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研究課題名(和文) Advancing interfaces and algorithms used in traveler-centric information systems supporting geographical, cultural and historical perspectives

研究課題名(英文) Advancing interfaces and algorithms used in traveler-centric information systems supporting geographical, cultural and historical perspectives

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研究成果の概要(和文)：1)インタラクティブな注釈付きガイド付き旅程の構築。2)ジャストウォークのコンセプトに基づいた屋外オーディオガイド用のモバイルコンポーネント。3)旅行後のシナリオで使用するために位置精度データを最適化するアプローチ。4)共同旅行計画のためにルートをマージする。5)イベントベースのレジャー活動の推奨。6)状況計画に対するオントロジーベースのアプローチの概念化。7)関連研究：(a)音声コンテンツからキーワードを抽出するためのアルゴリズムとツール。(b)モバイルテストのインフラストラクチャ。(c)都市の音の分類と旅行情報システムへのその適用性。

研究成果の学術的意義や社会的意義

The project follows a process of evolution of technology for developing software for personalized travel information services suggesting models, interfaces and software aimed at demonstrating how we can combine the traveler experience and rich facilities of the present-day information technology.

研究成果の概要(英文)：We produced a set of novel approaches for interfaces and algorithms that can be beneficial for further use and advancement in travel-centric information systems, which include but not limited to:

1) Interactive annotated guided itinerary construction; 2) Mobile component for outdoors audio-guiding based on the just-walk concept; 3) Approach to optimize location accuracy data for using in post-travel scenarios; 4) Merging routes for collaborative travel planning; 5) Event-based leisure activity recommendation; 6) Conceptualization of the ontology-based approach to situational planning; 7) Connected studies: (a) Algorithms and tools for keyword extraction from the speech content; (b) Infrastructure for mobile testing; (c) Urban sound classification and its applicability to traveling information systems.

研究分野：Human-centric computing

キーワード：Human-centric computing Information systems Traveling Software Knowledge Engineering

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様式 C-19、F-19-1、Z-19 (共通)

1. 研究開始当初の背景

Traveling may be understood could as a cognitive human activity, which is one of ways to discover the world. Current investigations demonstrate that the travel-centric information services connected to huge amount of data require more efforts in investigating formalized approaches that can be used to improve travel suggestions, advance journey planning algorithms, enhance system features and give new technology-driven possibilities for implementing post-travel scenarios. That's why, present day information services for travelers are much about personalization, extending usage scenarios, advancing journey recommendation algorithms on the base of the information retrieved from various warehouses and provided by experts.

The problems of developing better personalized services for travelers are within the scope of the emerging domain of urban computing, where suggestion environments are rapidly developing. In this project, we specifically addressed the aspects of (1) Journey preparation and planning; (2) Itinerary construction automation and navigation; (3) Multimedia assistance automation; (4) Traveler interaction and collaboration; (5) Post-travel experience; (6) Developing user's memorable experience with using new phenomena applied to the domain of travel-centric system.

2. 研究の目的

The project followed a process of evolution of models and technology for developing software for personalized travel information services. The general scope of this project is in suggesting models, interfaces and prove-of-concept software aimed at demonstrating how we can combine the traveler experience orientation and rich facilities of the present-day information retrieval, processing and presentation.

The important issue addressed in this research is to demonstrate how the problem of advancing algorithms, information presentation models and interfaces of travel-centric information systems within the context of their cultural and historical perspectives may be positioned and solved within a wider scope of human-centric computing applications that require transdisciplinary approaches. These approaches involve scientific and non-scientific sources or practices and do not simply assume either the integrated use of tools, techniques and methods referring to various disciplines nor the interconnection among academic disciplines, but rather an application of solutions achieved in one area of knowledge to a different human-centric domain.

3. 研究の方法

Figure 1 illustrates how the research on developing annotated travel-itinerary construction automation is organized according to the human-centric design process.

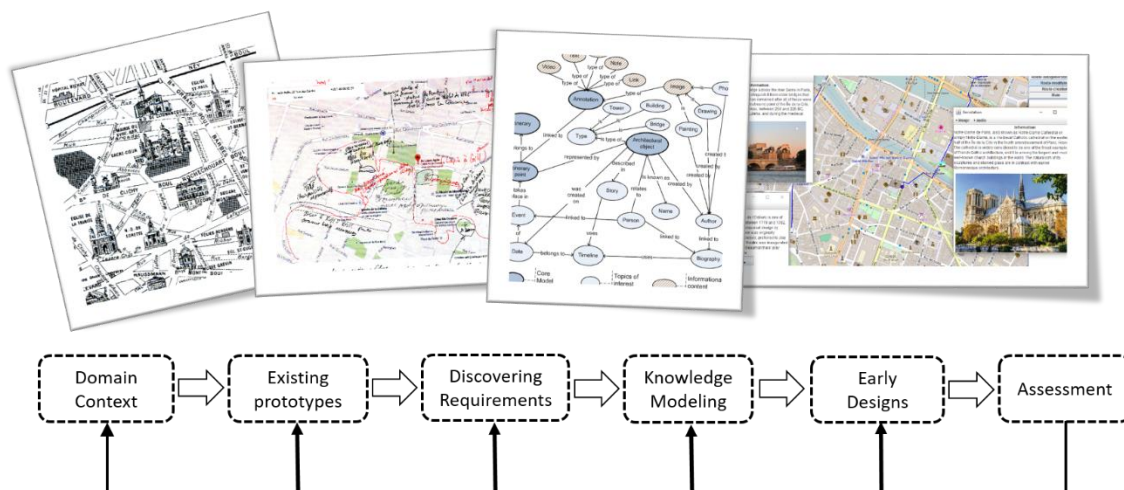


Figure 1. Human-centric design process.

Each large iteration of this process includes the following (often overlapping) referring to particular research methods and models required at every stages such as Domain context and existing prototype analysis; Requirement elicitation with involvement of potential stakeholders and interested users (using methods for data and use case modeling); Developing knowledge models including design of common-sense and domain-specific ontologies; Implementing early designs of prove-of-concept software, and its assessment [1].

4. 研究成果

The proposed project followed a process of evolution of models and technology for developing algorithms and software for personalized travel information services. Within the scope, we produced a set of novel approaches for interfaces and algorithms that can be beneficial for further use and advancement in travel-centric information systems.

(1) Based on the common-sense ontology shown in Figure 2, we improved the earlier implementation of prototype software system for interactive guided itinerary construction integrated with OpenStreetMap with partial guided route generation automation enabling better promotion of tour developers' creativity, originality and collaboration [1].

(2) We examined a number of solutions used in developing multimedia guiding systems for travelers and implemented a mobile application for outdoors audio-guiding based on the just-walk concept. We expect that this model is appropriate for better tour recommendation and playback automation of outdoor travel tours with using geo-positioning [2].

(3) We introduced an approach to optimize location accuracy data usage with respect to traveler needs and device properties (for example, quick discharging due to high frequency of location requests) [3]. Exact and accurate location data might sometimes become even more important in after-journey activities than during the trip. We introduced a design pattern aimed at improving behavior of existing location-aware applications. The pattern includes a companion application, which is aware about user context and any number of other general-purpose services (such as Google Timeline). Figure 3 shows, how the suggested solutions may significantly improve location accuracy using a companion application.

(4) We studied possible scenarios of collaboration travel-planning. In particular, we introduced a formalized approach to merging different tourists' routes aimed at improving user collaboration practices by fitting the contrasting requirements of tourist group members, where each might have own interests and preferences [4]. We demonstrated, why the standard solutions often using Traveling Salesman Problem do not describe the case of collaborative traveling adequately and suggested a model for maximization of route interestingness for a number of involved travelers

(5) We described a Google knowledge graph based mobile-centric approach to local event leisure activity recommendations [5]. Our idea is to go towards creating better motivators to improve travelers' experience quality by extending the usual scenarios supported by existing tourist guidebooks and travel sites. In this sub-project, we made an effort to address the current concerns in leisure management, which are about improving the quality of experience for the individuals, not just extending the number of available facilities. Indeed, while attending local events, such as sport competitions, music concerts, exhibitions, folklore festivals, celebrations, etc., travelers might be interested in visiting some attractive tourist or leisure spots nearby. However, sometimes the travelers are too focused on a particular event, therefore, they are not encouraged enough to search for some more potentially interesting activities.

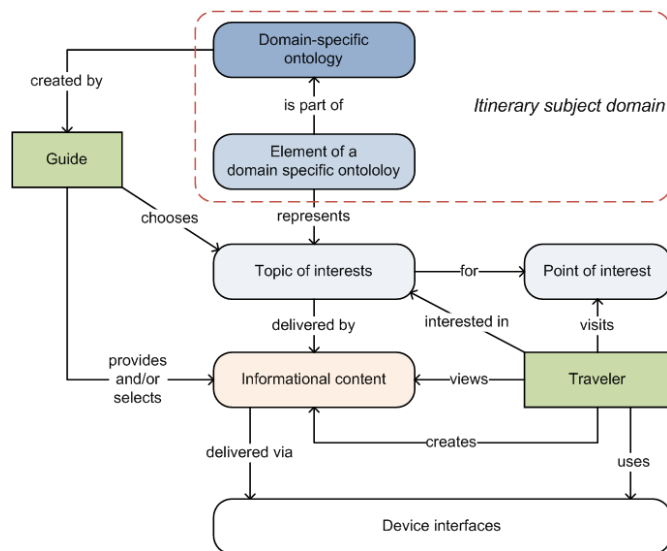


Figure 2. Common-sense ontology.

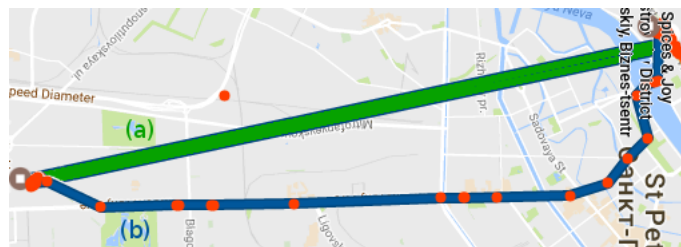


Figure 3. Increased accuracy enabled by the location managing assistant application.

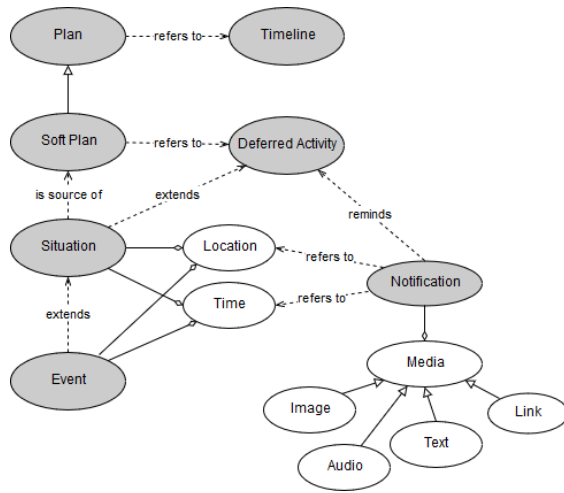


Figure 4. Soft planning entities and relationships.

(6) We examine the planning scenarios based on a variety of possible use cases, when the plans are not fixed and depend on some previewed (but not yet strictly planned) activities [6]. We analyzed the notification features of modern smart devices and the approaches that may be helpful in developing mobile tools supporting situation-based soft planning. We described a conceptualization of personalized deferred activity planning process based on subject domain ontology models and give some examples illustrating the applicability of this concept to designing the personalized planning components of travel-centric applications with respect to a number of practical real-life stories (see Figure 4).

(7) We supported a number of side-research studies that may be beneficial for further works in developing travel-centric application. These studies include the following:

(a) Algorithms and tools for keyword extraction from the speech content that can be used for producing audio sample metadata that can be helpful in creating better multimedia-based annotations in guiding applications [7, 8].

(b) Approach to create an infrastructure for time- and resource-consuming testing of mobile applications [9].

(c) Urban sound classification and its applicability to traveling information systems. This study is scope of so called digital disruption enablers for smart cities, helping in creating applications allowing travelers to develop their own emotionally intense journey experience related to distinctive sounds, specific for particular locations. Our hypothesis that sound tourism is an example of a new possible business, where the places are offered to travelers, because of their particularly interesting soundscapes. Such an approach could enhance the multimodality of travel experience together with other approaches researched within the scope of this project [10].

References

1. E. Pyshkin, "Designing Human-Centric Applications: Transdisciplinary Connections with Examples," In Proc. of 2017 3rd IEEE International Conference on Cybernetics (CYBCONF), Exeter, UK, Jun 21-23, 2017, pp. 455-460. ISBN: 978-1-5386-2201-8.
2. E. Pyshkin and P. Korobenin, "Just Walk: Rethinking Use Cases in Mobile Audio Travel Guides," In Proceedings of the 2017 Federated Conference on Computer Science and Information Systems, M. Ganzha, L. Maciaszek, M. Paprzycki (eds). ACSIS, Vol. 11, pages 281-287, 2017. DOI: 10.15439/2017F188.
3. A. Kuznetsov and E. Pyshkin, "Approach to Develop an Assistant Application for Controlling Trace Accuracy in Travel Timelines," The 8th International Conference on Advances in Human-oriented and Personalized Mechanisms, Technologies, and Services (CENTRIC 2018), Oct 14-18, Nice, France, IARIA, 2018, pp. 1-6. ISBN: 978-1-61208-670-5.
4. F. Shkolnikov, A. Kuznetsov, and E. Pyshkin, "Merging Tourist Routes for Collaborative Trip Planning," In Proceedings of the 3rd International Conference on Applications in Information Technology (ICAIT'2018), N. Bogach, E. Pyshkin, and V. Klyuev (Eds.). ACM, New York, NY, USA, 35-40, 2018. DOI: <https://doi.org/10.1145/3274856.3274864>.
5. T. Hirota and E. Pyshkin, "Mobile Application for Local Event Leisure Activity Recommendations," L conference on Control Processes and Stability (CPS-2019), April 8-12, 2019, St. Petersburg, Russia, Vol. 6, No. 22, pp. 387-394.
6. Z. Tang and E. Pyshkin, "Ontological Approach to Personalized Situational Planning: Concept and Scenarios," 2019 IEEE International Conferences on Ubiquitous Computing & Communications (IUCC) and Data Science and Computational Intelligence (DSCI) and Smart Computing, Networking and Services (SmartCNS), Shenyang, China, 2019, pp. 561-564. DOI: 10.1109/IUCC/DSCI/SmartCNS.2019.00118.
7. I. Lezhenin, A. Zhuikov, N. Bogach, E. Boitsova, and E. Pyshkin, "PitchKeywordExtractor: Prosody-based Automatic Keyword Extraction for Speech

- Content,” In Proceedings of the 2017 Federated Conference on Computer Science and Information Systems, M. Ganzha, L. Maciaszek, M. Paprzycki (eds). ACSIS, Vol. 11, pages 265–269. DOI: 10.15439/2017F326.
8. I. Lezhenin, E. Boitsova, V. Diachkov, A. Zhuikov, A. Lamtev, N. Bogach, E. Pyshkin, and I. Krylov, “Automatic Intonation-based Keyword Extraction From Academic Discourse,” Proceedings of the 2018 Federated Conference on Computer Science and Information Systems, M. Ganzha, L. Maciaszek, M. Paprzycki (eds). ACSIS, Vol. 15, pages 165–168 (2018). DOI: <http://dx.doi.org/10.15439/2018F42>.
 9. M. Mozgovoy and E. Pyshkin, “Pragmatic approach to automated testing of mobile applications with non-native graphic user interface,” International Journal On Advances in Software, IARIA, 2018, vol. 11, no. 3 & 4, pp. 239-246. ISSN: 1942-2628.
 10. I. Lezhenin, N. Bogach, and E. Pyshkin, “Urban Sound Classification using Long Short-Term Memory Neural Network,” Proceedings of the 2019 Federated Conference on Computer Science and Information Systems, M. Ganzha, L. Maciaszek, M. Paprzycki (eds). ACSIS, Vol. 18, pp. 57–60 (2019). DOI: <http://dx.doi.org/10.15439/2019F185>.

5. 主な発表論文等

〔雑誌論文〕 計1件（うち査読付論文 1件/うち国際共著 1件/うちオープンアクセス 1件）

1. 著者名 M. Mozgovoy and E. Pyshkin	4. 巻 11, no. 3 & 4
2. 論文標題 Pragmatic approach to automated testing of mobile applications with non-native graphic user interface	5. 発行年 2018年
3. 雑誌名 International Journal on Advances in Software	6. 最初と最後の頁 239-246
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〔学会発表〕 計16件（うち招待講演 3件/うち国際学会 14件）

1. 発表者名 Tomoya Hirota
2. 発表標題 Mobile Application for Local Event Leisure Activity Recommendations
3. 学会等名 L conference on Control Processes and Stability (CPS-2019) (国際学会)
4. 発表年 2019年

1. 発表者名 Iurii Lezhenin and Evgeny Pyshkin
2. 発表標題 Urban Sound Classification using Long Short-Term Memory Neural Netwo
3. 学会等名 2019 Federated Conference on Computer Science and Information Systems (FedCSIS-2019) (国際学会)
4. 発表年 2019年

1. 発表者名 Ziqiang Tang and Evgeny Pyshkin
2. 発表標題 Ontological Approach to Personalized Situational Planning: Concept and Scenarios
3. 学会等名 2019 IEEE International Conferences on Ubiquitous Computing & Communications (IUCC-2019) (国際学会)
4. 発表年 2019年

1. 発表者名 Evgeny Pyshkin
2. 発表標題 Aalto and Japan: Interinfluence of Environmental Integration Architecture Idioms
3. 学会等名 Nordcode-2019 (招待講演)
4. 発表年 2019年

1. 発表者名 Evgeny Pyshkin
2. 発表標題 Human-Centric Development for Society and Education
3. 学会等名 Research Seminar in the University of Luxembourg (招待講演)
4. 発表年 2019年

1. 発表者名 M. Mozgovoy and E. Pyshkin
2. 発表標題 A comprehensive approach to quality assurance in a mobile game project
3. 学会等名 14th Central and Eastern European Software Engineering Conference Russia (CEE-SECR '18) (国際学会)
4. 発表年 2018年

1. 発表者名 A. Kuznetsov and E. Pyshkin
2. 発表標題 Approach to Develop an Assistant Application for Controlling Trace Accuracy in Travel Timelines
3. 学会等名 8th International Conference on Advances in Human-oriented and Personalized Mechanisms, Technologies, and Services (CENTRIC 2018) (国際学会)
4. 発表年 2018年

1. 発表者名 M. Mozgovoy and E. Pyshkin
2. 発表標題 Mobile Farm for Software Testing
3. 学会等名 20th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI '18) (国際学会)
4. 発表年 2018年

1. 発表者名 E. Pyshkin and M. Mozgovoy
2. 発表標題 Mobile Software Testing: Challenges and Pragmatic Solutions
3. 学会等名 APSCIT-2018 Annual Meeting (招待講演) (国際学会)
4. 発表年 2018年

1. 発表者名 F. Shkolnikov, A. Kuznetsov, and E. Pyshkin
2. 発表標題 Merging Tourist Routes for Collaborative Trip Planning
3. 学会等名 3rd International Conference on Applications in Information Technology (ICAIT'2018) (国際学会)
4. 発表年 2018年

1. 発表者名 Y. Machishima, E. Pyshkin, and A. Kuznetsov
2. 発表標題 Trace Accuracy Analysis for Improving Sightseeing Trip Timelines
3. 学会等名 APSCIT-2018 Annual Meeting (国際学会)
4. 発表年 2018年

1. 発表者名 M. Mozgovoy and E. Pyshkin
2. 発表標題 So you want to build a farm: An approach to resource and time consuming testing of mobile applications
3. 学会等名 13th International Conference on Software Engineering Advances (ICSEA 2018) (国際学会)
4. 発表年 2018年

1. 発表者名 Evgeny Pyshkin
2. 発表標題 Designing Human-Centric Applications: Transdisciplinary Connections with Examples
3. 学会等名 2017 3rd IEEE International Conference on Cybernetics (CYBCONF) (国際学会)
4. 発表年 2017年

1. 発表者名 Evgeny Pyshkin
2. 発表標題 Just Walk: Rethinking Use Cases in Mobile Audio Travel Guides
3. 学会等名 2017 Federated Conference on Computer Science and Information Systems (国際学会)
4. 発表年 2017年

1. 発表者名 Iurii Lezhenin, Evgeny Pyshkin
2. 発表標題 PitchKeywordExtractor: Prosody-based Automatic Keyword Extraction for Speech Content
3. 学会等名 2017 Federated Conference on Computer Science and Information Systems (国際学会)
4. 発表年 2017年

1. 発表者名 Bektur Ryskeldiev
2. 発表標題 Distributed metaverse: creating decentralized blockchain-based model for peer-to-peer sharing of virtual spaces for mixed reality applications
3. 学会等名 2018 9th Augmented Human International Conference (国際学会)
4. 発表年 2018年

〔図書〕 計0件

〔産業財産権〕

〔その他〕

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