

Modelling emotion expression through agent oriented methodology

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ABSTRACT

This paper presents Modelling Emotion Expression through Agent Oriented Methodology. Considering emotions of the intended users in the software engineering can uncover new requirements to improve and more accepted the system. While emotion is paying much attention nowadays, there is lacking systematic way to model the emotion based system. Without the systematic approach, it is hard to debug, design and develop an emotion based system. Since the emotional requirement of people has not being fully investigated, the research outcome propose the emotion modelling as part of the complete set of agent-oriented modelling for virtual character in eLearning system, The contribution of this paper is to introduce agent oriented modelling to systematic model an emotion based solution for an eLearning system and instructional video design. With the emotion model, it can serve as a guide to design, redesign, and discuss the emotion elements among the software development team. This is important for better debugging and project management especially for emotion led system.

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1. INTRODUCTION

Emotion are intense feelings that are either directed at a specific person or event [1]. People play video game because of the emotional engagement in the games [2] They can feel fun, excitement, thrill, fear and also to avoid boredom. The consideration of emotion in area of human-computer interaction design, affective computing and information system has become common [3]. Nonetheless, acknowledge the emotions fully thorough the software engineering lifecycle has not been explore [4]. Old software development methodologies primarily focused on functional and functional in collecting the requirements [2]. The emotional desires of users in relation to the use of the system are often ignored [2]. This lead to unhappy end users [5]. One of the major causes of software failure is the result of little consideration of requirements [6]. User emotional needs are often being ignored since these requirement are not easily to be converted to either functional or non-functional requirements in software engineering methodologies [7]. Software engineers fail to present emotional needs of users. Despite the software engineering have mature enough to handle the functional and non-functional requirements of a systems, what has not being investigated is the emotional need of people were not taken into consideration [8]. As a result, socio-technical systems receive a low level acceptance [2]. In turn, end-product will be fails to achieve the emotional needs of users [3]. Though the design is elegant and functional [3]. Thus, emotional goal should be treated equal importance as functional goals when designing a system [9].

User emotions are crucial in determine for social systems to be accepted [5]. Developing emotion models only have few standards and systematic guidelines available in the design process [4]. The important issue is how to relate the emotion to the software analysis, design and implementation? How to transform

those information so that the software engineer can benefit and use during the software development of emotion led application?. Therefore, in this study the emotional model is used to capture, support and enhance emotional need of what do user wants to feel, the way people feel and how do they feel to the adoption of the sociotechnical system.

Agent oriented modelling (AOM) is an agent-oriented methodology that uses the notion of agent or actor in all stages of its process [10]. The AOM is useful to model a socio technical system. In AOM, various agent models have been introduced. These include goal models, Role and Organization Models, Domain models, Agent and Acquaintance Models, Interaction Models, Knowledge Models, Behavior Models and Service Models [10]. To date, the agent-oriented modelling has been adopted in ICTD4 [8], 3D virtual characters, ecommerce [11], collaborative learning etc. Furthermore, the agent oriented modelling is useful for people oriented software engineering. The AOM can support better understanding of the system and discussion with stakeholders [10]. By engaging the stakeholders, it can reduce the number of errors introduced during the analysis stage. For example, agent concepts such as roles and goals are natural abstraction of the real interactions between people and systems.

Emotional model has been introduced to capture and model the most important emotional aspects of socio-technical systems [4]. Previous work highlighted the importance of considering user emotions during software development [2]. In line with the previous work [4, 9 and 2], this section adopts a similar extension method to develop emotion driven eLearning. ELearning is introduced to promote self-learning anytime and anyway. To date, various components have been added into an eLearning platform to produce an interactive and engagement eLearning platform. While emotion is paying much attention nowadays, there is lacking systematic way to model the emotion based eLearning. Without the systematic approach, it is hard to debug, design and develop an emotion based eLearning system. In this study, we are demonstrate how to design complete set of model emotional goals in early requirement and detailed design for emotion-based quiz master as an embedded emotion element for eLearning system through the proposed modelling approach

The emotion-based quiz master is a virtual character that will interact with the students through various emotion characters. As the virtual character need to engage with the users, modelling the virtual character as a socio technical system is worth to explore. Several components have been used to embed emotion components into this research. These include general principles to design emotion in e-learning and virtual character. The summary of each technique is briefly elaborated in the following description. Christopher Pappas described some tips on how to create eLearning courses that claim to engage and motivate learners' emotional nature [12]. There are 4 tips to design emotionally driven eLearning courses. These include creating interesting stories and real world examples, creating visual engagement, chose well-chosen image and interactive scenario. While many researchers believe that the holy grail of technologically enhanced tool in higher education lies in the replication of actual human aspects in the classroom [13]. Virtual character, also known as pedagogical agent is visual character that is located within a digital space of virtual learning system. They can take instructional roles such as tutor, learning companion and coach in eLearning environments [14]. Also, virtual character can scaffold learners by asking questions, providing hints, or offering alternative perspectives during learning [15]. Study shows that facial expression in talking virtual agents can persuade automatically the emotional and motivational responses of the learners unconsciously. There are list of findings in help the designer to produce the emotional driven eLearning. The smiling expression had negative impacts on participant emotions and motivations [15]. Research has shown that instead of providing learners with a choice of agent, it would be preferable to provide them instead with an attractive agent that resembles them with respect to gender, ethnicity/race, age, and perceived competency in the domain [16].

Facial expressions such as eye, eyebrow, and mouth movements and deictic gestures including pointing with arms and hands, head-nodding are important for pedagogical agents to promote learning-related outcomes [27]. Thus, in order to virtual character express joy emotion, they have to display excitement voice response [18], show two hands raised up in the air [18], express the smile [19], shows the thumb up [18], do clapping [20], and last but not least is compliment the learner [18]. While for virtual character express the trust emotion, they have to give the learner privilege second chance in answering the question [21], express smile [22], and present similar ethnicity [23]. For virtual character to express fear emotion, they have to display fear voice response, they can show blushing and sweating [24], express worry and wrinkles [18], stop gesture with hand [1], show discomfort body language [18], and give the advice [1]. For virtual character express surprise emotion, they have to display excited voice response and express wide eye raised expression [25], and avatar speak the user's name for the first time [20]. For virtual character to express sad emotion, they have to display concern's voice response[18], two arms crossing in front of the chest[18], express dropping upper eyelids expression [18], show fists and arms swimming up and down gestures [18], show discomfort body language [18] and motivate the learner [18]. For virtual character to express anger

emotion, they have to display angry's voice response [18], hands on hips [18], lower the eyebrow expression [18], show kvinde cross hand gestures [18], show discomfort body language [18] and showing the anger [18].

For virtual character to express anticipate, they have to display excite voice's response, show dilate eye expression, show hand gestures and let the learner to be anticipate for the next question and the total mark. As mentioned, several techniques have been introduced to embedded emotion into eLearning system. How to transform those information so that the software engineer can benefit and use during the software development of emotion led application? Agent oriented models is adopted in the research method.

In general, this paper present modelling emotion expression through AOM extension. This study use to solve the problem of the few standards and systematic guidelines in designing emotion models. With the emotion model, it can serve as a guide to design, redesign, and discuss the emotion elements among the software development team. This is important for better debugging and project management especially for emotion led system. The important issue is how to relate the emotion to the software analysis, design and implementation?

2. RESEARCH METHOD

In this study, the steps for extending AOM with emotion model are using the conceptual space to represent research methodology. Conceptual space can view the system in open concept rather than fixed concept. Thus conceptual space contains three abstraction layers. These include conceptual domain modelling or motivation layer, system design layer and platform deployment layer [10]. Therefore, the steps for extending AOM are using the conceptual space to represent methodology for this study. Motivation Layer has been used to discuss the problem and find the solution for purpose of sociotechnical system. Under motivation layer does consist emotion model, goal model, role model, organization model and domain model. While system design layer consist notions need to model and design sociotechnical system. These include Agent and Acquaintance Model, Interaction Model, Knowledge Model, Scenarios Model, Behavior Model and Service Model. In this study are focus on five model that have emotion model. These include Goal model, Role model, Interaction model, Scenario model and Behavior model [7]. Figure 2 depicted the propose research methodology for emotion based system.

In this research, the emotion modelling is modelled based on the notation from Leon Sterling [10] and Tropos quality goal. Figure 1 presents the emotion through Tropos goal dependency. It models how various types of emotion can combine and form a new emotion relationship. In 1980, Robert Plutchik constructed diagram of emotions visualizing eight basic emotions. These include acceptance, anger, anticipation, disgust, joy, fear, sadness and surprise. Plutchik also theorized twenty-four "Primary", "Secondary", and "Tertiary" dyads (feelings composed of two emotions). All emotions other than basic emotions are various combinations and mixtures of the basic emotions. For example, Optimism is product of Anticipate and Joy basic emotion. Love is product of Joy and Trust basic emotion. Submission is the mixture of Trust and Fear basic emotion. While Awe is the combine of Fear and Surprise. Disapproval is the combination of Surprise and Sadness. Remorse is the product sadness and disgust. Contempt is the product of disgust and anger. Aggressive is anger and anticipation basic emotion.

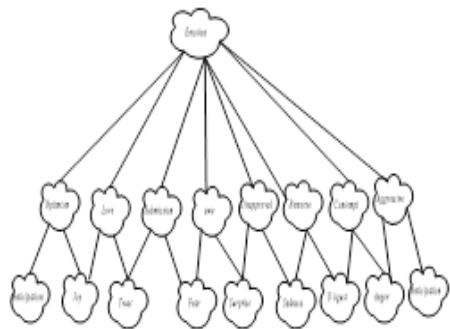


Figure 1. Goal dependency in tropos

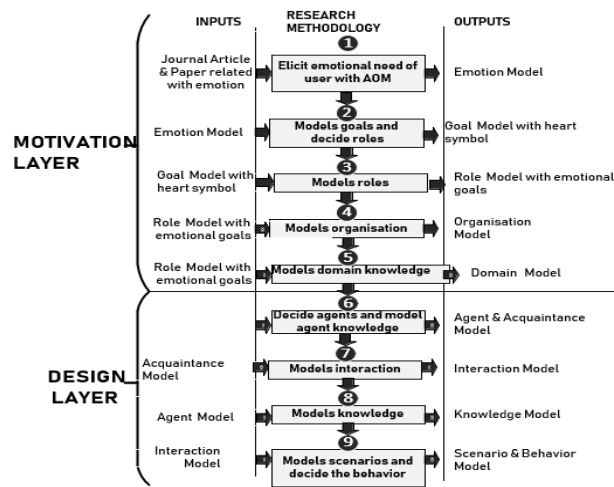


Figure 2. Research methodology

Goal model as depicted in Figure 3, is represent the functional goals of the system to be developed along with the quality and emotional goals linked to the functional goals [10]. It act as primary tools and useful at early stage of requirements to understand the problem, purpose and goals of system in overall way. It does consist emotional goal (with heart shape), functional goal, quality goal, role and arcs. Figure 1 shows modification of goal model with emotion model [4]. Functional goal (parallelogram) does capture main functional requirement of the system. It does relate with what system does. Along with the functional goal have linked with quality goal and emotional goal. Quality goal (cloud) is act as non-functional goal and represent how functional goal should achieved. Quality goal is the property of system. Role (stick like Figure) is represent set of responsibilities that system need to allow functional goal could be achieved [10].



Figure 3. Notation for goal model

Emotion model is showing is the non-functional goals that capture emotional need of what user wants to feel about sociotechnical system in order to feel connected. It does consist emotional goal as positive emotion and emotional threat as negative emotion [9]. Addition of emotional goals is modification of the original version of goal model. It does represent property of people and not property of system [4].

Role model is model that identify roles and responsibilities of different agents involve in socio-technical system and how responsibilities can be achieved in details. It does consists responsibilities, constraints and new components of emotional goals. Emotions are included since they are the properties of people.

Interaction model is model that represent set of interaction between agents of the sociotechnical system. Interaction model were based on UML-style sequence diagram and to annotate the interactions between system and user with appropriate emotional goals [10].

Scenario model is a behaviour model which describe how a particular goal is achieved by agents of the sociotechnical system [10]. Each of the scenario consist information regarding particular functionality, associated quality, emotional goals, the initiator, how function gets triggered and list of activities [3]. Emotion goals has been added associated with activities [3].

3. RESULTS AND ANALYSIS

3.1. Modelling Emotion Expression for Virtual Character in Elearning System

The case study of this project is based on the work of QuizMaster. QuizMAStEr is an educational game that integrate with game base learning [26]. It is designed based on the TV quiz show, where the game show host will present questions to a group of contestants who are competing with each other. In QuizMAStEr, contestants are replaced by students, and the host are replaced by an intelligent software agent to provide appropriate feedback through studying the reaction of students. It allows students to perform collaborative learning through friendly competition [26]. We remodel the quiz master as presented in Canada [26] by introducing emotion element into the quiz master through face expression.

Figure 5 describe about the emotion modelling for take quiz. This study are using all emotion visualize by Robert Plutchik. Emotional need during take quiz are joy, trust, anticipate, sad, surprise, anger and fear. Disgust is emotional threat that should be avoided by during take the quiz. Figure 6 shows the Goal model consist of four notation. These include provide answer, receive question, set the question and mark answer. The functional goal of Mark answer consist sub goals of express emotion as shown in Figure 7. Under express emotion can be further decomposed into smaller related sub goal as depicted in Figure 8. These include handle joy expression, handle trust expression, handle fear expressio, handle surprise expression, handle sadness expression, handle anger expression and handle anticipate expression. Figure 9 described the goal model to handle joy expression. These include display excitement voice response, show two hands raised up in the air, express smile, show thumb up, do clapping and compliment learner. The roles include quiz master and learner. Learner happy decribed as quality goal that functional goal should achieved. Figure 10 depected the Interaction Model for Joy expression.

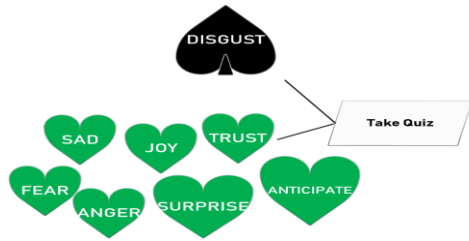


Figure 5. Emotion modelling for take quiz

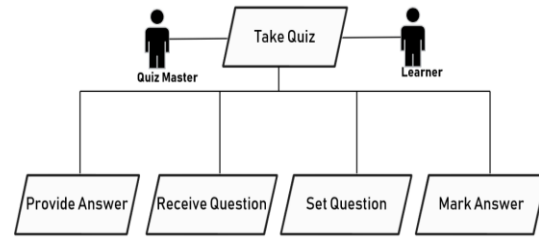


Figure 6. Goal modeling

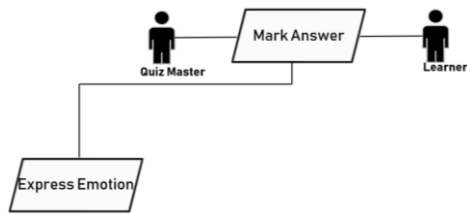


Figure 7. Sub goal modelling

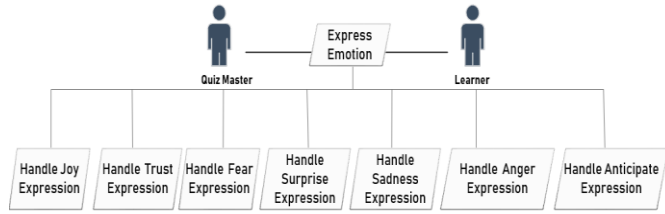


Figure 8. Sub goal (2) express emotion

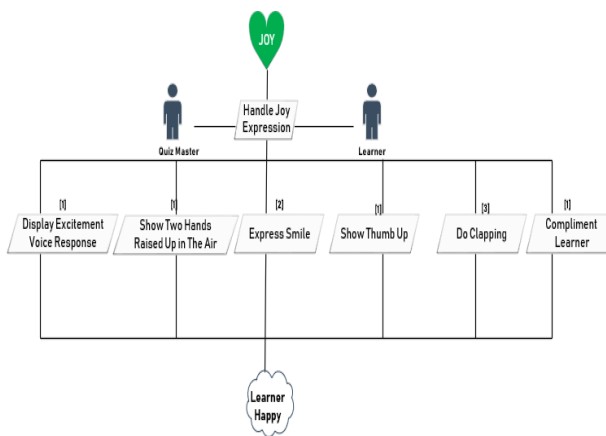


Figure 9. Goal model for handle joy expression

-JOY INTERACTION MODEL

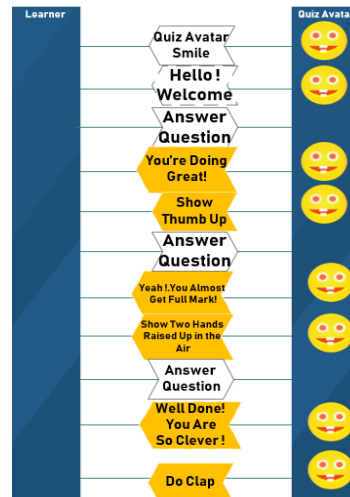


Figure 10. Joy interaction modelling

4. CONCLUSION

This paper presents Modelling Emotion Expression using Agent Oriented Modelling by emphasise the importance of such emotional goal during system design and provides a set of emotion –oriented techniques to develop eLearning system. This is important for better debugging and project management. It is worth noting that this paper presents the preliminary work and results on this project. More works are needed to explore the potential of this approach to systematically design an emotion led virtual character. Meanwhile, comparison study on using agent-oriented approach and conventional way to model the emotion system as well as empirical survey among the students are worth to explore in future.

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