



A Survey on Interactive Voice Based Chatbot in VR-Kitchen Learning Game

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ABSTRACT

The technologies like virtual reality and artificial intelligence are popular across in gaming industry and as well as game based and web based learning. In the simulated environment the user can interact with different 3D objects to learn the real time activities and collaborate artificial intelligence make the learning more suitable. The survey focus on providing a preliminary knowledge on cooking and kitchen tools through a conversational AI chat-bot and real time experience with virtual reality.

Keywords: Game based learning, conversational AI chat-bot, virtual reality and 3D objects.

1. INTRODUCTION

Game based learning is acquiring more significance in modern world. Game based learning allows students of all ages to learn the real time experiences in better way by providing necessary tools and services. By emerging virtual reality in game based learning increase the potential of student education by interacting virtually rich objects containing environment. Virtual reality in game based learning steadily increased interest of students. By implementing a conversational AI chatbot in the system fusion with virtual reality gives a great outcome in virtual game based learning. The system provides a teaching agent and conversational chatbot for developing skills in user and also teach them real time cooking. The richness of 3D objects which creates in virtual environment help them to learn the task more efficiently.

2. THEORY

2.1 Game Based Learning

Game based learning refers as using some gaming principles and apply them to engage users to learn certain things. Game based learning allows students to engage with educational materials in a playful way. It have an extreme role in teaching by making students or user to collaborate, communicate, interact and work in teams. Using game based learning is highly effective for improving learning outcomes. Its application and strategies and the way of teaching techniques tends to be increase concentration in students and make them to take quick decisions in critical times.

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2.2 Conversational AI Chatbot

Conversational AI is a technology where it allows user and the computer to communicate clearly through speech and text. The working of conversational AI is that it recognize the speech and text patterns and predicts the intent of them and gives a proper response with an adaptive automated script. Today's conversational AI platform can create a truly natural human like interaction by learning the sense of speech and gives a emotional outcome. Conversational AI uses the technologies like natural language processing to analyze the human language and speech, interpreting contextual nuances and extract the proper data from that. AI uses this data to predict the outcome of communication. And machine learning enables the system to learn and improve from experience without a prebuild program.

2.3 Virtual Reality and 3D Objects

A virtual reality experience means creating that world and all objects in it without having a physical interactions. Using 3D objects make this reality more interesting and user friendly. There are so many programs out there for 3D modeling but they are not optimal for VR. When we build a normal object or an character we usually don't think about the 360 degree view but in VR it is different. Making a 360 degree in a VR environment requires 3D modeling. There is some platforms for 3D modeling in VR are gravity sketch, NURBS, and so on.

3. RELATED WORK

The blending of virtual reality and artificial intelligence for game based learning [1] and [2] has emerged a new focus of research in many fields like industrial, medical, education and so on. Ever since we began to realize the potential benefits of these technologies which they are always overthrow the difficulties in many fields and build a calm and uncomplicated. It is incredible that VR together with AI can educate the next generation of professionals in life threatening and high risk jobs.

[1] a VR escape room game in which it provide a virtual reality escape room game for the user to leveling up the skill. A normal escape room game sometimes cant unlock and found by completing puzzle .So here the paper propose to create an environment that have varieties of cultures of different countries that help the player to interact with and puzzle solving challenges to solve to escape from each rooms in the game. The challenges are like math, arrangement, and pattern recognition. The paper focus to gather data about the significance of VR games. And the goal of this project is use the free time of player for developing skills. The game also propose a different method from other relevant VR escape room games that it use teleportation to enter the next stage of room without walking so this method helps the player from VR sickness and reduce complexity it is the unique feature of this game. Also the game intent to use free time of user efficiently to bettering up the skills like solving puzzles, math, arrangement, and pattern recognition which followed by a good background story with culture and tradition of different countries and it help the player to develop skills in problem solving, critical thinking, cognitive skills, and also the game sharpen their concentration. Here it have a limitation is that it is compatible with HTC vive gear only but this limitation is not that much crucial.

In this paper [2] it design and implement a virtual reality kitchen which have an embodiment agent to perform cooking which is teach and trained by the creator and also there is an evaluation benchmark and data collection tools. The system have two sets of real time cooking task that is we commonly use tools and preparing dishes in a virtual kitchen VR kitchen. And task learning with sample procedures. The game also proposes a new challenge that is VR chef challenge for providing a standardized evaluation for noticing different approaches in terms of their learning efficiency in complex 3D environments. It implements a wide range of 3D virtual kitchen environment which allow physical simulation with object state changes and compositional goals. Includes a tool kit VR based user interface for collecting human demonstrations and API for training and testing the AI algorithm in virtual reality environment. A human demonstration data set of various cooking task .training and teaching the AI agent with the help virtual reality device human users serves as teachers for the agents by providing demonstrations in the virtual environment. Here the system builds agents in human like appearance and detailed embodiment representation. The system have limitation like it is time consuming and already trained things will done and we can partially cope up with this limitations.

This paper propose [3] an AI agent feature to support a VR serious game. it introduces a pedagogical game agent which means this agent is designed for interacting students and user. Here it is also entrusted with the role of a motivator the state of the game is built in PGA pedagogical structure. During the progress of the game and monitors through virtual objects they assistance both on the individual level to each student on team level to each team of student. Next is the AI chatbot they provide useful information about the game rules to user and they are designed in human like avatars. Students communicate with the chatbot by using a private text chat sent questions to them and get personalized response. For the implementation of chatbot AIML artificial intelligence markup language is used. And next is the progress map which is used to show the achieved progress of each team it operates collaboratively and was implemented as head up display. By these following features the game aims to explore that by this AI features in game based learning in education can affect in students attitude and behavior towards the learning and educational game. The intelligent game environment increases concentration in classroom after completion of this game they become more active in helping, supporting and become connected to eachother. The game propose to provide collaborative educational procedure by the support of intelligent interfaces. The agent and additional features were designed for playing some specific roles in game like motivator, navigator, collaborative assistant game facilitator and to transform the game space into a virtual learning environment. There is some limitations in this system like limited time or an immersive 3D environment results anxiety in students and affect students attention leading them to ignore or to be annoyed by the presence of an agent. [4] This paper propose a scripting model for training the virtual environment by combining a pedagogical control and the emergence of relevant learning situations and tracks the learners actions. The system enable the user to learn about the virtual environment and learn from their errors without constraints or activity guidance. The system allows dynamically control the

learning and the total consistency of the environment. Here the system propose a learner tracking by using plan recognition technique which finalized the activity that mainly contains the observations of situation the compromises made by the operators and frequently occurring errors. Based on the reference model in the system which allows to determine the task performed by the user committed errors from observable actions which left in the virtual environment. In return for that the system script the virtual environment on the contextual rules and on two calculated parameters like complexity and sensitivity. The game observing the virtual environment contained observable actions or affect and it send a message for tracking and scripting system. Here the system uses a task recognition technique were it determines the effective task and committed errors. Then it analyze the determined feedbacks, performance, complexity and severity based on the contextual rules and pedagogical set. At last it trace the record in xml form. It is less efficient because of no better training.

[5] The paper implements a spoken conversational interface for making social interactions. The system is designed to notice and record the time taken by the user and keep them engage with the game character. And then evaluate the emotional detection and response in spoken dialogue. Here the system uses sentimental and emotional analysis for giving the user a better outcome. The conversational AI is split into three components first is the unity engine which handles the prototype he input is taken from the Automated Speech Recognition(ASR) unity creates a VR background where player can control the character like looking and walk around in the environment. Next is speech recognition here system use Microsoft windows speech and also cortana a window 10 built in assistant which is unity compatible. Speech recognition is done by in terms of turns of dialogue there is no interruption happen when the NPC is talking. And there is a microphone given in the side bar with is allowed to use when this NPC stops talking allow user to interact. And the icon placed in the left corner of screen indicates green and red in times of speaking when to start. Next component is IBM Watson it is a cloud service for tone analysis on the text. This module handles the response audio synthesis via IBM Watson text to speech after the processing a response by the dialogue manager it sent to IBM Watson text to speech service the audio file is return to and played in unity game. Next is conversational AI here the system uses a modified version of Alana system. Here user can freely talk with AI using an unconstrained speech input.

Using 3D objects to make more interested and richness in virtual reality there is some important things to consider collision detection is one of those things [6] in this paper it implement a virtual museum where user can interact with certain objects, such as museum door, manuscript, and lift. The system is enhanced with animated object. Also add up a collision detection mechanism to prevent avatar from penetrating objects. The advantage of virtual museum is that the museum visitors can see the collection from internet. It uses an interactive whiteboard that has a special whiteboard marker as the input device the man objective of this paper to make the virtual museum which enables virtual interaction with object and implement collision detection on every wall. Here in this system works creating a virtual reality application which creates a mirror image of museum. Here system implement a collision detect to avoid the possibility that the user emerge through the virtual wall thus user can walk freely in the virtual museum. The collision prevention is an important issue in 3Dgraphics. Here the system use detection algorithm having two steps. First step used to detect the collision of avatar wit wall. If collision happen it give response as it backing avatar to nearest position. The application was tested by ten users and they satisfied with the interaction of simulated objects and result of collision detection.

Speech recognition has become an integral part of human computer interface they are present in Google assistant, Microsoft cortona, and so on. The speech command models which are able to recognize single words start, stop, left etc. And recurrent neural networks work best for speech recognition.

[7] this paper is to study about recurrent neural networks and there performance and also the use of RNN by famous speech to text conversational engines. Speech recognition is also said as computer speech recognition because which making the computer understandable. Speech recognition consist of microphone for user to speak, recognition of speech software and a computer to perform the task. First an audio is given as input to process then it feed to deep neural network after feeding small audio to network then it will figure out the letter which matches the spoken sound. The RNN it has a memory that decides the future predictions. The commonly used RNN is long short term memory LSTM it consist of four structure and main element is cell state using gates it add or remove any information as required. Here it have 3 gates that are input, output, and forget gates. These gates are generally used to protect or control cell state. RNN is the best training algorithm for speech recognition but training algorithm is again very complex and it have better result than multilayer perceptron.

This paper [8] is a review on the three application fields of game AI. First is believable NPCs then procedural level generation and player experience modeling. Paper provide the user a timeline history about the AI in game field. NPCs are designed by using reinforcement learning it can handle two major challenges exploring a huge state space while still being human like. Second is exhibiting behavior diversity. Next is natural language processing it also have importance for making narrative human like game NPCs. In this it focus on level generation only. Procedural generation means programming generating game level randomly. It leads in series of unpredictable possible game levels. A player experience modeling is a branch of player modeling it aims to model how the player feels during game playing. The main aim is that implementing AI in games give interesting and immersive game experience to user.

[9] in this paper it implement a college inquiry chatbot by using AI and NLP. Usually when we logged into a college website some us have difficulties in collecting proper information from that website. If a the information gainer is not a student or a staff in there they may get difficulty in there to search. By implementing an inquiry chat bot which gives fast and standard information it will enhance the user experience as well as effective information to user. Here they introduce this chatbot for due to various reasons like when a person is enter to website they have doubts about some things and where does they have to collect the information. Some need notifications of upcoming things some of need grades time table of upcoming exams and so on so implementing a chatbot there helps a lot to make them clear inquiry. It works as first applies a input text to standardized the input as requirements and based on the keyword used there the appropriate context is recognized. Receiving personal queries like CGPA, attendance it is checked through user id and password if the detail is invalid the response is sent. Else the input text is processed to extract keywords. According to the keyword it recognize and sent proper data from database. Here if the user try to communicate with the chatbot the input is mapped to an appropriate pattern in Artificial Intelligence Modeling Language (AIML). If the response is there it sent to user if the pattern is not available in there it gives an invalid message. The paper [10] practically develops a game based learning system to improve efficiency of student's learning. For evaluating the learning experience of students paper uses 3D game development tools course content corresponding to game content. Here a group of students are separated into two teams for an experimental

design one team is experimental group and other one is control group. After the game based learning the achievement score and questionnaires are collected from each group and evaluate both experimental group and control group. The goal of this study is to discuss the effect of different teaching methodologies on learning motivation and achievement in a system analysis course. The result shown that the students who involves in game based learning have great learning achievement than the traditional face to face learning students. The study had implement a role playing game based learning system for system analysis course and the learning performance are significant after system evaluation.

[11] In this paper it designed a multisensory model for a directed navigation in complex indoor environment. Here in this model the simulator hold a large datasets of complex 3D objects and support flexible multimodal sensor sets. System use a deep learning navigation based method to analyze the influence on environmental complexity on navigation performance. Here first the simulator provides access to a large number of realistic environment. Second the simulator helps and support in multimodal sensing which involve vision, depth, surface normal, touch and segmentation. Next the simulation allows for procedural reconfiguration of the environment by a modification of composition and appearance. At last rendering provides high frame rates that is hundreds of frames per second on a typical workstation and consume a millions of simulation steps on training. Here system setup a navigation task point goal, object goal, and room goal. In real outside world this signal is provided by the GPS. The result shown in this paper that the agents are tested for 10 episodes per scene have a previous sample set they selected to use span a range of distance from the goal. The experiments conducting in multimodal simulation navigation in indoor environment demonstrates that current deep reinforcement learning approaches fail in large realistic indoor environment.

The paper [12] propose to develop a spoken conversational AI agent in virtual reality. This chat is meant to create for interacting and make conversation within e-learning platform through spoken dialogue. The components like Natural Language Understanding, dialogue manager, Natural Language generator using open source software. Here the 3D environment built using unity 3D platform it is a game engine used to develop serious games and non-serious games. The chatbot component NLU is extract the speech of user mapping from speech to text and then producing a linguistic structure handled by the dialogue manager. The VR environment built in here consist of three scenes that is welcoming scene, facility navigation scene, and virtual equipment understanding scheme. Welcoming scene gives a proper guidance about the available learning facilities and how to navigate through the environment navigation scene allows to know the power system facilities which can be manipulated and explore the multiple facilities. Testing of the system shows the recognition of speech of valid and invalid intentions. Experiment shows the capability of chatbot is promising.

[13] in this paper designs and implement a realistic and rich 3D environment. The paper propose a 3D house, rich and efficient environment contains of approximately 45,000 and more human designed 3D scenes of visually realistic houses using SUNCG dataset. The SUNCG dataset is built for researching on large scale 3D object recognition problems and thus carries a variety of objects, scene layout and structure. To build a great realistic 3D environment system develops renders for the SUNCG. It is based on OpenGL and it can run on both Linux and MacOS, Here the system uses a concept driven navigation called RoomNav based on house 3D. It is consider as multi target learning problem then the system performs some policies on it. In task RoomNav it first compare models with discrete and continuous action spaces with different input modalities. Then it explain the observations and show that technique improves success rate of navigation in the test set.

[14] this paper propose Gibson virtual environment to solve the problem of developing real world perception of active agents. Gibson virtual environment is based on virtualizing real spaces instead of using artificial designed ones. The main features of Gibson are being in real world and shows its complexity, next is having an internal synthesis mechanism next is the embodiment of agents and making them subject to constraints of physics and space. Here explain that by proposing a perceptual active agent it receives a visual observation from the environment there is a set of actions which can lead a physical change in the environment. System attempt to address some concerns in agent and propose Gibson virtual environment for training and testing real world perceptual agents. Here it imported a car or a humanoid then embodied and placed in a large and diverse set of real space. Then it is subjected in constraints of collision and gravity with a physical engine it can freely do mobility task as long as it satisfies the constraints. Then the Gibson virtual environment provides a stream of visual observations from a viewpoint then the rendering engine operate. There are some limitations like it provides a good learning navigation and does not allow manipulation. Second it do not have full material property and there is no existing physics simulator. Next it provides a quantitative evaluations of Googles mechanism for transferring to real world.

This paper proposed [15] a virtual reality testbed for realistic human robot interaction. The name of this system is VRGym which is differ from others (existing tools and virtual environment it builds and train both physical and interactive agent for robotics and machine learning. It is able generate diverse 3D scenes with high realism on physical simulation. The system demonstrates that it can able to collect human interaction and manipulation, support experiments for human robot interaction and also able to provide toolkits for training the state of the art machine learning algorithms. The other distinct feature which is capable to represent the physical human agents as avatar in virtual environment. To record the actions, movements, and manipulations accurately the human agent is tracked in real time and the humanoid mesh deform accordingly based on the underlying tracked body skeleton and the hand poses. The system highlight the capability for users to interact with the virtual environment the user can use three input devices for needs oculus touch controller, the commercial hand pose sensing products, and an open source glove based device. After finishing multiple evaluations it indicates that the system has a robust performance in the communication and performance with ROS. And it have demonstrate four different robotic interactive task can be effectively done in VRGym.

[16] this paper presents the impact of agents and also related technologies which are used in educational research in software and application of designing and implementing intelligent tutoring system. It also tend to a brief overview in educational software adopt the pedagogical agents to make a simple interaction and dynamic changes in teaching learning environment. Many systems adopts pedagogical agents for a better interaction and dynamics changing on teaching learning environments. The paper gives a study information of use agent techniques on intelligent tutoring techniques. Providing a agent in games gives efficient in learning activities and progress in students behavior and so on.

The [17] paper is a research and study about educational agent and learning companion, educational agent and its various roles, and give a brief information about the design issues occur in educational agent, and issues while the implementation. This paper is taken because to study the impact and what are the main problems that occur in its implementation level. A learning companion is simply a simulated character in computer where it have a

human like characteristics and it plays a non- authoritative character in learning environment. The agent can express to student in text, graph, icons, voice, animation, virtual reality and so on. Educational agents can classified on the basis of their role and function some of are pedagogical agent which involve in social learning activities for a specific purpose. Learning companion denote non- authoritative pedagogical agent simulated by the computer it can act as a peer tutor. Next is personal assistant provides each user with useful information about learning activities.

[18]this paper is HCCL human computer collaborative learning system called as people power implemented in CLOS. The system contains a micro world in which learner creates a electoral system and simulate election. The task of the learner is to make relation between the features of electoral system and distribution system. In this system it conduct a game where given different countries and the learner have to recognize the map in order gain seats for their party. This model relates three ideas first is group of subjects as a single cognitive system. That is reasoning and collaborative dialogue is the second is isomorphism which is not new and it is third. [19] this paper is a study in benefits of virtual characters in social enrichment. The focus is on potential benefits associated with the social dimensions that virtual characters may supply to electronic learning environments. The proposed pedagogical benefits are learners experiencing a material as less difficult or intimidating. Reduce the level of frustration in learner, increase self- efficiency.

[20]in this paper it propose a chatbot to enhancing the game. Here they use a pre- existing serious game environment called EMERGO and extending this environment by introducing chat bot in it and this chatbot helps enhance the interaction of student and game. Here after implanting the whole if the student perceive the interactions with the chatbot as compared to EMERGO. Finally depending on the result of evaluation the chatbot is become an integral part of EMERGO toolkit.

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