K.J. Somaiya College of Engineering, Mumbai-77.

Application of Stacks using Game-Based Learning

Research Paper:

Digital Game-Based Learning of Stack Data Structure Using Question Prompts

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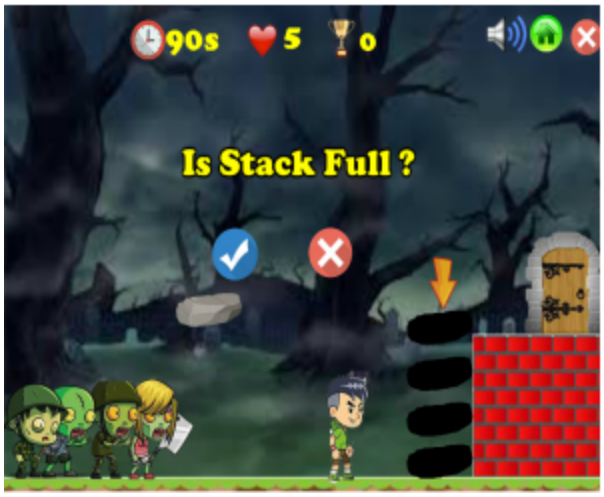
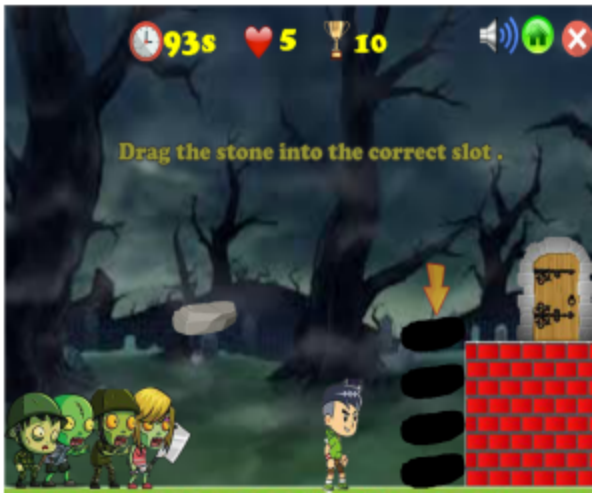
Data structures are ways of organising data in computers which can be operated using various algorithms. It is a core course in Information Technology (IT) programs in tertiary education as it is a fundamental knowledge applied in multiple areas. It gives the fundamental idea about how a computer goes through an algorithm. Since it is a very abstract topic, understanding it becomes difficult as though processes are taking place in the background, visualizing it and understanding how it works becomes difficult to understand for many of the learners. The complexity of the data structures topic just gets more advanced as one starts to dive into it and not having a clear idea about the basic concepts of the data structures can lead to the waste of time and energy of the learners, as he/she will again need to go back to the basics multiple times when problems will be faced.

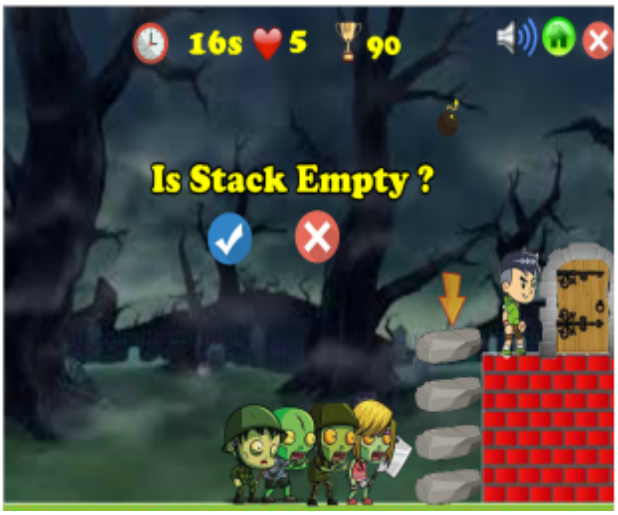
This research is based on a game model in which there are three phases; Input, Process, and Outcome. The objective is to design an instructional program that incorporates certain characteristics of games that trigger a cycle that includes user judgments or reactions, user behaviours, and further system feedback. The extent to which this cycle results in engagement in gameplay which leads to the achievement of learning outcomes depends on the success of pairing instructional content with appropriate game features. The model was combined with data structure game design which consists of general game design elements, game appearance design, and game mechanics design.

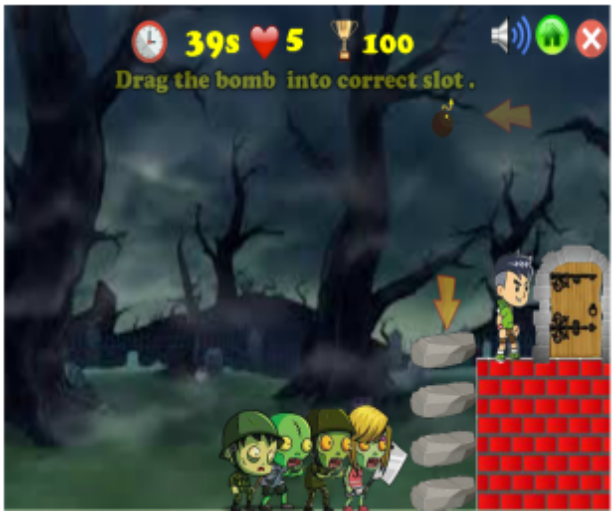
Players need to stack and unstack four stones. Before each stacking, the player will be asked whether the stack is full. The Player then drag and drop a stone in the slot





Before each unstacking, the player will be asked whether the stack is empty. The Player then drag and drop a bomb in the slot. The series of questions is a replication of the thinking process that a student should undergo to solve problems regarding the array implementation of stack data structure. Because game can be used as training as it can be repetitively played, the idea here is for the students to ingrain the problem-solving process in their mind until the point that they can recreate (self-ask) the series of questions when solving problems of similar nature.





This research showed a positive understanding of stacks implementation in students before and after seeing the live application of stacks in a game thus making it easier to understand and making the thinking process much more aligned towards the right way of thinking while using these data structures. This research attempted to simplify the learning of array implementation of stack data structure operations through game-based learning with question prompts. Educators

could use the game to diversify teaching methods and students can use it to self-assess understanding. Testing calls for improvements in terms of game design, appearance, and mechanics.

Guest Lecture-

"**Industrial Application of Data Structure**" session conducted in our college helped me understand that concepts such as stacks, queues, Linked Lists etc are not just limited to books rather they help us build the thinking required to solve industrial problems using data structures. With memes in between learning, those concepts became interesting. Absolutely loved the session as it helped me build on my existing knowledge and look more towards the application of the concept being taught in class