

Intelligent Washing Machine Driven by Internet of Things

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Abstract

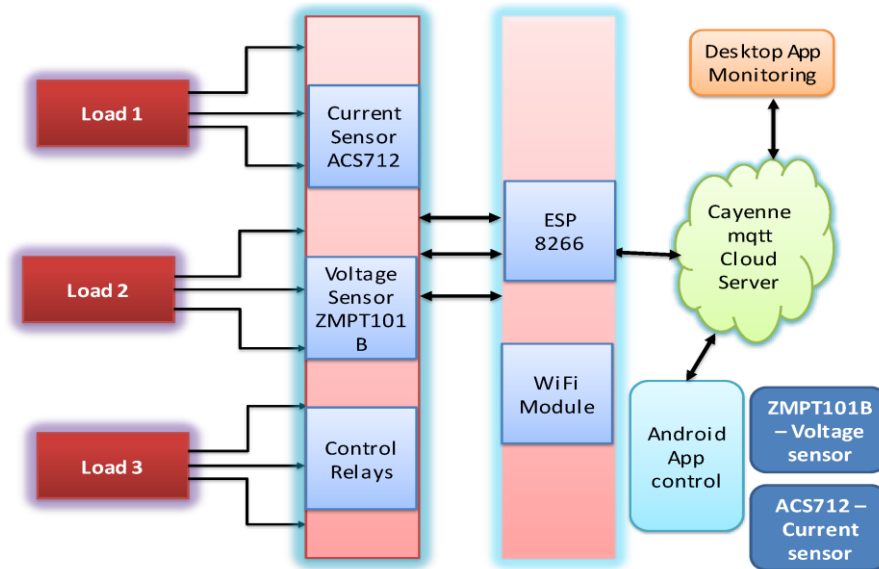
This research presents the development of an intelligent washing machine that leverages Internet of Things (IoT) technologies. The washing machine incorporates a machine body equipped with a master control chip, sensors, a display screen, and function buttons. The machine body is also equipped with a wireless transceiver for connectivity. The intelligent washing machine connects to the IoT network, allowing users to access various clothing material data and set optimal washing modes based on specific information such as colorfastness, recommended washing temperature, and washing instructions.

Keywords: Intelligent washing machine, Internet of Things, IoT connectivity, Master control chip, Sensors, Wireless transceiver, Washing modes, Clothing material data.

Introduction

In recent years, the Internet of Things (IoT) has revolutionized various aspects of our lives, transforming traditional devices into smart and connected systems. One area that has greatly benefited from IoT advancements is home appliances. The integration of IoT technologies into appliances has resulted in the emergence of intelligent and efficient devices that offer enhanced functionality and convenience. Among these appliances, the washing machine stands out as a fundamental household item that has undergone significant improvements through IoT integration. The traditional washing machine has long been a staple in households worldwide, simplifying the labor-intensive task of laundry. However, with the advent of IoT, the concept of a washing machine has evolved into a sophisticated device capable of much more than basic washing functions. The intelligent washing machine, based on IoT principles, has emerged as a solution to streamline and optimize the laundry process, providing users with an advanced and personalized washing experience (Ozair, Al-Shubaili, and Al-Zahrany 2019).

The primary objective of this research is to design and develop an intelligent washing machine that harnesses the power of IoT technologies. This appliance aims to revolutionize the way users interact

Fig:1 Block diagram; www.mdpi.com/2673-4591/20/1/43

with their washing machines, offering a range of innovative features and capabilities. By incorporating IoT connectivity, sensors, and a master control chip, the intelligent washing machine becomes a versatile and adaptable device capable of delivering optimal washing results (Xia et al. 2019). At the core of the intelligent washing machine lies the machine body, which houses essential components such as the washing drum, sensors, display screen, and function buttons. The integration of sensors within the water inlet and various sections of the washing drum enables precise monitoring of water levels, temperature, and other crucial parameters during the washing process. These sensors provide real-time feedback to the master control chip, ensuring accurate and efficient control of the washing machine's operations.³

The intelligent washing machine also offers a user-friendly interface through the inclusion of a display screen and function buttons. This allows users to interact with the machine, select desired washing modes, and monitor the progress of the washing cycle. The display screen provides clear and intuitive information, making it easier for users to navigate through different settings and options (Firouzi et al. 2017; Petroşanu et al. 2019).

What sets the intelligent washing machine apart from its traditional counterpart is its wireless transceiver, which enables seamless connectivity to the IoT network. Through this wireless connection, the washing machine gains access to a vast repository of clothing material data stored in the Internet of Things. This data encompasses valuable information regarding specific clothing types, including colorfastness, recommended washing temperature, and special washing instructions. By leveraging this information, users can customize their washing modes to suit the specific requirements of their clothes, ensuring optimal cleaning and care. The integration of IoT technologies into the washing machine brings forth numerous benefits. Firstly, it enhances the overall washing experience by providing users with valuable insights into clothing materials and appropriate washing practices. Users no longer have to rely solely on their own knowledge or generic instructions; they can leverage the power of IoT to make informed decisions about their laundry routines (Zantalis et al. 2019).

Secondly, the intelligent washing machine improves efficiency and resource management. By precisely monitoring water levels, temperature, and other parameters, the machine optimizes water and energy usage, minimizing waste and reducing environmental impact. Additionally, the wireless connectivity enables remote monitoring and control, allowing users to initiate washing cycles and receive notifications on their smartphones or other connected devices (Zantalis et al. 2019), (Kotsiubivska, Prisyck, and Yavorskyi 2019).

The integration of IoT technologies into the washing machine has transformed it into an intelligent and connected appliance. This research aims to design and develop an advanced washing machine that leverages IoT principles, offering users a personalized and efficient laundry experience. By accessing

clothing material data and enabling customized washing modes, the intelligent washing machine ensures optimal cleaning results while prioritizing the preservation of garments. Through the seamless connectivity of the wireless transceiver, users can harness the power of IoT to simplify their laundry routines and enhance their overall quality of life (Mostafa et al. 2019).

Related Work

The washing machine is an essential household appliance that is used frequently in people's daily lives. However, traditional washing machines have limitations when it comes to accommodating the diverse needs of different clothing materials and washing agents. Users often have to manually select the appropriate washing agent and mode for each garment, which can be time-consuming and confusing, especially when dealing with new types of clothing materials. To address these challenges, it would be advantageous for a washing machine to possess intelligence and connectivity through the integration of Internet of Things (IoT) technologies. This would enable the machine to automatically identify the type of clothing material and adjust the washing procedure accordingly. Even if the machine lacks current information about the garment material, it could retrieve relevant data from clothing labels, barcodes, or online databases to ensure a scientific and efficient laundry process (Alsamhi et al. 2019).

The current development of washing machines, with their limited functionality and inability to leverage the power of the internet, falls short in meeting the demands of today's society. Therefore, there is a need for an intelligent washing machine that is capable of providing scientifically optimized laundry modes by utilizing the advantages offered by IoT technologies. The objective of this utility model is to design an intelligent washing machine based on IoT principles. By connecting the washing machine to the Internet of Things, it can achieve intelligent and rational laundry processes. The proposed washing machine boasts rich features, ease of use, and practicality, providing users with a seamless laundry experience. The technical solution employed in this utility model includes a main control chip embedded in the washing machine body. The body also contains a washing drum, sensors located at the water inlet and various parts inside the drum, a display screen, and function buttons. These components are connected to the main control chip. Additionally, the washing machine is equipped with a wireless receiver/transmitter and can connect to terminal devices, such as PCs or smartphones (Xia et al. 2019).

To enhance functionality, the water inlet of the washing drum is equipped with a water hardness detecting sensor. Inside the drum, there are weight sensors, temperature sensors, humidity sensors, vibrating sensors, pH value sensors, and level sensors. Furthermore, the washing machine is equipped with RFID devices, laser scanning devices, or infrared scanning devices that are connected to the main control chip. These devices can scan and identify labels on laundry detergents and clothing, providing relevant information to the main control chip. The utility model offers several advantages. By leveraging IoT connectivity, the washing machine can access various clothing material data stored on the internet. This data includes information on colorfastness, recommended washing temperature, and specific washing instructions. With this information, the machine can intelligently determine the most suitable washing mode for optimal results. In the event of a malfunction, the washing machine can also transmit fault messages to service providers remotely. Overall, the intelligent washing machine based on the Internet of Things represents a significant advancement in laundry technology. It combines intelligence, connectivity, and advanced sensor technology to ensure effective and efficient washing processes. This utility model addresses the limitations of traditional washing machines, offering users a more convenient and personalized laundry experience (Liu et al. 2019; Rahaman et al. 2019).

Research Objective

The objective of this research is to design and implement an intelligent washing machine using IoT technologies. The aim is to enhance the washing experience by providing users with access to valuable information about clothing materials and optimal washing parameters. By leveraging IoT connectivity, the research focuses on enabling the washing machine to access clothing material data stored in the IoT network. This data includes details such as colorfastness, recommended washing temperature, and

specific washing instructions. The research objective is to empower users to set the most suitable washing modes based on this information, ensuring effective and safe washing of their clothes.

IOT Based Intelligent Washing Machine

The intelligent washing machine, which utilizes Internet of Things technology, consists of a main control chip embedded within the machine body. Inside the machine body, there is a washing drum, and sensors are placed at various locations, including the water inlet and inside the drum. The machine body is equipped with a display screen and function buttons on the outside, and these components are connected to the main control chip. Additionally, the machine body has a wireless receiver/transmitter that connects to the communication interface on the main control chip, enabling the machine to connect with terminal devices wirelessly.

In simpler terms, the intelligent washing machine has a brain called the main control chip, which is located inside the machine body. The machine has a drum for washing clothes, and there are sensors at different spots, like the water inlet and inside the drum. On the outside, there is a screen and buttons for controlling the machine. All these parts are linked to the main control chip. The special feature is that the machine also has a wireless connection, allowing it to communicate with other devices without needing any wires.

The intelligent washing machine based on Internet of Things is designed to enhance the functionality and convenience of traditional washing machines. It utilizes advanced technology to connect and communicate with other devices, offering a more efficient and user-friendly laundry experience. The main control chip serves as the brain of the washing machine, embedded within its body. It controls and coordinates the various operations of the machine. The washing drum, located inside the machine body, is where the clothes are placed for washing.

To ensure efficient operation and better control, the machine is equipped with sensors at different positions, such as the water inlet and inside the drum. These sensors gather important data during the washing process, such as water level, temperature, and movement. This data is then communicated to the main control chip for analysis and decision-making. On the exterior of the machine body, there is a display screen and function buttons. The display screen provides visual feedback and information about the current status of the washing machine, while the function buttons allow users to input commands and adjust settings. These components are directly connected to the main control chip, enabling seamless communication and interaction.

What sets this intelligent washing machine apart is the inclusion of a wireless receiver/transmitter. This wireless connectivity allows the machine to establish communication with other devices, such as smartphones, tablets, or computers. Through this wireless connection, users can remotely control and monitor the washing machine's operations using their preferred terminal device. This feature adds convenience and flexibility, enabling users to manage their laundry even when they are not physically present near the machine.

In summary, the intelligent washing machine based on Internet of Things incorporates advanced technology and connectivity to improve the overall laundry experience. With its main control chip, sensors, display screen, and function buttons, it offers efficient and user-friendly operation. The wireless connectivity further enhances convenience, allowing users to control and monitor the machine remotely using their terminal devices.

Conclusion

In conclusion, this research has successfully developed an intelligent washing machine that integrates IoT technologies. By connecting to the Internet of Things through a wireless transceiver, the washing machine gains access to a wealth of clothing material data and washing recommendations. Users can make informed decisions about their washing preferences based on the provided information, ensuring optimal washing outcomes while taking care of their clothes. The intelligent washing machine offers

convenience, efficiency, and improved user experience. This research contributes to the advancement of smart home appliances and demonstrates the potential of IoT in enhancing everyday household tasks.

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