Comparative Study of Intelligent Personal Assistants to Explore Usability Issues and their Solutions

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Abstract: **In today technological world we can easily accessed on to the desired information through Intelligent Personal Assistants. These Intelligent Personal Assistants performs concierge-type tasks or provides input based on voice inputs or commands. We found still other issues related to the intelligent Personal Assistants published during our study 1) IPA security needs to be done in order to enhance the system intelligence. 2) Voice recognition sometimes fails to recognize voice. 3) IPA intelligence will be challenged if learning and suggestions failed. 4) Set standards between personal and professional tasks. 5) IPA has to go through intense knowledge that's helps react when user is not available to perform task in his absence. 6) Improvement in IPAs in terms of the context awareness IPAs. 7) IPA intense knowledge that's helps react when user is not available to perform task. In this paper we will explore the mentioned usability issues of Intelligent Personal Assistants with their suggested solutions. Our focus is only to provide the concept and idea and maybe there is need to explore each of the issue in detail in future aspects.**

Keywords: **Artificial Intelligence, Software Agents, Intelligent Personal Assistants, Software Assistants.**

1. Introduction

We have studied different researches on IPAs and found that the approach to develop a personal assistant that reduces the use of input devices like mouse and keyboard on our PC as well as their representations models [3]. Some paper discussed about the specific IPA like what Siri does, how she works, what makes her better than her competitors and what all she still needs to learn to become even stronger [4]. Other Paper focuses on IPAs could be integrated into ubiquitous computing environments in an Internet of Things (IoT) context. Therefore, it is necessary to integrate wireless sensor networks with the Internet properly, considering many different factors, such as the heterogeneity of objects and the diversity of communication protocols and enabling technologies [5] also they present the design of Sirius, an open end-to-end IPA web-service application that accepts queries in the form of voice and images, and responds with natural language [6].

We found some other interesting user study that was designed to measure user satisfaction over a range of typical scenarios of use: controlling a device, web search, and structured search dialog. Using this data, we study how user satisfaction varied with different usage scenarios and what signals can be used for modeling satisfaction in different scenarios [7]. How robot is mainly designed for this group of people as its main purpose is to offer assistance to an elderly or disabled person [7]. The approach to develop a personal assistant that reduces the use of input devices like mouse and keyboard on our PC. Giving commands via speech makes it user friendly [8]. Examine the potential use of IPAs that use advanced cognitive computing technologies and Natural Language Processing (NLP) for learning [3]. design and implement a Personal Assistant and Intelligent Home Assistant in a same device (via world –wide-web) or even any mode of Internet-Access, which gives the ability to control your home appliances and to perform task or service for an individual [9].

We have some other interesting analysis that is how personal assistant becomes helpful for the disable persons [10]. We have also studied an approach to the idea of implementing web-based artificially intelligent chat-bot as a personal assistant of the user, which stimulates setting and initiating meetings of user with his clients [11]. We found some other way of our Learning by Instruction Agent (LIA), an intelligent personal agent that users can teach to perform new action sequences to achieve new commands, using solely natural language interaction [12]. We have studied how a bot uses an ordered tree data structure, called TRIE or a prefix tree to dynamically store the things it learns and what to reply when a person command asks him something, with a little modification [13]. How we develop consistent and automatic approaches that can evaluate different tasks in voice-activated intelligent assistants [14].

Most of the above papers also highlight the list of issues and still looking for their solutions for example many voice recognition sometimes fails to recognize voice [2]. Search problems also occur as well no security logins like Siri based IPA [1]. Now a day IPAs are programmed with artificial intelligence, machine learning, and voice recognition technology to learn from the data input and become better at predicting the end user needs.

2. Related Work

We have collected some interesting data from AAWP (All

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about Windows Phone) smartphone platform voice assistant's tests by setting up some list of specific questions and get the responses of each personal assistant to analyze the comparative analysis between the renowned personal assistants [2] as mentioned below:

A. *Notes/Methodology*
1. In each case, he got around any accusations that one assistant might have got to know my voice already by using newly reset smartphones.
2. If a query or command wasn't responded perfectly, I tried again at least once, to eliminate random recognition quirks.
3. He scored each response out of ten, to try and achieve an overall final score (out of 200) and ranking.

He also tried to be as ambitious and demanding as I thought I could get away with. Each of the voice assistants *should* be able to handle all of the questions or commands below - if they're smart enough, Steve Litchfield is the editor at All about Windows Phone scored each response out of ten, to try and achieve an overall final score (out of 200) and ranking [2].

Score based Rankings:

After analyzing on provided data [2] we can see that by adding up the assistant scores effectively tied, between Google Now and Cortana, both of which have improved in their intelligence and responses since May, and both proved more consistent overall than even Apple's Siri

Table 1

Personal Assistants	Score Achieved	Assigned Rank
Cortana	145	1st
Google Now	144	2nd
Siri	131	3rd

(Published by Steve Litchfield at 6:31 UTC, September 1st 2015) [2]

3. Usability Issues & Solution

During this comparative study we analyze the highlighting issues related to different IPAs already mentioned. Now we are suggesting some ideas for these solutions which still need to further examine to implement in latest intelligent personal Assistants for future perspective but could be a great IPAs Architectures.

A. *Working on the IPA security needs to be done in order to enhance the system intelligence in terms of authenticity or authorizations and accounting [1]*
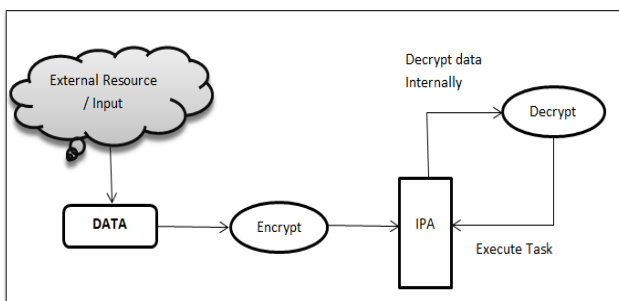

Fig. 1.

Proposed Solution: Security means how we will protect our

data after enhancing the system intelligence in terms of authenticity. IPA does not have enough security mechanism to ensure the data is secure in front of other users. We should encrypt everything which will be in and out from the IPA device and introduced encryption and decryption Algorithms as needed. Please see the following diagram Figure 1 which illustrate the security mechanism among different IPAs using centralized configurations using cloud.

B. *IPA Schedule Data should be centralized and not device oriented because if a person has more than one device then personal assistant should work same for all*

Proposed Solution: In almost all IPAs currently in the market saved their data into a device which means small database exists in those IPAs saved list of tasks in it and executes them accordingly. If any user has more than smart phones and tablets then there is need to save the same lists of tasks independently which could be hassle to manage. The idea behind is we should assign the tasks centrally on cloud but not on a single device as mentioned in the below diagram an all-other different devices and different IPAs will communicate accordingly.
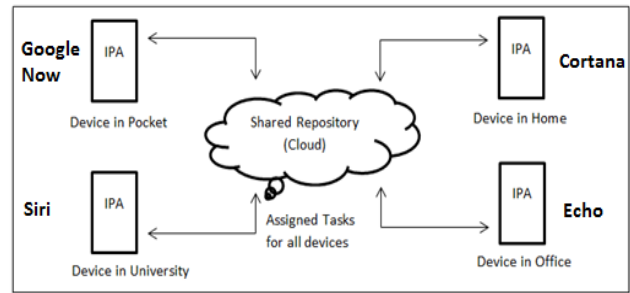

Fig. 2.

C. *Siri is based on voice recognition sometimes its fails to recognize voice. Search problems also occurs as well no security logins [1]*

D. *Creation of better speech recognition mechanisms to address all the current problems that IPAs present to recognize voice commands, such as the environmental noise [9]*

Proposed Solution: The Figure 2 illustrate that how the latest machine learning techniques can resolve these tiny issues related to the failure in voice recognition. There should be a massive data sets having a predefined model that how people can speak with different voice patterns using different pronunciations will resolve the recognition failure otherwise device prompt for again voice input to do its job better. Also authentication should introduce before access device data.

E. *IPA intelligence will be challenged if learning and suggestions failed [1]*

Proposed Solution: If IPA intelligence failed then IPA should have Q & A session on the basis of the previous input and try to resolve the execution process to get the better results.

F. *Sets standards between personal and professional tasks parallel execute which works in favor of user guidelines [1]*

Proposed Solution: IPAs should recognize the assigned tasks type either it is professional task or personal task. Please see the

following Figure 3 illustrate the idea behind the *Three Layered Approach.*

Layer 1: At this level IPA recognize the task location it is related to the office then it should assigned a type "Professional Task" otherwise assigned "Private Task".

Layer 2: After this IPA will priorities the task accordingly and update the shared repository if it will be on cloud otherwise in device database.

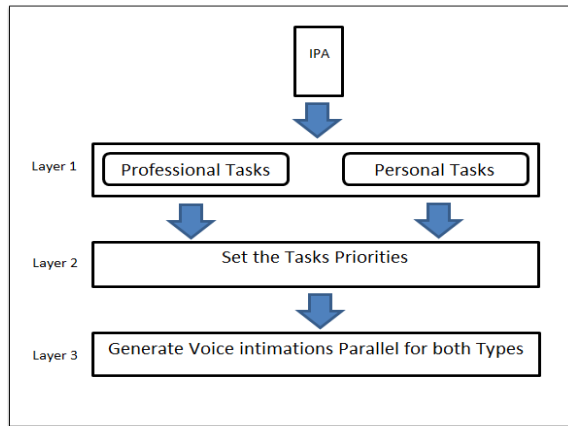*Layer 3:* It will generate voice alerts to accomplish both tasks on Parallel basis.

Fig. 3.

G. IPA has to through intense knowledge that helps to react when user is not available to perform task in his absence [1], [4]

Proposed Solution: There should be a mechanism in which IPAs track user activity continuously through sensors and take decision to send voice alert back to the user to accomplish the task. I think this needs further examination and analysis required to get the final solution

H. How will all the heterogeneous objects (including IPAs) communicate among themselves? This is a big issue that currently has no definitive answer using Internet Of things IoT [9]

Proposed Solution: Please see the Figure 4, the edge computing model could be the best way for communicate nearby edge computing device (Gateway/Switch & Router) through sensors and other connected devices.
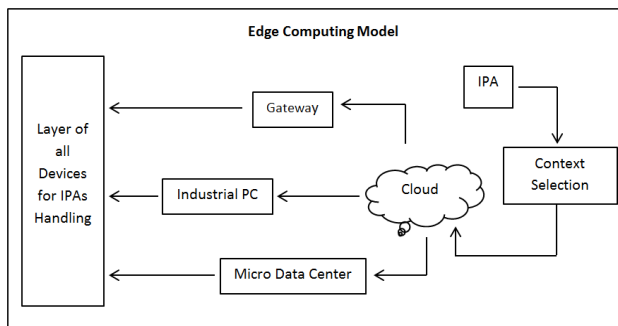

Fig. 4.

I. Improvement of the context awareness on IPAs. With these issues correctly addressed, IPAs can be used on different

contexts, giving humans the opportunity to have a smart personal assistant to complete almost every task that they need to perform [9]

Proposed Solution: Please consider the Figure 5 for context awareness we should add a mechanism into the IoT based Architecture because I that case we have different context as

1. Execute command for any other device to operate.
2. Request for Scheduled tasks to execute.
3. Any other IoT based command on cloud interface.

For this we will add another context awareness step before calling cloud interface. Please see the following.
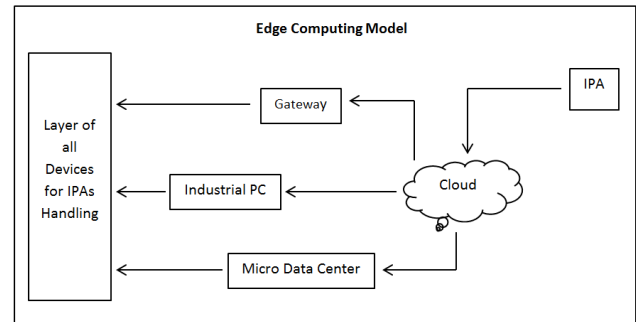

Fig. 5.

4. Conclusion

In this paper we have done the comparative analysis between three common intelligent personal assistants and rank them by collecting data from other resources. During this comparative analysis we found some other issues related to the personal assistants. We proposed some ideas or solutions to overcome on those problems but not tried to apply those solutions. These solutions are still need to further examination with some other test cases before implementation. Also we have suggested the IPAs to work with on greater environments with different context to communicate with other devices as well. Still some other detailed examination or analysis are required for IoT testing and developments.

Acknowledgement

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