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To cite this article: Akila Victor *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **981** 042089

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E-Brainstorming Engenders Synergy Based on Ontology

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Abstract. The E-brainstorming system involves piggy bagging of ideas which results in more idea generation by the agents. Triggering of an idea for one participants happens from another participants, which will help the participants with the new idea. But with ordinary search and retrieval methods only few ideas are generated when compared with E-brainstorming method. More agents' participation in E-brainstorming results in more ideas generation. The effect of combined participation of two or more agents is more than the sum of the effect of individual agents. The main goal of the project is to build an E-Brainstorming system where the agents represent the session participants and to build an idea evaluation system which is not domain specific. The E-brainstorming system is built so that it can be used both by the facilitator and the ordinary user who don't have knowledge about the domain. The input idea given to the system is a sentence and the system solves the problem of input idea being a simple keyword or term.

1. Introduction

E-brainstorming has been a solution that helps organizations to urge ideas through computer-mediated transmission. E-Brainstorming utilizes transmission to exchange verbal communications and thus eliminates problem like production blocking. The system combines human knowledge with the intelligent agent, devising an automated decision agent that can represent a session participant to actively participate in brainstorming. Each agent has their own knowledge base. Ontology is used to describe and represent an area of knowledge. Moreover, the system has to be built with a Collective Blackboard Brainstorming session where the agent will be able to post their ideas. The agents communicate with each other through the blackboard and construct an ideation map. The system builds an idea evaluation system using log based method which performs valued idea selection. The Valued ideas are evaluated based on the ideas with the highest hit count. The system builds a sentence generator which generates a description for the input idea given by the user taking into account all the selected agents' knowledge. Using the brainstorming session the organisation are able to generate creative ideas using teamwork and collaborative work. The team that is involved in brainstorming has to sit together at a same place at a same time to provide ideas.

The brainstorming session is conducted and controlled by a facilitator who should have knowledge about the area of discussion. This type of brainstorming is called verbal brainstorming. The problem with this is production blocking, where a single person talks continuously not giving chance



for others to participate in discussion. This was overcome by E-brainstorming. It also breaks the restriction that all the team members should be together at the same place. In E-brainstorming the following is done with respect to the ideas are Idea representations, Ideation map construction, Idea extraction, Idea evaluation. The idea representation is done using idea ontology. The ideation map construction is done in the blackboard with the participation of the agents. The ideation map contains the idea given by which agent and at which round. In idea extraction the agents extract the ideas from their knowledge base. The idea evaluation system uses log base method which perform valued idea selection. E-brainstorming is achieved by giving a "open problem" (initial topic or issue) to the system. The open problem is defined as an idea instance represented in idea ontology. The collective brainstorming blackboard receives the initial idea and provides an environment for the agents to learn and share their knowledge by building a communication platform. The agents receive the initial idea from the blackboard and access the client's domain knowledge. It creates an extract an idea and return the idea to the blackboard.

An Ideation map will be constructed by repeatedly interacting with the blackboard and agents. At last, the valued ideas are selected and given as output. To build a E-brainstorming system for a Construction domain where the agents represent the session participants and to incorporate an idea evaluation system. Initial idea, domain and the participants an input and valued ideas as output. To build a sentence generator which generates the description for the input idea. Initial idea, domain and the participants as input and the description for the input idea as output. The objective is to build an E-brainstorming system with an idea evaluation system generic for any domain.

E-brainstorming is the electronic communication with the computer mediated device. In E-brainstorming each participant is given equal chances in participating the brainstorming process which can be utilized in the companies, industry, organisation and colleges. Brainstorming replaces the verbal communication by utilizing the electronic communication and then it eliminates the problem like blocking of production data. E-brainstorming produces more proposals than oral brainstorming groups in general. In E-brainstorming, concepts are taken into account for generation of ideas. Participants can not replicate their proposals in this respect and a new idea may emerge. E-brainstorming produces many proposals and tests multiple ideas. A brainstorming theory involves becoming an understanding of humanity.

E-brainstorming can only be described as a buckling mechanism for producing ideas by the use of the four rules for thought, namely that deferring judgement is the method by which ideas and alternatives are stopped in order to decide that many ideas are produced. The amount striving for more innovations has contributed to better quality innovations. Participants who offer themselves a freewheeling ability to be playful and aim for creativity. The combination quest for variations-generating concepts based on already stated concepts-aims to create ideas. In other words, the thinking of a participant will cause another participant's substitute concept, which would not be generated otherwise. The time and place constraints are removed by replacing agents in the place of human participants. Now these agents represent the session participants in E-brainstorming. The agents are given the knowledge of the participants and they are allowed to involve in brainstorming. So it is not necessary for the human participants to be at the same place at the same time. Thus the problem of time and place are solved. The evaluation system is a part of brainstorming which avoids social loafing. The evaluation system which is already present is domain specific. So for different domain different evaluation system has to be built. This is overcome by a generic evaluation system which can be used for any domain.

2. Literature Review

In 1941 Alex Osborn, a marketing officer, noticed that traditional corporate meetings hindered the advancement of new concepts and suggested laws to encourage them. He sought laws that allowed people the freedom of thinking and action to inspire and expose new ideas. The word "dream up" originally represented the method which he created and was renamed "brainstorming" in turn. Brainstorming was characterised as a "conference strategy by which a group aim to solve a particular

problem by spontaneously collecting all ideas from its participants." The rules he created are: No critique of ideas, go for multiple ideas, focus on ideas and promote crazy and over-exaggerated ideas. Al-Samarraie, Het al (2018) have presented the theory addressing the structural aspects of Group Support System (GSS) and creative techniques. Group Support System (GSS) is used to improve the quality and quantity of ideas obtained by the group of generating ideas. The usage of creative technique with the GSS will help us to improve the creativity thinking among the group more effectively.

To increase the creativity, brainstorming and other creative techniques can be used. Using GSS, three creative techniques are implemented namely, Brainstorming, Assumption Reversals and Analogies results are supported in the proposed theory. Analogies is the system produced fewer ideas but its more creative ideas. Assumption reversals will generate the most important ideas but those ideas are less creative than the ideas revealed by the analogies and brainstorming. DeVreede, G. Jet al (2020) explain how the GDSS on wireless handheld device can be augmented to the person to person group discussion, Factors affecting the social responsibility like status difference which affects the person in participating for the group discussion. Computerized group decision support system (GDSS) will help us to reduce the social impact of allowing the members to communicate and contribute anonymously and in parallel with the system.

Social distinct like status can be conveyed in a variety of ways when it happens in the face to face (FTF) group. Few of the status on the decision process influences to have practical implication to the decision itself since it is only one person in a group will be on the floor during the FTF meeting where those with the greater status will dominate the meetings by talking more and negative effects can be the result. Thought blocking or production occurs only when an individual forgets about what the person was to say while waiting for another one to finish and their can also be an occurrence of social loafing. In order to augment the face to face group discussion the system has created the group decision support system (GDSS) and it also enhance the decision-making process and performance of the system. The system has a dedicated networked computer system and a screen to help the communication among the members, coordination and collaboration among the members in a group. GDSS Technology are used to house the decision-making process and wireless devices can be utilized in different locations and can be used more spontaneously.

Mohammed, A. Aet al (2018) describes the relationship between time and brainstorming. The imagination and viability actions are operationalized by adding the brainstorming session's quality performance and the brainstorming session 's quality declines after the session. The claim of Bounded Ideation Theory was introduced by Jing, D et al (2020). The relationship between the amount of good ideas received during the Ideation meeting and the total number of ideas was designed when a novel casual model was created. The theory postulates the spacing of boundaries and three main points are identified. Although very big groups have to brainstorm in smaller groups, Javadi, Eet al (2017) says that meeting planners have two options: let any subset start from scratch, or let each next subgroup draw on the outcomes of the previous subgroups. The Collaborative Brainstorming Decision (CBDS) framework has helped us develop an atmosphere for the semantic ideation learning agent to learn and exchange information with us. It is a mechanism that is constructive in associating concepts and not in helping the framework in passive ways. The three main characteristics of human creativity such as comprehension, perceptual limits and persistence have improved electronic brainstorming.

E service recommendation is improved by the agent-based e-brainstorming system. Maaravi, Yet al (2020) has keen in charging the system for free, he insisted on open source technologies for user community with the useful tools to construct the domain models and knowledge-based applications with ontologies. Protect implements a rich framework for the modelling of information and facilitates behaviour such as the development, simulation and exploitation of ontology in different models. In addition a pupil can be expanded with a plug in architecture and Java Application Program Interface (API) for the creation of knowledge based tools and applications. Protege has been tailor designed to include friendly domain support for building a Knowledge Model. The Security OWL publisher helps the user to create ontologies for different fields and particularly the Web Ontology Language (OWL) of the W3C. In the basis of ontology, OWL formal semanticizes how the logical consequences are derived, but also the semanticized consequences. OWL Ontology includes a

definition of classes, properties and conditions. Semantic consequences are focused on the individual document or several dispersed documents together with a given OWL mechanism. The Protegeframe Editor permits the user to create and complement ontologies based on the open-source networking protocol.

3. E-brainstorming

E-brainstorming takes place for generating related ideas of the initial idea and the ideas about the initial idea. The input idea is given to the agents who are involved in brainstorming. The agents extract the ideas with respect to the input idea and sent it to the blackboard and slowly an ideation map is constructed in the blackboard. After constructing the ideation map the evaluation system selects the valued ideas using log method. This is shown in the figure 1.

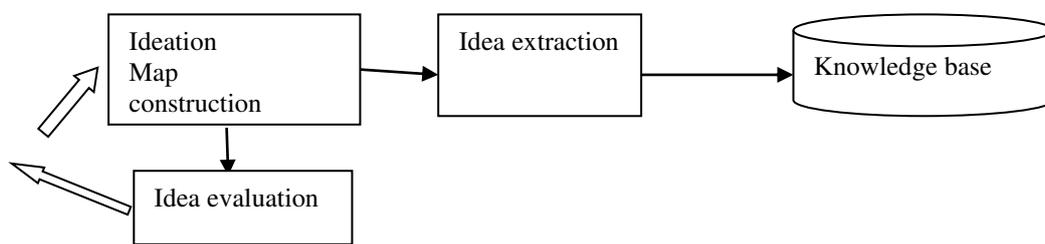


Figure 1: E-Brainstorming Process

3.1. Sentence Generation

The sentence generator gets as input from the user interface the input idea, for which it has to produce the description. Another input is the participants whose knowledge base is considered to produce the description. The input idea is given to the agents and it extracts the following as Parent idea, Child ideas, Relation between parent idea and input idea, Relation between child ideas and input idea and give it back to the sentence generator. With the above dataset the sentence generator generates the description as shown in figure 2.

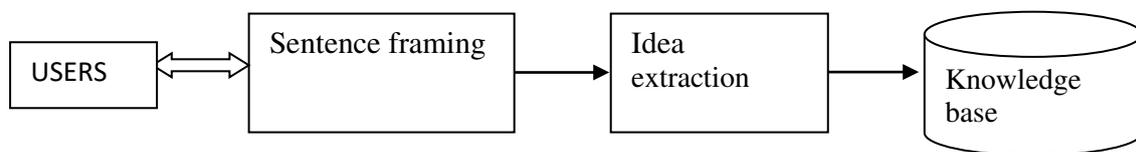


Figure 2. Sentence Generation Process

3.2. System Architecture

The system is to develop and aim at constructing a E-brainstorming decision model with the integration of human knowledge into the agents which represents the participation of E-brainstorming. Figure 3 describe the architecture with its components and its interactions are described as follows.

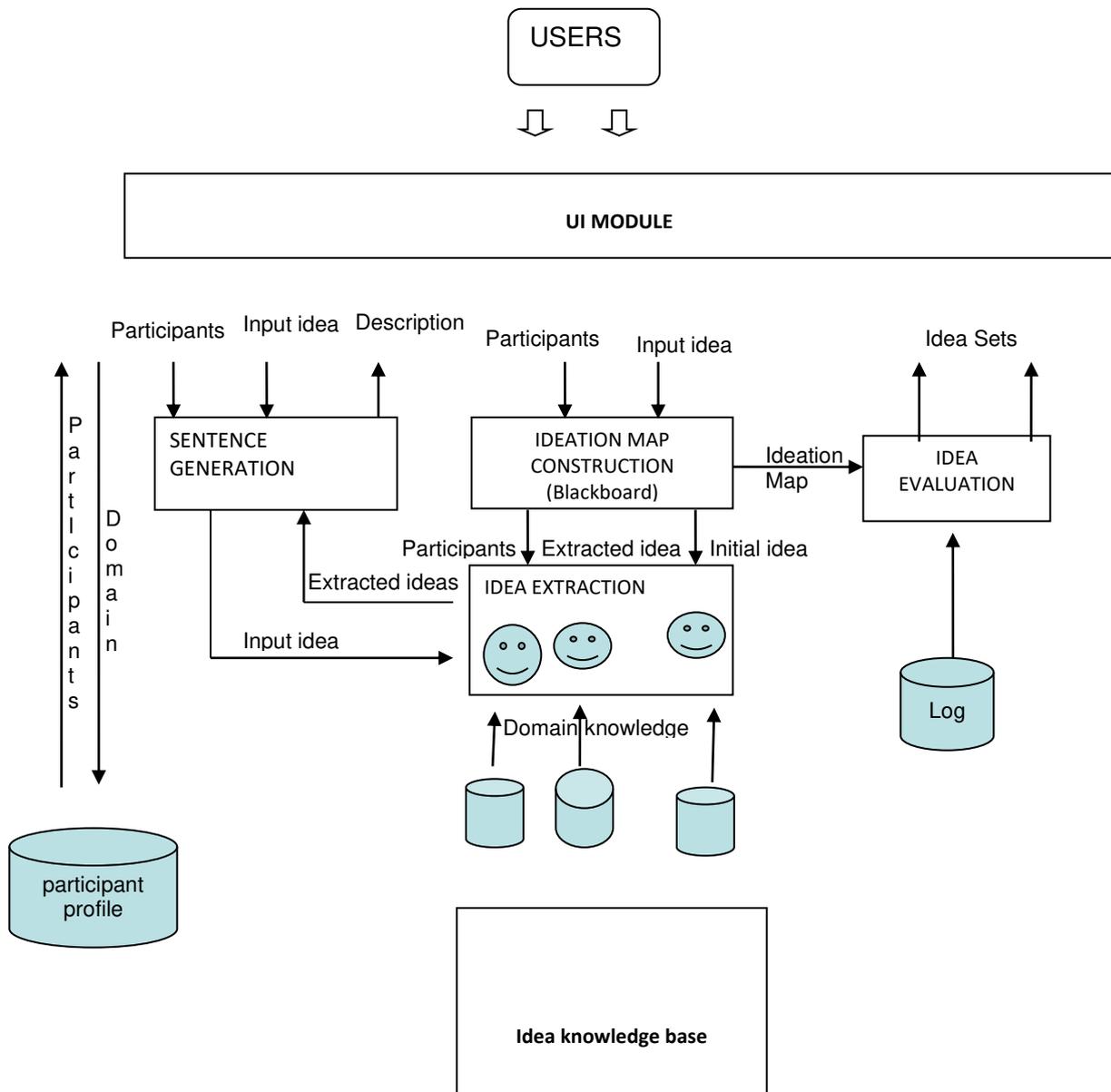


Figure 3.System Architecture

3.3 Ideation Map Construction

The concept chart includes concepts, the number of ideations and the agent generates the concept. Any round of ideas would have an idea for feedback. The initial concept, for example, is to enter into the concept in round1, and the idea created by the agent1 in the round of ideation1 is to be the inspiration for round2. The map of ideas is designed before the idea map has "no idea" about all the nodes. The goal of the protocol for map creation is that all operators are required to work with each other to achieve the greatest ingenuity. The data structure used to build the blackboard is the queue, which has two indexes the front and the rear. The insertion of ideas from the agents takes place at the rear. The idea at the front is sent as input to the agents. The implementation of the ideation map is

given in figure 3.7. Three queues are used to implement the ideation map. They are Idea queue to store the ideas generated by the agent, Agent queue to store which agent generated the idea, Round queue to store the ideation round.

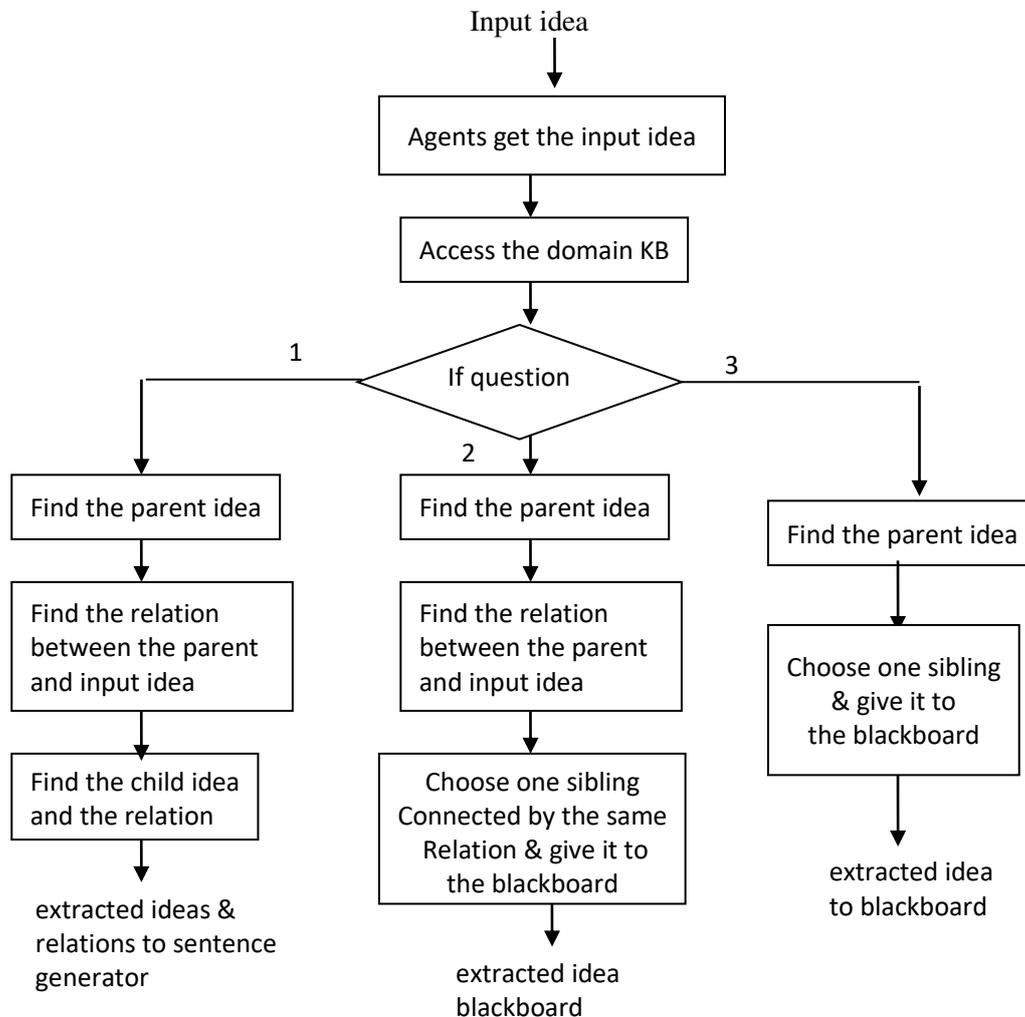


Figure 4.Ideation Map Construction

3.4 Idea Extraction

An agent may represent the customer and take part in the brainstorming session and handle the concept retrieval process. The agent's job is to follow the next steps, e.g. getting the feedback concept from the brainstorming panel or sentence generator., Extracting an idea based on its input idea, Returning the extracted idea to the collective blackboard brainstorming or sentence generator.

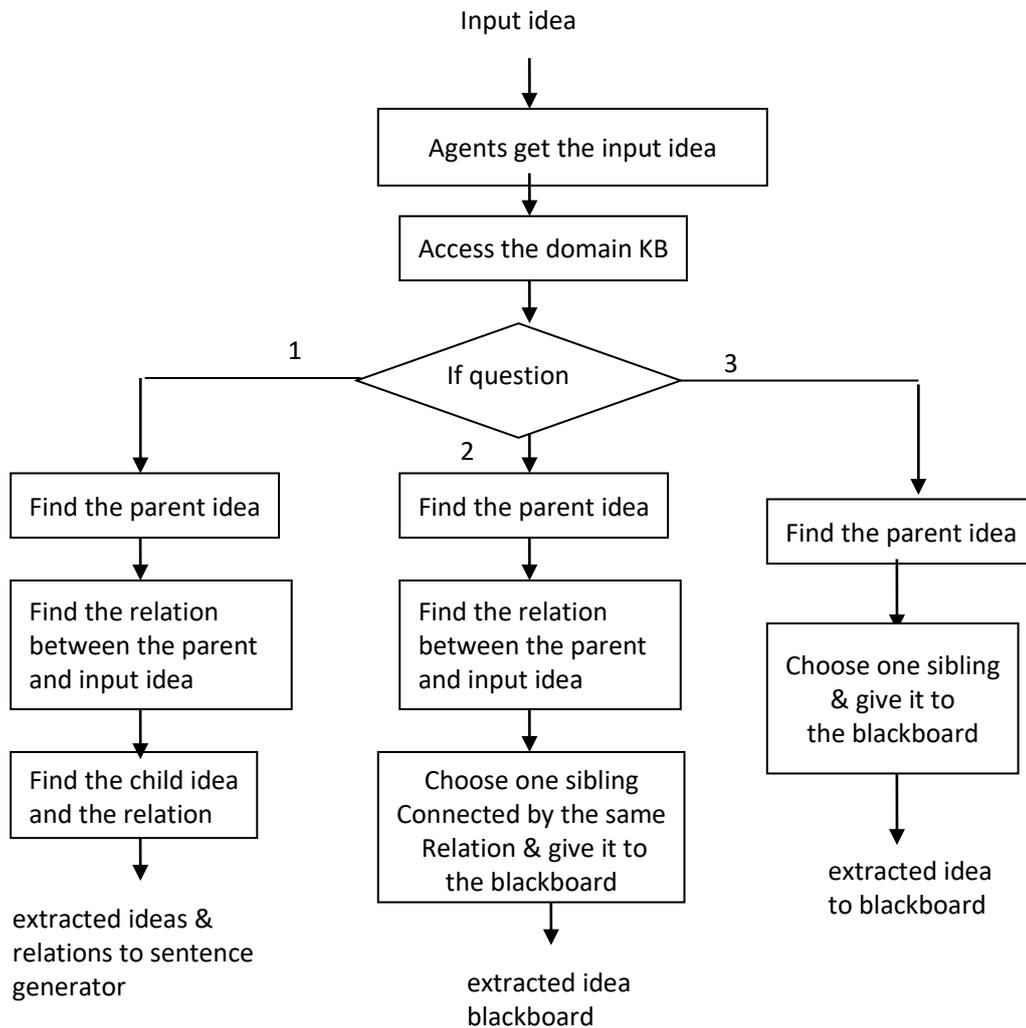


Figure 5.Idea Extraction

3.5 Idea Evaluation

The idea evaluation module does deferred judgment of ideas, which is a part of brainstorming process..It avoids judging proposals and choices before more things fall into being. It allows useful choice of concepts. Table 1 demonstrates a scheme for the log. It uses log base approach for choosing valued ideas. The expectations of the consumer are taken into consideration in this method and the system is based on the entry. The respected ideas are found and measured on the basis of the high hit count of the ideas.

Table 1. Log

Column name	Data type
Idea	Text
Hitcount	Number

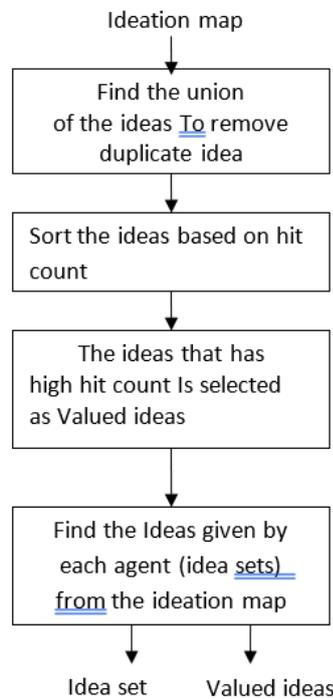


Figure 6.Idea Evaluation

3.6 Sentence Generation

The sentence generator gets as input from the user interface the input idea, for which it has to produce the description. Another input is the participants whose knowledge base is considered to produce the description. The figure 7 shows the flow of sentence generation.

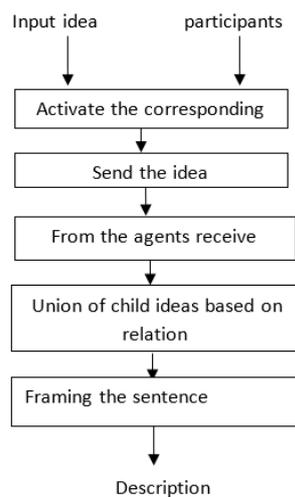


Figure 7.Sentence Generation

4. Result and analysis

In brainstorming, piggy bagging of ideas are considered for idea generation. In this, the participants are not allowed to repeat his ideas and an idea should trigger a new idea. In brainstorming ideation map is constructed. In ordinary search and retrieval, the input idea is searched and if it is found the relevant ideas are retrieved. If the input idea is not found the relevant ideas are not retrieved even though they are present. In this ideation map is not constructed. The number of different ideas generated during brainstorming and searching is considered for ten randomly selected input ideas. It is represented in the table 2.

Table 2. Comparison between Brainstorming and Searching

S.No	Input Idea	Brainstorming- No of ideas	Searching- No of ideas
1	Gtstrudal	6	4
2	Steel Electrode Grade	12	9
3	Steel Arch Design	8	5
4	Gardening	5	5
5	JCB Receipt	15	11
6	MaterialOrder Progress	9	9
7	Fixing Lofts	8	4
8	Pile Load Test	11	7
9	Slab Formwork	5	4
10	Beam Formwork	5	5

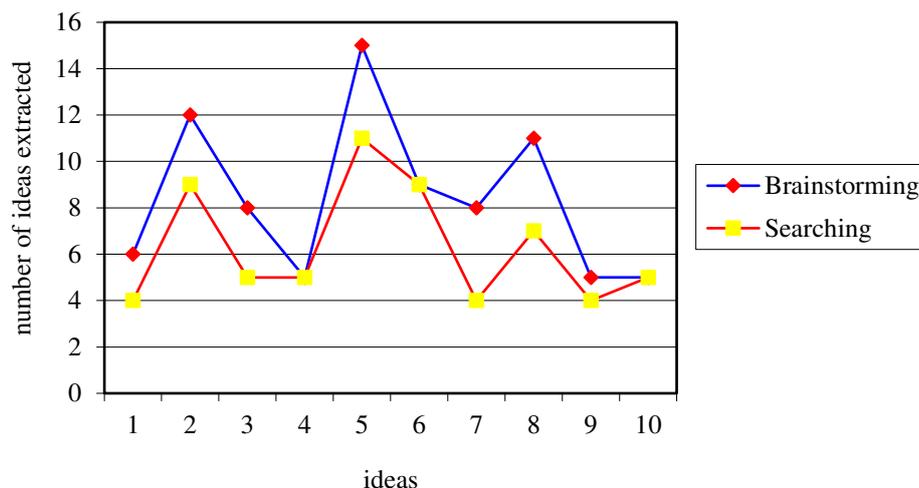


Figure 8. Graph representing Brainstorming Vs Searching

So, we can conclude brainstorming aims at producing more number of ideas than ordinary search. The main advantage of brainstorming is building the ideation map. Comparison between the combined participation of the agents and the sum of the individual participation in brainstorming. The combined participation of two or more agents is greater than the sum of their individual participation.

Table 3.Synergy

S.No	Input Idea	No. of agent1 ideas	No. of agent2 ideas	Total no of ideas (agent1+agent2)	Combined participation of agent1 & agent2 ideas
1	Gtstrudal	4	0	4	8
2	Steel Electrode Grade	9	0	9	19
3	Steel Arch Design	0	5	5	12
4	Gardening	4	3	7	7
5	JCB Receipt	0	11	11	22
6	Material Order Progress	7	7	14	14
7	Fixing Lofts	4	0	4	10
8	Pile Load Test	7	0	7	15
9	Slab Formwork	0	4	4	8
10	Beam Formwork	3	4	7	7

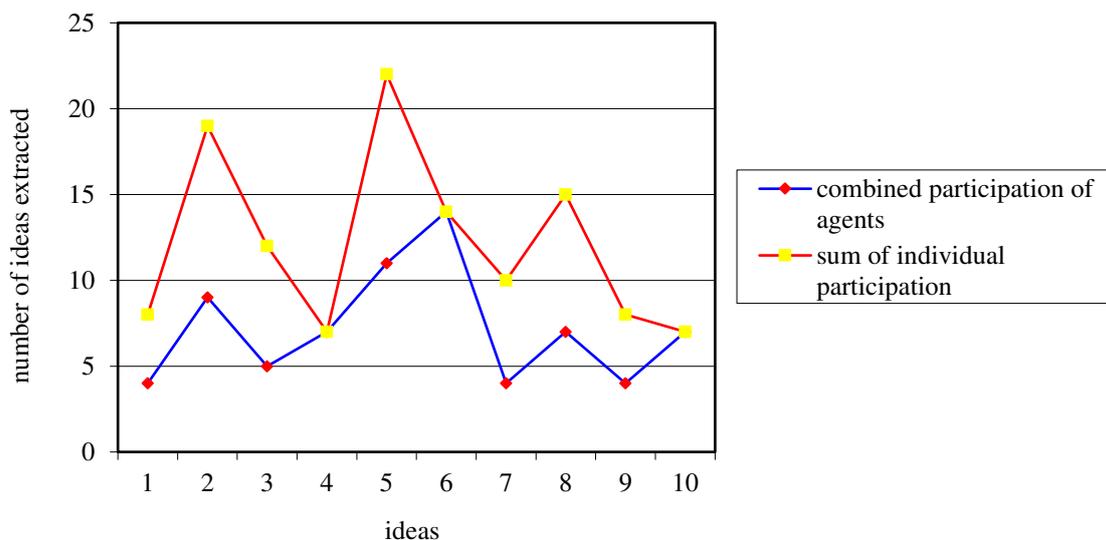


Figure 9.Graph representing Synergy

In So we can conclude that the combined participation of two or more agents is greater than the sum of the individual agent in brainstorming

5. Conclusion

The system demonstrates the use of multi-agent process in order to reach the automatic collective decision making by E-brainstorming. The blackboard is the design and ecosystem of ideation, from which agents can learn and exchange information. The competence for the agents is generated by ontology. The device chooses appreciated ideas from the needs of the consumer. The device also produces a sentence generator that explains the user's concept of feedback, and takes all the agents' information into account. Thus the system has developed a Collective Brainstorming Decision System which can be used by any user with or without knowledge about the domain. It has also built a generic idea evaluation system.

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