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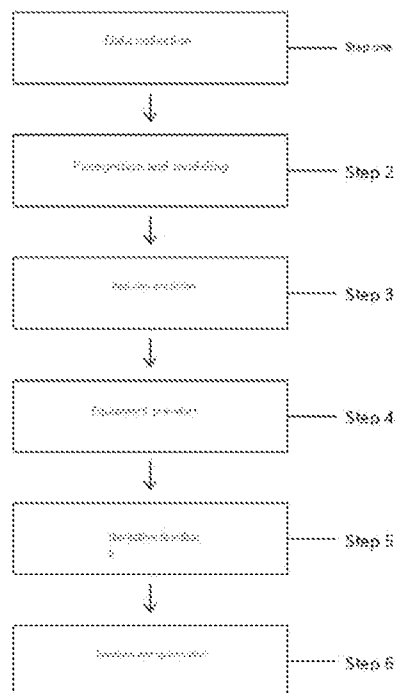
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A smart home control system and method based on Internet of Things.

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The invention relates to the technical field of intelligent home control and discloses an intelligent home control system based on the Internet of Things. The invention predicts the next operation prediction of the user in real time by using the sensor data and the user input through the user behavior prediction module. The invention continuously optimizes the prediction of the next operation of the user in advance before the actual operation of the user through the regression model. The invention starts in advance through the real-time prediction result or the state of the equipment is already good before the operation of the user so as to respond quickly when the user needs, thus achieving the beneficial effect of faster interaction time of the household equipment.



Technical fields

The present invention relates to the field of smart home control technology, specifically a smart home control system and method based on the Internet of Things.

Background technology

Smart home is the embodiment of IOT under the influence of the Internet. Smart home through the Internet of Things technology will be home to a variety of equipment (such as audio and video equipment, lighting systems, curtain control, air conditioning control, network appliances, etc.) connected together to achieve interactive control and other functions and means. Compared with ordinary home, smart home not only has the traditional function of living, both building, network communication, information appliances, equipment automation, providing a full range of information interaction functions. However, for the commonly used garbage cans and other equipment in the family, the interactive control under the Internet of Things has not been realized, thus, for the use of the family, the garbage cans do not bring the intelligent experience under the smart home for the user, and the convenience of its use needs to be further improved.

After searching, it is found that a smart home control system and method based on the Internet of Things with the public number of CN110488616A include an intelligent garbage can and a mobile terminal. The intelligent garbage can includes a processor and a visual sensor connected to the processor, speakers, voice acquisition unit, walking unit, weighing sensor and wireless communication unit; The vision sensor is used to collect the user's image, the speaker is used to output confirmation information according to the first control command, the voice acquisition unit is used to collect the user's feedback information, the walking unit is used to move to the user according to the second control command, the weighing sensor is used to measure the weight information of garbage, and the wireless communication module is used to upload the weight information to the mobile terminal; The processor is used to output the first control instruction according to the gesture action of the image analysis user, calculate the distance and plan the moving path, and output the second control instruction; The mobile terminal is used to receive weight information. The invention can realize intelligent human-computer interaction control, and its intelligent experience is better.

In the aforementioned technical solutions to improve the trash can so that it can carry out human-computer interaction, but still need to collect the information of the user to the trash can walk to determine the interaction, and so on the same pool, air conditioning, computers and lamps, these home equipment into the system need to collect the information of the user's obvious use of

the information to be able to carry out the interaction, at this time the user has been close to the body of the device, the interaction time is too slow, can not predict the user's thoughts in time. By this time, the user is already close to the device, and the interaction time is too slow to anticipate the user's thoughts in time.

5 **invention content**

Technical issues addressed.

In view of the shortcomings of the existing technology, the present invention provides a smart home control system and method based on the Internet of Things, which has the advantages of faster interaction time of home equipment, and the system can clearly prejudge the user's intention and start the home equipment that the user needs to use in advance, so as to solve the problems of the above technology.

Technical Programs.

In order to achieve the above purpose, the present invention provides the following technical solution: an intelligent home control system based on the Internet of Things, said control system comprising a historical information collection module, a user behavior prediction module, a device control and pre-starting module, an interaction feedback module, a mobile terminal module and a data communication and security module, said control system.

Historical information collection module is used to record the user's detailed information in the use of home equipment, including operating time, operating frequency, characteristic actions: gestures and voice commands and equipment status changes, the collected user data is stored in the database to support long-term data accumulation and querying, the application of data analysis technology to identify the user's behavioral patterns, the pattern for a specific period of time for the commonly used equipment and operating habits, based on the historical data to establish a user behavioral model, predict the possible operation of a specific situation; historical data to establish a user behavioral model, predict the possible operation of a specific situation Based on the historical data, user behavior model is established to predict the possible operation of the user in a specific situation.

The said user behavior prediction module is used to combine real-time data from sensors and user input, compare with the behavior model provided by the historical information collection module, predict the user's next operation in real time, use the regression model to continuously optimize the prediction accuracy, and process user behavior data in different time periods and scenarios.

Equipment control and pre-start module is used to communicate with home equipment, control the switching state of the equipment, adjust the parameters, according to the results of user

behavior prediction, pre-start or adjust the state of the equipment, real-time reception of the user's feedback and actual operation, dynamic adjustment of the equipment settings.

The interaction feedback module is used to recognize the user's gestures, voice commands and other interaction modes through the camera and microphone, provide instant feedback according to the user's actual operation, confirm the operation through voice prompts or show the device status through the display.

The mobile terminal module is used to recommend commonly used settings and operations according to the user's historical behavior and current needs, enhancing the user's control convenience.

The data communication and security module is used to encrypt and protect user data to ensure information security.

Preferably, the expression for recording detailed information of a user in the use of a home device in said historical information collection module is.

$$H_i(t) = [T_i(t), F_i(t), M_i(t), \theta_i(t), S_i(t)]$$

Among them, $H_i(t)$ denotes the user i During operating hours, the history of the information recorded, the $T_i(t)$ denotes the user i the specific time of the operation. $F_i(t)$ denotes the user i Frequency of operation of equipment. $M_i(t)$ denotes the user i Characteristic actions used during operation include gestures and voice commands, the $\theta_i(t)$ denotes the user i The change of state of the device during operation, the $S_i(t)$ denotes the user i Specific operational actions on the equipment.

Preferably, the expression for establishing a user behavior model based on historical data in said historical information collection module is.

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \dots + \theta_q \epsilon_{t-q} + \epsilon_t$$

Among them, Y_t It's time t of the observations, the $\theta_1, \theta_2, \dots, \theta_q$ is a moving average MAC coefficients.

Preferably, the real-time predictive behavior formula in said user behavior prediction module is.

$$\hat{Y}_t = f(X_t, \Theta)$$

where ϵ , ϕ , and X_t It is real-time data that includes sensor data and user input data. Θ are the model parameters, and the historical behavioral model is $\hat{Y}_t$ is the output of a predictive model constructed on the basis of historical data, and the actual observed behavior is Y_t ;

The regression model optimization expression is.

The objective of the regression model is to optimize the prediction accuracy by minimizing

the prediction error, which is defined as $E_t = Y_t - \hat{Y}_t$;

The loss function for the regression model is $L(\Theta) = \frac{1}{N} \sum_{t=1}^N E_t^2$, of which N is the number of observed data points in the time period or scenario.

The optimization objective of the regression model is to minimize the loss function.

$$\hat{\Theta} = \arg \min_{\Theta} L(\Theta).$$

Preferably, said data expression for processing user behavior data for different time periods and scenarios in the module for behavior prediction is $\hat{Y}_t = f(X_t, \Theta, T_t, S_t)$. Among them T_t is time characterized as a time period or date.

Said user behavior prediction module is comprehensively expressed as.

$$\hat{Y}_t = f(X_t, \Theta^*), \text{ of which } \Theta^* = \arg \min_{\Theta} \frac{1}{N} \sum_{t=1}^N (Y_t - f(X_t, \Theta))^2$$

At the same time, the regression model was adjusted to time and scenario characteristics.

$$\hat{Y}_t = f(X_t, \Theta^*, T_t, S_t).$$

Preferably, said device control and startup module adjusts a device state expression as.

$$\hat{S}_t = g(\hat{Y}_t)$$

The calculation of the device control command is represented as follows.

$$U_t = \text{Control}(\hat{S}_t, S_t)$$

where the current state of the device is that S_t , the target state is $\hat{S}_t$, predicted to be $\hat{Y}_t$, the control instructions for the equipment are U_t , the adjustment rule function is $g(\hat{Y}_t)$.

Preferably, the timely feedback expression in said interactive feedback module is.

$$F_t = \text{Feedback} \left(h \left(f_g(I_t), f_v(S_t), f_o(X_t) \right) \right)$$

$f_g(I_t)$ is a gesture recognition function, the $f_o(X_t)$ is a function that recognizes other interactions. Feedback is a function that generates feedback based on the interaction state.

Preferably, the recommended expression in said mobile general segment module is.

$$R = \text{Recommend}(f_h(H), f_c(C))$$

H is the user's historical behavioral data, the C is the current demand data. $(f_h(H))$ is a function that processes historical behavioral data, the $(f_c(C))$ is a function that processes the current demand data, the R is the function that generates the recommendation results.

Preferably, said data communication and security module data encryption expression is.

$$C = E(D, K)$$

Among them D is plaintext data. E is the encryption algorithm.

Key generation and management is a process to ensure the security of encryption key K . Key generation is represented by the function $K=G$, where G is the key generation algorithm:

$$K = G.$$

A smart home control system and method based on the Internet of Things, comprising the steps of.

Step 1, data collection: the historical information collection module continuously records the user's operation data, including time, frequency, action and equipment status.

Step 2: Pattern recognition and modeling: through the analysis of historical data, identify user behavioral patterns and construct behavioral models.

Step 3, real-time prediction: user behavior prediction module based on real-time data and historical models, predicting the user's upcoming operations.

Step 4: equipment pre-start: the equipment control module, based on the prediction results, in advance of the start-up or adjustment of equipment settings to ensure that the equipment has been prepared before the actual operation of the user.

Step 5, interactive feedback: interactive feedback module real-time processing of user operations, providing instant feedback and personalized settings.

Step 6: Feedback and Optimization: The system records the user's feedback and actual operation data for subsequent analysis and optimization to improve prediction accuracy and user experience.

Compared with the prior art, the present invention provides a smart home control system and method based on the Internet of Things, with the following beneficial effects.

1, the present invention through the user behavior prediction module using sensor data and user input real-time prediction of the user's next operation, prediction through the regression model is constantly optimized, before the user's actual operation, in advance to prepare, through the real-time prediction results, in advance of the startup or adjustment of the device state in the user's operation before the user has been ready to the state of the device, so that in the user's need to respond quickly, the interaction feedback module by the The interaction feedback module provides instant feedback by recognizing user gestures and voice commands through the camera and microphone. The system can quickly recognize the user's interaction mode and provide instant feedback through voice prompts or the display screen. The history information collection module records the user's detailed operation data, including operation time, frequency, action and device status, which is used to build a user behavior model so that the system can understand the user's habits and preferences, based on which the system more accurately predicts the user's needs and further shortens the response time to achieve the goal of home device interaction. Based on these

data, the system can more accurately predict user needs and further shorten the response time, which achieves the beneficial effect of faster interaction time of home devices.

2, the invention through the history of information collection module records the user in the home equipment use of detailed information, including operating time, operating frequency, characteristics of the action: gestures and voice commands, equipment status changes, the data is stored in the database and used for analysis, the household behavior prediction module combined with the sensor data and the user's real-time inputs, the use of history of behavioral models to predict the user's next operation, through the regression model Through the regression model, the prediction accuracy is continuously optimized, which makes the system's prediction of the user's intention more accurate. The system processes the user's operation feedback in real time through the interactive feedback module to further optimize the pre-starting and adjusting process of the equipment, and the actual operation of the user and the feedback data are used to continuously improve the prediction model, so that the system can more accurately predict the user's intention to achieve the beneficial effect of the system being able to clearly predict the user's intention and start up the home equipment in advance of the user's intention. The system is able to predict the user's intention more accurately and achieve the beneficial effect that the system can clearly predict the user's intention and activate the home equipments in advance.

The accompanying illustration

Figure 1 shows a schematic diagram of the method flow of the present invention.

Specific implementations

The following will be combined with the accompanying drawings in the embodiments of the present invention, the technical solutions in the embodiments of the present invention are clearly and completely described, obviously, the described embodiments are only part of the embodiments of the present invention, not all of the embodiments. Based on the embodiments of the present invention, all other embodiments obtained by the ordinary technical personnel in the field without making creative labor under the premise, are within the scope of protection of the present invention.

Referring to FIG. 1, a smart home control system based on the Internet of Things, said control system comprising a historical information collection module, a user behavior prediction module, a device control and pre-starting module, an interaction feedback module, a mobile terminal module, and a data communication and security module, said control system.

Historical information collection module is used to record the user's detailed information in the use of home equipment, including operating time, operating frequency, characteristic actions: gestures and voice commands and equipment status changes, the collected user data is stored in

the database to support long-term data accumulation and querying, the application of data analysis technology to identify the user's behavioral patterns, the pattern for a specific period of time for the commonly used equipment and operating habits, based on the historical data to establish a user behavioral model, predict the possible operation of a specific situation; historical data to establish a user behavioral model, predict the possible operation of a specific situation Based on the historical data, user behavior model is established to predict the possible operation of the user in a specific situation.

The said user behavior prediction module is used to combine real-time data from sensors and user input, compare with the behavior model provided by the historical information collection module, predict the user's next operation in real time, use the regression model to continuously optimize the prediction accuracy, and process user behavior data in different time periods and scenarios.

Equipment control and pre-start module is used to communicate with home equipment, control the switching state of the equipment, adjust the parameters, according to the results of user behavior prediction, pre-start or adjust the state of the equipment, real-time reception of the user's feedback and actual operation, dynamic adjustment of the equipment settings.

The interaction feedback module is used to recognize the user's gestures, voice commands and other interaction modes through the camera and microphone, provide instant feedback according to the user's actual operation, confirm the operation through voice prompts or show the device status through the display.

The mobile terminal module is used to recommend commonly used settings and operations according to the user's historical behavior and current needs, enhancing the user's control convenience.

The data communication and security module is used to encrypt and protect user data to ensure information security.

Said control method is generated based on a control system, said control method being.

Step 1, data collection: the historical information collection module continuously records the user's operation data, including time, frequency, action and equipment status.

Step 2: Pattern recognition and modeling: through the analysis of historical data, identify user behavioral patterns and construct behavioral models.

Step 3, real-time prediction: user behavior prediction module based on real-time data and historical models, predicting the user's upcoming operations.

Step 4: equipment pre-start: the equipment control module, based on the prediction results, in advance of the start-up or adjustment of equipment settings to ensure that the equipment has

been prepared before the actual operation of the user.

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Step 5, interactive feedback: interactive feedback module real-time processing of user operations, providing instant feedback and personalized settings.

Step 6: Feedback and Optimization: The system records the user's feedback and actual operation data for subsequent analysis and optimization to improve prediction accuracy and user experience.

The user behavior prediction module uses sensor data and user input to predict the user's next operation in real time, and this prediction is continuously optimized through regression models to prepare the user in advance before the actual operation. In this way, the system can quickly respond to the user's needs, thus reducing the waiting time.

The prediction model is built based on real-time and historical data and optimized by regression model. The optimization of the model improves the accuracy by minimizing the prediction error and makes the prediction more accurate.

The device control and pre-start module starts or adjusts the device state in advance by predicting the results in real time. This means that the system has already prepared the state of the equipment before the user operates it, so that it can respond quickly when the user needs it. For example, if the system predicts that the user is about to turn on the air conditioner, it will start the air conditioner in advance and adjust it to the right temperature, so that the user can experience the expected effect immediately during operation.

The module also dynamically receives the user's feedback and actual operation, real-time adjustment of device settings, to further optimize the user experience and response speed.

The interaction feedback module recognizes the user's gestures and voice commands through the camera and microphone, and provides instant feedback. The system can quickly recognize the user's interaction mode and provide instant feedback through voice prompts or the display screen. Timely feedback can reduce the interaction delay between the user and the system, so that the user's commands can be responded to quickly.

The historical information collection module records detailed user operation data, including operation time, frequency, actions and device status. These data are used to build user behavior models, which enable the system to understand user habits and preferences. Based on these data, the system can more accurately predict user needs and further shorten response time.

The mobile terminal module recommends commonly used settings and operations based on the user's historical behavior and current needs, and the recommendation system enables users to quickly find the required functions or settings, reducing the number of operating steps and thus improving interaction efficiency.

Although embodiments of the present invention have been shown and described, it is understood to one of ordinary skill in the art that a wide variety of changes, modifications, substitutions, and variations of these embodiments can be made without departing from the principle and spirit of the present invention, the scope of which is limited by the appended claims

5 and their equivalents.

1. A smart home control system based on the Internet of Things, characterized in that said control system comprises a historical information collection module, a user behavior prediction module, a device control and pre-starting module, an interactive feedback module, a mobile terminal module, and a data communication and security module, said control system.

Historical information collection module is used to record the user's detailed information in the use of home equipment, including operating time, operating frequency, characteristic actions: gestures and voice commands and equipment status changes, the collected user data is stored in the database to support long-term data accumulation and querying, the application of data analysis technology to identify the user's behavioral patterns, the pattern for a specific period of time for the commonly used equipment and operating habits, based on the historical data to establish a user behavioral model, predict the possible operation of a specific situation; historical data to establish a user behavioral model, predict the possible operation of a specific situation Based on the historical data, user behavior model is established to predict the possible operation of the user in a specific situation.

The said user behavior prediction module is used to combine real-time data from sensors and user input, compare with the behavior model provided by the historical information collection module, predict the user's next operation in real time, use the regression model to continuously optimize the prediction accuracy, and process user behavior data in different time periods and scenarios.

Equipment control and pre-start module is used to communicate with home equipment, control the switching state of the equipment, adjust the parameters, according to the results of user behavior prediction, pre-start or adjust the state of the equipment, real-time reception of the user's feedback and actual operation, dynamic adjustment of the equipment settings.

The interaction feedback module is used to recognize the user's gestures, voice commands and other interaction modes through the camera and microphone, provide instant feedback according to the user's actual operation, confirm the operation through voice prompts or show the device status through the display.

The mobile terminal module is used to recommend commonly used settings and operations according to the user's historical behavior and current needs, enhancing the user's control convenience.

The data communication and security module is used to encrypt and protect user data to ensure information security.

2. A smart home control system based on the Internet of Things according to claim 1,

characterized in that: the expression for recording the user's detailed information in the use of a home device in said historical information collection module is.

$$H_i(t) = [T_i(t), F_i(t), M_i(t), \theta_i(t), S_i(t)]$$

Among them, $H_i(t)$ denotes the user i During operating hours, the history of the information recorded, the $T_i(t)$ denotes the user i the specific time of the operation. $F_i(t)$ denotes the user i Frequency of operation of equipment. $M_i(t)$ denotes the user i Characteristic actions used during operation include gestures and voice commands, the $\theta_i(t)$ denotes the user i The change of state of the device during operation, the $S_i(t)$ denotes the user i Specific operational actions on the equipment.

3. a smart home control system based on the Internet of Things according to claim 1, characterized in that: the expression for establishing a user behavior model based on historical data in said historical information collection module is.

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \dots + \theta_q \epsilon_{t-q} + \epsilon_t$$

Among them Y_t It's time of the observations, the $\theta_1, \theta_2, \dots, \theta_q$ is a moving average MACoefficients.

4. a smart home control system based on the Internet of Things according to claim 1, characterized in that: the real-time predictive behavior formula in said user behavior prediction module is.

$$\hat{Y}_t = f(X_t, \Theta)$$

where ϵ , ϕ , and X_t It is real-time data that includes sensor data and user input data. Θ are the model parameters, and the historical behavioral model is $\hat{Y}_t$ is the output of a predictive model constructed on the basis of historical data, and the actual observed behavior is Y_t ;

The regression model optimization expression is.

The objective of the regression model is to optimize the prediction accuracy by minimizing the prediction error, which is defined as $E_t = Y_t - \hat{Y}_t$;

The loss function for the regression model is $L(\Theta) = \frac{1}{N} \sum_{t=1}^N E_t^2$, of which N is the number of observed data points in the time period or scenario.

The optimization objective of the regression model is to minimize the loss function.

$$\hat{\Theta} = \arg \min_{\Theta} L(\Theta).$$

5. a smart home control system based on the Internet of Things according to claim 4, characterized in that: said data expression for processing user behavior data under different time periods and scenarios in the behavior prediction module is $\hat{Y}_t = f(X_t, \Theta, T_t, S_t)$ Among them T_t is time characterized as a time period or date.

Said user behavior prediction module is comprehensively expressed as.

$$\hat{Y}_t = f(X_t, \Theta^*), \text{ of which } \Theta^* = \arg \min_{\Theta} \frac{1}{N} \sum_{t=1}^N (Y_t - f(X_t, \Theta))^2$$

At the same time, the regression model was adjusted to time and scenario characteristics.

$$\hat{Y}_t = f(X_t, \Theta^*, T_t, S_t).$$

6. A smart home control system based on the Internet of Things according to claim 1, characterized in that: the expression for adjusting the state of a device in said device control and startup module is.

$$\widehat{S}_t = g(\widehat{Y}_t)$$

The calculation of the device control command is represented as follows.

$$10 \qquad U_t = \text{Control}(\widehat{S}_t, S_t)$$

where the current state of the device is that S_t , the target state is $\hat{S}_t$, predicted to be $\hat{Y}_t$, the control instructions for the equipment are U_t , the adjustment rule function is $g(\hat{Y}_t)$.

7. A smart home control system based on the Internet of Things according to claim 1, characterized in that: the timely feedback expression in said interactive feedback module is.

$$F_t = \text{Feedback} \left(h \left(f_g(I_t), f_v(S_t), f_o(X_t) \right) \right)$$

$f_g(I_t)$ is a gesture recognition function, the $f_o(X_t)$ is a function that recognizes other interactions. Feedback is a function that generates feedback based on the interaction state.

8. A smart home control system based on the Internet of Things according to claim 1, characterized in that: the recommended expression in said mobile total segment module is.

$$20 \quad R = \text{Recommend}(f_h(H), f_c(C))$$

His the user's historical behavioral data, the C is the current demand data. ($f_h(H)$) is a function that processes historical behavioral data, the ($f_c(C)$) is a function that processes the current demand data, the $Recommend$ is the function that generates the recommendation results.

9. A smart home control system based on the Internet of Things according to claim 1,
25 characterized in that: said data encryption expression of the data communication and security
module is.

$$C = E(D, K)$$

Among them D is plaintext data. E is the encryption algorithm.

Key generation and management is a process to ensure the security of encryption key K . Key generation is represented by the function $K=G$, where G is the key generation algorithm:

$$K = G_{\circ}$$

10. a smart home control method based on the Internet of Things according to claim 5, characterized in that said control method is generated based on a control system, said control method being.

5 Step 1, data collection: the historical information collection module continuously records the user's operation data, including time, frequency, action and equipment status.

Step 2: Pattern recognition and modeling: through the analysis of historical data, identify user behavioral patterns and construct behavioral models.

Step 3, real-time prediction: user behavior prediction module based on real-time data and historical models, predicting the user's upcoming operations.

10 Step 4: equipment pre-start: the equipment control module, based on the prediction results, in advance of the start-up or adjustment of equipment settings to ensure that the equipment has been prepared before the actual operation of the user.

Step 5, interactive feedback: interactive feedback module real-time processing of user operations, providing instant feedback and personalized settings.

15 Step 6: Feedback and Optimization: The system records the user's feedback and actual operation data for subsequent analysis and optimization to improve prediction accuracy and user experience.

1. ein intelligentes Haussteuerungssystem, das auf dem Internet der Dinge (IoT) basiert, dadurch gekennzeichnet, dass das Steuerungssystem ein Modul zur Sammlung historischer Informationen, ein Modul zur Vorhersage des Benutzerverhaltens, ein Modul zur Gerätesteuerung und zum Vorstart, ein Interaktionsrückmeldemodul, ein Modul für ein mobiles Endgerät und ein Datenkommunikations- und Sicherheitsmodul umfasst, wobei das Steuerungssystem;

Das historische Informationssammelmodul wird verwendet, um detaillierte Informationen des Benutzers bei der Verwendung von Heimgeräten aufzuzeichnen, einschließlich Betriebszeit, Betriebshäufigkeit, charakteristische Aktionen: Gesten und Sprachbefehle und Gerätestatusänderungen, die gesammelten Benutzerdaten in einer Datenbank zu speichern, um eine langfristige Datenakkumulation und -abfrage zu unterstützen, Datenanalysetechnologie anzuwenden, um das Verhaltensmuster des Benutzers zu identifizieren, wobei das Muster die üblicherweise verwendeten Geräte und Betriebsgewohnheiten für einen bestimmten Zeitraum sind, und auf der Grundlage der historischen Daten ein Benutzerverhaltensmodell zu erstellen, um den möglichen Betrieb des Benutzers in einem bestimmten Kontext vorherzusagen;

Das Modul zur Vorhersage des Benutzerverhaltens wird verwendet, um Echtzeitdaten von Sensoren und Benutzereingaben zu kombinieren, mit dem vom Modul zur Sammlung historischer Informationen bereitgestellten Verhaltensmodell zu vergleichen, die nächste Bedienung des Benutzers in Echtzeit vorherzusagen, ein Regressionsmodell zu verwenden, um die Vorhersagegenauigkeit kontinuierlich zu optimieren, und Daten zum Benutzerverhalten in verschiedenen Zeiträumen und Szenarien zu verarbeiten;

Das Gerätesteuerungs- und Vorstartmodul wird verwendet, um mit dem Heimgerät zu kommunizieren, den Schaltzustand und die Einstellparameter des Geräts zu steuern, den Zustand des Geräts entsprechend den Ergebnissen der Vorhersage des Benutzerverhaltens vorzustarten oder einzustellen und die Geräteeinstellungen dynamisch anzupassen, indem das Feedback des Benutzers und der tatsächliche Betrieb in Echtzeit empfangen werden;

Das Interaktionsrückmeldemodul wird verwendet, um die Gesten des Benutzers, Sprachbefehle und andere Interaktionsmethoden über die Kamera und das Mikrofon zu erkennen, sofortige Rückmeldung auf der Grundlage der tatsächlichen Bedienung durch den Benutzer zu geben, die Bedienung durch Sprachaufforderungen zu bestätigen oder den Gerätestatus über das Display anzuzeigen;

Das Modul für das mobile Endgerät wird verwendet, um häufig verwendete Einstellungen und Vorgänge auf der Grundlage des bisherigen Verhaltens und der aktuellen Bedürfnisse des Benutzers zu empfehlen und so den Bedienungskomfort für den Benutzer zu erhöhen;

Das Datenkommunikations- und Sicherheitsmodul dient der Verschlüsselung und dem Schutz von Benutzerdaten, um die Informationssicherheit zu gewährleisten.

2. intelligentes Haussteuerungssystem, das auf dem Internet der Dinge basiert, gemäß Anspruch 1, dadurch gekennzeichnet, dass der Ausdruck für die Aufzeichnung der detaillierten Informationen des Benutzers bei der Verwendung der Hausausrüstung in dem historischen Informationssammelmodul ist:

$$H_i(t) = [T_i(t), F_i(t), M_i(t), \theta_i(t), S_i(t)]$$

Davon sind die $H_i(t)$ bezeichnet den Benutzer i Während der Betriebszeiten ist die t die Geschichte der aufgezeichneten Informationen. $T_i(t)$ bezeichnet den Benutzer i den genauen Zeitpunkt des Vorgangs. $F_i(t)$ bezeichnet den Benutzer i Häufigkeit des Betriebs der Geräte. $M_i(t)$ bezeichnet den Benutzer i Zu den charakteristischen Aktionen bei der Bedienung gehören Gesten und Sprachbefehle, die $\theta_i(t)$ bezeichnet den Benutzer i Die Zustandsänderung des Geräts während des Betriebs, die $S_i(t)$ bezeichnet den Benutzer i Spezifische betriebliche Maßnahmen an den Geräten.

3. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 1, dadurch gekennzeichnet, dass der Ausdruck für die Erstellung eines Benutzerverhaltensmodells auf der Grundlage historischer Daten in dem Modul für die Sammlung historischer Informationen lautet.

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \dots + \theta_q \epsilon_{t-q} + \epsilon_t$$

Darunter Y_t Es ist an der Zeit t Beobachtungen der $\theta_1, \theta_2, \dots, \theta_q$ ist ein gleitender Durchschnitt MA Koeffizienten.

4. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 1, dadurch gekennzeichnet, dass die Formel zur Echtzeit-Vorhersage des Verhaltens in dem Modul zur Vorhersage des Benutzerverhaltens lautet.

$$\hat{Y}_t = f(X_t, \Theta)$$

wobei X_t , Θ und Y_t Es handelt sich um Echtzeitdaten einschließlich Sensordaten und Benutzereingaben. Θ sind die Modellparameter, und das historische Verhalten wird wie folgt modelliert $\hat{Y}_t$ ist das Ergebnis eines Vorhersagemodells, das auf der Grundlage historischer Daten erstellt wurde, und das tatsächlich beobachtete Verhalten ist Y_t ;

Der Ausdruck für die Optimierung des Regressionsmodells lautet.

Das Ziel des Regressionsmodells ist die Optimierung der Vorhersagegenauigkeit durch Minimierung des Vorhersagefehlers, der wie folgt definiert ist. $E_t = Y_t - \hat{Y}_t$;

Die Verlustfunktion für das Regressionsmodell lautet. $L(\Theta) = \frac{1}{N} \sum_{t=1}^N E_t^2$ davon N ist die Anzahl der beobachteten Datenpunkte in dem Zeitraum oder Szenario.

Das Optimierungsziel des Regressionsmodells besteht darin, die Verlustfunktion zu minimieren.

$$\hat{\Theta} = \arg \min_{\Theta} L(\Theta).$$

5. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 4, dadurch gekennzeichnet, dass der Datenausdruck für die Verarbeitung von Benutzerverhaltensdaten unter verschiedenen Zeiträumen und Szenarien im Verhaltensvorhersagemodul ist. $\hat{Y}_t = f(X_t, \Theta, T_t, S_t)$ Darunter T_t ist die Zeit, die als Zeitspanne oder Datum charakterisiert wird.

Das Modul zur Vorhersage des Nutzerverhaltens wird umfassend beschrieben als.

$$\hat{Y}_t = f(X_t, \Theta^*) \text{ wobei } \Theta^* = \arg \min_{\Theta} \frac{1}{N} \sum_{t=1}^N (Y_t - f(X_t, \Theta))^2$$

Gleichzeitig wurde das Regressionsmodell an Zeit- und Szenariomerkmale angepasst.

$$\hat{Y}_t = f(X_t, \Theta^*, T_t, S_t).$$

6. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 1, dadurch gekennzeichnet, dass der Ausdruck für die Einstellung des Zustands eines Geräts in dem Gerätesteuerungs- und Startmodul ist.

$$\hat{S}_t = g(\hat{Y}_t)$$

Die Berechnung des Gerätesteuerungsbefehls wird wie folgt ausgedrückt.

$$U_t = \text{Control}(\hat{S}_t, S_t)$$

wobei der aktuelle Zustand des Geräts S_t ist, dass $\hat{S}_t$ ist der Zielzustand $\hat{S}_t$ vorausgesagt werden $\hat{Y}_t$ sind die Kontrollanweisungen für das Gerät U_t ist die Funktion der Anpassungsregel $g(\hat{Y}_t)$.

7. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 1, dadurch gekennzeichnet, dass der Ausdruck für die zeitnahe Rückmeldung in dem interaktiven Rückmeldemodul ist.

$$F_t = \text{Feedback} \left(h \left(f_g(I_t), f_v(S_t), f_o(X_t) \right) \right)$$

$f_g(I_t)$ ist eine Gestenerkennungsfunktion. $f_o(X_t)$ ist eine Funktion, die andere Interaktionen erkennt. Feedback ist eine Funktion, die auf der Grundlage des Interaktionsstatus eine Rückmeldung erzeugt.

8. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 1, dadurch gekennzeichnet, dass der empfohlene Ausdruck in dem mobilen Gesamtsegmentmodul ist.

$$R = \text{Recommend}(f_h(H), f_c(C))$$

H sind die historischen Verhaltensdaten des Nutzers, die C sind die aktuellen

Nachfragedaten. ($f_h(H)$) ist eine Funktion, die historische Verhaltensdaten verarbeitet, die ($f_c(C)$) ist eine Funktion, die die aktuellen Bedarfsdaten verarbeitet, die $Recommend$ ist die Funktion, die die Empfehlungsergebnisse erzeugt.

9. ein auf dem Internet der Dinge basierendes intelligentes Haussteuerungssystem nach Anspruch 1, dadurch gekennzeichnet, dass: der Ausdruck für die Datenverschlüsselung des Datenkommunikations- und Sicherheitsmoduls ist.

$$C = E(D, K)$$

Darunter D sind Klartextdaten. E ist der Verschlüsselungsalgorithmus.

Bei der Schlüsselgenerierung und -verwaltung handelt es sich um den Prozess zur Gewährleistung der Sicherheit des Verschlüsselungsschlüssels K . Die Schlüsselgenerierung wird durch die Funktion $K=G$ dargestellt, wobei G der Schlüsselgenerierungsalgorithmus ist:

$$K = G.$$

10. ein auf dem Internet der Dinge basierendes Smart-Home-Steuerungsverfahren nach Anspruch 5, dadurch gekennzeichnet, dass das Steuerungsverfahren auf der Grundlage eines Steuersystems erzeugt wird, wobei das Steuerungsverfahren wie folgt abläuft

Schritt I. Datenerfassung: Das historische Informationssammelmodul zeichnet kontinuierlich Benutzerbetriebsdaten auf, einschließlich Zeit, Häufigkeit, Aktion und Gerätestatus;

Schritt II, Mustererkennung und Modellierung: Identifizierung von Benutzerverhaltensmustern und Erstellung eines Verhaltensmodells durch Analyse historischer Daten;

Schritt 3, Echtzeitvorhersage: Das Modul zur Vorhersage des Benutzerverhaltens sagt die bevorstehenden Aktionen des Benutzers auf der Grundlage von Echtzeitdaten und historischen Modellen voraus;

Schritt 4: Vorstart des Geräts: Das Gerätesteuermodul startet das Gerät oder passt die Geräteeinstellungen im Voraus auf der Grundlage der Vorhersageergebnisse an, um sicherzustellen, dass das Gerät vor der tatsächlichen Bedienung durch den Benutzer bereit ist;

Schritt 5: Interaktives Feedback: Das interaktive Feedback-Modul verarbeitet die Bedienung des Benutzers in Echtzeit und liefert sofortiges Feedback und personalisierte Einstellungen;

Schritt 6: Feedback und Optimierung: Das System zeichnet das Feedback des Benutzers und die tatsächlichen Betriebsdaten für die anschließende Analyse und Optimierung auf, um die Vorhersagegenauigkeit und das Benutzererlebnis zu verbessern.

