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COURSE COORDINATION IN ACADEMIC SECTOR: AN EXPERT SYSTEM FOUNDATION

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ABSTRACT. *Artificial Intelligence (AI) has come out from science fiction movies and it is now enabling machines to behave like human experts. Computers have some advantages over human beings because of their immunity toward perturbation factors. These factors include fatigue, stress and diminished attention. This ability makes computers more efficient and reliable in decision making. The real goal of AI is to computerize human intelligence. In this paper we explored "Expert Systems" that is one of the most important branches of AI. In expert systems, we simulate expertise of domain experts in computer systems. Machines can work like doctors, engineers and consultants and can be able to learn and use their judgmental power to conclude the situations. In academia, many subjects are being offering in every degree programs. A course coordinator is an expert who allot related subject to instructors by using some factual and heuristic knowledge. The real task is to simulate the judgment ability that he obtained after many years of experience. We proposed an expert system that will stimulates the intelligence of course coordinator and will make reliable decisions.*

Keywords*:* Artificial Intelligence, Expert Systems, Course coordination, research in academic sector, Expert Knowledge

1. **Introduction.** Artificial Intelligence covers cognitive skills like ability to learn, solve problems, and make judgments. The overall objective is to solve complicated problems through reasoning. There are four major types of Artificial Intelligence: Expert Systems; Artificial Neural Networks; Fuzzy Logic; and Exhaustive Search. Software architecture in AI programs is a bit different from traditional or conventional systems. The most important and emerging area of AI is "expert system. Expert systems are programs that aim to computerize all possible knowledge of experts. Before designing any expert system we should know what are the knowledge and skills that an expert has. Experts always have two type of knowledge about domain. First, they have some factual information. Factual information is very common and one can gain it from books, newspapers and other knowledge sources. The second and maybe more important type of knowledge is heuristic knowledge. Heuristic knowledge is More Experiential and judgmental. In fact it is the real expert opinion [02]. In this paper, we explored factual and heuristic knowledge of a course coordinator. We explained how he thinks while making any decision. We identified his factual and cognitive information. We

proposed how we can make our system able to learn as a course coordinator learns. We also discusd some techniques for judging the personality and making decisions based on an expert's knowledge.

2. **Intelligence**. Intelligence includes analytical abilities and creative abilities .Analytical abilities are used to analyze, judge, contrast and compare the things [05]. On the other hand, creative abilities are used to create, discover, imagine and invent the things. It may also include practical abilities, used to apply, utilize, activate and implement. Intelligence exists in nature everywhere. It is a quality of human beings, animals and of plants that enables them to solve their problems, conclude decisions and create something new. Plants are limited to use this ability only in specific cases. They can behave intelligently while growing in jungle among many others or some plants behave intelligently while hunting insect. Animal are more intelligent than plants [07]. They use this ability in many areas of life. Human are the most blessed creation. They have changed this world by their intelligence. There are some attributes that indicate intelligence. Those are creativity, learning ability, problem solving ability and judgmental power. Reasoning or cognitive process is another attribute of intelligence.

2.1. **Problem Solving Ability**. Problem solving ability means how somebody solves any problem in a correct way. It depends both on knowledge and intelligence. In our everyday life we solve many problem based on our knowledge, past experience and some judgmental ability. Problem Solving is the most important topic in artificial intelligence. A lot of work has been done in this area and today we have systems that solve many problems like human beings [04].

2.2. **Creativity and Decision Making Power.** Creativity is an ability to make or create something new. It depends on factual and cognitive knowledge. In any creative activity our heuristic knowledge plays important role. A creative person uses his brain power for creativity. Intuitive impressions are not the solution to make any decision. Decisions play important role in our life. We have to take decisions regarding our private and public life. Decision making is the ability that enables us to behave ourselves. People wins and losses by their decisions [11]. How we take decisions? We simply utilize our factual knowledge and our cognitive skills and reach to a conclusion. Many people may have same factual knowledge but their cognitive skills make them different. These skills are based on experiences of their lives

3. Artificial Intelligence (AI). AI is a branch of computer sciences that use some techniques to make computers intelligent. This ability will make future more productive than todays. Different futures computers from today's computer. It is the area of computer science that focuses on creating machines/computer systems that can show some behaviors that humans consider as intelligent. Since old ages, the ability to create intelligent machines has intrigued human beings. Today after the advent of computer and many years of research into artificial intelligence programming techniques, the dream of intelligent machines is becoming reality in our time. Today, scientists are creating systems which can simulate human thought, can understand speech; paly with human even beat the best human chess player, and a lot of other acts never before possible. Many areas of life including military is also applying artificial intelligence to their systems [09].

There are many branches of AI. The expert systems, fuzzy logic, and artificial neural networks are key branches. In this paper, we explored expert systems and proposed the ways how to simulate thoughts into a computer system.

4. Expert System. Experts Systems are intelligent computer programs that computerize human expertise. In other words, these systems simulate the judgment and behavior of a human expert. These are domain experts that answer our questions or solve our problems as human experts are doing. These programs have all relevant information about domain and expert's intelligence as well [06]. An expert System consists of three components:

1. **User Interface:** User interface works between a user and the expert system in some problem solving activity. A good expert system always has a user friendly and effective interface. User Interface has to accept the all queries/instructions in a specific form that the user enters data [04]. It translates them into working instructions. It also has to be able to present answers that are produced or generated by the system. It is important to make the expert system as user friendly.

2. **Knowledge Base:** The knowledge base is the main database of the system. It stores all the factual information and rules about a particular area. It also makes these available to the inference engine in a form.

3. **Inference Engine:** The inference engine the brain of any expert system. It processes the rules factual information and reach to a conclusion. It is the program that locates the appropriate knowledge in the knowledge base. After finding knowledge inference engine infers new knowledge by applying logical processing.

5. Course Coordination. Course coordination means to allocate courses to teachers as per their ability and course requirements. It is an official responsibility of an expert that is known as "course coordinator". Course coordinator assigns courses to different teachers as per their abilities. While assigning any course he makes decisions based on some pre-defined rules and regulations and he also uses his experimental knowledge. Pre-defined rules can be teacher's educational qualification, teaching experience, research work and some sort of practical knowledge about subject. A course coordinator assigns courses based on these predefined rules but he has to use his experience when many teachers fulfill that criteria. In that case he uses his heuristic knowledge to support his decision. He keeps in mind three most important factors whereas he makes decisions. These three objects are; teachers; classes; and courses. Below we will describe some key characteristics of these objects.

5.1 **Teachers.** In any department different teachers have different qualifications and different personality characteristics. Every teacher has his own attitude and behavior. Course coordinator uses his cognitive skills and assigns them courses as per their personality. Personality is combination of "I" and "Me". "I" means their inner man, their nature and attitude. "Me" indicates their thoughts about society or their behavior. In next sections we will discuss some personality characteristics and Course coordinator's heuristic knowledge to deal with those attributes. We will use these characteristics for allocating them suitable subjects. For example a cheerful teacher is suitable for new comers. He can help new student to adjust them in a new environment. A research oriented teacher is better for senior classes.

5.2 **Courses.** Like teachers, courses may also have different characteristics. These characteristics may be factual and heuristic as well. Factual information about courses includes: title; credit hours; nature (practical or explanatory); and pre-requisite course required. This list will long but it will be limited. Second type of knowledge about courses is heuristic knowledge. This heuristic knowledge may include course important in whole degree program. In other words, a course coordinator's job is to imagine the course in big picture. For example some courses motivate students to make decisions for their specialization or research program and some courses aims just to enhance their personality.

5.3 **Students.** Students are third object that plays important role when a course coordinator makes decision for assigning courses. Like teachers and courses, we can divide knowledge about students in two categories: factual; and cognitive. Coordination expert's job is to classify this knowledge. Factual information about students will be their age group, previous degree or certification, gender, and their performances in relative fields.

6. Experimental Knowledge. Course coordination is an official duty of an expert. He may have several years of experience. He has to follow pre-defined rules and have to use his cognitive skills. He uses both type of knowledge while decision making.

7. **Knowledge Seeking Process.** The most important task is how to simulate that both type of knowledge in computer systems. As we discussed before that only factual knowledge is not enough for cognition process. We must have to simulate heuristic information as well. Today, conventional systems also have ability to simulate factual information. There is a marvelous advancement in databases in last decade. These databases store information through forms. On the other hand, simulation of experimental knowledge is a bit tricky because intelligence has variable attributes and it is not possible to store this information in that way. It is almost impossible to store this knowledge in a straight forward way. Here we will discuss how an intelligent system (expert system) will get knowledge and use it in decision making process.

7.1. Seeking Factual Knowledge. Factual knowledge about teachers is usually available in resumes and some sort of other official documents. This knowledge may include their educational qualification, educational background, experience, research publications, practical experience about subject rather than just teaching, gender and pay scale. This knowledge can be added in system knowledge base with the help of forms. This information will have priority while allotting any course to teachers.

7.2. **Seeking Cognitive Knowledge.** Dealing with cognitive knowledge is a bit tricky. It is not straight forward type of information. It is in fact the complete personality understanding of any teacher. If we assume artificial intelligence as a tree then its roots will be some social and natural sciences. Phycology and sociology will be primary roots in our system. While judging anybody's personality we have to identify his "I" and "We". "I" is the inner man of a person. "I" indicates his inner self, his nature and attitude. Everybody has very different type of "I" related attributes. "We" means how one learns from society. How he behaves. In a society there are always some values defined. Some values are universal like truth, integrity, justice etc. But in some societies these values may be changed. "We" simply means how a person behaves. How he will react in a specific situation.

8. Students Feedback Information. Intelligent Coordinator will use some tricky questionnaires for seeking this knowledge. System will also use feedback forms from students. After analyzing questioner answers and student's feedback system will guess a teacher's personality. These questionnaires will have some cross questions and it will be required to answer in a given time. Here we can see a part of student's feedback form and a technical questionnaire that will be offered to teachers.

Students' Feedback form will include these type of questions:

- Teacher is prepared for each class.
- Teacher arrives on time.
- Teacher provided additional knowledge apart from course and provide related material as well.
- Teacher's behavior was cheerful.
- Teacher has ability to control the class.
- Teacher is fully prepared, when he comes for lectures.
- Teacher integrates course course's theoretical concepts with real world.
- Teacher behaves gently in class.
- Teacher gives undue favor on gender basis.
- Teacher gives special favor to any student.
- Teacher has good interpersonal skills.

Student will have five possible choices to answer. These choices will be: Strongly agree; agree; Uncertain; Disagree; and strongly disagree. Every choice will have special weight. For example strongly agree will have weightage of four, whereas strongly disagree will have zero as value. System will evaluate feedback from students and store information in knowledgebase.

9. Questionnaires From Teachers. Knowledge gathering from teachers is a very tricky process. System will have many cross questions to make judgments. Questions can be as follows:

- I try to be courteous to everyone, I meet.
- I like to have a lot of people gathering around me.
- I often get angry at the way people treat me.
- I am not a worrier.
- I keep my belongings neat and clean.
- I am a cheerful high spirited person, I laugh easily.
- I seldom notice the moods or feelings that different environments produce.
- I would have difficulty just letting my mind wander without control or guidance.

Here are some more tricky questions for decision making support. Examples are:

- I am pretty good about pacing myself so as to get things done on time.
- When I am under a great deal of stress, sometimes I feel like I am going to pieces.
- I have no sympathy for beggars.
- Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
- Some people think I am selfish and egotistical.
- I don't get much pleasure from chatting with people.
- I rarely feel lonely or blue; I really enjoy talking to people.
- I believe letting students hear controversial speakers can only confuse and mislead them.
- Sometimes I am not as dependable or reliable as I should be.
- I try to perform all the tasks assigned to me conscientiously,
- I like to be where the action is.
- Poetry has little or no effect on me.
- I often come into situations without being fully prepared.
- I am a productive person who always gets the job done.
- I would rather go my own way than be leader of others.
- I prefer jobs that let me work alone without being bothered by other people.
- I think it's interesting to learn and develop new hobbies.
- I experience a wide range of emotions or feelings.

Here is different type of cross questions.

- I waste a lot of time before setting down to work.
- I shy away from crowds of people.
- I often feel as if I am bursting with energy.
- I generally try to be thoughtful and considerate.
- I rarely feel fearful or anxious.
- I work hard to accomplish my goals.
- I enjoy concentrating on a fantasy or day-dreams and exploring all its possibilities, letting it grow and develop.
- I am better than most people into doing what I want them to.
- Some people think of me as cold and calculating.

Here are some questions guessing 'I' of a teacher.

- When I make a commitment, I can always be counted on to follow through.
- Too often when things go wrong, I get discouraged and feel like giving up.
- If I don't like people, I let them know it.
- When I've been insulted, I just try to forgive and forget.
- I strive for excellence in everything I do.
- I am intrigued by the patterns I find in art and nature.
- I am seldom sad or depressed.
- My life is fast paced.
- I have little interest in speculating on the nature of the universe or the human condition.
- I have a clear set of goals and work toward them in an orderly fashion.
- I tend to assume the best about people.
- At times I have felt bitter and resentful.
- I am a very active person.
- I have a lot of intellectual curiosity.
- I often feel helpless and want someone else to solve my problems.
- I often enjoy playing with theories or abstract ideas.

- At times I have been so ashamed I just wanted to hide.
- Sometimes I feel completely worthless.
- I never seem to be able to get organized.
- If necessary, I am willing to manipulate people to get what I want.
- If someone starts a fight, I am ready to fight back.

10. **Relationship Between Objects.** After getting information from students and teacher system will give value to personality attributes. This weightage may be zero or maximum as four. In table 1 we showed some maximum and minimum level of certain qualities.

MINIMUM AND MAXIMUM LEVELS

Minimum Level	Maximum
Courteous	Rude
Cheerful	Depressive
Confident	Un-certain
Blunt	Sharp
Pessimist	Optimist
Sympathetic	Uncaring

Table 1. Attributes showing the highest and lowest stage of some personality qualities

11. Conclusion. Expert Systems can fulfill the deficiency of human expert in an excellent way. In some cases, these systems can work even better than human expert. It can learn both factual and cognitive knowledge as an human expert learns. These systems have potential to enhance their knowledge with time but a human expert cannot do that because he is mortal. “Intelligent Course Coordinator” behaves like human expert. It has ability to conclude decisions. The real task is to simulate intelligence that is of course not very easy. Intelligence has no boundaries. It can be enhanced day by day. In this paper we designed initial design of “Intelligent |coordinator”. We identified key objects that plays role in decision making process. Further work required to create some tricky questionnaires for cloning expert knowledge. Like “Intelligent Coordinator” we can computerize skills and intelligence of several area experts.

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