

Automatic soil detection and analysis system based on artificial intelligence

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Abstract

With the continuous development of China's science and technology, the modernization and intelligence of agriculture continue to deepen, the state attaches more and more importance to the three rural problems, for which the state vigorously promotes the "Internet of Things +" modern agriculture, the application of the Internet of Things, big data and mobile Internet and other modern technologies to promote agricultural transformation and upgrading. We use the Internet of Things communication, sensor technology and mechanical design, designed can automatically detect and analyze the soil quality of the trolley, the equipment can achieve automatic detection on different land, analysis of nitrogen, phosphorus and potassium, pH, temperature and humidity and conductivity in the soil, combined with the analysis of planting crops after the generation of analysis programs and then transmitted to the mobile phone, more scientific guidance to users to plant crops, can maximize the utilization rate of water and fertilizer, Avoid a series of environmental pollution problems caused by excessive use of fertilizer.

Keywords

Microcontroller IoT Soil Detection Sensor Automatic Nitrogen, Phosphorus and Potassium pH Conductivity.

1. Introduction

1.1. First, the function of the system introduction

The automatic soil detection and analysis system based on artificial intelligence adopts a trolley design, which greatly increases the space and carrying capacity of the system, and the automatic folding sensor device provides the basis for the endurance of the platform and the accuracy of the data. The sensor device is mainly composed of soil nitrogen, phosphorus and potassium sensor unit, temperature and humidity sensor unit, power management unit, brake unit, wireless transmission unit and main control unit. Each functional unit is independent of each other into a module, which is convenient for product design and assembly, and convenient for later product maintenance and repair.

Compared with other traditional products, this project has the advantages of wireless transmission distance, high signal accuracy and stability, and accurate data processing of sensors, etc. The project is more adaptable to the environment and can better cope with the complex geological environment. Our project presents data to users, when the soil quality changes slightly, the analysis car gives users some suggestions, so that users can take countermeasures to prevent major losses. The analysis car uses our intelligent algorithm to analyze the collected data and then propose a plan to the user, prompting the user to improve soil salinity, pH and so on.

1.2. Second, the overall structure and rationale of the system

Master unit

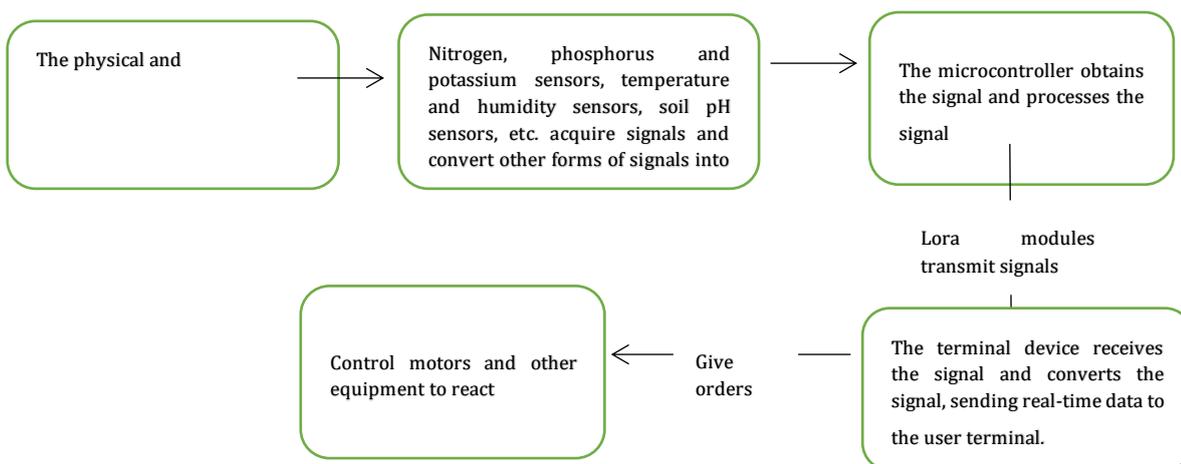
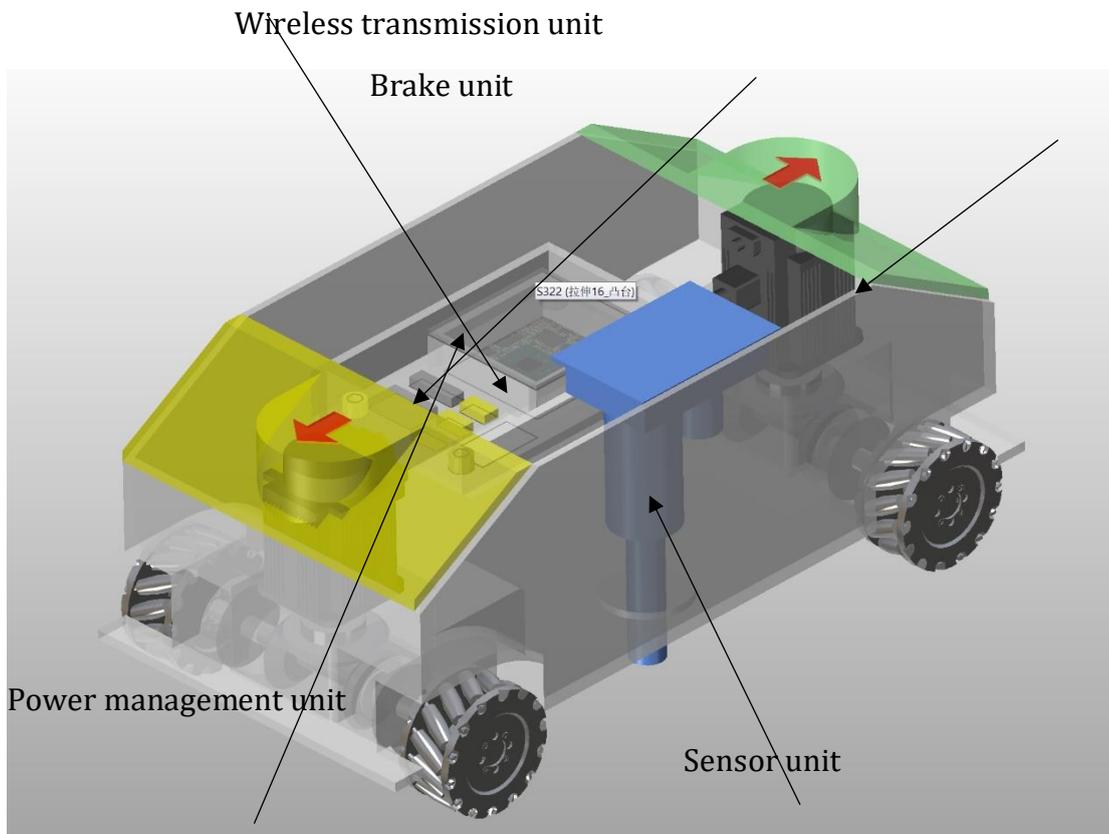


Figure Schematic diagram of the automatic soil detection and analysis system based on artificial intelligence

Master ATmega32u8 processor

The main purpose of the main control ATmega32u8 chip is to save external pins to drive each sensor, send control signals and receive sensor detection information, calculate and process the received and transmitted signals, repeat the transmission and reception process, and then connect various parts of the components, and integrate the functions.

The design and development of the main control part is not only conducive to reducing the interference signal generated by other functional units, but also facilitates later hardware maintenance and firmware upgrades.

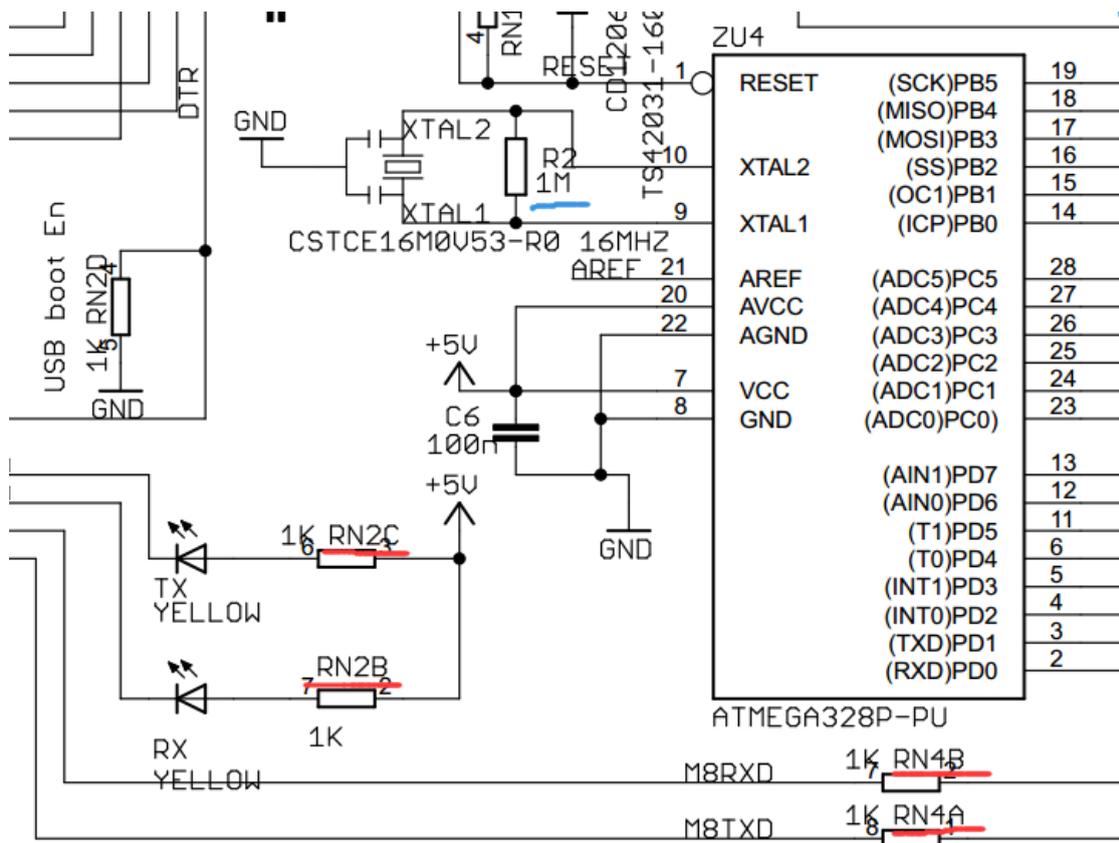


Figure Master control ATmega32u8 chip

Wireless transmission module

The wireless transmission module has two functions, one is the implementation of data transmission, and the other is satellite positioning. In the communication mode between the car and the terminal we use LoRa wireless communication technology, the reason why we choose LoRa wireless communication technology is first of all because of its long communication distance and strong anti-interference ability, suitable for low signal strength and large working range of working environment, followed by its low power consumption, its received state current is only 12mA, only 32mA of emission current, less than 1µA of sleep current. The signal transmission system we designed greatly improves the endurance of the equipment under the premise of ensuring the communication distance and quality.

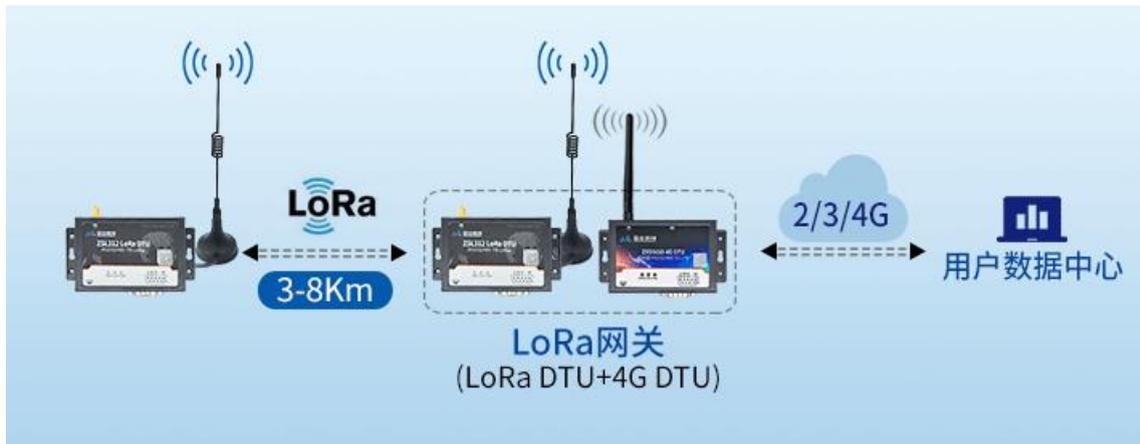


Figure Schematic diagram of the LoRa communication process

GPS satellite positioning module, mainly using WF-NEO-6M GPS module, which is characterized by high performance, low power consumption, through the time difference and speed to calculate the distance and then determine the user's position. The satellite positioning module is also installed in the wireless transmission unit, which can greatly reduce the signal interference between the module and other units, and greatly enhance the stability and reliability of the system. When the navigation button is pressed, the microcontroller sends a command to the GPS module to automatically navigate the route that has been set

Soil sensor detection module

Soil sensors include: soil nitrogen, phosphorus and potassium module, soil pH module, soil conductivity module, etc. The sensor module converts the collected information into an analog signal and transmits it to the main control chip, in order to enable the main control chip to accurately identify the connected sensor module and the connection between it and its access, we have added to the module The eeprom chip stores the sensor's information in it, and each socket has an independent SPI bus, which converts the corresponding data when the master part detects the sensor information at the corresponding port.

Different consumers have different practical use needs, different types of sensors are applied in a specific environment, and not all consumers need all sensors. In our design, the sensor modules are independent of each other, forming a unified, standardized module component for consumers with different needs to combine.

Power management module

There are many components with high voltage requirements, such as the A/D conversion part inside the main control unit, the wireless transmission unit, etc., and we will design the power supply part separately to ensure the stability of the power supply. The power management unit provides an independent dc-dc power supply circuit for each other part to ensure the stability of each part of the power supply, and each dc-dc can control its enable state independently, which is convenient for achieving the overall low-power function.

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