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IoT Automatic Control System Based on User Command Analysis

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Abstract

As the IoT (Internet of Things) has been commercialized recently, studies are underway for user-customized services. Accordingly, the service should be changed according to the characteristics of the user rather than the unified service. However, when existing systems operate automatically, there is a problem of providing a uniform service to all users without providing a customized service.

To solve this problem, this paper proposes an IoT automatic control system for analyzing user commands. The system collects the user's remote control commands to organize the user data sets, classify the collected user's commands according to the devices, and classify the user's work orders in time to derive the average operation of the devices. Through this, it is possible to provide services with improved user convenience and system accuracy.

Keywords: Data Analysis, IoT, Sensor, Smart Home, Visualization

INTRODUCTION

Currently, the IoT technologies being studied include user pattern analysis and inter-device collaboration to provide customized services. When IoT is used inside the home, it arranges the smart device and connects it to a single network for data communication. Applications can also be used to remotely control smart devices or monitor the internal environment measured by sensors. Accordingly, the smart device in the home is controlled to provide the service to the user [1-3].

Existing IoT systems provide services such as environment control and repeating operation. As the work progresses automatically, there is a problem with accuracy. Accordingly, the user should be able to receive the service at a desired time. Also, it is required to provide a user-oriented service by changing the system according to the user. [4-8].

To solve this problem, this paper proposes a system that automatically analyzes the user 's remote control commands and then controls the environment inside the home. It also visualizes and displays smart device usage over time. Then, the user can operate by selecting the automatic operation mode and the remote control mode. In this way, since the operation inside home is performed by analyzing the user's smart device usage record, it is possible to provide a user-customized service. As a result, it is possible to provide a service with higher accuracy unlike the existing system.

SYSTEM DESIGN

The proposed system collects user 's remote control command and analyzes it, so that the service can be provided based on the user' s record. Figure 1 shows the configuration of the proposed IoT automatic control system based on user command analysis.

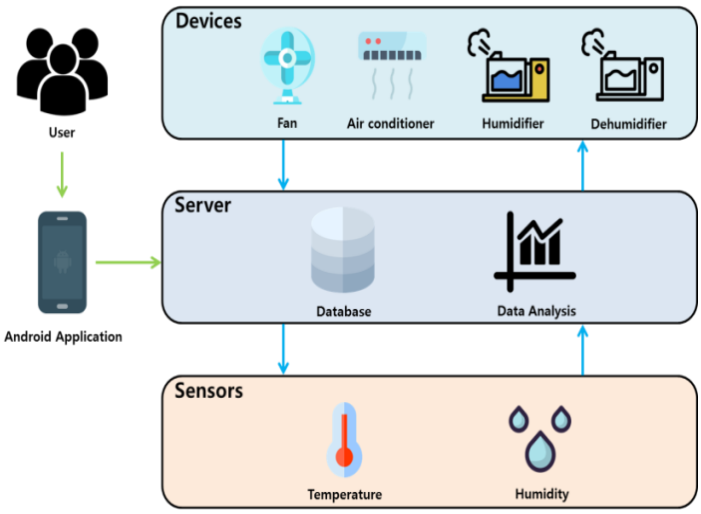

Figure 1. Automation Control System Block Diagram

The user uses the Android application to transmit the remote control command to the server. The server controls the device according to the command, collects the corresponding commands, analyzes the information, and visualizes the amount of usage of the smart device by the user. Figure 2 shows the structure of the automatic control system.

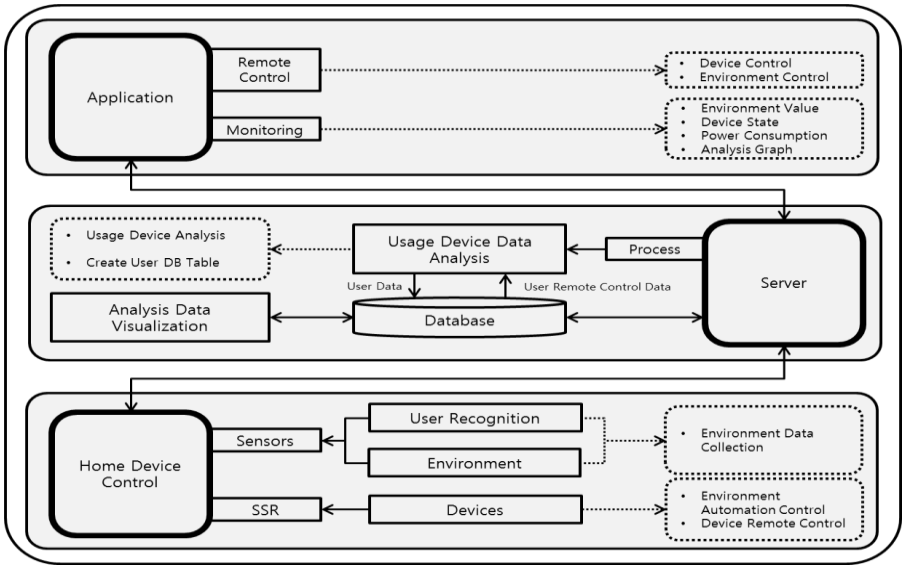

Figure 2. Automation Control System Architecture

Fig. 2 shows the structure of the automatic control system. In the home device control module, each sensor is connected to the Arduino, the sensor value is measured, transmitted to the server, and then the sensor value is stored in the database. The application module allows the user to remotely control the smart device, monitor the status of each device, sensor data, and device usage by time. In addition, the server collects the control commands and analyzes the remote control commands of the user to derive the average operation of the apparatus by time and the usage rate of the apparatus by time.

The device usage rate by time is visualized and provided to the user, and the device average operation by time is utilized when the device inside home is automatically controlled when the mode is changed to the automatic operation mode. Figure 3 shows the flow of the user command analysis algorithm.

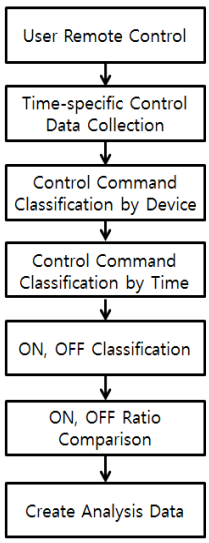

Figure 3. User Command Analysis Algorithm

When the user performs remote control, the analysis algorithm proceeds. You need to classify by time to identify device usage by time. The control type is classified as ON and OFF, and the ON data is analyzed to derive the average operation per time. Based on the analysis results, the average operation of the device by time is derived. The analysis is based on the type of remote controlled device, the time controlled by the user, and the type of control.

SYSTEM IMPLEMENTATION

The proposed system utilizes the application to collect user commands and monitor the status of the device. It can also provide the user with visualized information or change the operating mode. The user can change the status of the device by using the remote control function and can check the status of the devices by utilizing the monitoring function. You can also check the data measured by sensors in the home and check the usage of the devices in a graph. Figure 4 shows the application implementation screen and Figure 5 shows the implementation screen of device usage visualization.

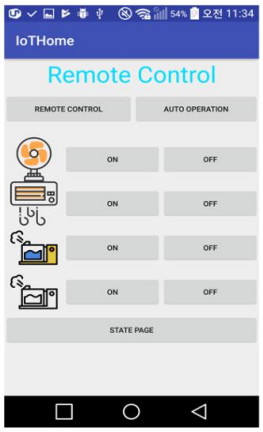

Figure 4. Remote Control Page

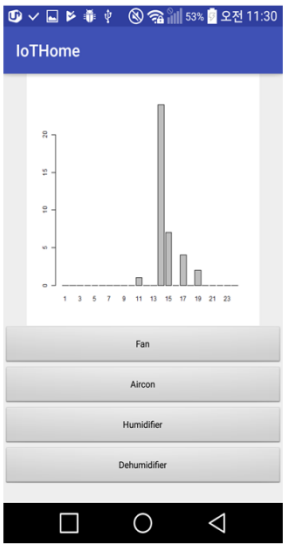

Figure 5. Usage Graph by Device

The operation of the device is divided into ON and OFF. When the user clicks the button, the changed status value is transmitted to the server. The server loads the state value into the database and transmits an operation command according to the changed state value of the device to operate the device. In case of mode change, it is divided into remote control mode and automatic operation mode. The remote control mode is not affected by the threshold of the sensor because the devices operate based on the user's remote control command. In the automatic operation mode, the remote control of the user is impossible and the operation changes according to the analyzed result value. The threshold value of the sensor provides the service based on the sensor value when it is in the remote control mode. The user can click the button of the desired device to view the graph. This allows the user to obtain information on the analyzed data.

REVIEW

When the user performs the remote control, the remote control command is collected on the server and analyzed to derive the average operation of the device. And analyzing the operation of the device during the time from 1 o'clock to 24 o'clock, thereby provides a customized service. The user can visualize the information by visualizing the usage of the device and providing it to the user.

Experiments were conducted to verify the performance of the proposed system. Figure 6 is a graphical representation of the operation of the existing system, and Figure 7 is a graphical representation of the operation of the proposed system.

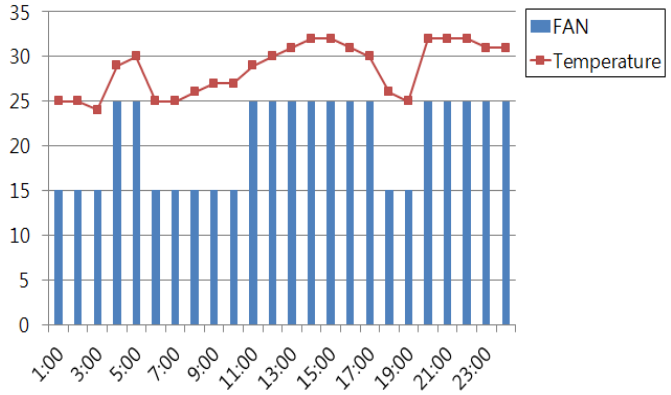

Figure 6. Existing System Operation Graph

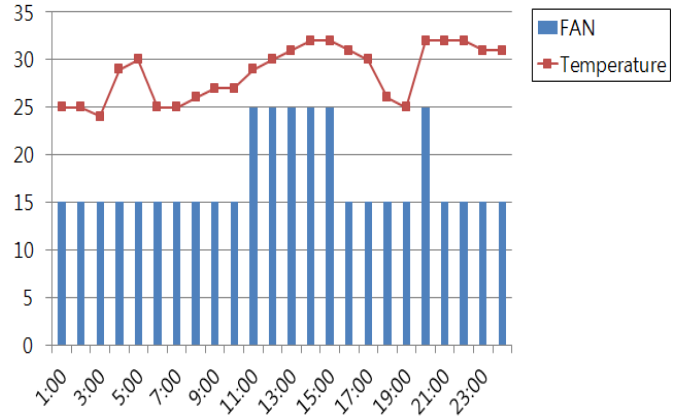

Figure 7. Proposed System Operation Graph

While the existing system manages the operation of the fan, the operation proceeds regardless of the time when the sensor data exceeds the threshold value. Since the user can not set the threshold value and the operation time, the user is provided with the unified service. In the proposed system, the temperature exceeded the threshold at 4:00 and 5:00, but it did not work. This does not work even when the threshold value is exceeded because the time is set to the time when the operation of the apparatus is not advanced and the operation of the apparatus is stopped from 20:00 to 24:00. In the existing system, since the operation is performed through the sensor data and the set threshold value, the environment-based service is provided instead of the user-oriented one. On the other hand, the proposed system is able to provide customized services and increase the accuracy of work because it is based on user 's usage record.

CONCLUSION

Recently IoT has been used in various fields. The smart device can be connected to the network and communication can be performed to operate the device or to provide the sensor data to the user. Accordingly, methods of providing services in various ways are being studied.

Existing systems provide only the same service on the basis of the set threshold value, and operation of the device operation judgment is performed according to the environment inside the home rather than the user. Also, the user can not control the device.

To solve this problem, this paper collects and analyzes user 's remote control command. Based on this, we propose an automatic control system. When a user performs remote control using an application, the system collects the commands, loads them in the database, and sorts the data according to devices and time. Once the analysis is complete, device averaging is derived and the device is automatically controlled based on the analysis results. As a result, a customized service can be provided for the characteristics of the user. Also, device usage can be derived and provided to the user as a graph.

Future research should be based on complex data based on subdivision of scope and contents of analysis.

ACKNOWLEDGMENT

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