. 6: Send schematic label instructions

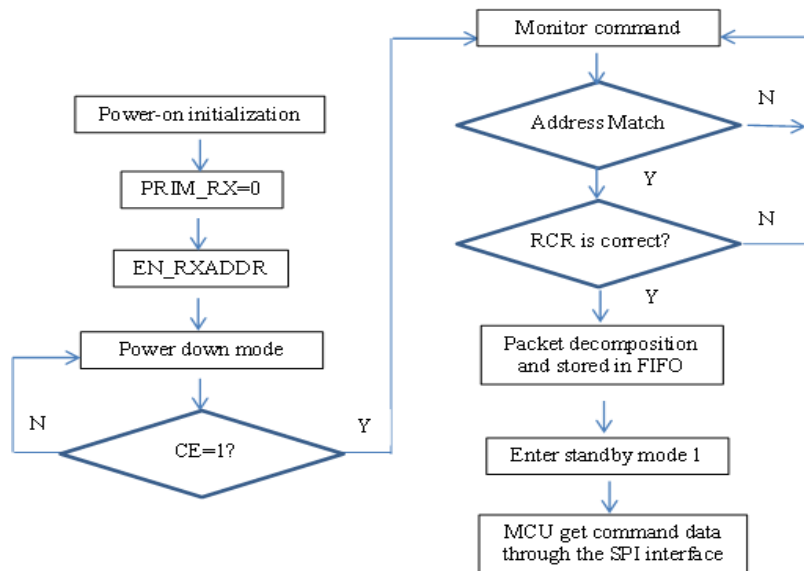


Fig. 7: Label instructions to receive schematic

instruction operates in Fig. 6 and 7, respectively, the micro-controller to perform read and write operations in the process, which accurately processing RFID work-related information play a key role (Lifang *et al.*, 2011).

Determined command transmission effect mainly by accepting the response signal, if the system receives a corresponding response signal, the data begins to delete TX FIFO, this time describing the instructions transfer was successful; on the contrary, the data has been transmitted, the automatic retransmission valid state. Data transfer instruction rely automatic retransmission counter counts, when the count value exceeds the maximum limit register is set, the high status register MAX_RT position, this time, IRQ effective information transmission process will produce MAX_RT interruption, while PLOS_CNT lost count of the counter is incremented, the command is sent after entering standby mode. RFID tag reader after receiving

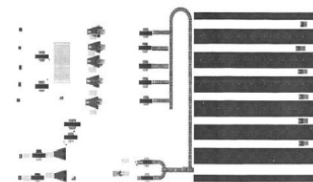


Fig. 8: Flexsim model of integrated system

information, send "PWR_UP = 0", this time, the electronic tag enters power-down mode, the entire process efficient and stable transmission of data to complete the information.

System simulation and testing: Flexsim Software Production company produced the simulation system, the software system is widely used in manufacturing, logistics, transportation and other fields, through object-

oriented technology, a more realistic simulation of the display setting environment. Shown in Fig. 8, Flexsim model for the integrated system, the simulation of the actual production process have better guidance.

System is mainly used for communication test. The system reset, the computer's COM port DART serial communication module for the pre-configured with the same parameters baud rate, set the serial port baud rate of 9600 bps logistics tracking system in the Device Manager PC software and connected to the appropriate COM port. If the RFID reader has a response that communication is successful, if the communication quality is poor, need to loop tuning parameters and ultimately communicate.

Through simulation and testing shows that, RFID and AGV systems in acquisition and integration of data transfer rates faster feedback system waits a short time, greatly improving the operational efficiency of the system. Thanks to intelligent features designed AGV system to greatly reduce labor requirements and further improve the accuracy for the transport control for greater help to improve economic efficiency.

CONCLUSION

This study discusses and designed a combination of RFID and AGV integrated systems, this design can be used in food production and transport. According AGV design features RFID and integrated systems, while oriented technology combined with RFID tags, enabling multi-target food production, BVR recognition and loading, handling and automatic storage function, increase the flexibility of the system.

Using a monolithic integrated RF front-end, simplifying the application system, the stability and reliability of wireless systems is enhanced, while making the research and development easier, reducing the cost of the system, the whole system of low power consumption, small size, easy to expand, rebuild convenient, high reliability, suitable for efficient food production.

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