Artificial Intelligence and Internet-of-Things in Consultancy Services

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Abstract:

Business patterns are now hugely dependent on technologies to expand and grow as a company. With the passing time, old fashioned monolithic business attitude is becoming obviated. Consultancy Services use technology to extend their abilities and to serve their customers while strengthening their grip on the market. Company owners have the vision to recognize consumer wants and to devise ways to meet them. Two of the latest methods to achieve so are Artificial Intelligence (AI) and Internet of Things (IoT). AI not just has a tremendous future scope, but is already used to automate mundane as well as administrative operations. Discovering new data, via IoT, and reporting them with the help of AI, is a new method, as well as a challenge, companies are willingly accepting today. AI is also focusing on maximizing customer experience providing an active and live approach towards data analytics. Being one of the brightest future technologies, we need to start training existing workers and make possible, a successful way to implement the technology when the time arrives. This paper explains the different way in which AI and IoT can be integrated to provide a promising model for efficient use in the today's world.

Keyword s : *Artificial Intelligence (AI); Internet of Things (IoT); Cognitive Consultant; Agent; Consultancy; ViSe2.*

I. Introduction

"Artificial Intelligence" and "Internet of Things" – Two very commonly used jargons of this era which are indeed extremely trending and upcoming technologies that are gathering attention and importance in various fields. Artificial Intelligence or AI in very simple terms is the mechanism using which machines gain the „intelligence" or the ability to work out a solution for any solvable problem in the world. Internet of Things on the other hand is like a bunch of smart devices that can communicate and gather as well as exchange data through the Internet [1]. Many of the times IOT and AI go hand in hand when it comes to solving problems. As these technologies have evolved, they have proven to be a big help for mankind. The agenda of this paper is to discuss the use of these technologies in „Consulting Businesses" which are making an extensive use of AI and IOT in their daily operations. Examples of such companies and products are

Alexa by Amazon, IBM Watson, KPMG"s 49x and many more [2].

Consulting refers to studying trends and gaining knowledge about the industry and accordingly providing a solution for any respective client"s problem [3]. Clients who take advice from consultants do not possess enough knowledge about the industry and therefore require some expert suggestions regarding how they can play around with the industry at minimum risk. Getting AI and IOT into this kind of a scenario would just automate the whole process of consulting and have minimum dependence on humans. [4] The solution that will be implemented using these technologies will be based on a model known as „Cognitive Model". Cognitive Model refers to a model in which human behaviour and human problem solving skills are simulated using a machine, typically a computer with the help of its Artificial Intelligence. This computer can perceive important information which would be helpful for solving a given problem, through smart devices(Internet-Of-Things). [9] Hence the resulting solution here will be known as a „Cognitive Consultant"It is evident from the above figure that, with the use of AI and IOT, key players in the consulting industry have been able to come up with better and more efficient strategies which have in turn resulted in higher client satisfaction.

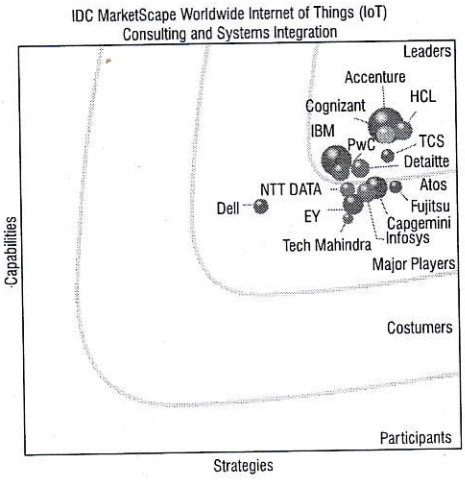

Fig. 1. IDC MarketSpace Worldwide IoT Consuting and Systems Integration

The benefits that companies will obtain with the use of AI
and IOT in their regular operations serve as the perfect
„Return on Investment" for all the money, time and effort that would have to be put in for their implementation. It would not be wrong to predict that more and more consulting firms will implement these technologies in the coming decade.

II. LITERATURE REVIEW

A. Advantages of using Cognitive Solutions for Consulting

Currently, IT departments of the consulting firms have to manually collect data from various sources, arrange the data, analyze the data and build up a solution accordingly. Specialized and dedicated teams are formed for performing each of these tasks, wherein the output produced by each team is an input to another. This process is slow and often tedious. In this scenario, using AI and IOT will speed up the process drastically and reduce unnecessary communication and coordination as all the tasks will be performed by a single system and machines are always faster than humans. [5]

In the case of manual data processing, the sources have to be limited in number as it is not practically possible for a human to analyze the volume of data that is being produced these days by various smart devices. On the other hand, using AI and IOT will allow more number of sources for gathering information about the industry and hence will result in a more precise solution for any client. [5]

The consulting industry is a very competitive one

like any other industry. Implementing AI and IOT in its operations will give any firm an upper hand over other companies in the industry. [5] Automation of the consulting process will reduce

the requirement of employees; these employees can then work on other projects where automation cannot be put to use.

B. Disadvantages of Cognitive Solutions for Consulting

The initial investment for creating and installing a system as per the needs of any consulting firm is very high as setting up a cognitive consultant requires a humongous amount of money, time and effort to be put in.

Cognitive consultants provide a world class client experience when compared to human consultants, but this experience is the best possible one and cannot be improved with time. Instead, due to wear and tear of the system, this experience actually degrades over time. [6]

As discussed above, automation reduces the amount of human beings required – this can in turn result to unemployment of a major number of human consultants.

A cognitive consultant cannot give the client an alternative solution for any given problem. This is because the „brain" of a cognitive consultant cannot think as creatively and innovatively like a human brain. [6]

III. CASE STUDY

A. ViSe2

ViSe2 [7] basically is an automated consultant which provides clients with a suitable solution for their problem(s). It makes extensive use of Artificial Intelligence and Internet of Things in its operation. This system works in two stages

When given a problem as an input by any user, the machine first studies the problem thoroughly and extracts all the data related to the problem present in its local memory. Next, it analyses all the data that it has acquired and tries to build a solution for the problem. In case it fails to do so, it seeks help from peer machines via „cooperation". This is analogous to what human beings do when we are not able to solve a given problem.

Once the peer machine receives the required inputs from the initial machine, it carries out the same procedure that has been discussed above. This approach has been termed as the

„Twin-Base" approach by the creators of ViSe2. For
implementing the ViSe2 approach successfully and efficiently, there are certain conditions that have to be achieved.

Multiple agents have to be employed for carrying out the designated procedure. ViSe2 has an MAS (Multiple Agent System) framework.

All these agents have their own processors – for carrying out the data analysis procedure, and their own local memory – for storing information that they have gathered from various sources.

All the agents have their own format and data structures for receiving information. Information to any peer agent has tobe sent in a format specified beforehand by that agent. All these agents are connected to each other through a network (preferably high-speed). This connection is required for enabling cooperation between multiple agents.

In each ViSe2 framework, one agent is a dedicated "cooperation trader" that is responsible and knows about all the communication and cooperation taking place in the framework at any point of time. Each agent consists of a User Interface (UI) which enables users to interact with the agent smoothly and without any difficulties. Each agent consists of a Communication Interface (CI) which enables other agents to interact with the agent smoothly and without any difficulties.

One important issue to discuss here is that in the VeSe2 framework, if an agent fails to solve a given problem on its own, how will it decide on a peer agent to seek assistance for the same?

As per the creators of ViSe2, this is decided based on a parameter called as the „trust factor". Every agent has a „trust factor"; the problem is always passed on to the agent with the highest trust factor. This trust factor is dynamically updated over time, based on user experience and performance.

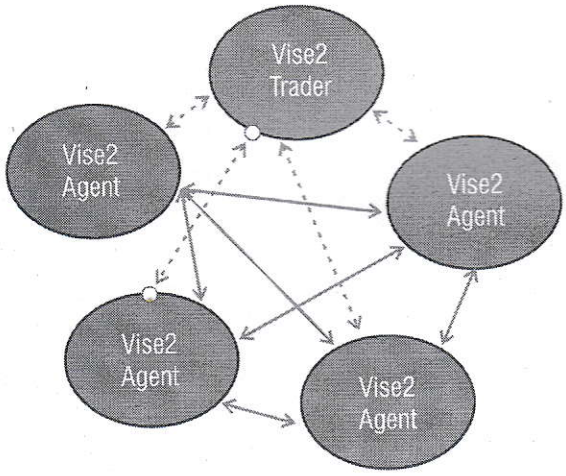

Fig. 2. Architecture of a ViSe2 framework [7]

It is evident from the above diagram that all the agents in the ViSe2 framework are arranged in a mesh topology in which the trader is linked to every agent using an import/export link whereas each agent is connected to every other agent using a cooperation link. ViSe2 can be the perfect cognitive consultant for any consulting business given that there are not too many agents in a single framework or group, as that will lead to high network traffic and high latency time.

B. Cognitive Consultants in a marriage consulting service

The marriage consulting service considered here is an online dating site which uses algorithms based on Artificial Intelligence to recommend matches to its users based on historical data sets gathered by the help of IOT through smart devices. This kind of a service has become very popular in countries like Japan, USA etc. Statistics of these countries have conveyed that 26.7% of married couples in Japan, and 35% of married couples in USA met through online dating sites [8]. The algorithm that this website is using to provide recommendations to its users is different from that of websites recommending products to its customers (For E.g. Flipkart, Amazon etc.) as the recommendations here have to suit both the parties and therefore the interests and features of both the parties have to be considered. These kinds of recommendations are known as „reciprocal recommendations" [8].

Before providing any recommendations to the user, many calculations and matching processes have to be carried out to ensure a satisfactory experience. Numerical features such as height, weight, age and income are compared. Users with similar numerical features are grouped together.

Each user has to specify certain qualities that he/she wants in a potential partner while creating a profile. These qualities are matched and users with complementing qualities are grouped. Facial attractiveness of each person is also analyzed representing the image/profile picture that any user has uploaded in the form of a graph. Users with

similar level of attractiveness are grouped.

One more very important factor is considered while constructing the dataset for analysis, that is nothing but the chat and reply history of the users. If a certain User A initiates a conversation with another User B, and User B also replies back to User A – a positive connection is mapped in between Users A & B. On the other hand, if User B would not have replied to User A"s message – a negative connection would have been mapped between them indicating that the recommendations made to User A were not appropriate.

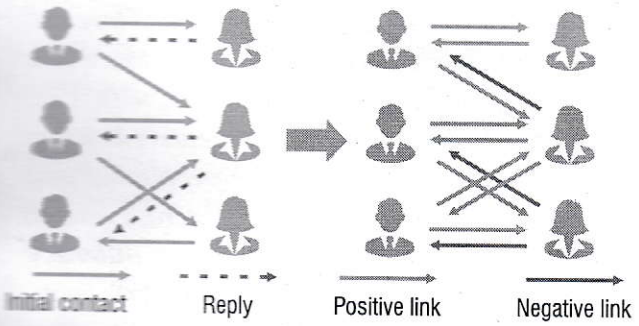

Fig. 3. Mapping of Connections between users [8]

This algorithm is being widely followed around the world in various online dating websites and has shown a commendable efficacy.

IV. FUTURE SCOPE

This paper aimed at studying the potential of implementing solutions for consultancy firms that were based on AI and IOT to implement „Cognitive Consultants". Furthermore, we would like to expand our field of research firstly, by exploring other technologies which can be incorporated into this solution to improve it further in all aspects and secondly, by studying other fields in which the use of AI and IOT can bring a revolution like it has brought in the field of consultancy.

V. CONCLUSION

The paper covers two very major and popular technologies of today's world that is AI and IOT and their use in the implementation of 'Cognitive Consulting'. Besides this, two real life applications that have implemented these technologies are thoroughly studied out of which one is a general automated consultant called 'ViSe2" and the second is an online dating application which is an automated marriage consultant. Thus, all the vitalities are discussed and taken care of further yielding optimal results for the same.

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