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OPTIMIZATION OF SMART HOME NETWORK WITH INTERNET OF THINGS USE

Abstract
for a Master's Degree
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INTRODUCTION

For the current rapid development of Internet of Things technology, smart home occupies an important position in it. The development of smart homes is inseparable from the help of the network. Building different smart home networks according to different needs plays an important role, and the choice of network communication protocols and network cloud platforms is very important in building a network environment. In this master thesis we introduce the concept of analytic hierarchy process in operations research and use this algorithm to study the communication protocol of devices in the smart home network and the selection of the Internet of Things cloud platform.

The purpose of this master thesis is to optimize the IoT smart home network environment based on hierarchy analytics method (HAM). When building the network, choosing a communication protocol suitable for the current solution and the IoT cloud platform play an important role. In this master thesis the relevant algorithms evolved from the HAM are used to study the relevant content and obtain the optimization results. The purpose of optimizing the network is achieved.

The research plan of this master thesis comes from the analysis of the current situation of smart home development. Then according to the actual situation, it is found that different companies in different regions use many different solutions to solve related problems. Among them, the choice of network equipment communication protocol and system control cloud platform is varied and uneven. Therefore, considering this situation, choosing a suitable platform plays an important role according to different protocols and the characteristics of cloud platforms.

GENERAL DESCRIPTION OF WORK

Relevance of the subject

The work corresponds to paragraph 1 «Digital information and communication and interdisciplinary technologies based on them production» of the priority areas of scientific, technical and innovative activities for 2021 - 2025. The work was carried out in the educational institution Belarusian State University of Informatics and Radioelectronics. Dissertation research was carried out within research work SB 21-2033 «Processing, coding and transmission information in network-centric systems».

The aim and tasks of the work

The aim of the work is to perform element optimization work on IoT-based

smart home networks.

To achieve this aim, the following tasks were solved in the dissertation:

1 The origin and development status of the current Internet of Things and smart home are introduced in detail.

2 Various solutions and features of the leading smart home network are introduced in detail.

3 Research and use HAM to optimize the selection of communication protocol for smart home network.

4 The selection of the smart home network cloud platform is optimized by using HAM.

Personal contribution of the author

Thesis includes the selection of network optimization algorithms, the selection of HAM applied to the smart home network communication protocol and the selection clock of the cloud platform, the adaptive setting of the experimental scheme and the application of the algorithm, and the analysis of the results, and the relative best results are obtained. Optimization conclusion. And using Excel tool, the algorithm data is automatically calculated, and the results are obtained. Task setting and discussion of the results were carried out together with the Supervisor Doc. of Sc., Professor Vishniakou Uladzimir Anatolievich.

Testing and implementation of result

The main provisions and results of the dissertation work were reported and discussed at international conference: Telecommunications: Networks and technologies, algebraic coding and data security (Minsk, November - December 2021); international seminar: Coding and digital processing of signals in infocommunications (Minsk, March - April 2022).

Author's publications

According to the results of the research presented in the dissertation, 3 author's works were published, including: 3 articles in international conference and seminar proceedings.

Structure and size of the work

The dissertation work consists of introduction, general description of the work, four chapters with conclusions for each chapter, conclusion, bibliography.

The total amount of the thesis is 85 pages, of which 59 pages of text, 18 figures on 7 pages, 18 tables on 6 pages, a list of used bibliographic sources (51 titles on 4

pages), a list of the author's publications on the subject of the thesis (3 titles on 1 pages), graphic material on 8 pages.

Plagiarism

An examination of the dissertation «Optimization of smart home network with internet of things use» by Author's Full Name was carried out for the correctness of the use of borrowed materials using the network resource «Antiplagiat» (access address: https://users.antiplagiat.ru/) in the on-line mode 31.03.2022. As a result of the verification, the correctness of the use of borrowed materials was established (the originality of the thesis is 96,34%).

SUMMARY OF WORK

In the first chapter introduces in detail the definition of the Internet of Things and smart homes, as well as their development history and basic structure. Then we described the application of the Internet of Things to smart homes. It comprehensively expounds the current development of information communication and the current communication method of information communication in the Internet of Things network. Then it talks about the various problems that may exist in the smart home network based on the Internet of Things, as well as possible solutions and research directions.

In the second chapter mainly introduces the types of smart home network construction based on the Internet of Things, and the types of problems that exist in the smart home network, as well as various optimization directions and approximate method distances. Finally, it introduces the common models of smart home network optimization, as well as the selection of models when studying smart home network optimization and a general introduction to the composition system.

In the third chapter we use the basics of linear programming and the methods for utilizing linear programming in network optimization for optimizing IoT smart homes. We introduced the basic content and algorithm steps of HAM, and then practiced use this. The algorithm simulation of the information transmission standard in the smart home network and the cloud platform for building the system are carried out respectively. According to different quality rules, the corresponding optimal selection is obtained to achieve the purpose of optimizing the network. We proposed how to use Excel to automatically calculate each sub-table in HAM and the final result table. The table can be expanded and adjusted as needed, and the optimal result can be obtained more conveniently. We described the basic information of the IoT cloud platform currently on the market and outline the

application scenarios and development trends of the IoT platform.

CONCLUSION

Under the premise of optimizing the current smart home network based on the Internet of Things network, we are doing the following work in master thesis.

1 In the first chapter, the development foundation of the Internet of Things, the definition of the Internet of Things and the basic architecture are introduced in detail. Then it introduces the development history of the Internet of Things and the current application status. Then we introduced the infrastructure of the smart home based on IoT and made a targeted and detailed introduction from the definition and development of the smart home. We introduced the fundamentals, definitions, and development of information communication in networks. Finally, it is about the main tasks and directions in the current IoT network optimization.

2 In the second chapter we introduce the architecture foundation and model of the smart home network in detail. As well as the advantages and disadvantages of the current network models and their comparison. It is about the common models and choices of the network structure optimization of the smart home based on the Internet of Things.

3 In the third chapter we introduce several algorithms to realize network optimization, namely linear programming and hierarchy analytics method. Then, according to the characteristics of the HAM algorithm, it is actually applied to the structure optimization of the smart home network, and the selection of network communication protocols for nodes and smart devices, as well as the selection of the Internet of Things cloud platform, is compared and optimized. According to different requirements, the algorithm of HAM is used to optimize each selection. Finally, we introduce the concept and development status of IoT cloud platform. We investigated and explained the future development trend of cloud platform in smart home.

LIST OF AUTHOR'S PUBLICATIONS

1-A. Visniakou U.A. IoT network: models, structure, communications, problems / U.A. Vishnyakou, Hu Zhifeng, Du Zongqi, Liu Zhenhua, Yu Chunyu // Telecommunications: Networks and Technologies, Algebraic Coding and Data Security : материалы междунар. науч.-техн. семинара (Республика Беларусь, Минск, ноябрь – декабрь 2021 г.) / редкол. : М. Н. Бобов [и др.]. – Минск :

БГУИР, 2021. – С. 56-61.

2-A. Chuyue Yu. Design of school bell automatic control system based on single-chip microcomputer / Yu Chuyue, Xia Yiwei, Du Zongqi, Liu Zhenghua // Telecommunications: Networks and Technologies, Algebraic Coding and Data Security : материалы междунар. науч.-техн. семинара (Республика Беларусь, Минск, ноябрь – декабрь 2021 г.) / редкол. : М. Н. Бобов [и др.]. – Минск : БГУИР, 2021. – С. 69-71.

3-A. Visniakou U.A. Optimizing smart home network protocol selection by hierarhy analuthes methos / U.A. Vishniakou, Du Zongqi // Coding and digital processing of signals in infocommunications: Materials of the International. scientific study. conf. (Republic of Belarus, Minsk, April 19, 2022) / Redaction. : V.C. Konopelko, V.Y. Tsykkov, L.A. Shicko. - Minsk: BSUIR, 2022 . – P. 96-99.