DEVICE AND METHOD FOR CREATING A VIRTUAL 3D ENVIRONMENT FOR A SIMULATION

TECHNICAL FIELD

[0001] Various aspects of this disclosure relate to devices and methods for creating a virtual 3D environment for a simulation.

BACKGROUND

[0002] In many applications, users may create content, in particular virtual 3D environments, e.g. levels for a computer game or virtual environments for testing, e.g. of a control policy for automated driving. The creation of a 3D environment typically involves placement of a multiplicity of objects where multiple parameters needs to be set, in particular position which includes, in a 3D environment, height. Setting these parameters is cumbersome for the user, which is especially true if a mobile terminal device is used for the creation of the content (e.g. when creating a level for a mobile game), since these devices are limited with regard to the size of the screen area which can be used to set parameters.

[0003] Accordingly, approaches for efficient creation of virtual 3D environments, in particular using mobile devices, are desirable.

SUMMARY

[0004] Various embodiments concern a method for creating a virtual 3D environment for a simulation including receiving a user input specifying an object insertion height level to be applied to a plurality of virtual 3D objects and, upon reception of an object insertion command for any one of the objects of the plurality of objects, inserting an instance of the object into the 3D virtual environment at the object insertion height level.

[0005] According to one embodiment, the method includes displaying a graphical user interface including an object insertion height level selection element including one or more height level selection icons, wherein the user input specifying the object insertion height level is at least one selection of at least one of the one or more height level selection icons.

[0006] According to one embodiment, the at least one selection is a touch or a click on the at least one of the one or more height level selection icons.

[0007] According to one embodiment, the object insertion command for the object includes a selection of an object placement icon.

[0008] According to one embodiment, the user input is a selection of the object insertion height level from a set of discrete height levels according to a predetermined granularity.

[0009] According to one embodiment, the method is performed by a virtual 3D environment creation tool, wherein all instances of the objects are inserted at the object insertion height level until another user input specifying another object insertion height level is received or the virtual 3D environment creation tool is restarted.

[0010] According to one embodiment, the method includes displaying the virtual 3D environment and displaying, within the virtual 3D environment, a plane representing the object inserted height level.

[0011] According to one embodiment, the method includes displaying, during a position selection process by a user for a position of one of the plurality of the objects into the virtual 3D environment, a representation of the object such that the representation is located on the plane.

[0012] According to one embodiment, the object insertion height level is applied to instances of the virtual 3D objects yet to be inserted into the virtual 3D environment.

[0013] According to one embodiment, the method includes inserting a sequence of instances of the plurality of objects in response to respective object insertion commands at the object insertion height level.

[0014] According to one embodiment, the simulation is a 3D game or is a simulation for evaluating a control policy of at least one of the software applications.

[0015] According to one embodiment, the method is performed on a mobile terminal device.

[0016] According to one embodiment, the mobile terminal device is a handheld mobile terminal device.

[0017] According to one embodiment, the mobile terminal device is a mobile phone or a tablet.

[0018] According to one embodiment, a terminal device is provided including a communication interface, a memory and a processing unit configured to perform the method of any one of the above embodiments.

[0019] According to one embodiment, a computer program element is provided including program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of the above embodiments.

[0020] According to one embodiment, a computer-readable medium is provided including program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of the above embodiments.

[0021] It should be noted that embodiments described in context of the method for creating a virtual 3D environment for a simulation are analogously valid for the terminal device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The invention will be better understood with reference to the detailed description when considered in conjunction with the non-limiting examples and the accompanying drawings, in which:

- FIG. 1 shows a data processing system.
- FIG. 2 shows an example of graphical user interface displayed on a data processing device for the creation of a 3D environment according to various embodiments.
- FIG. 3 shows a flow diagram illustrating a method for creating a virtual 3D environment for a simulation according to an embodiment.

DETAILED DESCRIPTION

[0023] The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the disclosure may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the disclosure. Other embodiments may be utilized and structural, and logical changes may be made without departing from the scope of the disclosure. The various embodiments are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments.

[0024] Embodiments described in the context of one of the devices or methods are analogously valid for the other devices or methods. Similarly, embodiments described in the context of a device are analogously valid for a vehicle or a method, and vice-versa.

[0025] Features that are described in the context of an embodiment may correspondingly be applicable to the same or similar features in the other embodiments. Features that are described in the context of an embodiment may correspondingly be applicable to the other embodiments, even if not explicitly described in these other embodiments. Furthermore, additions and/or combinations and/or alternatives as described for a feature in the context of an embodiment may correspondingly be applicable to the same or similar feature in the other embodiments.

[0026] In the context of various embodiments, the articles “a”, “an” and “the” as used with regard to a feature or element include a reference to one or more of the features or elements.

[0027] As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0028] In the following, embodiments will be described in detail.

[0029] FIG. 1 shows a data processing device 100 like a computer or smartphone.

[0030] The data processing device 100 has a CPU (central processing unit) 101 and a random access memory (RAM) 102. The RAM 102 is used to load program code, for example from a hard disk 103, and the CPU 101 executes the program code.

[0031] In the present example, it is assumed that a user intends to use the data processing device 100 to create content for a software application

[0032] To do so, the user executes a content creation (software) tool 104 on the CPU 101.

[0033] The content creation tool 104 enables the user to create and test content 105. The content may be intended for various devices 106, i.e., target hardware.

[0034] According to various embodiments, the content is a virtual 3D environment for a simulation, such as a level of a computer game that users of the devices 106 can play. For example, the devices are handheld devices, such as smartphones or tablets or dedicated handheld gaming devices. In such an example, the content creation tool 104 may be provided inside the gaming application, i.e. the creation of a level may be selected within the game.

[0035] The user of the data processing device may distribute the created content to appropriate devices 106 via a communication network 107. For example, the user uploads the created content to a server 108 (connected to the communication network 107) from which users of the other devices 106 may download the content (e.g. a computer game level).

[0036] According to various embodiments, the data processing device 100 is itself a handheld device (which may e.g. be used to play the game as well).

[0037] Such a scenario gives rise to various challenges for creation of content. For example, since handheld devices (like a smartphone) typically lack a proper keyboard, it is inconvenient to input individual letters and numbers for creating content. Moreover, the screen is typically small and must be efficiently used. It is for example usually not possible to have an window showing a preview of a 3D environment containing objects along with a high number of menus and tabs showing detailed information and/or allowing input of parameters which are permanently shown. Additionally, it is not only cumbersome to input letters or numbers but having to perform inputs in general like choosing from a menu may be cumbersome for the user, thus reducing the speed at which content is created, increasing the effort of the creation of content and leading to errors in the created content.

[0038] Therefore, according to various embodiments, an approach is provided allowing a creation of content with less effort and less risk of error. Specifically, according to various embodiments, the content is assumed to be a virtual 3D environment for a simulation, such as a level of a computing game (like a battlefield for a shooting game) but also, for example, an 3D environment to test control software (or a control policy) for a robotic device (e.g. a 3D environment to test software for a drone or small vehicle controlled by the handheld device).

[0039] It should be noted that the approaches described herein not only apply to the creation of 3D environments on a handheld device but may also be applied to the creation of 3D environments on (non-handheld) computers to make the creation process more efficient and less error-prone.

[0040] Various embodiments specifically address the setting of the height level of a 3D environment. In a 3D environment, each object is associated with a certain height. When an object is added to a 3D environment which is being created, it is usually added at a default height level (usually $z = 0$) and the user needs to adjust the object's height to the desired height level. This requires a lot of input from the user and the user may even forget to set the height since, in a preview of the 3D environment, the height may be difficult to see. This is especially true on a handheld device where the preview (if any) will be small and possibly also not very detailed since processing power is limited. Additionally, an object at a default height level may even not be visible, e.g. when, due to it being added at the default height level, it is added in the basement while the user currently creates the first floor of a building.

[0041] Therefore, according to various embodiments, a user can set, via input in the content creation tool an object insertion height level at which objects, which the user adds after setting the object insertion height level, e.g. via drag-and-drop, clicking or touching, are added to the 3D environment. Thus, the user may easily insert groups of objects which are located at the same height level (e.g. on a plateau, in a certain floor of a building, etc.).

[0042] The function of setting of a object insertion height level may be seen as a function to define a of a virtual floating plane which, as explained provides a convenient means of placing objects on the same evaluated height, in particular in the air. This means that all objects that are inserted are inserted on the floating plane which may be displayed in the virtual environment in which the user adds the objects.

[0043] FIG. 2 shows an example of graphical user interface (GUI) displayed on a data processing device for the creation of a 3D environment according to various embodiments.

[0044] In a screen 201, a representation of a virtual environment that is created by a user of the data processing device is displayed. The screen may for example include an avatar 202 of the user with which the user may traverse the virtual environment to get to locations where the user wants to place objects.

[0045] An object selection screen 211 having icons for objects allows the user to select an object to be inserted (by clicking or touching a corresponding icon for an object to be inserted). In the present example, the user has inserted a first bench 203 (i.e. a first instance of a bench object) on a level of the ground 210 of the virtual environment. The level at which objects are inserted may be selected with an object insertion height level selection (GUI) element 204. The object insertion height level selection element 204 includes an indication 205 of the object insertion height level, an height level increase icon 206 which may be activated (by click or touch) to increase the object insertion height level and an height level decrease icon 207 which may be activated (by click or touch) to increase the object insertion height level. The object insertion height level is increased and decreased in certain steps. For example, a step corresponds to 1m in the virtual environment but other granularities are also possible.

[0046] In the example of FIG. 2, the object insertion height level is set to 1. Assuming that the ground level is object insertion height level 0, a second bench 208 (i.e. a second instance of the bench object will be inserted above ground level, e.g. 1m above ground level. This is true for all objects that the user inserts into the virtual environment until the user adapts

(reselects) the object insertion height level (or the object height level is reset due to another reason, e.g. a restart of the content creation tool 104). The second bench 208 may be represented in a transparent manner until the user has selected its location.

[0047] A virtual plane 209 is displayed in the screen 201 to illustrate to the user at which height objects will be inserted. This means that the virtual plane 209 is shown at a height corresponding to the object insertion height level set in the object insertion height level selection element 204.

[0048] According to various embodiments, the content creation tool 104 (specifically, a 3D environment creation tool, e.g. a game level building tool) may have the following features (in addition to the setting of a object insertion height level as explained above)

- a convenient way to build levels based on a ray detection logic and the processing of a 3D grid of the map, to quickly create standardized (game, e.g. battle) levels.
- a dynamic navmesh creation mechanism which allows an AI to perform logical movements in any player's custom level
- rule editing based on an event-API: by encapsulating program logic into basic event and API units and corresponding visual processing, a user can freely create a variety of gameplay mechanisms and combine them with different levels
- an original data compression and encryption method: depending on the number of players and content creatures, free creation and play may generate high amounts of data traffic. To ensure that all levels can run on a server stably and securely for global players to play, all levels are processed by data processing, compression and hash encryption.

[0049] In summary, according to various embodiments, a method is provided as illustrated in FIG. 3.

[0050] FIG. 3 shows a flow diagram 300 illustrating a method for creating a virtual 3D environment for a simulation according to an embodiment.

[0051] In 301, a user input specifying an object insertion height level to be applied to a plurality of virtual 3D objects is received.

[0052] In 302, upon reception of an object insertion command for any one of the objects of the plurality of objects, an instance of the object is inserted into the 3D virtual environment at the object insertion height level.

[0053] The approach of FIG. 3 may for example be applied in a platform to allow a user to create custom computer game levels so that players can design and create their own levels in the game and thus bring in their own ideas and enrich the content of the game.

[0054] The specification (and thus selection) of the object insertion height level may be seen as an adaptation of a default height level.

[0055] The method of FIG. 3 is for example carried out by a terminal device, e.g. corresponding to the data processing device 100 of FIG. 1. The terminal device may include a communication interface (e.g. configured to communicate with a server distributing the created content). The terminal device further includes a processing unit and a memory. The memory may be used by the processing unit to store, for example, program data for the content creation tool and data representing the created content (e.g. game levels).

[0056] The methods described herein may be performed and the various processing or computation units and the devices and computing entities described herein may be implemented by one or more circuits. In an embodiment, a "circuit" may be understood as any kind of a logic implementing entity, which may be hardware, software, firmware, or any combination thereof. Thus, in an embodiment, a "circuit" may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g. a microprocessor. A "circuit" may also be software being implemented or executed by a processor, e.g. any kind of computer program, e.g. a computer program using a virtual machine code. Any other kind of implementation of the respective functions which are described herein may also be understood as a "circuit" in accordance with an alternative embodiment.

[0057] While the disclosure has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

1. A method for creating a virtual 3D environment for a simulation, comprising:
receiving a user input specifying an object insertion height level to be applied to a plurality of virtual 3D objects; and
upon reception of an object insertion command for any one of the objects of the plurality of objects, inserting an instance of the object into the 3D virtual environment at the object insertion height level;
wherein the object insertion height level is applied to instances of the virtual 3D objects yet to be inserted into the virtual 3D environment; and
wherein the instances of the virtual 3D objects yet to be inserted into the virtual 3D environment are represented in a transparent manner until the user has selected its location.

2. The method of claim 1, comprising displaying a graphical user interface including an object insertion height level selection element comprising one or more height level selection icons, wherein the user input specifying the object insertion height level is at least one selection of at least one of the one or more height level selection icons.

3. The method of claim 2, wherein the at least one selection is a touch or a click on the at least one of the one or more height level selection icons.

4. The method of any one of claims 1 to 3, wherein the object insertion command for the object comprises a selection of an object placement icon.

5. The method of any one of claims 1 to 4, wherein the user input is a selection of the object insertion height level from a set of discrete height levels according to a predetermined granularity.

6. The method of any one of claims 1 to 5, performed by a virtual 3D environment creation tool, wherein all instances of the objects are inserted at the object insertion

height level until another user input specifying another object insertion height level is received or the virtual 3D environment creation tool is restarted.

7. The method of any one of claims 1 to 6, comprising displaying the virtual 3D environment and displaying, within the virtual 3D environment, a plane representing the object inserted height level.

8. The method of claim 7, comprising displaying, during a position selection process by a user for a position of one of the plurality of the objects into the virtual 3D environment, a representation of the object such that the representation is located on the plane.

9. The method of any one of claims 1 to 8, comprising inserting a sequence of instances of the plurality of objects in response to respective object insertion commands at the object insertion height level.

10. The method of any one of claims 1 to 9, wherein the simulation is a 3D game or is a simulation for evaluating a control policy of at least one of the software applications.

11. The method of any one of claims 1 to 10, performed on a mobile terminal device.

12. The method of claim 11, wherein the mobile terminal device is a handheld mobile terminal device.

13. The method of claim 11, wherein the mobile terminal device is a mobile phone or a tablet.

14. A terminal device comprising a communication interface, a memory and a processing unit configured to perform the method of any one of claims 1 to 13.

15. A computer program element comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 13.

16. A computer-readable medium comprising program instructions, which, when executed by one or more processors, cause the one or more processors to perform the method of any one of claims 1 to 13.