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(54) **GENERATING A PROCESS ILLUSTRATION WITHIN A VIRTUAL REALITY ENVIRONMENT**

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(73) Assignee: **Enduvo, Inc.**, Peoria, IL (US)

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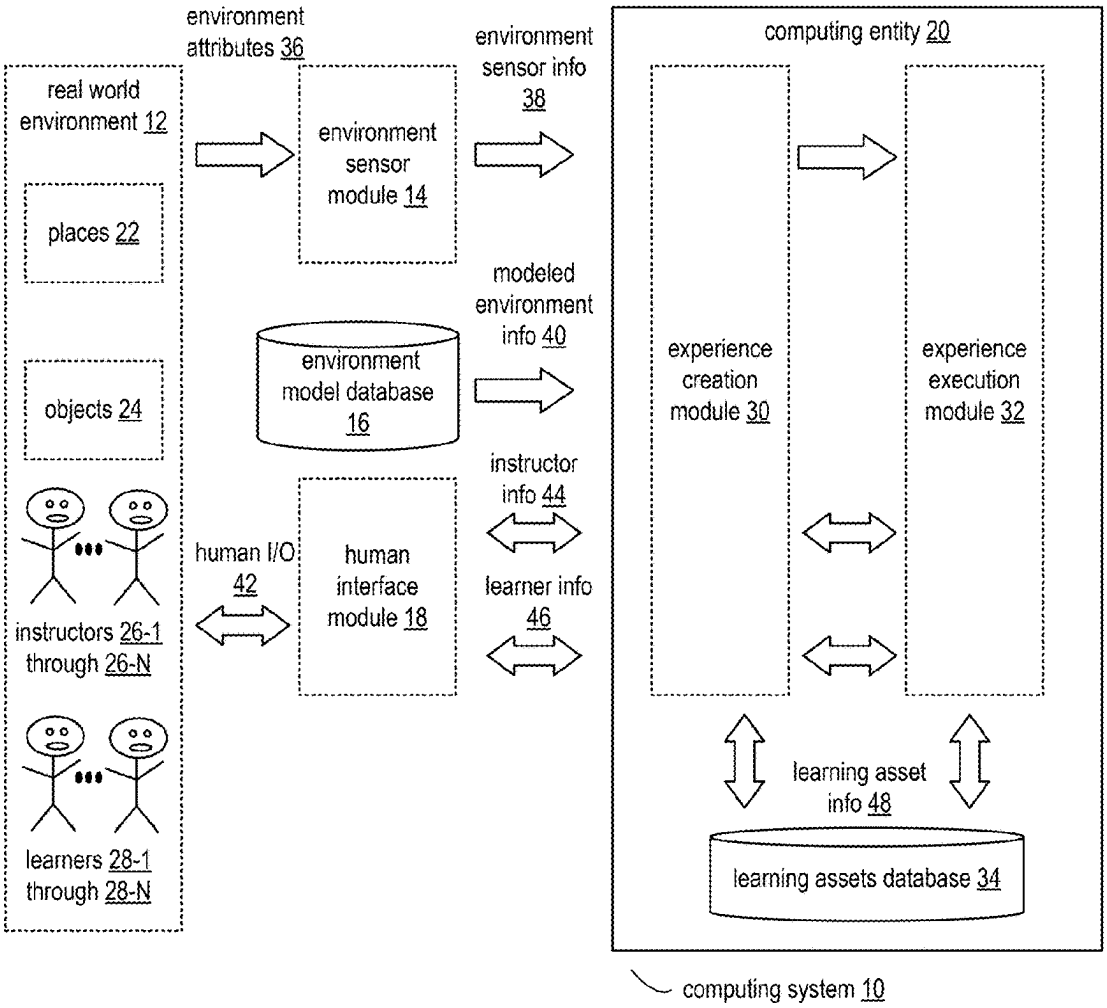
*G06T 19/20* (2011.01)

(52) **U.S. Cl.**
CPC ..... *G06T 19/20* (2013.01)

(57) **ABSTRACT**

A method executed by a computing entity includes generating a virtual reality environment utilizing a group of object representations by identifying three dimensional (3-D) physical objects corresponding to the group of object representations. The method further includes obtaining the group of object representations for the 3-D physical objects. The method further includes interpreting a first piece of information and a second piece of information to produce interaction information. The method further includes rendering, the group of object representations in accordance with the interaction information to produce 3-D video frames portraying the first piece of information and the second piece of information within the virtual reality environment.



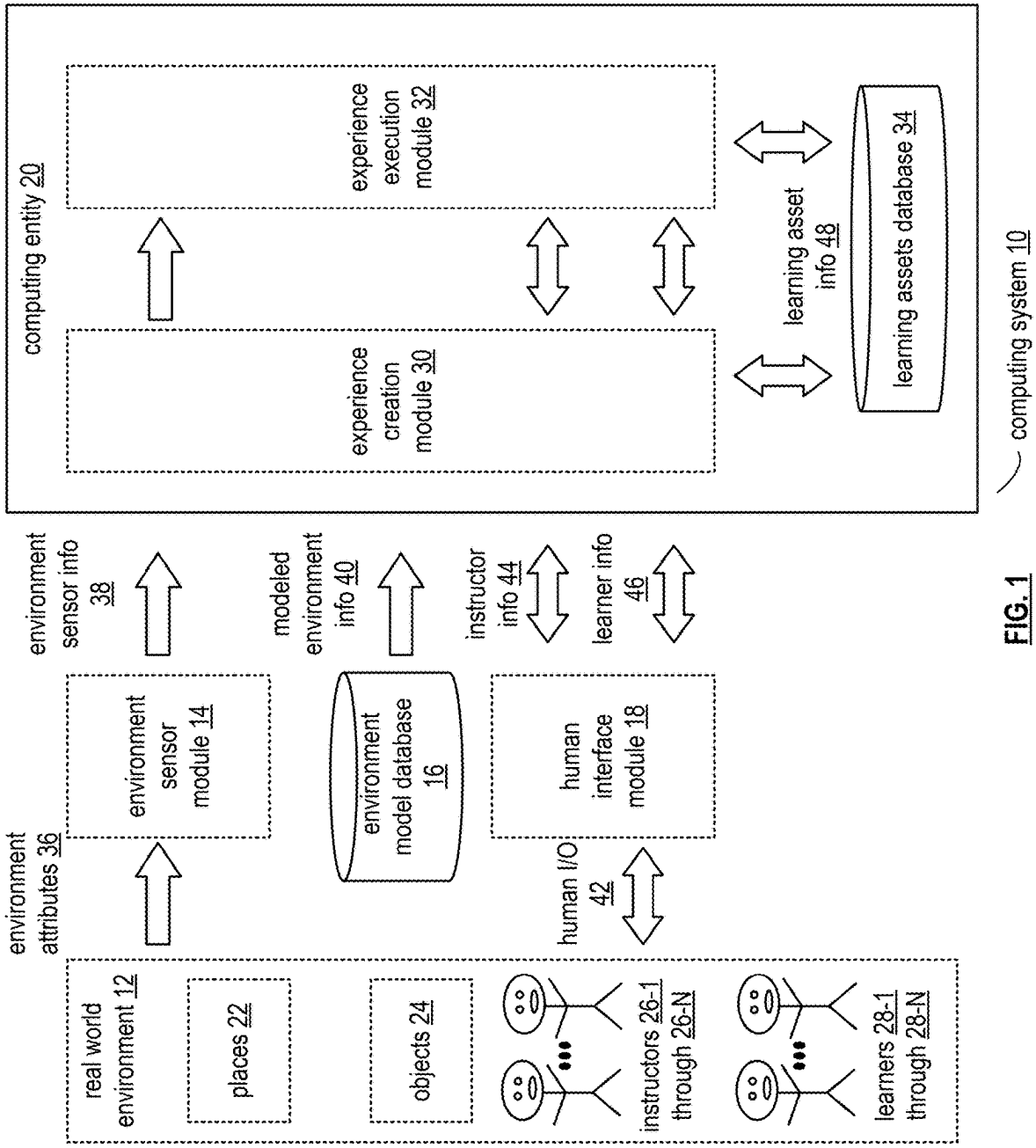

computing entity 20
experience creation module 30
experience execution module 32
learning asset info 48
learning assets database 34
computing system 10
environment sensor info 38
modeled environment info 40
instructor info 44
learner info 46
environment attributes 36
environment sensor module 14
environment model database 16
human interface module 18
human I/O 42
real world environment 12
places 22
objects 24
instructors 26-1 through 26-N
learners 28-1 through 28-N

FIG. 1

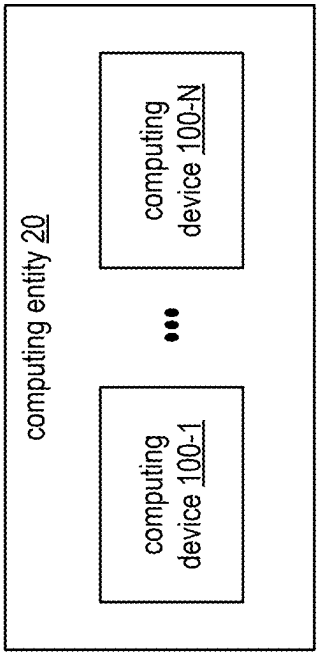

computing entity 20
computing device 100-1
computing device 100-N

FIG. 2A

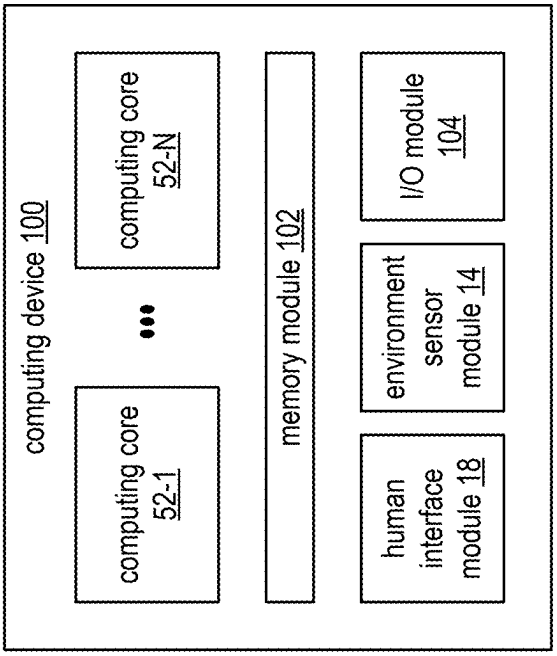

computing device 100
computing core 52-1
computing core 52-N
memory module 102
human interface module 18
environment sensor module 14
I/O module 104

FIG. 2B

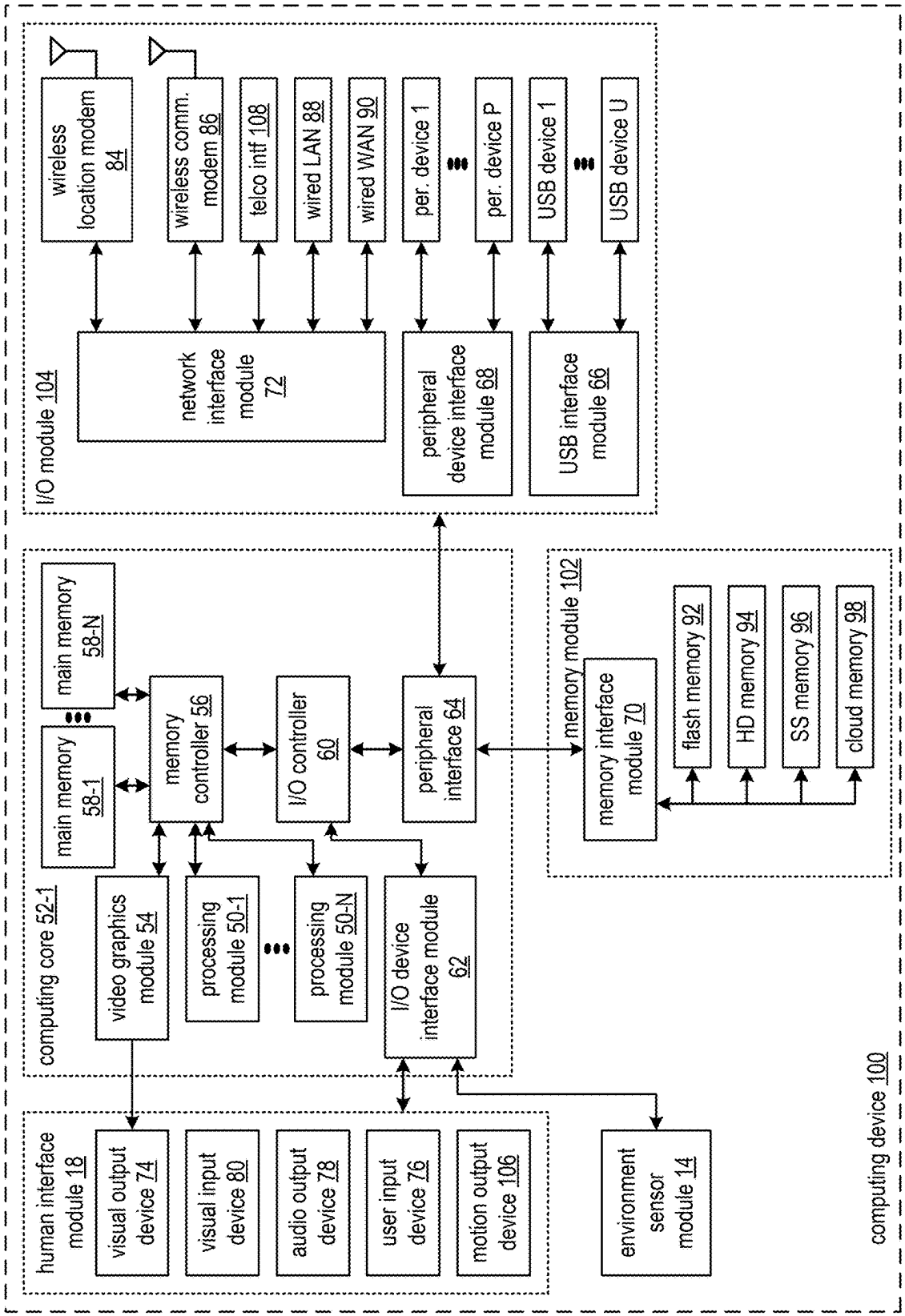

computing device 100
I/O module 104
wireless location modem 84
wireless comm. modem 86
telco intf 108
wired LAN 88
wired WAN 90
per. device 1
per. device P
USB device 1
USB device U
network interface module 72
peripheral device interface module 68
USB interface module 66
computing core 52-1
main memory 58-1
main memory 58-N
memory controller 56
I/O controller 60
peripheral interface 64
video graphics module 54
processing module 50-1
processing module 50-N
I/O device interface module 62
memory module 102
memory interface module 70
flash memory 92
HD memory 94
SS memory 96
cloud memory 98
human interface module 18
visual output device 74
visual input device 80
audio output device 78
user input device 76
motion output device 106
environment sensor module 14

FIG. 3

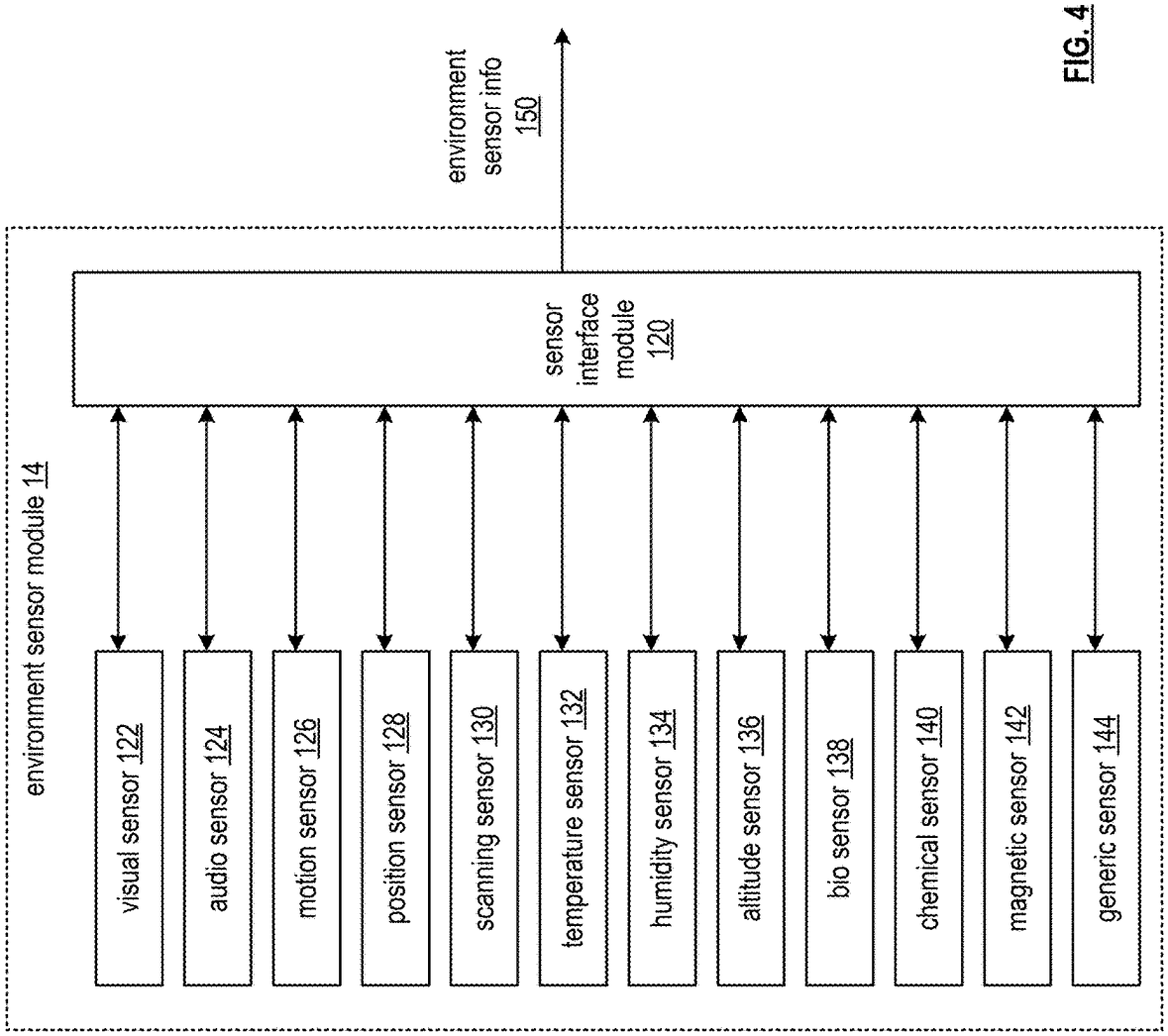

environment sensor module 14
visual sensor 122
audio sensor 124
motion sensor 126
position sensor 128
scanning sensor 130
temperature sensor 132
humidity sensor 134
altitude sensor 136
bio sensor 138
chemical sensor 140
magnetic sensor 142
generic sensor 144
sensor interface module 120
environment sensor info 150

FIG. 4

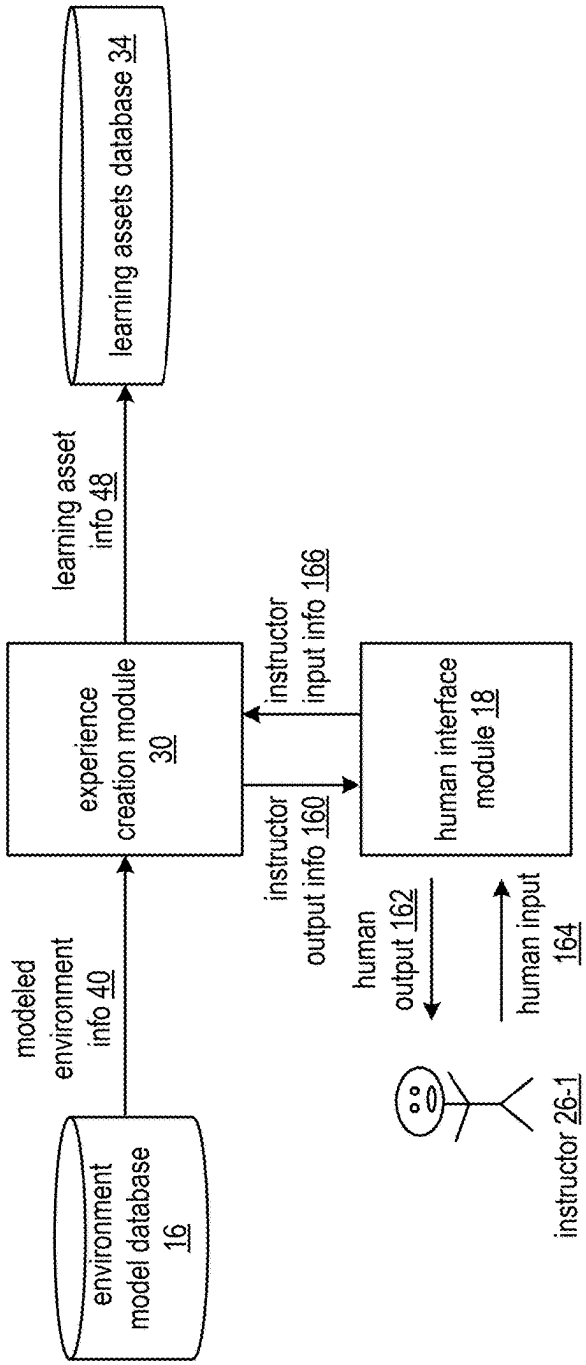

learning assets database 34
learning asset info 48
experience creation module 30
instructor input info 166
instructor output info 160
human interface module 18
modeled environment info 40
human output 162
human input 164
environment model database 16
instructor 26-1

FIG. 5A

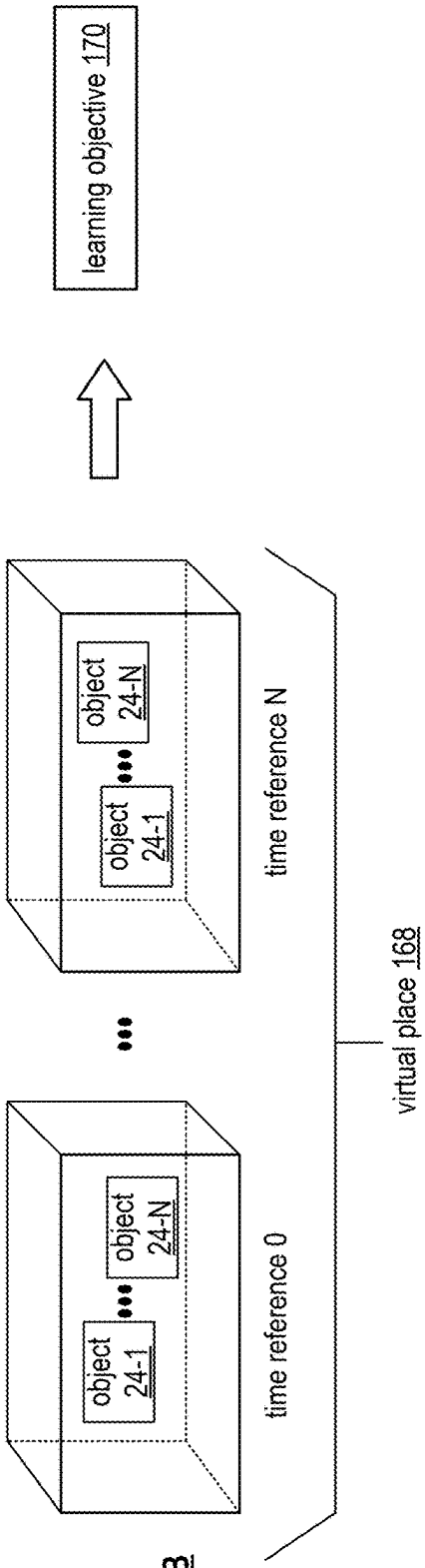

learning objective 170
object 24-N
object 24-1
time reference N
object 24-N
object 24-1
time reference 0
virtual place 168

FIG. 5B

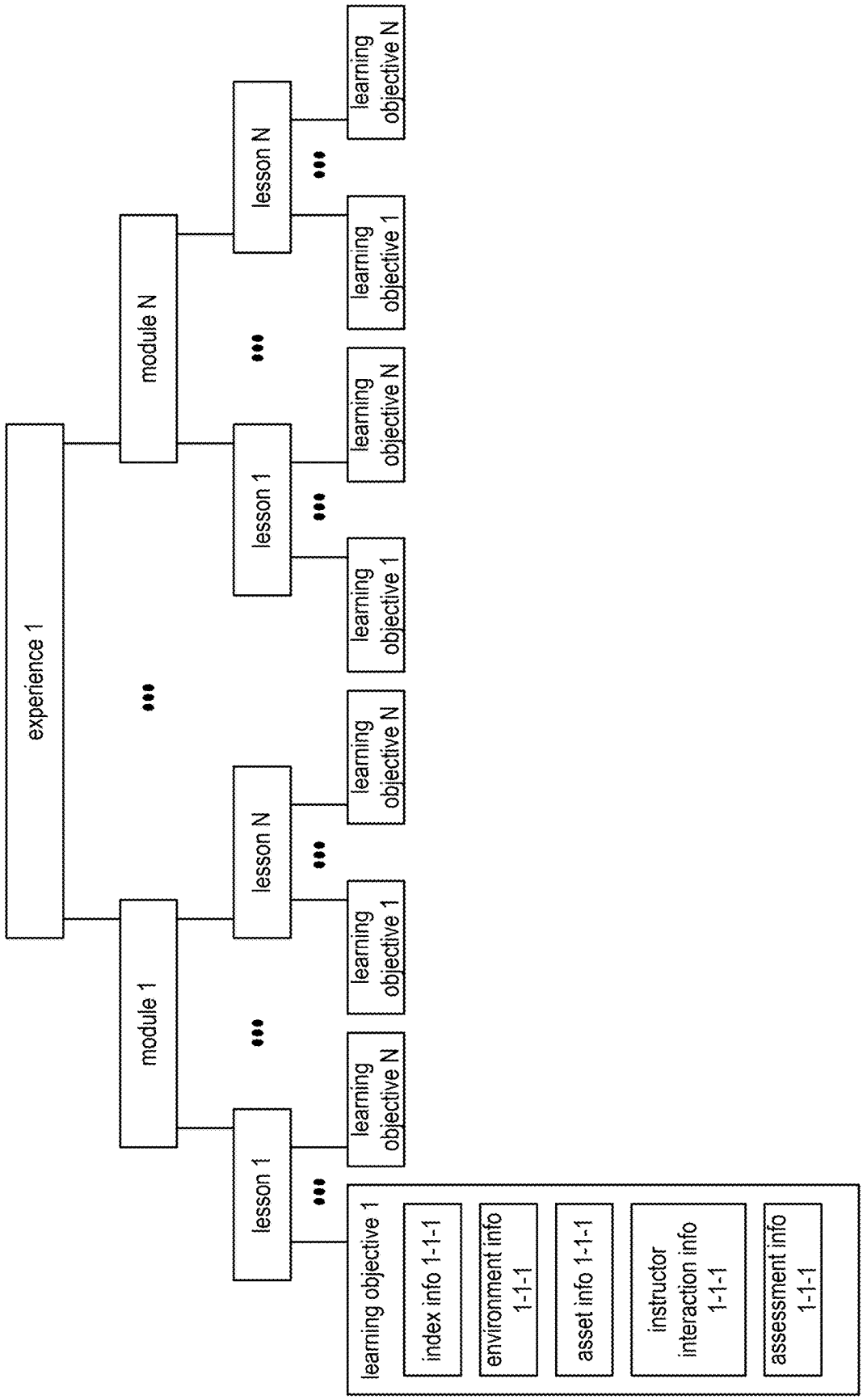

experience 1
module 1
module N
lesson 1
lesson N
lesson 1
lesson N
learning objective N
learning objective 1
learning objective N
learning objective 1
learning objective N
learning objective 1
learning objective N
learning objective 1
learning objective 1
index info 1-1-1
environment info 1-1-1
asset info 1-1-1
instructor interaction info 1-1-1
assessment info 1-1-1

FIG. 6

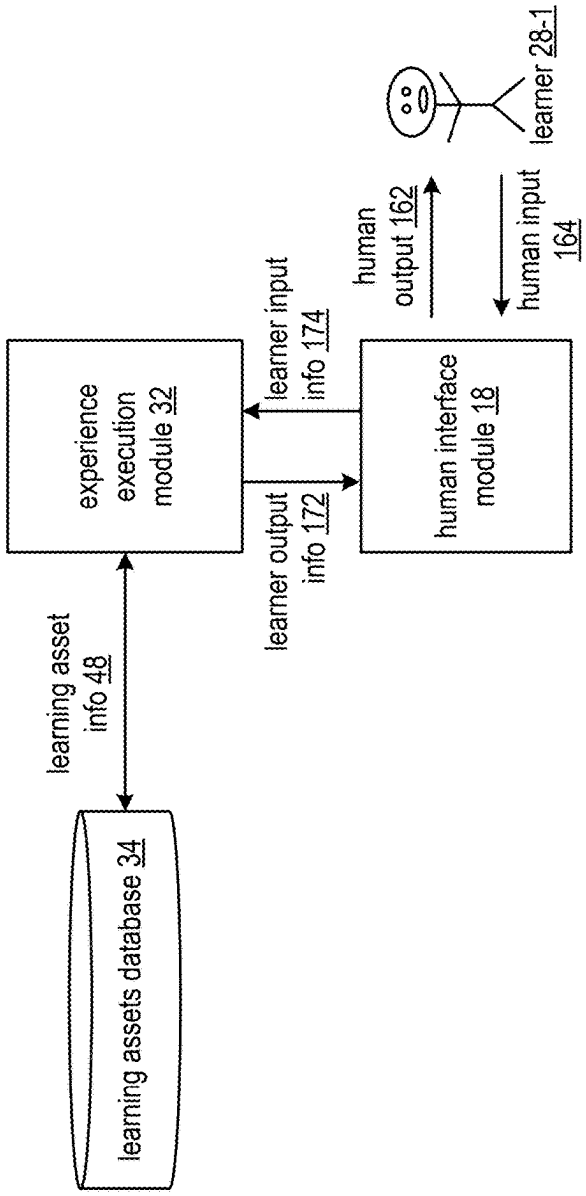

experience execution module 32
learning asset info 48
learning assets database 34
learner input info 174
learner output info 172
human interface module 18
human output 162
human input 164
learner 28-1

FIG. 7A

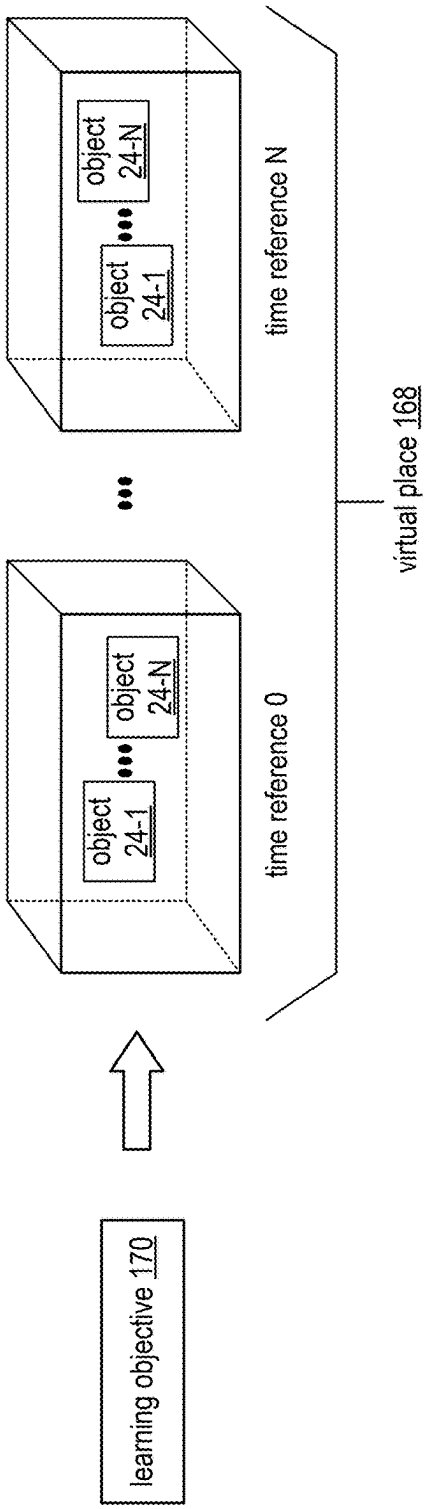

learning objective 170
time reference 0
object 24-1
object 24-N
time reference N
object 24-1
object 24-N
virtual place 168

FIG. 7B

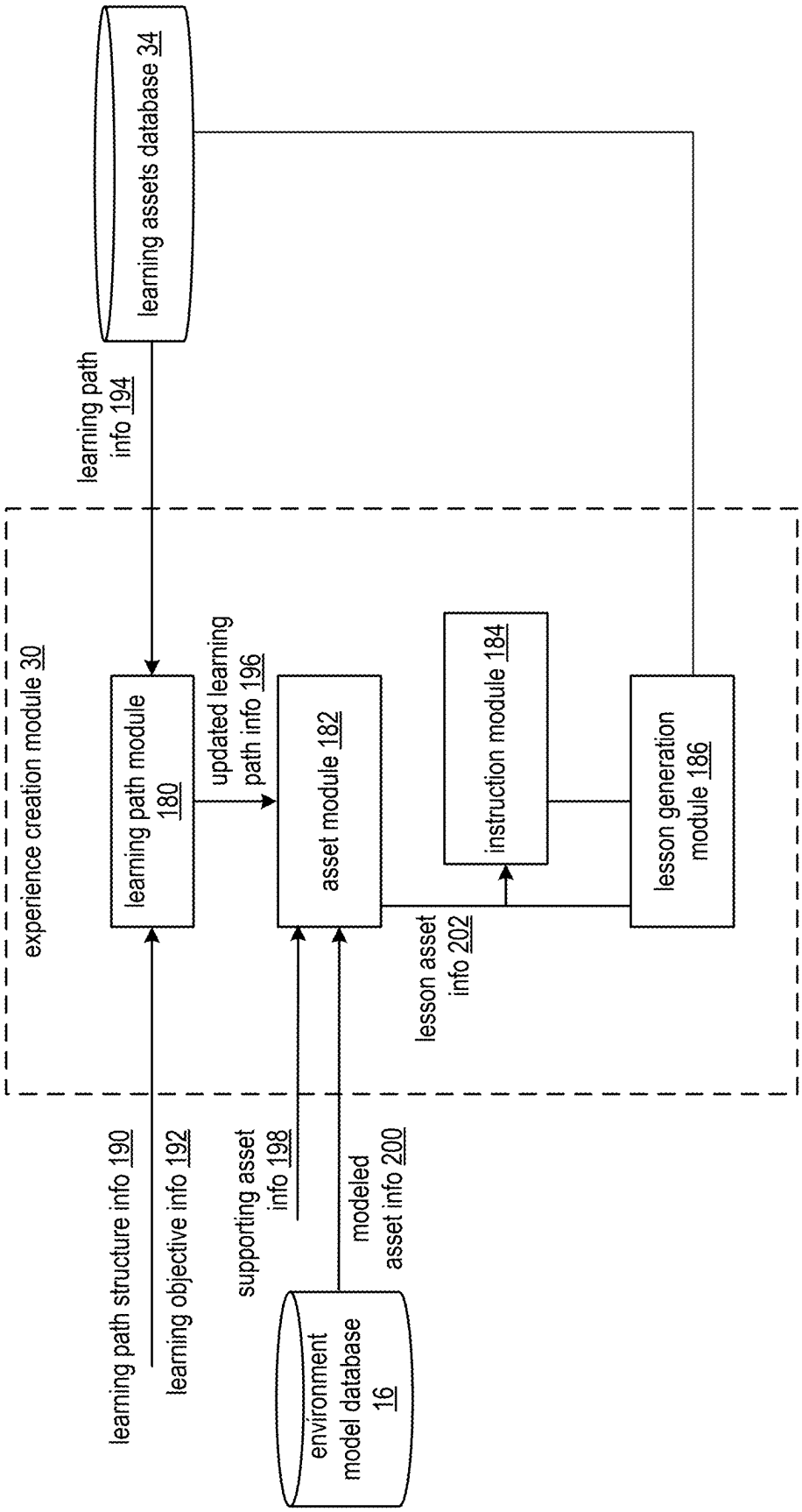

learning assets database 34
learning path info 194
experience creation module 30
learning path module 180
updated learning path info 196
asset module 182
instruction module 184
lesson generation module 186
lesson asset info 202
learning path structure info 190
learning objective info 192
supporting asset info 198
modeled asset info 200
environment model database 16

FIG. 8A

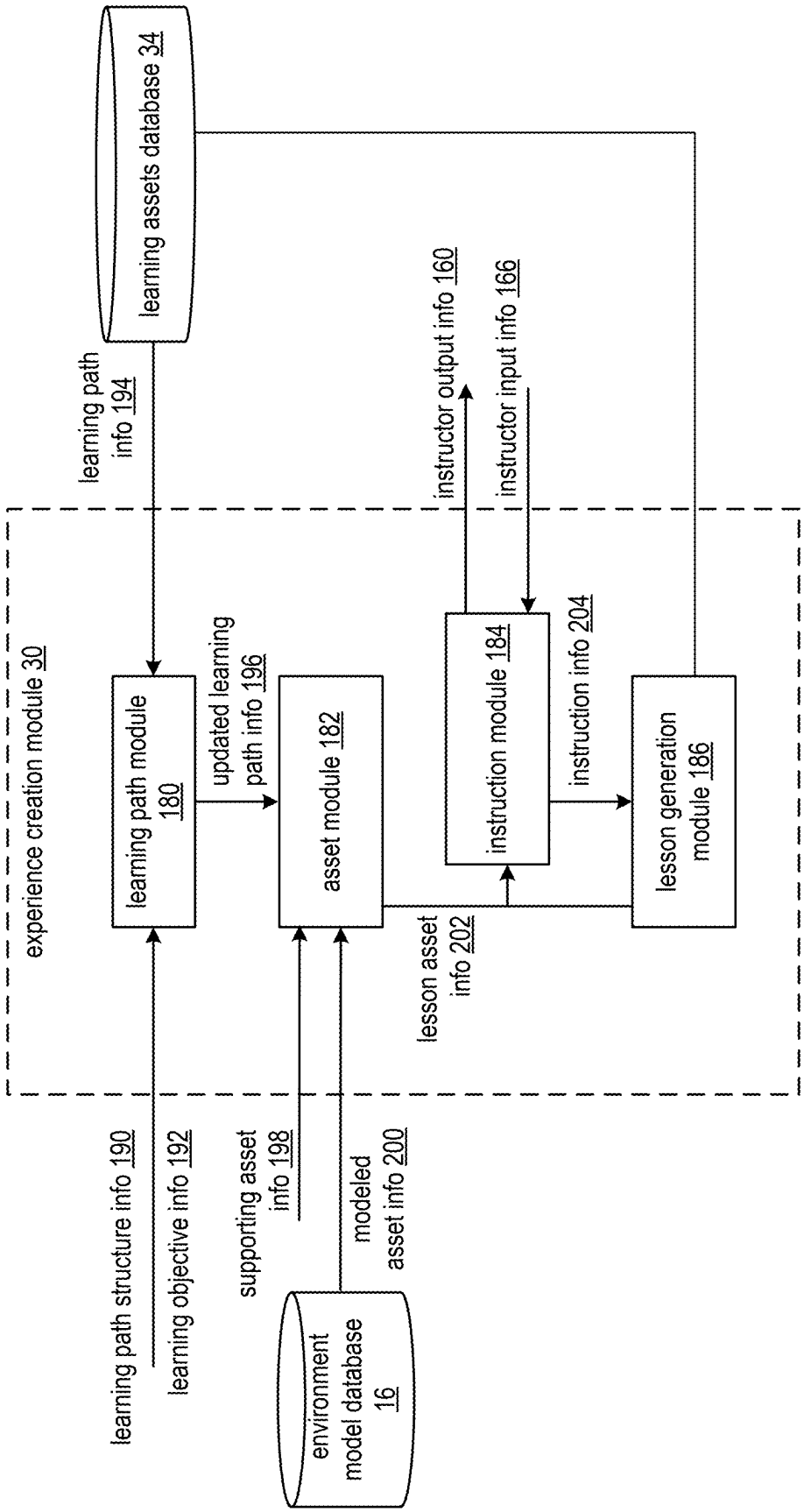

learning assets database 34
learning path info 194
experience creation module 30
learning path module 180
updated learning path info 196
asset module 182
instructor output info 160
instructor input info 166
instruction module 184
instruction info 204
lesson generation module 186
lesson asset info 202
learning path structure info 190
learning objective info 192
supporting asset info 198
modeled asset info 200
environment model database 16

FIG. 8B

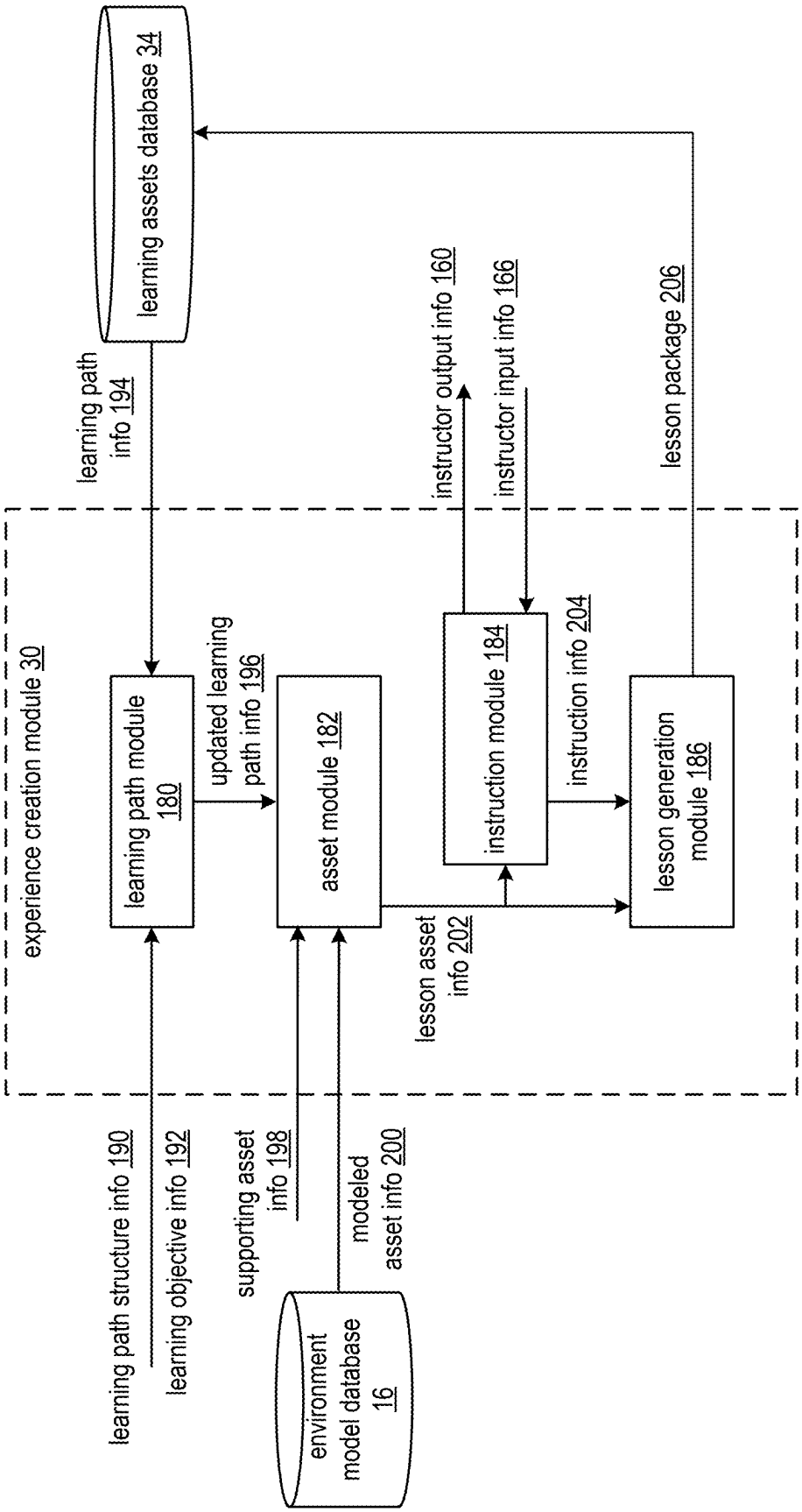

learning assets database 34
learning path info 194
experience creation module 30
learning path module 180
updated learning path info 196
asset module 182
instructor output info 160
instructor input info 166
instruction module 184
instruction info 204
lesson generation module 186
lesson package 206
lesson asset info 202
learning path structure info 190
learning objective info 192
supporting asset info 198
modeled asset info 200
environment model database 16

FIG. 8C

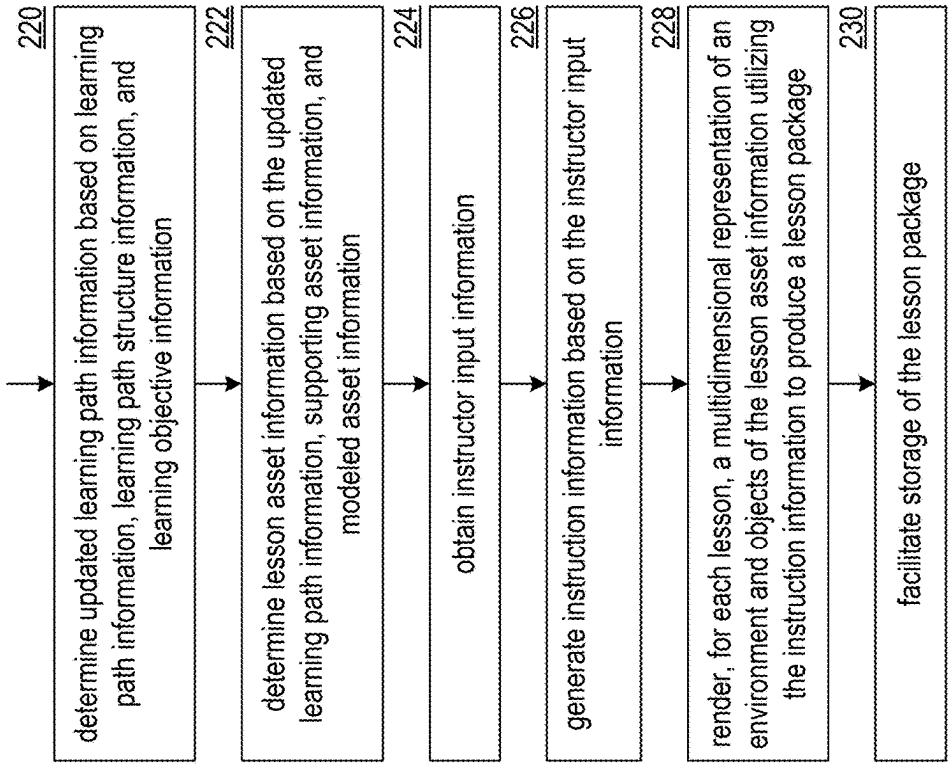

220
determine updated learning path information based on learning path information, learning path structure information, and learning objective information
222
determine lesson asset information based on the updated learning path information, supporting asset information, and modeled asset information
224
obtain instructor input information
226
generate instruction information based on the instructor input information
228
render, for each lesson, a multidimensional representation of an environment and objects of the lesson asset information utilizing the instruction information to produce a lesson package
230
facilitate storage of the lesson package

FIG. 8D

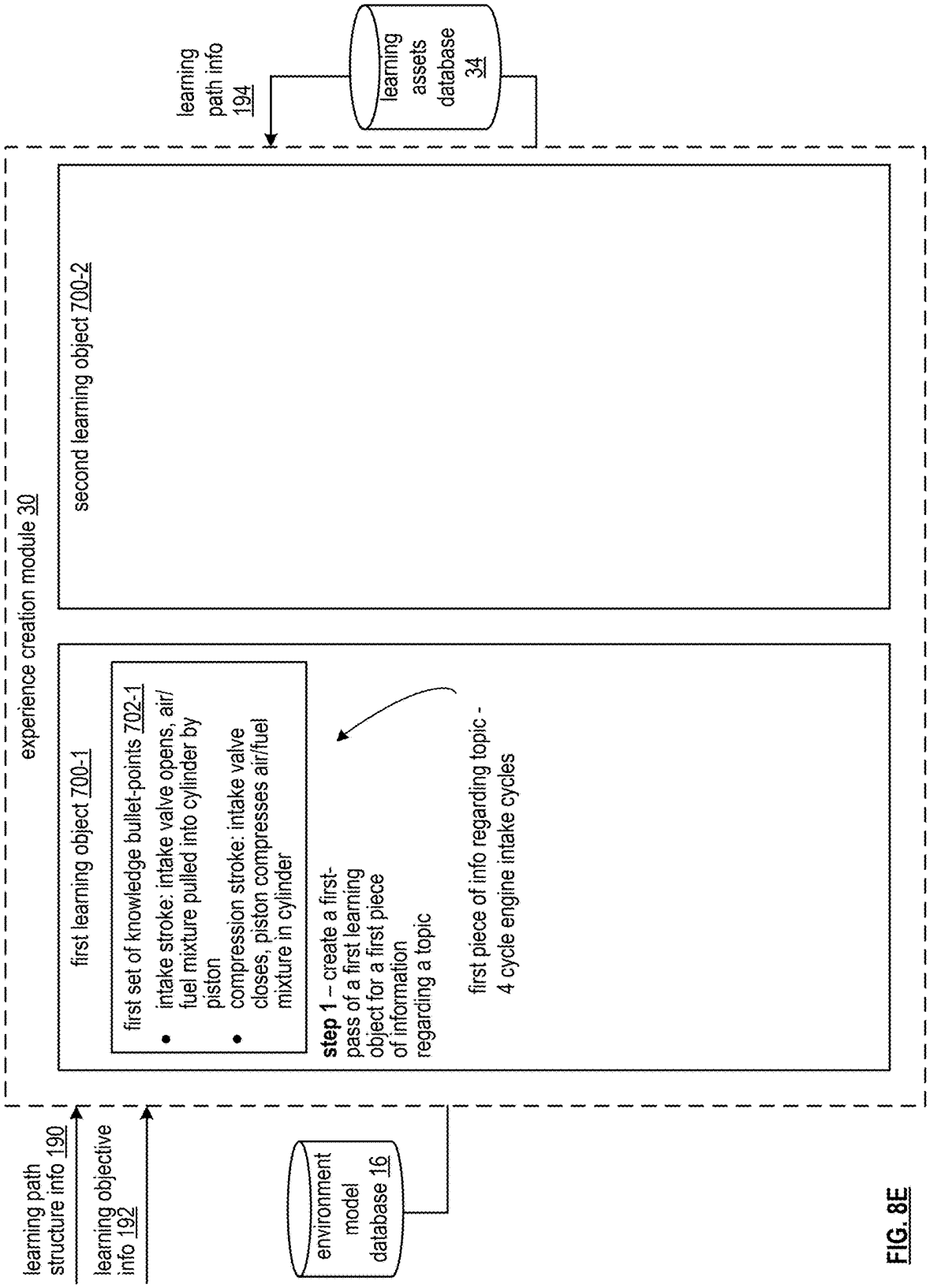

learning path info 194
learning assets database 34
experience creation module 30
second learning object 700-2
first learning object 700-1
first set of knowledge bullet-points 702-1
• intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
• compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
step 1 – create a first-pass of a first learning object for a first piece of information regarding a topic
first piece of info regarding topic - 4 cycle engine intake cycles
learning path structure info 190
learning objective info 192
environment model database 16

FIG. 8E

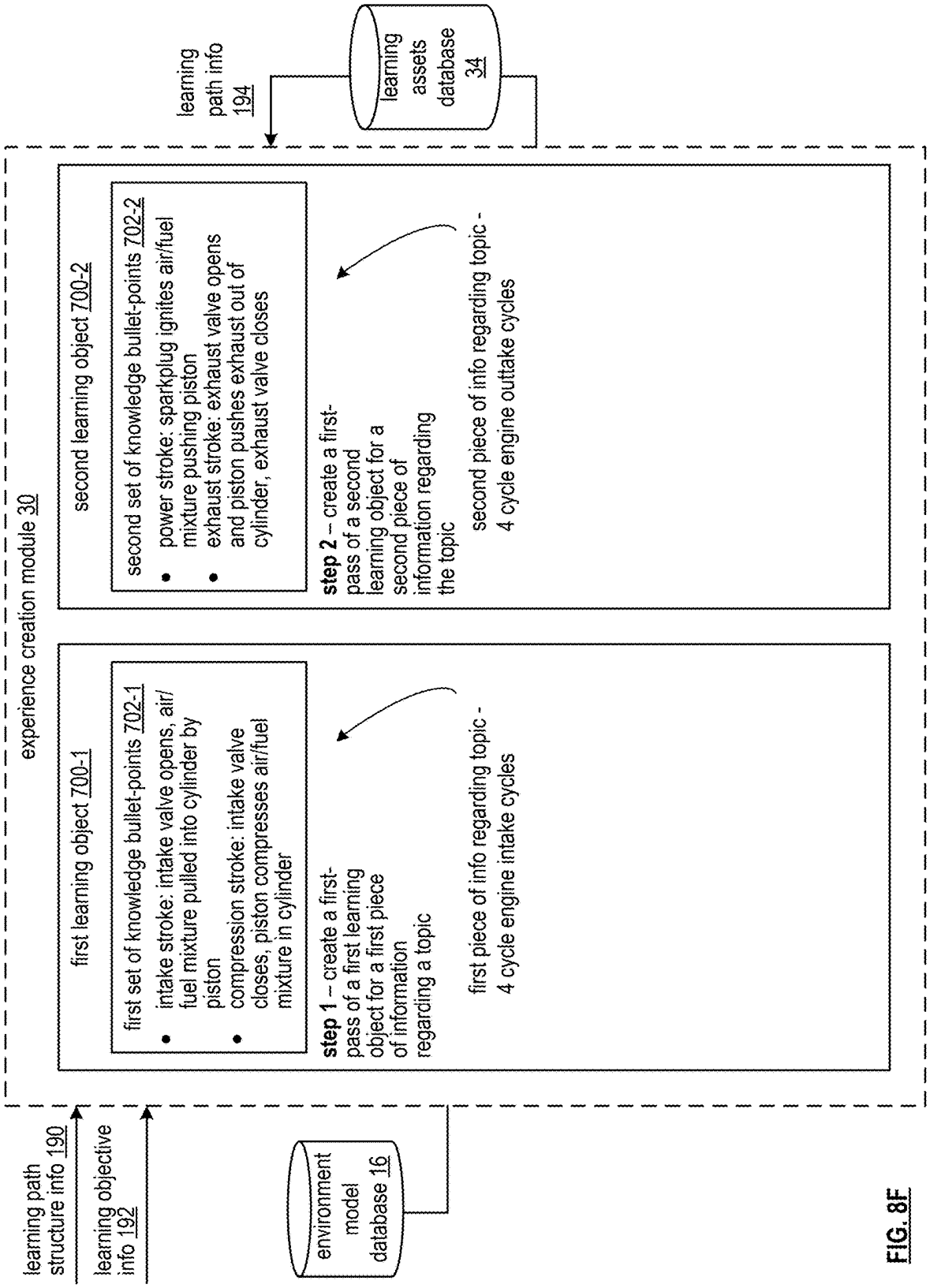

learning path structure info 190
learning objective info 192
environment model database 16
experience creation module 30
first learning object 700-1
first set of knowledge bullet-points 702-1
intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
step 1 – create a first-pass of a first learning object for a first piece of information regarding a topic
first piece of info regarding topic - 4 cycle engine intake cycles
second learning object 700-2
second set of knowledge bullet-points 702-2
power stroke: sparkplug ignites air/fuel mixture pushing piston
exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
step 2 – create a first-pass of a second learning object for a second piece of information regarding the topic
second piece of info regarding topic - 4 cycle engine outtake cycles
learning path info 194
learning assets database 34

FIG. 8F

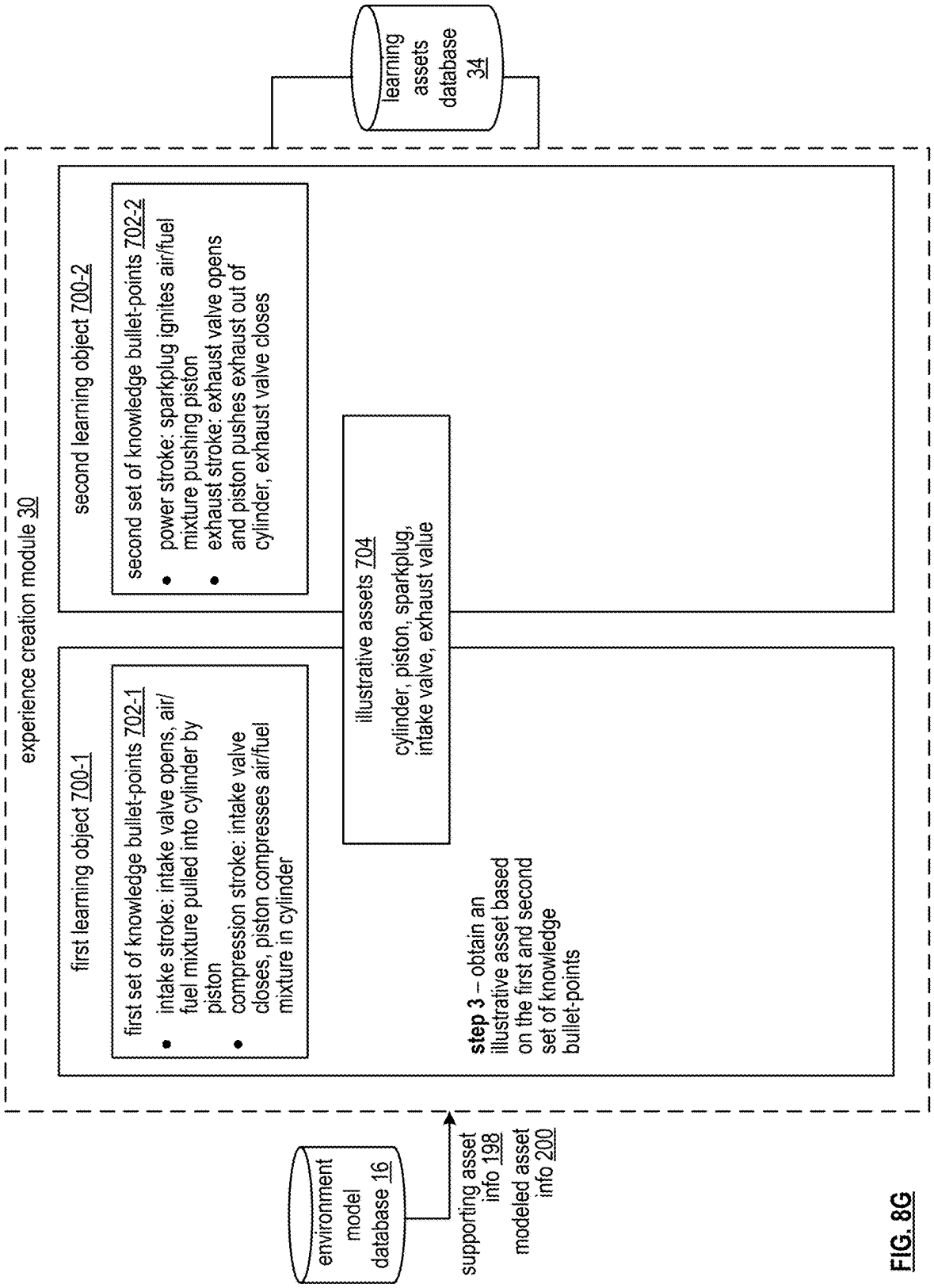

experience creation module 30
first learning object 700-1
first set of knowledge bullet-points 702-1
intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
second learning object 700-2
second set of knowledge bullet-points 702-2
power stroke: sparkplug ignites air/fuel mixture pushing piston
exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
illustrative assets 704
cylinder, piston, sparkplug, intake valve, exhaust value
step 3 – obtain an illustrative asset based on the first and second set of knowledge bullet-points
learning assets database 34
environment model database 16
supporting asset info 198
modeled asset info 200

FIG. 8G

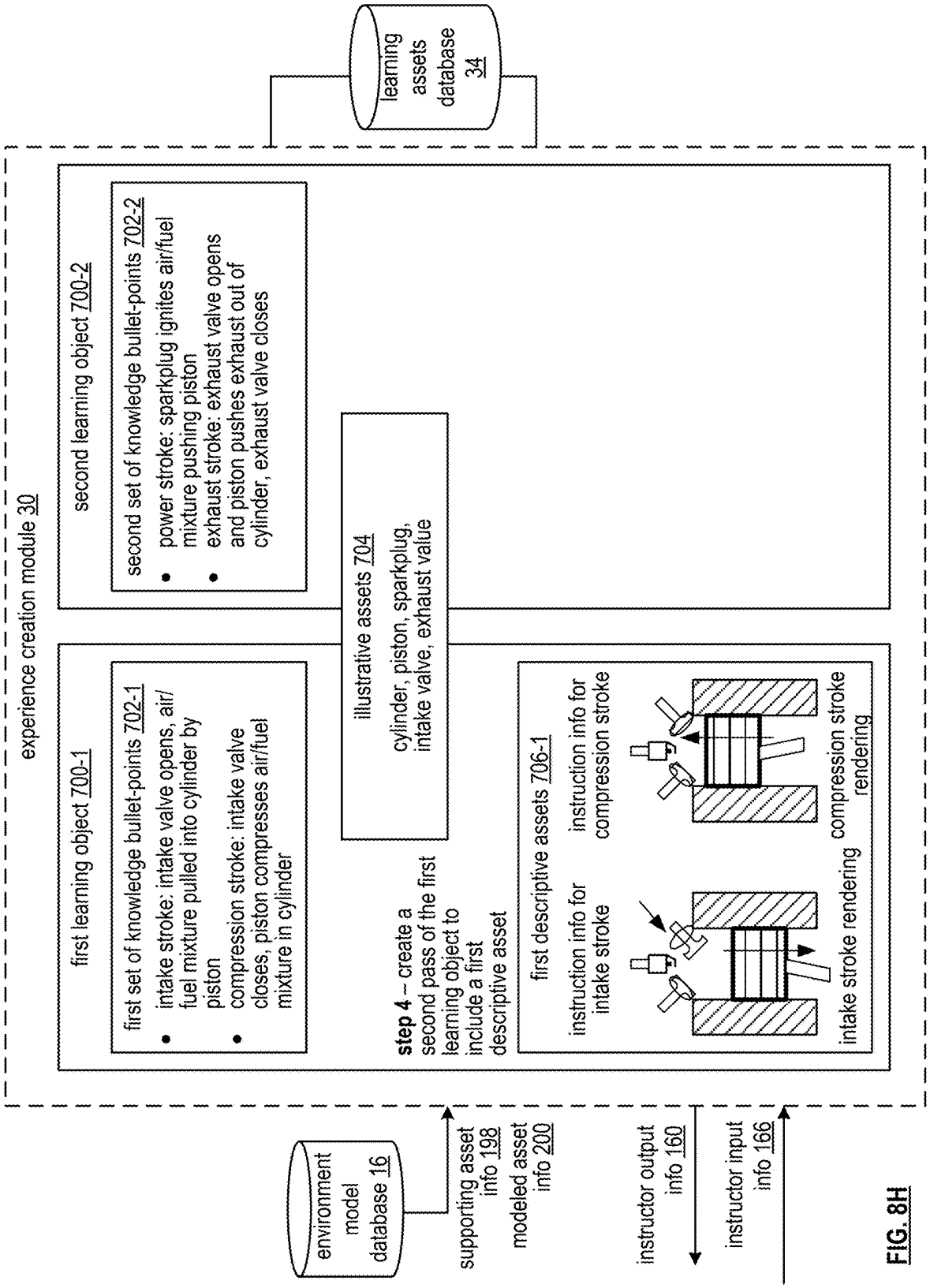

learning assets database 34
experience creation module 30
second learning object 700-2
second set of knowledge bullet-points 702-2
• power stroke: sparkplug ignites air/fuel mixture pushing piston
• exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
illustrative assets 704
cylinder, piston, sparkplug, intake valve, exhaust value
first learning object 700-1
first set of knowledge bullet-points 702-1
• intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
• compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
step 4 – create a second pass of the first learning object to include a first descriptive asset
first descriptive assets 706-1
instruction info for intake stroke
intake stroke rendering
instruction info for compression stroke
compression stroke rendering
environment model database 16
supporting asset info 198
modeled asset info 200
instructor output info 160
instructor input info 166

FIG. 8H

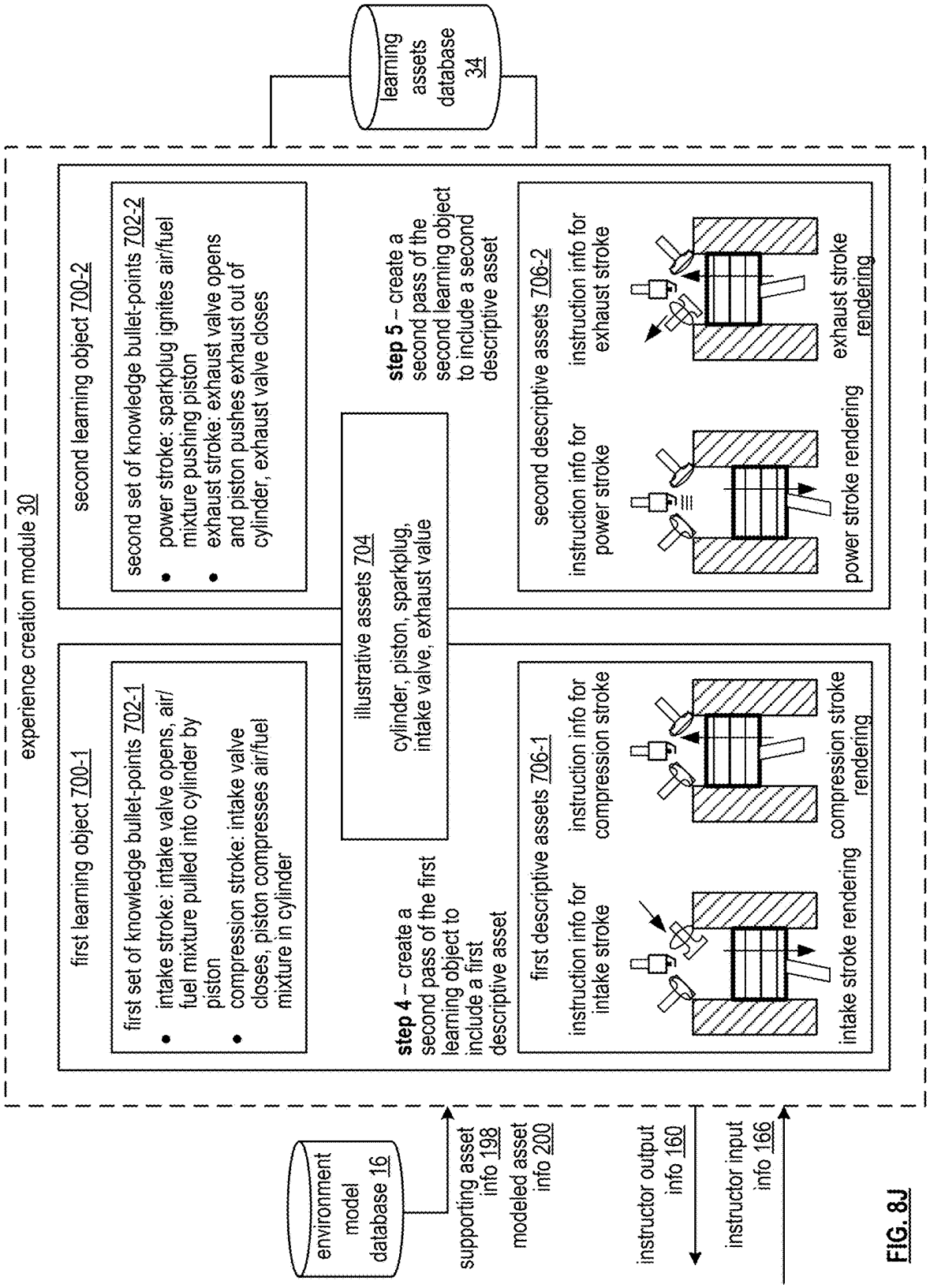

learning assets database 34
experience creation module 30
first learning object 700-1
first set of knowledge bullet-points 702-1
intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
second learning object 700-2
second set of knowledge bullet-points 702-2
power stroke: sparkplug ignites air/fuel mixture pushing piston
exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
illustrative assets 704
cylinder, piston, sparkplug, intake valve, exhaust value
step 4 – create a second pass of the first learning object to include a first descriptive asset
step 5 – create a second pass of the second learning object to include a second descriptive asset
first descriptive assets 706-1
instruction info for intake stroke
instruction info for compression stroke
intake stroke rendering
compression stroke rendering
second descriptive assets 706-2
instruction info for power stroke
instruction info for exhaust stroke
power stroke rendering
exhaust stroke rendering
environment model database 16
supporting asset info 198
modeled asset info 200
instructor output info 160
instructor input info 166

FIG. 8J

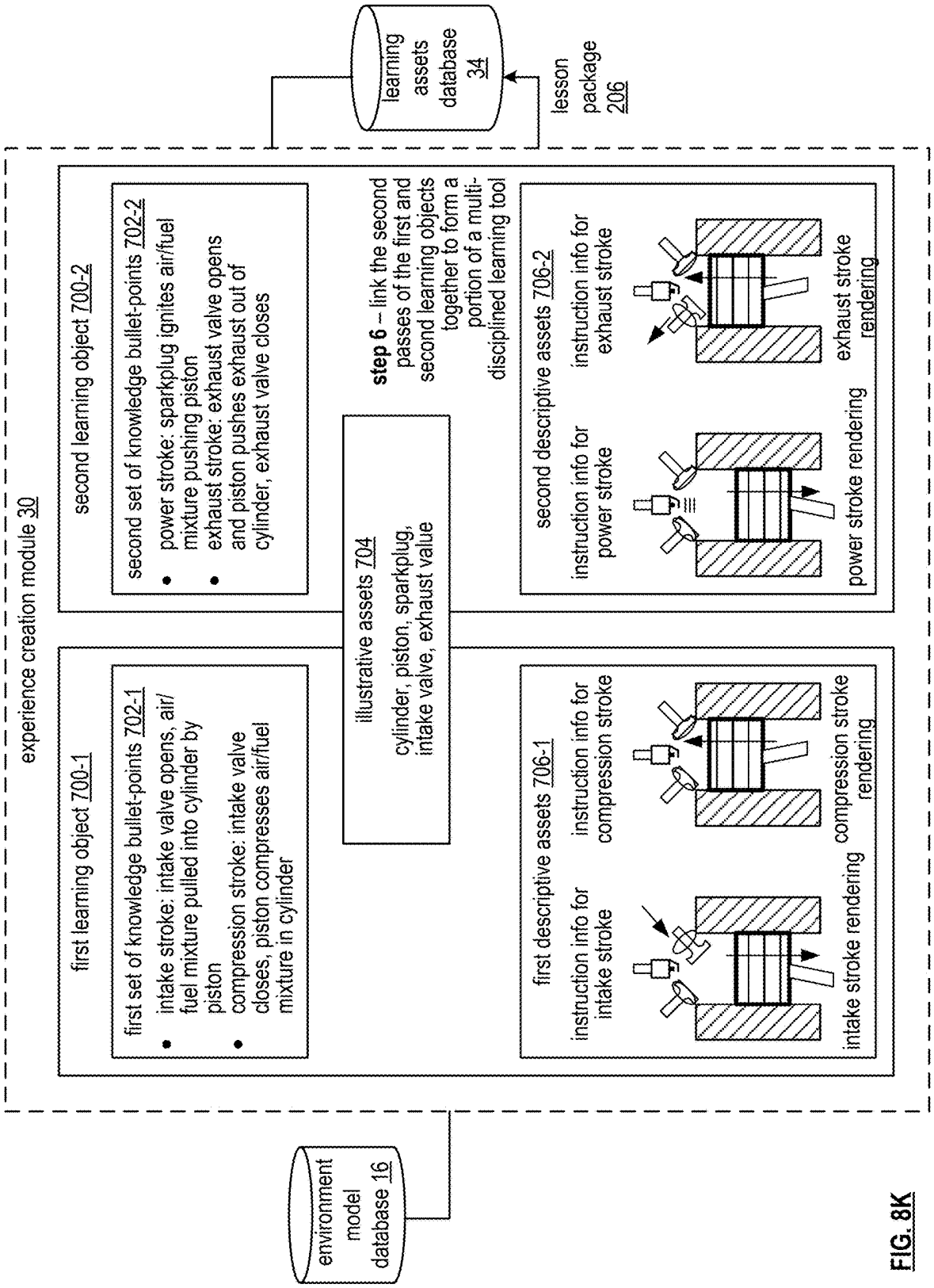

experience creation module 30
first learning object 700-1
first set of knowledge bullet-points 702-1
intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
second learning object 700-2
second set of knowledge bullet-points 702-2
power stroke: sparkplug ignites air/fuel mixture pushing piston
exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
illustrative assets 704
cylinder, piston, sparkplug, intake valve, exhaust value
step 6 – link the second passes of the first and second learning objects together to form a portion of a multi-disciplined learning tool
first descriptive assets 706-1
instruction info for intake stroke
instruction info for compression stroke
intake stroke rendering
compression stroke rendering
second descriptive assets 706-2
instruction info for power stroke
instruction info for exhaust stroke
power stroke rendering
exhaust stroke rendering
learning assets database 34
lesson package 206
environment model database 16

FIG. 8K

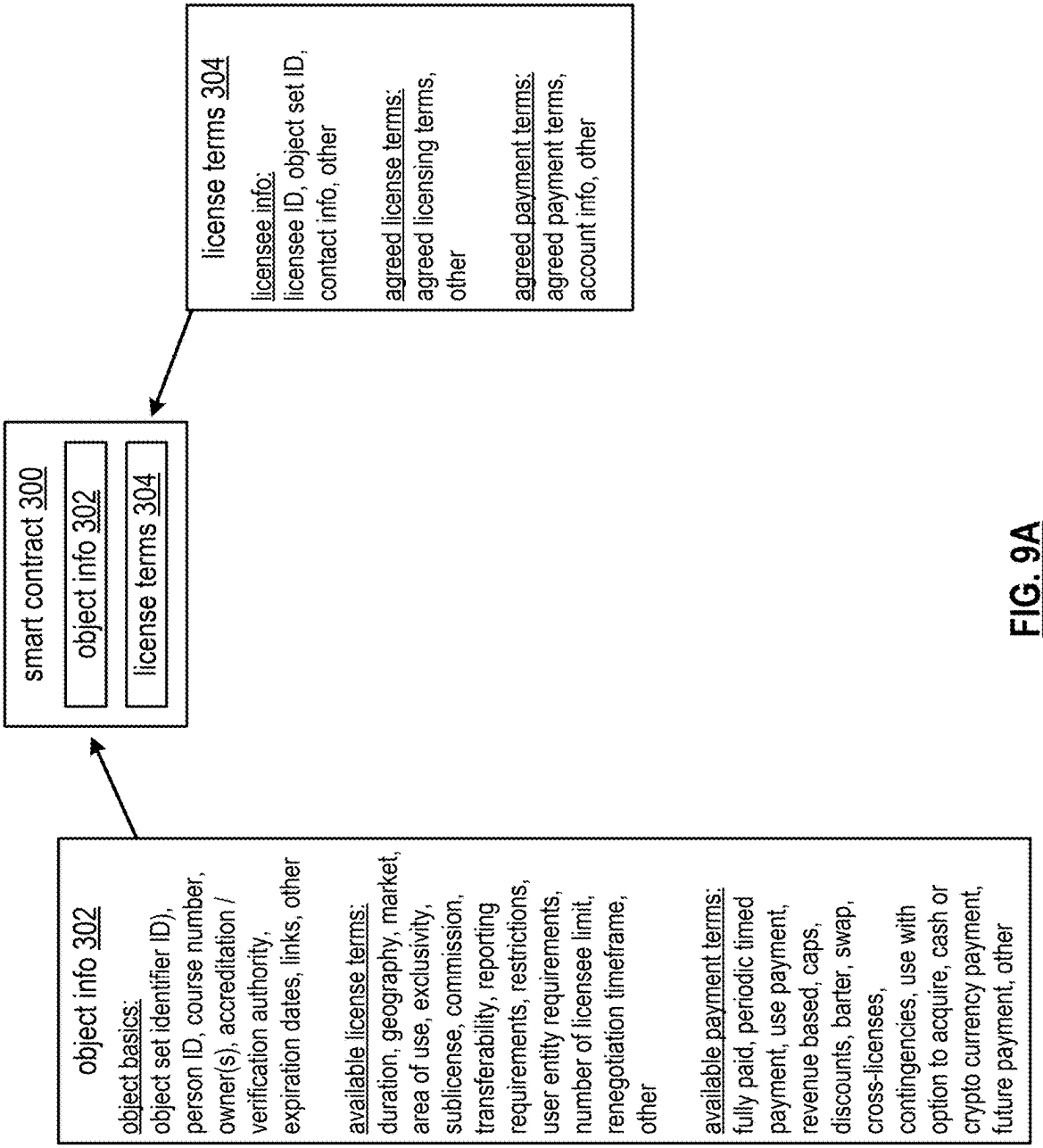

smart contract 300
object info 302
license terms 304
object info 302
object basics:
object set identifier ID), person ID, course number, owner(s), accreditation / verification authority, expiration dates, links, other
available license terms:
duration, geography, market, area of use, exclusivity, sublicense, commission, transferability, reporting requirements, restrictions, user entity requirements, number of licensee limit, renegotiation timeframe, other
available payment terms:
fully paid, periodic timed payment, use payment, revenue based, caps, discounts, barter, swap, cross-licenses, contingencies, use with option to acquire, cash or crypto currency payment, future payment, other
license terms 304
licensee info:
licensee ID, object set ID, contact info, other
agreed license terms:
agreed licensing terms, other
agreed payment terms:
agreed payment terms, account info, other

FIG. 9A

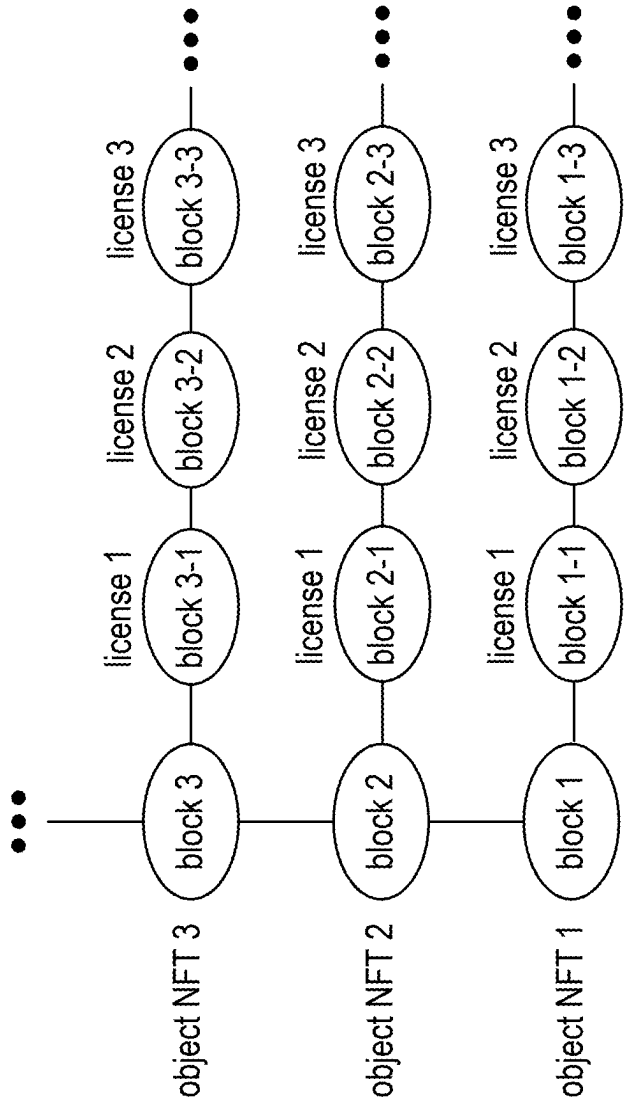

object NFT 3
object NFT 2
object NFT 1
block 3
block 2
block 1
license 1
license 2
license 3
block 3-1
block 3-2
block 3-3
block 2-1
block 2-2
block 2-3
block 1-1
block 1-2
block 1-3

FIG. 9C

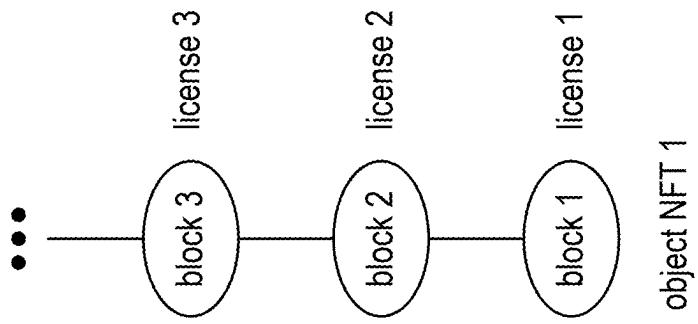

block 3
block 2
block 1
license 3
license 2
license 1
object NFT 1

FIG. 9B

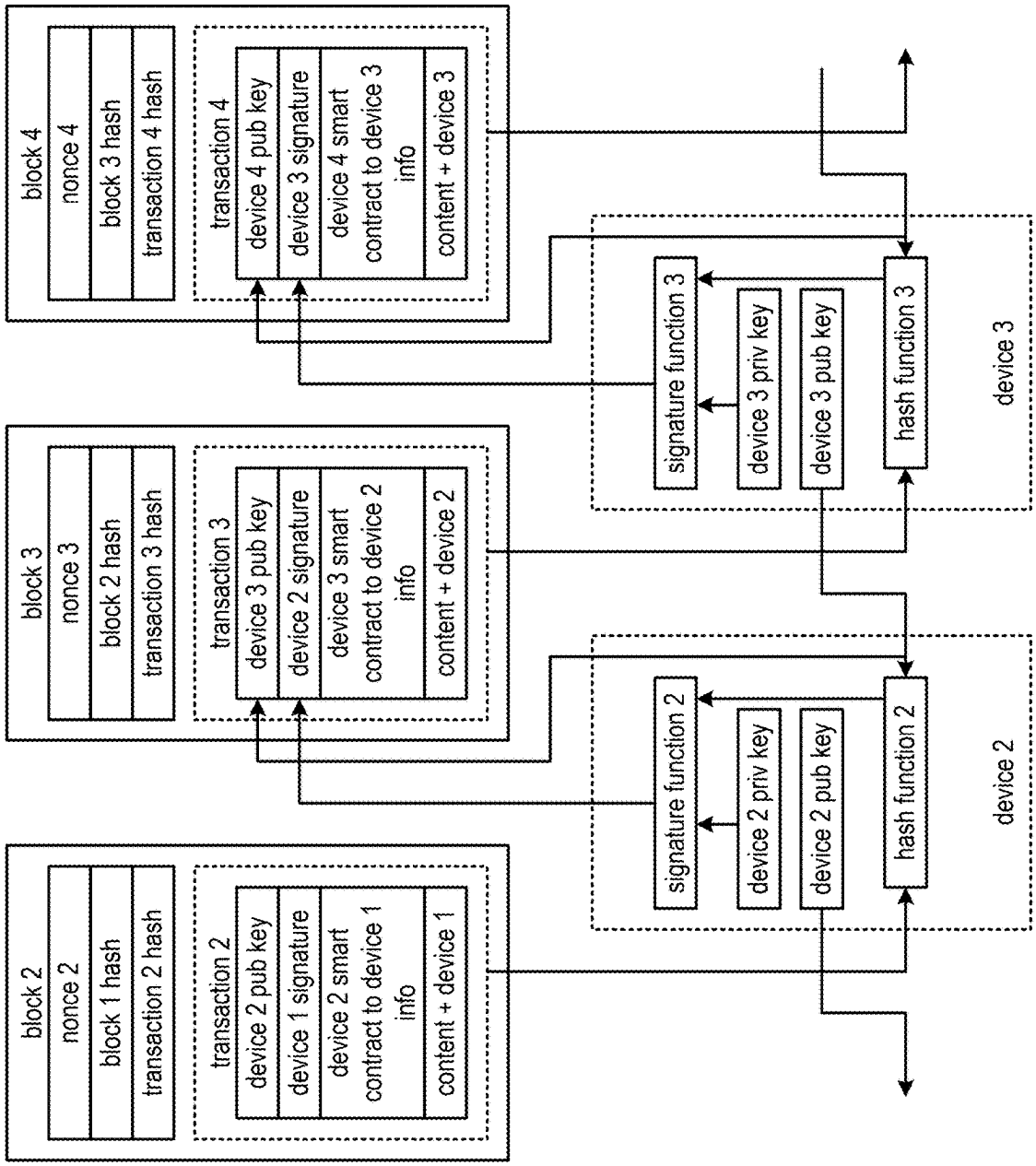

block 4
nonce 4
block 3 hash
transaction 4 hash
transaction 4
device 4 pub key
device 3 signature
device 4 smart contract to device 3 info
content + device 3
block 3
nonce 3
block 2 hash
transaction 3 hash
transaction 3
device 3 pub key
device 2 signature
device 3 smart contract to device 2 info
content + device 2
block 2
nonce 2
block 1 hash
transaction 2 hash
transaction 2
device 2 pub key
device 1 signature
device 2 smart contract to device 1 info
content + device 1
signature function 3
device 3 priv key
device 3 pub key
hash function 3
device 3
signature function 2
device 2 priv key
device 2 pub key
hash function 2
device 2

FIG. 9D

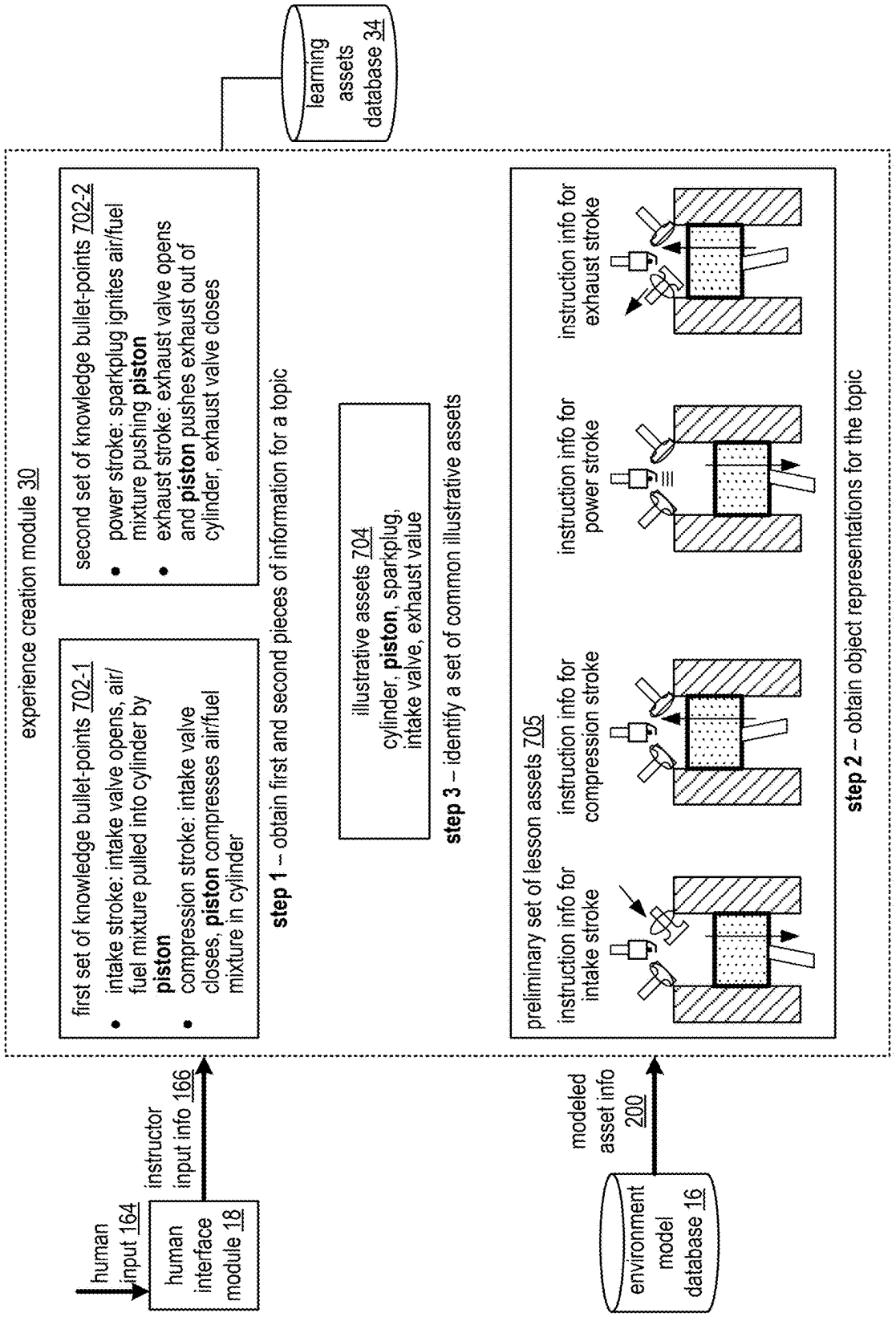

learning assets database 34
experience creation module 30
first set of knowledge bullet-points 702-1
intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
second set of knowledge bullet-points 702-2
power stroke: sparkplug ignites air/fuel mixture pushing piston
exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
step 1 – obtain first and second pieces of information for a topic
illustrative assets 704
cylinder, piston, sparkplug, intake valve, exhaust value
step 3 – identify a set of common illustrative assets
preliminary set of lesson assets 705
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
step 2 – obtain object representations for the topic
human input 164
human interface module 18
instructor input info 166
modeled asset info 200
environment model database 16

FIG. 10A

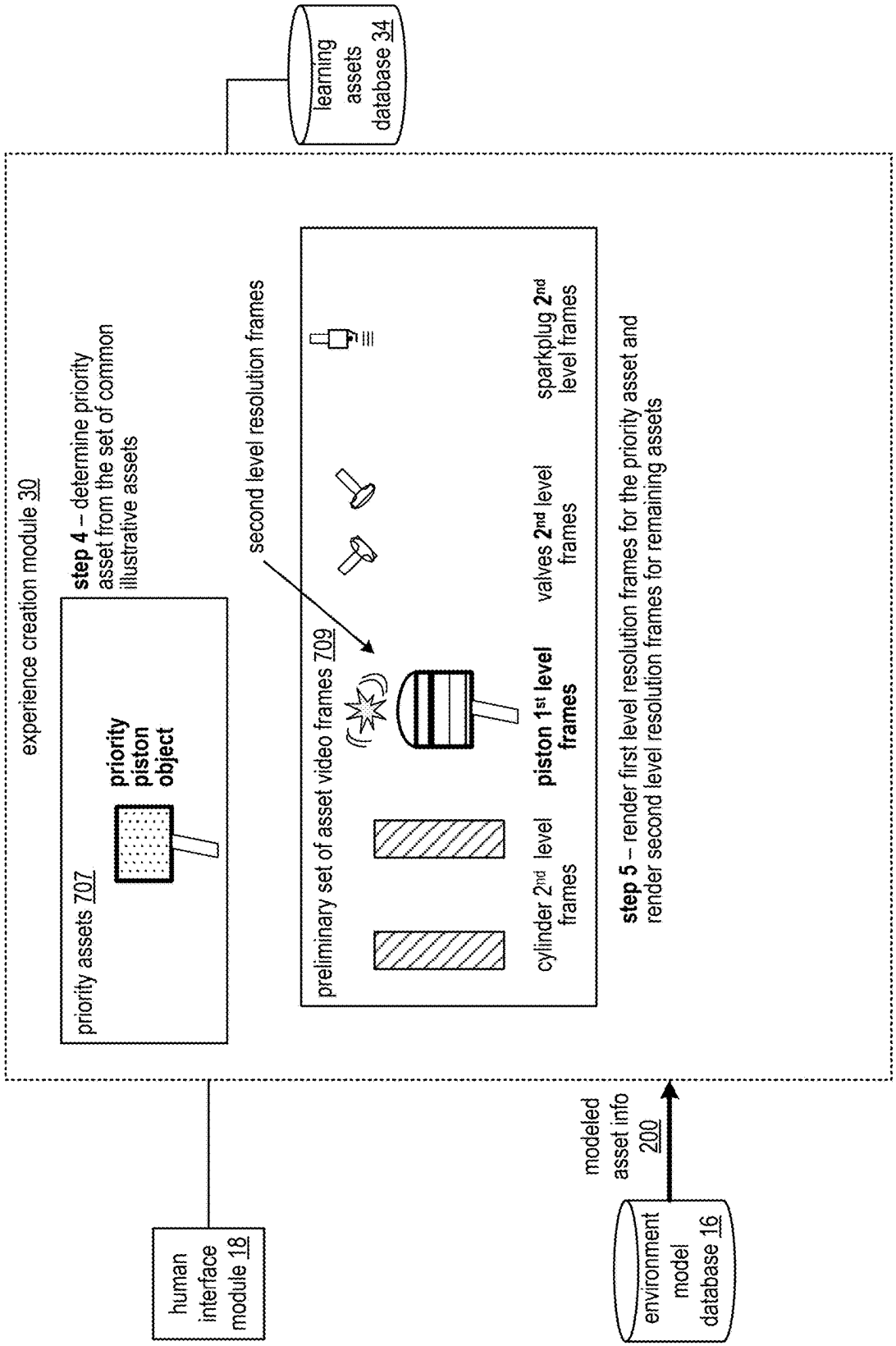

learning assets database 34
experience creation module 30
step 4 – determine priority asset from the set of common illustrative assets
second level resolution frames
priority assets 707
priority piston object
preliminary set of asset video frames 709
cylinder 2nd level frames
piston 1st level frames
valves 2nd level frames
sparkplug 2nd level frames
step 5 – render first level resolution frames for the priority asset and render second level resolution frames for remaining assets
human interface module 18
modeled asset info 200
environment model database 16

FIG. 10B

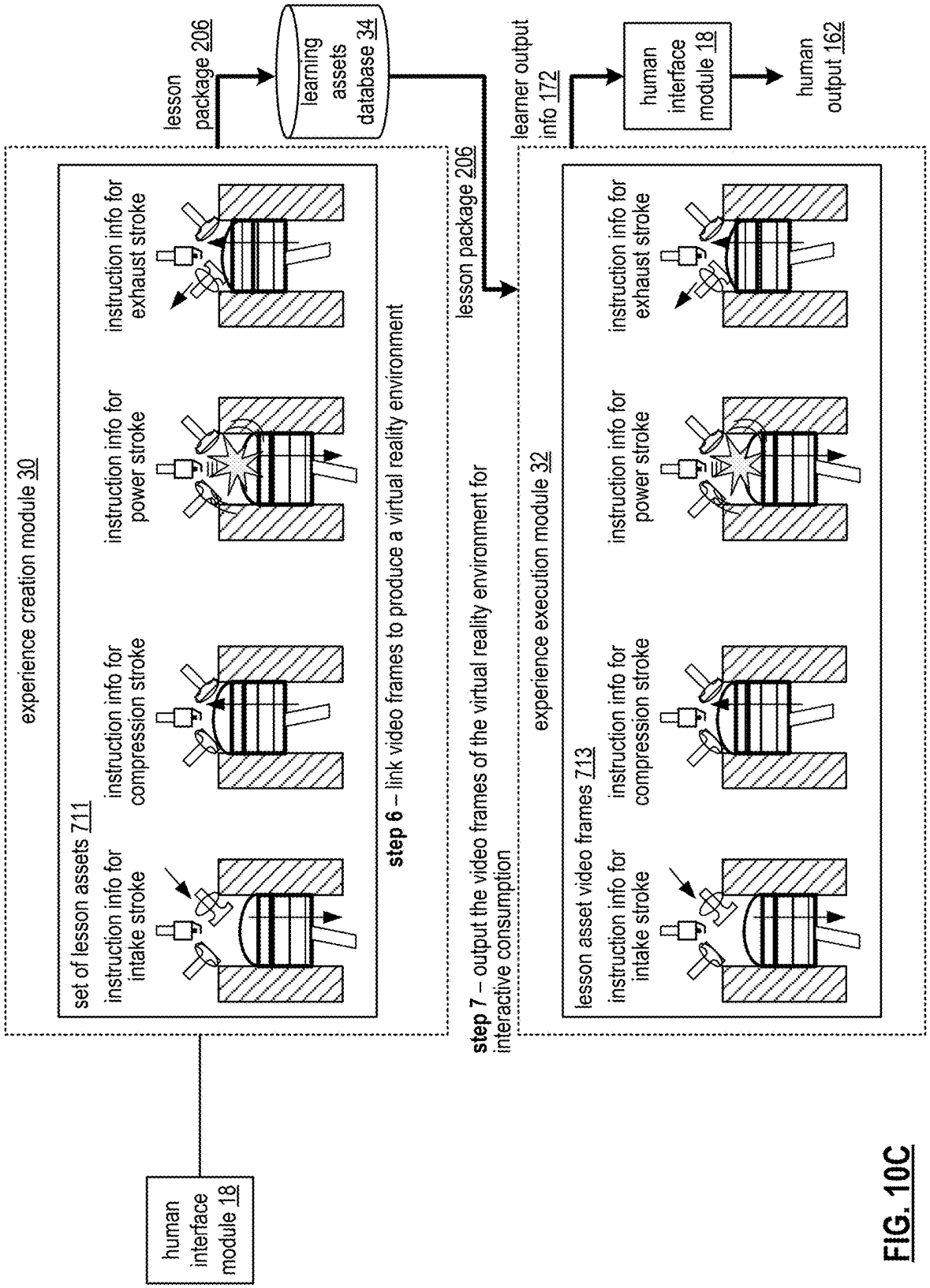

experience creation module 30
set of lesson assets 711
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
step 6 – link video frames to produce a virtual reality environment
lesson package 206
learning assets database 34
lesson package 206
step 7 – output the video frames of the virtual reality environment for interactive consumption
experience execution module 32
lesson asset video frames 713
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
learner output info 172
human interface module 18
human output 162
human interface module 18

FIG. 10C

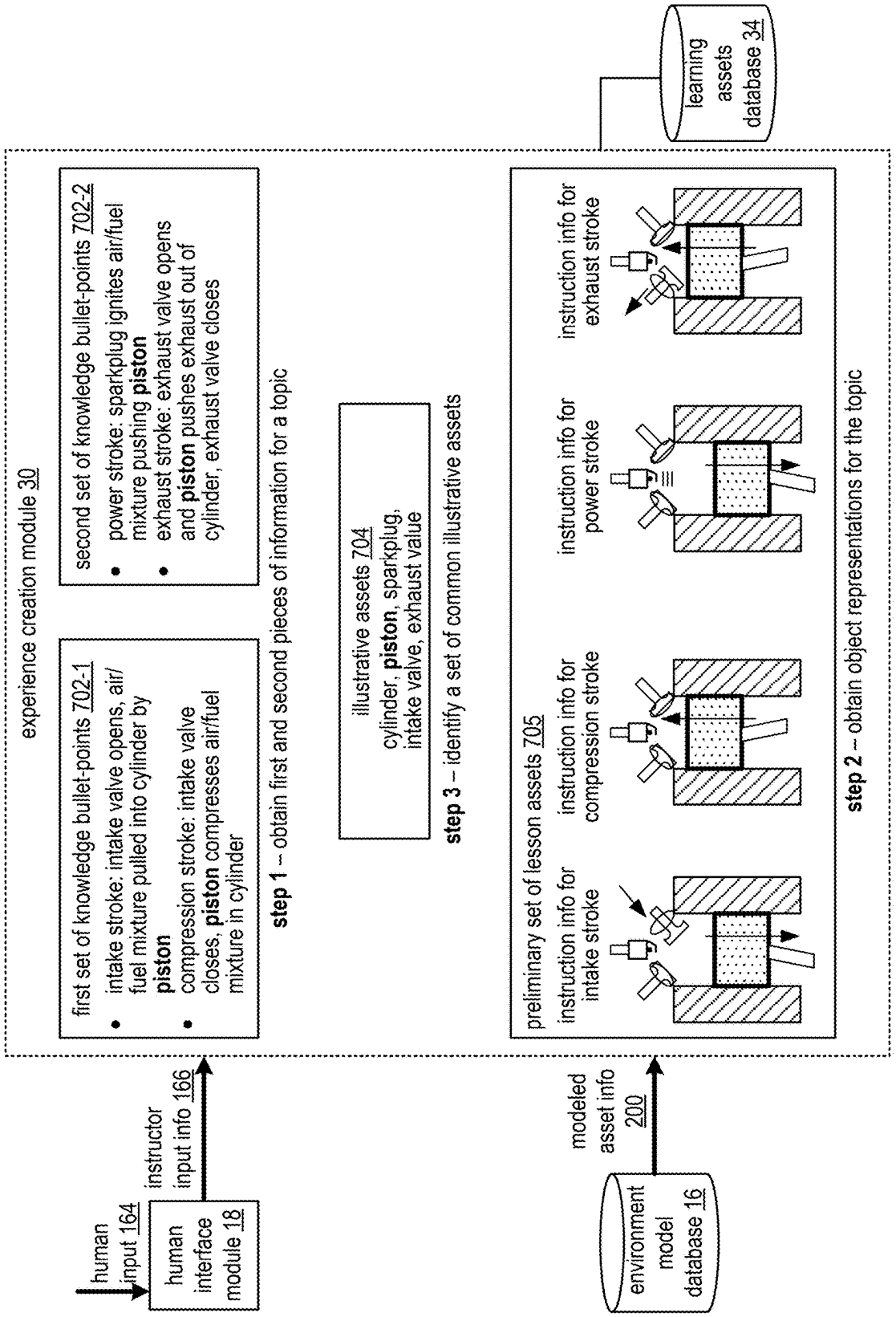

human input 164
human interface module 18
instructor input info 166
experience creation module 30
first set of knowledge bullet-points 702-1
intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston
compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder
second set of knowledge bullet-points 702-2
power stroke: sparkplug ignites air/fuel mixture pushing piston
exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes
step 1 – obtain first and second pieces of information for a topic
illustrative assets 704
cylinder, piston, sparkplug, intake valve, exhaust value
step 3 – identify a set of common illustrative assets
preliminary set of lesson assets 705
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
step 2 – obtain object representations for the topic
learning assets database 34
modeled asset info 200
environment model database 16

FIG. 11A

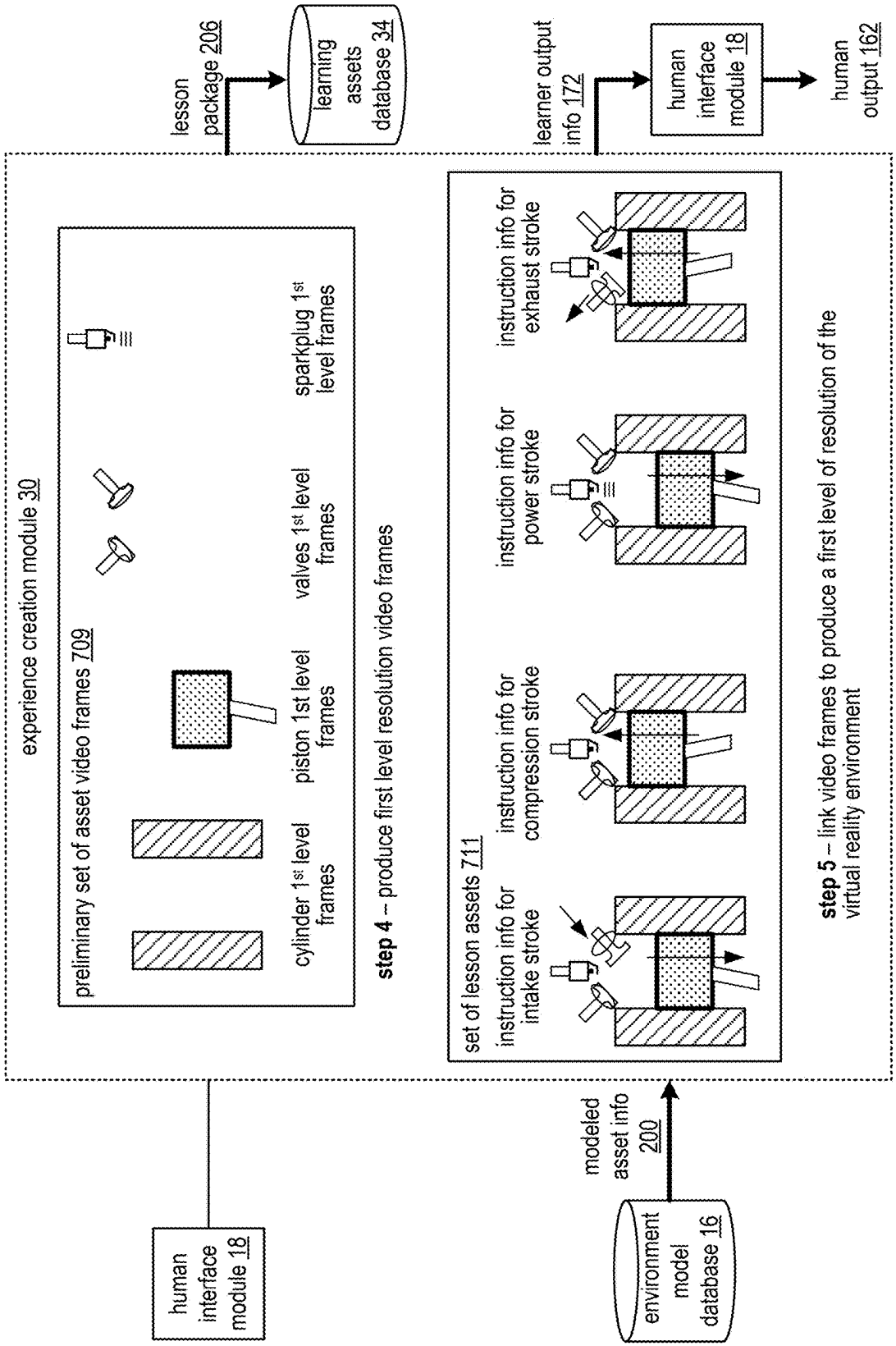

lesson package 206
learning assets database 34
learner output info 172
human interface module 18
human output 162
experience creation module 30
preliminary set of asset video frames 709
cylinder 1st level frames
piston 1st level frames
valves 1st level frames
sparkplug 1st level frames
step 4 – produce first level resolution video frames
set of lesson assets 711
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
step 5 – link video frames to produce a first level of resolution of the virtual reality environment
human interface module 18
modeled asset info 200
environment model database 16

FIG. 11B

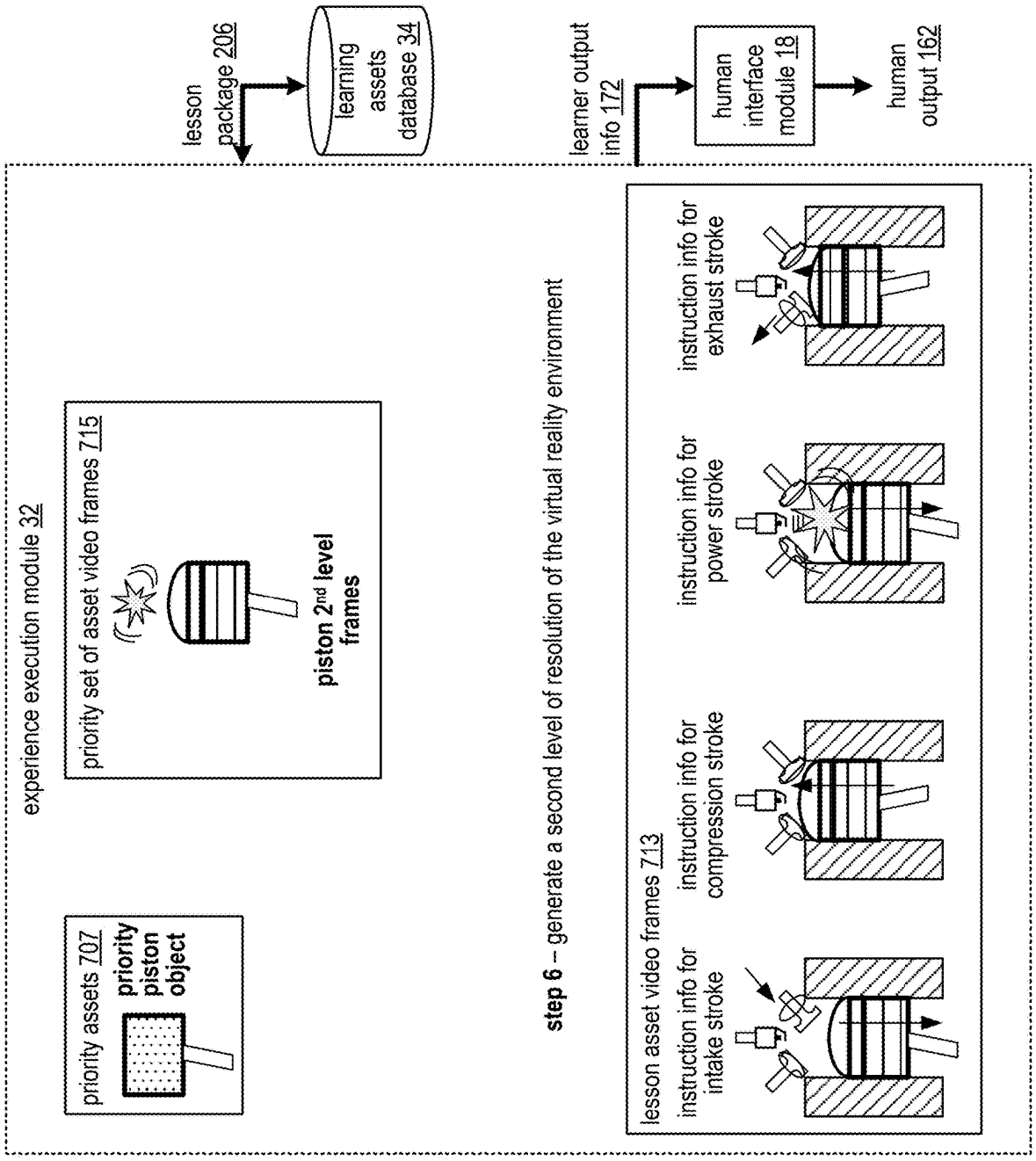

experience execution module 32
priority assets 707
priority piston object
priority set of asset video frames 715
piston 2nd level frames
lesson package 206
learning assets database 34
step 6 – generate a second level of resolution of the virtual reality environment
lesson asset video frames 713
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
learner output info 172
human interface module 18
human output 162

FIG. 11C

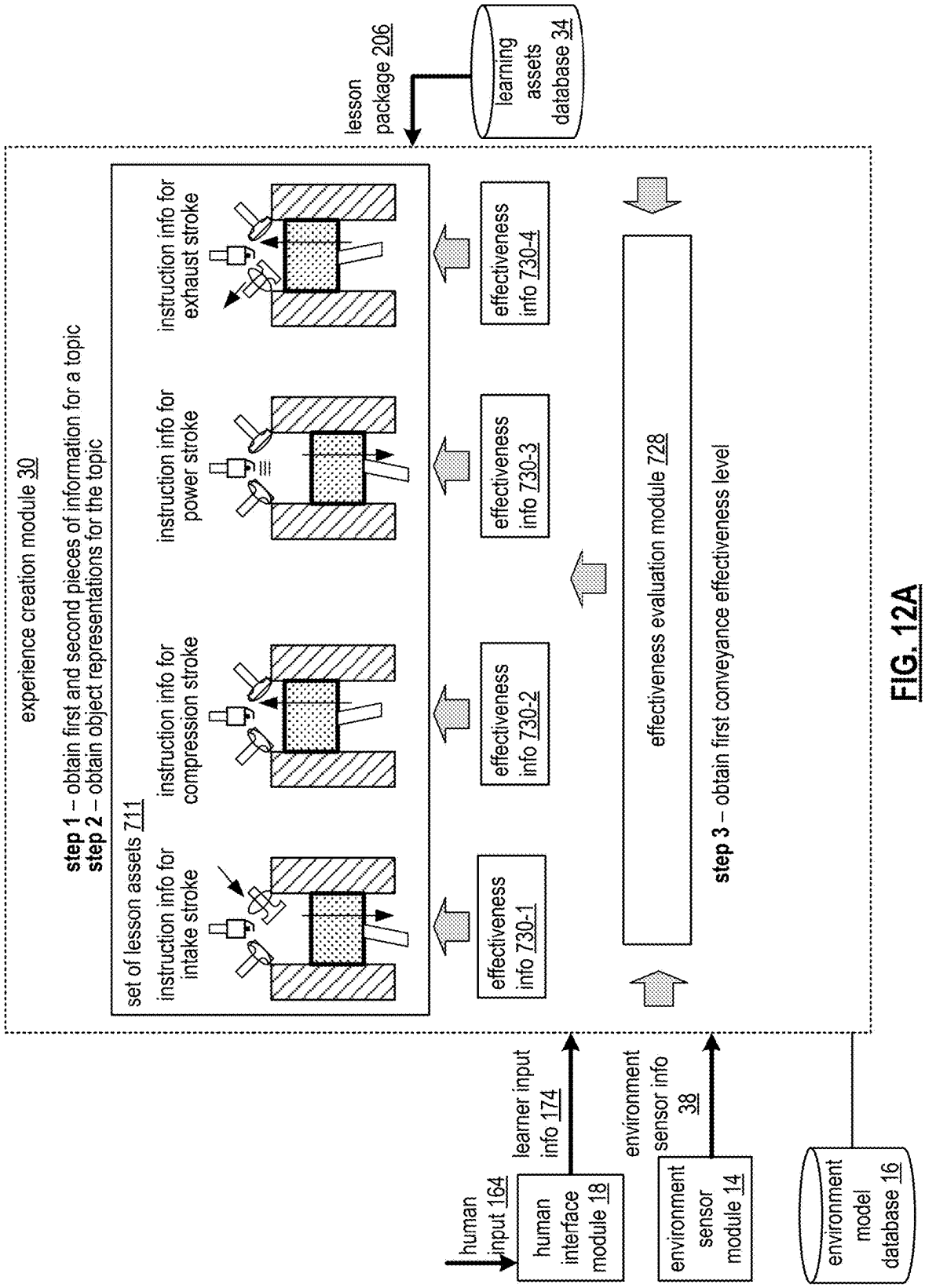

experience creation module 30
step 1 – obtain first and second pieces of information for a topic
step 2 – obtain object representations for the topic
set of lesson assets 711
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
effectiveness info 730-1
effectiveness info 730-2
effectiveness info 730-3
effectiveness info 730-4
effectiveness evaluation module 728
step 3 – obtain first conveyance effectiveness level
lesson package 206
learning assets database 34
human input 164
human interface module 18
learner input info 174
environment sensor module 14
environment sensor info 38
environment model database 16

FIG. 12A

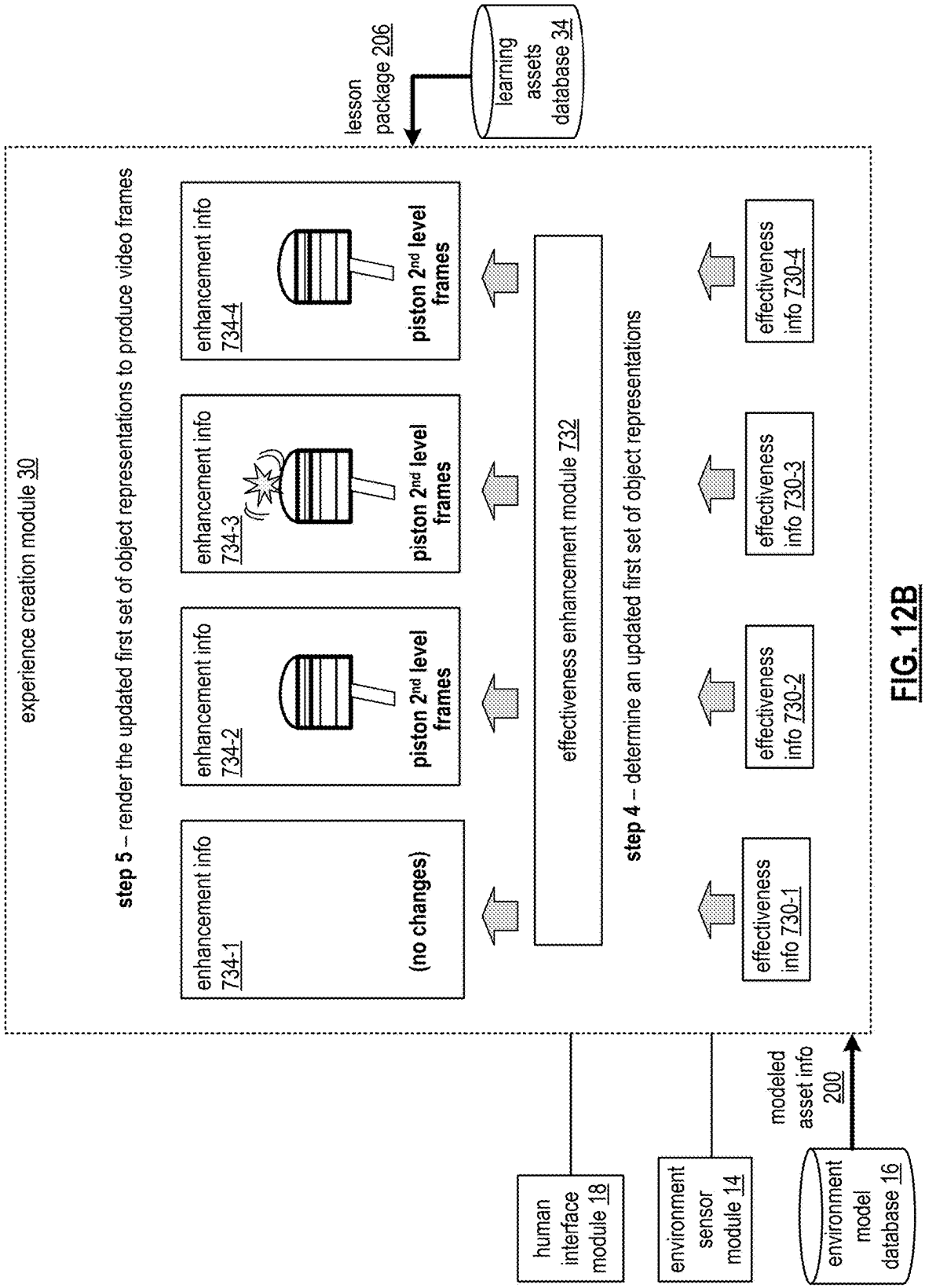

experience creation module 30
step 5 – render the updated first set of object representations to produce video frames
enhancement info 734-1
(no changes)
enhancement info 734-2
piston 2nd level frames
enhancement info 734-3
piston 2nd level frames
enhancement info 734-4
piston 2nd level frames
effectiveness enhancement module 732
step 4 – determine an updated first set of object representations
effectiveness info 730-1
effectiveness info 730-2
effectiveness info 730-3
effectiveness info 730-4
lesson package 206
learning assets database 34
human interface module 18
environment sensor module 14
modeled asset info 200
environment model database 16

FIG. 12B

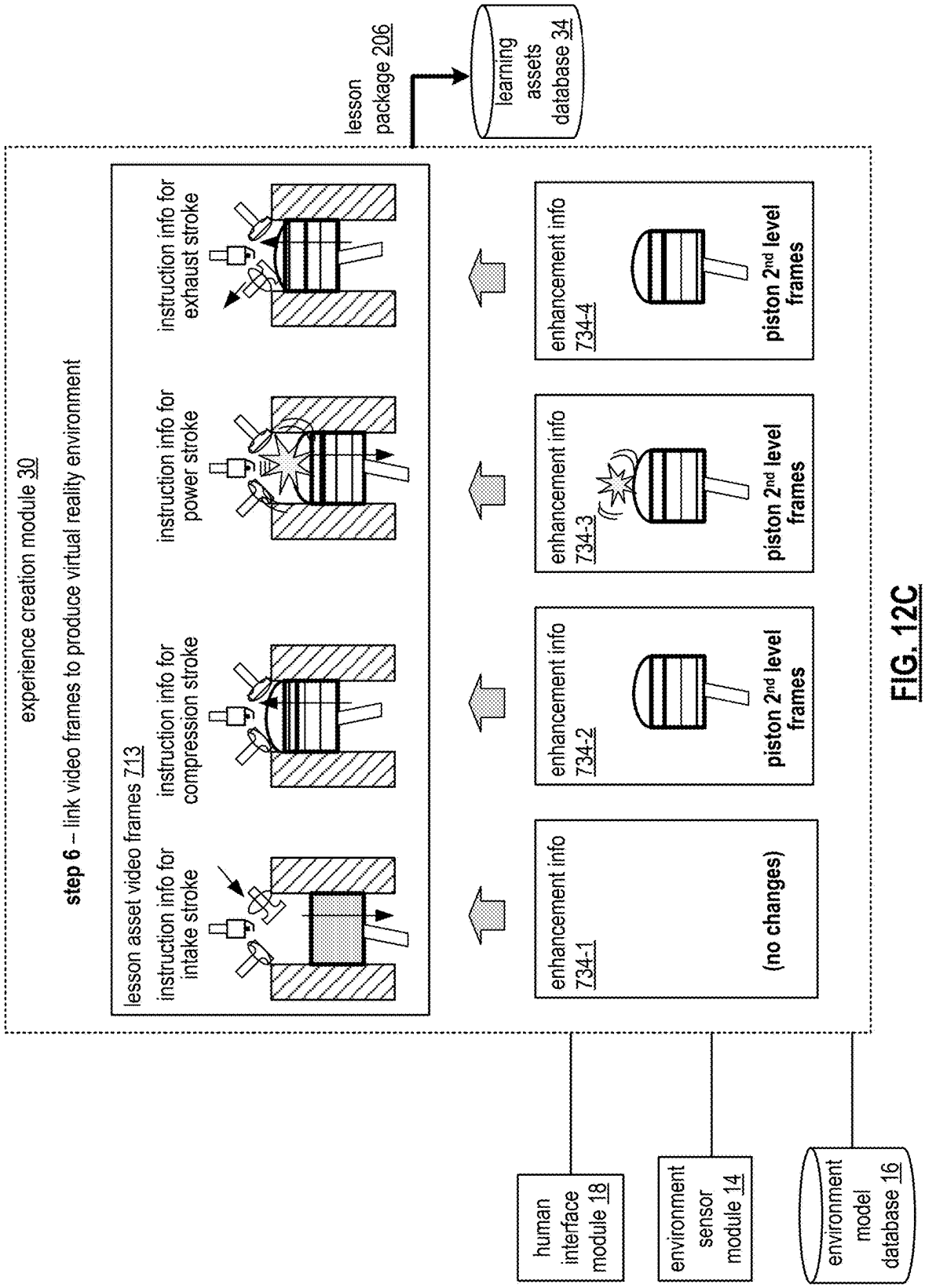

experience creation module 30
step 6 – link video frames to produce virtual reality environment
lesson asset video frames 713
instruction info for intake stroke
instruction info for compression stroke
instruction info for power stroke
instruction info for exhaust stroke
enhancement info 734-1
(no changes)
enhancement info 734-2
piston 2nd level frames
enhancement info 734-3
piston 2nd level frames
enhancement info 734-4
piston 2nd level frames
lesson package 206
learning assets database 34
human interface module 18
environment sensor module 14
environment model database 16

FIG. 12C

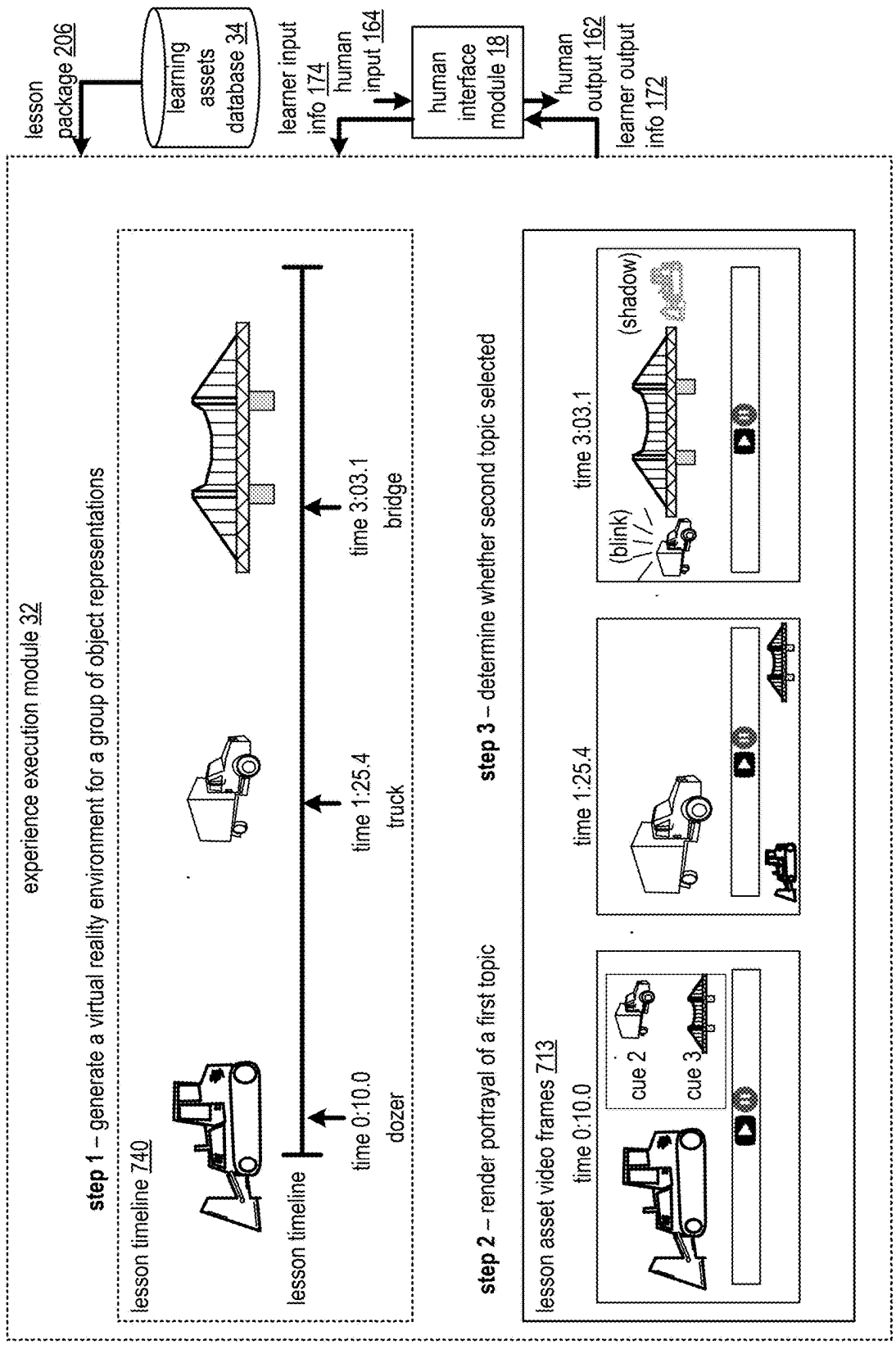

lesson package 206
learning assets database 34
learner input info 174
human input 164
human interface module 18
human output 162
learner output info 172
experience execution module 32
step 1 – generate a virtual reality environment for a group of object representations
lesson timeline 740
lesson timeline
time 0:10.0
dozer
time 1:25.4
truck
time 3:03.1
bridge
step 2 – render portrayal of a first topic
step 3 – determine whether second topic selected
lesson asset video frames 713
time 0:10.0
cue 2
cue 3
time 1:25.4
time 3:03.1
(blink)
(shadow)

FIG. 13A

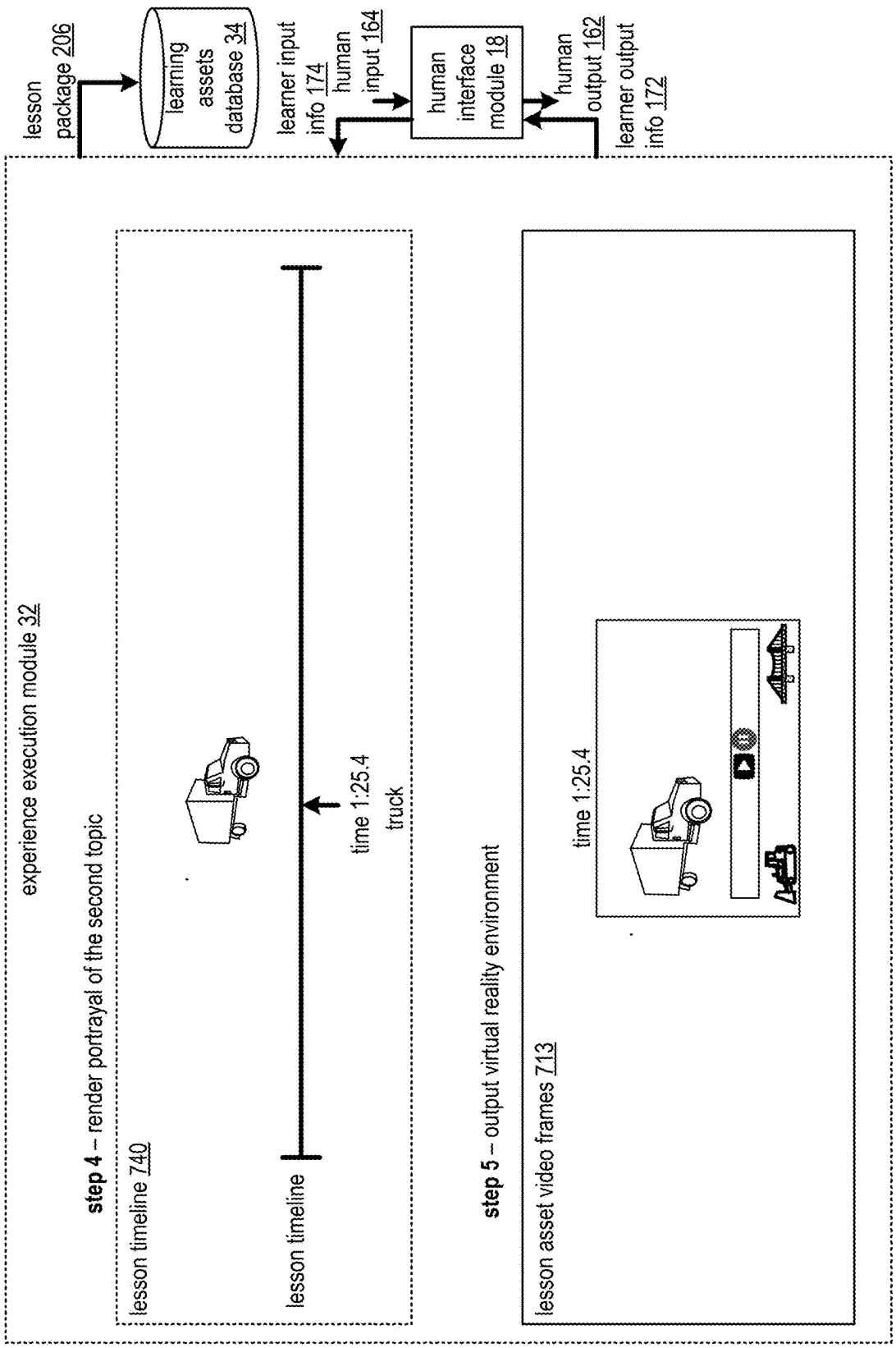

experience execution module 32
lesson package 206
learning assets database 34
learner input info 174
human input 164
human interface module 18
human output 162
learner output info 172
step 4 – render portrayal of the second topic
lesson timeline 740
lesson timeline
time 1:25.4
truck
step 5 – output virtual reality environment
lesson asset video frames 713
time 1:25.4

FIG. 13B

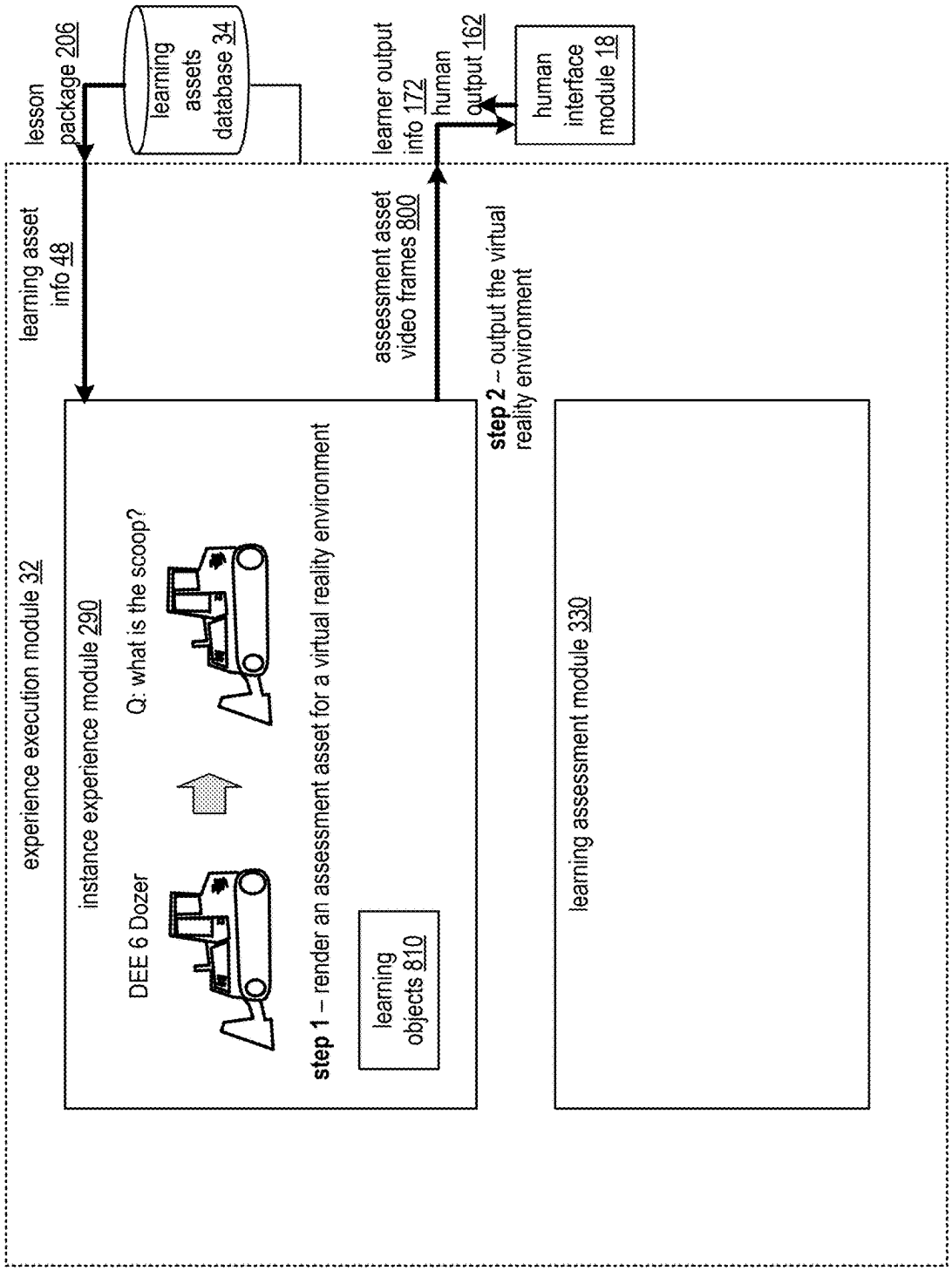

experience execution module 32
lesson package 206
learning assets database 34
learning asset info 48
learner output info 172
human output 162
human interface module 18
assessment asset video frames 800
instance experience module 290
DEE 6 Dozer
Q: what is the scoop?
step 1 – render an assessment asset for a virtual reality environment
learning objects 810
step 2 – output the virtual reality environment
learning assessment module 330

FIG. 14A

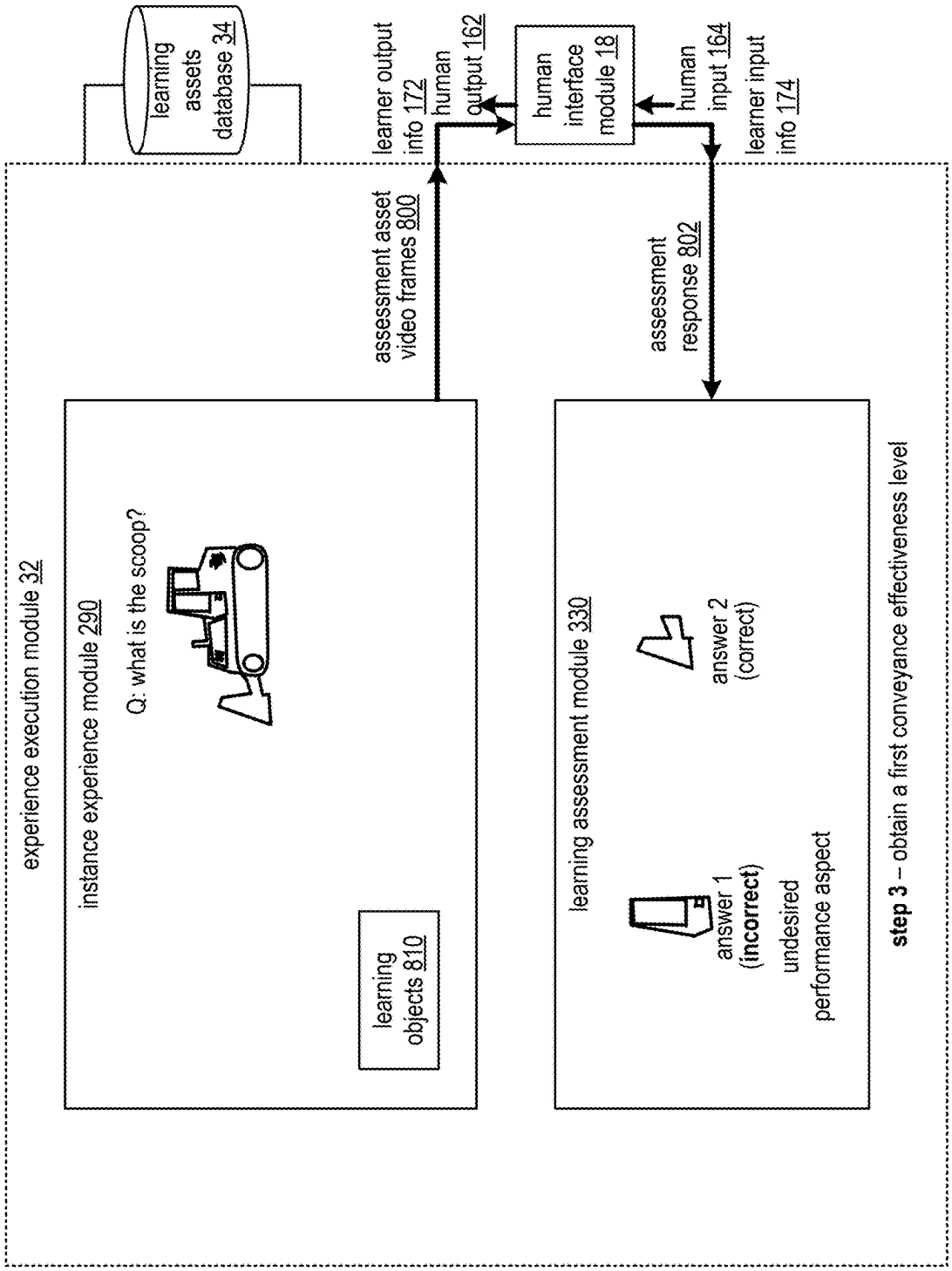

experience execution module 32
learning assets database 34
instance experience module 290
Q: what is the scoop?
learning objects 810
assessment asset video frames 800
learner output info 172
human output 162
human interface module 18
human input 164
learner input info 174
assessment response 802
learning assessment module 330
answer 1 (incorrect)
undesired performance aspect
answer 2 (correct)
step 3 – obtain a first conveyance effectiveness level

FIG. 14B

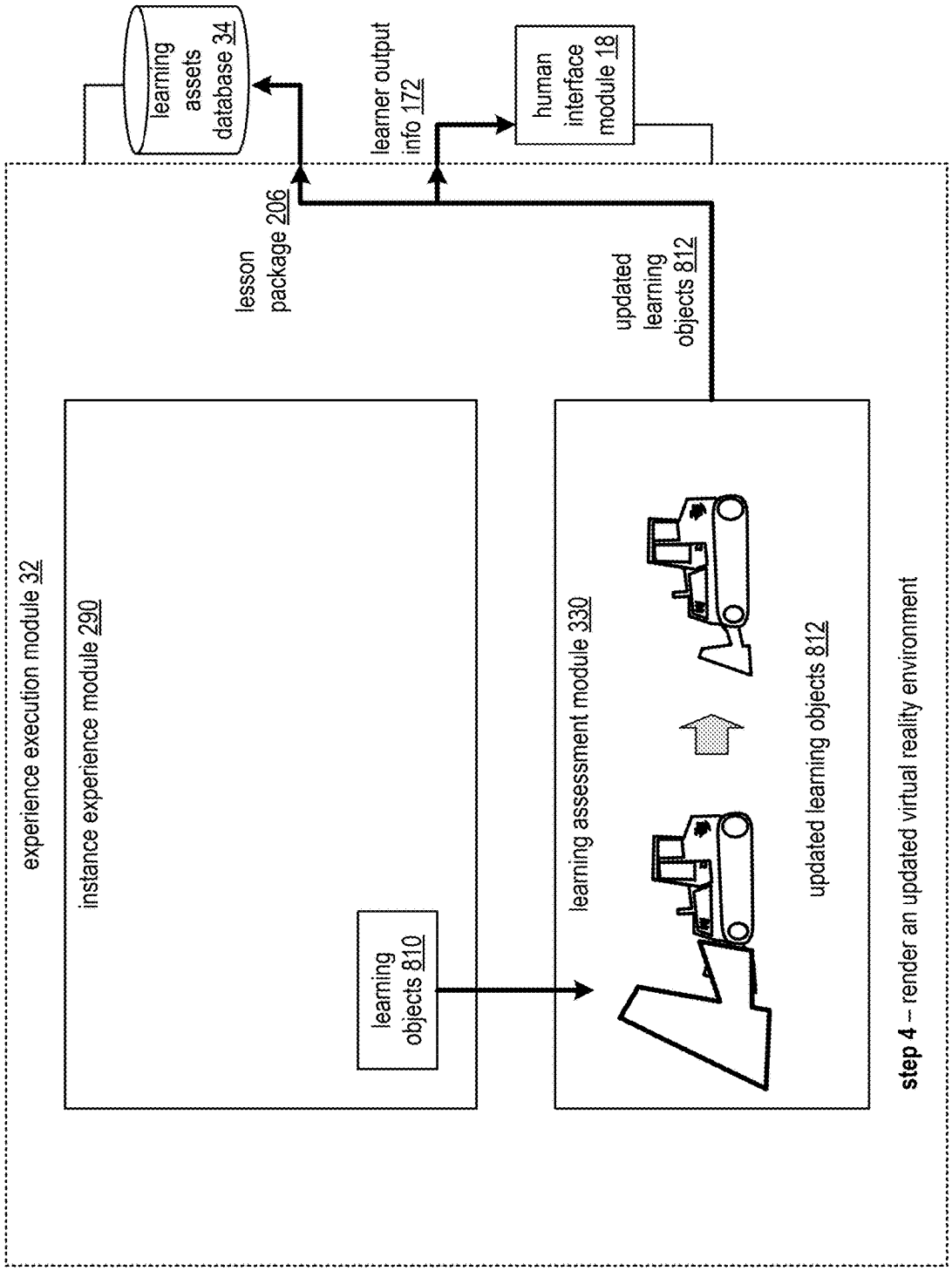

experience execution module 32
instance experience module 290
learning objects 810
learning assessment module 330
updated learning objects 812
lesson package 206
learner output info 172
updated learning objects 812
learning assets database 34
human interface module 18
step 4 – render an updated virtual reality environment

FIG. 14C

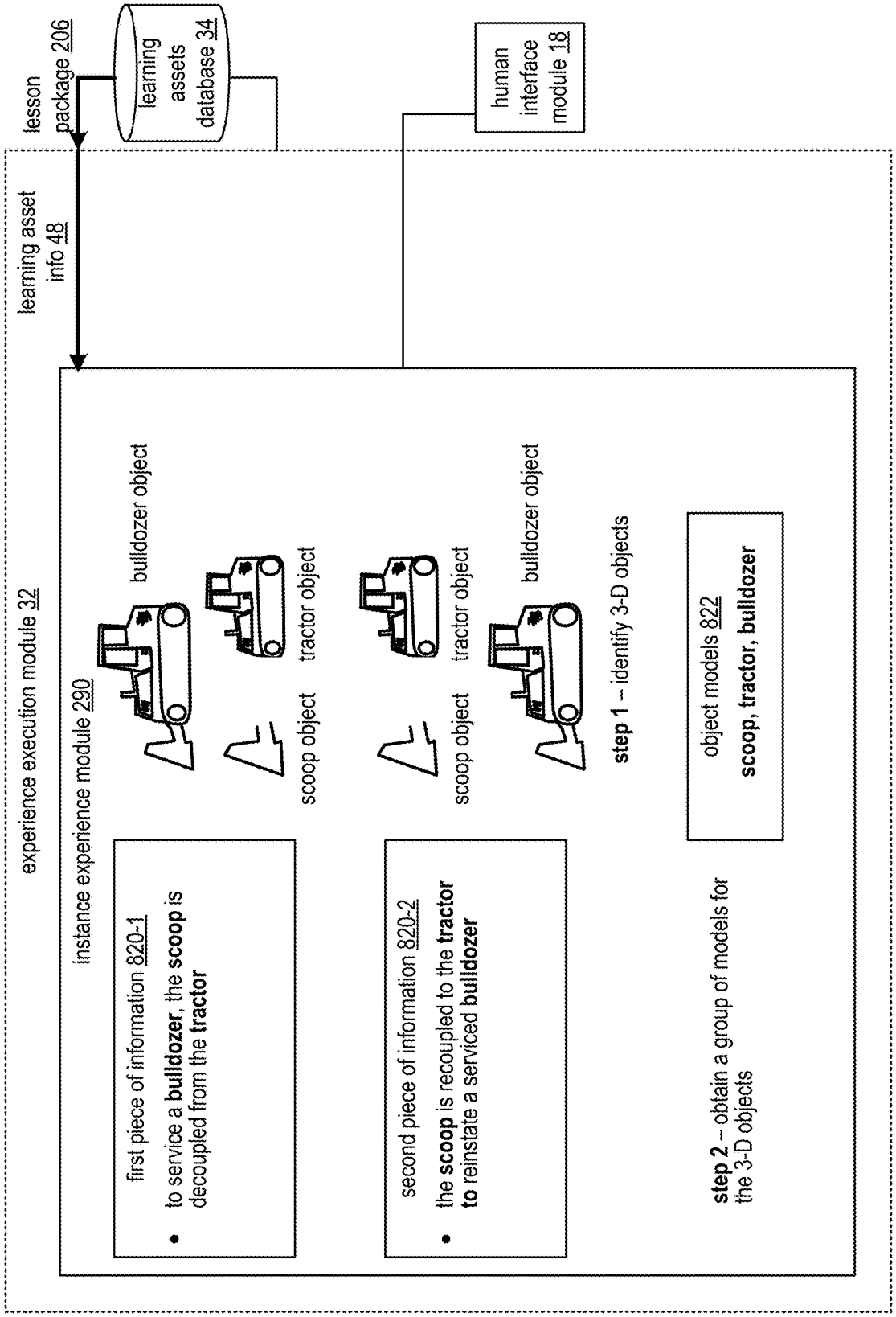

lesson package 206
learning assets database 34
human interface module 18
learning asset info 48
experience execution module 32
instance experience module 290
bulldozer object
tractor object
scoop object
tractor object
scoop object
bulldozer object
step 1 – identify 3-D objects
object models 822
scoop, tractor, bulldozer
first piece of information 820-1
• to service a bulldozer, the scoop is decoupled from the tractor
second piece of information 820-2
• the scoop is recoupled to the tractor to reinstate a serviced bulldozer
step 2 – obtain a group of models for the 3-D objects

FIG. 15A

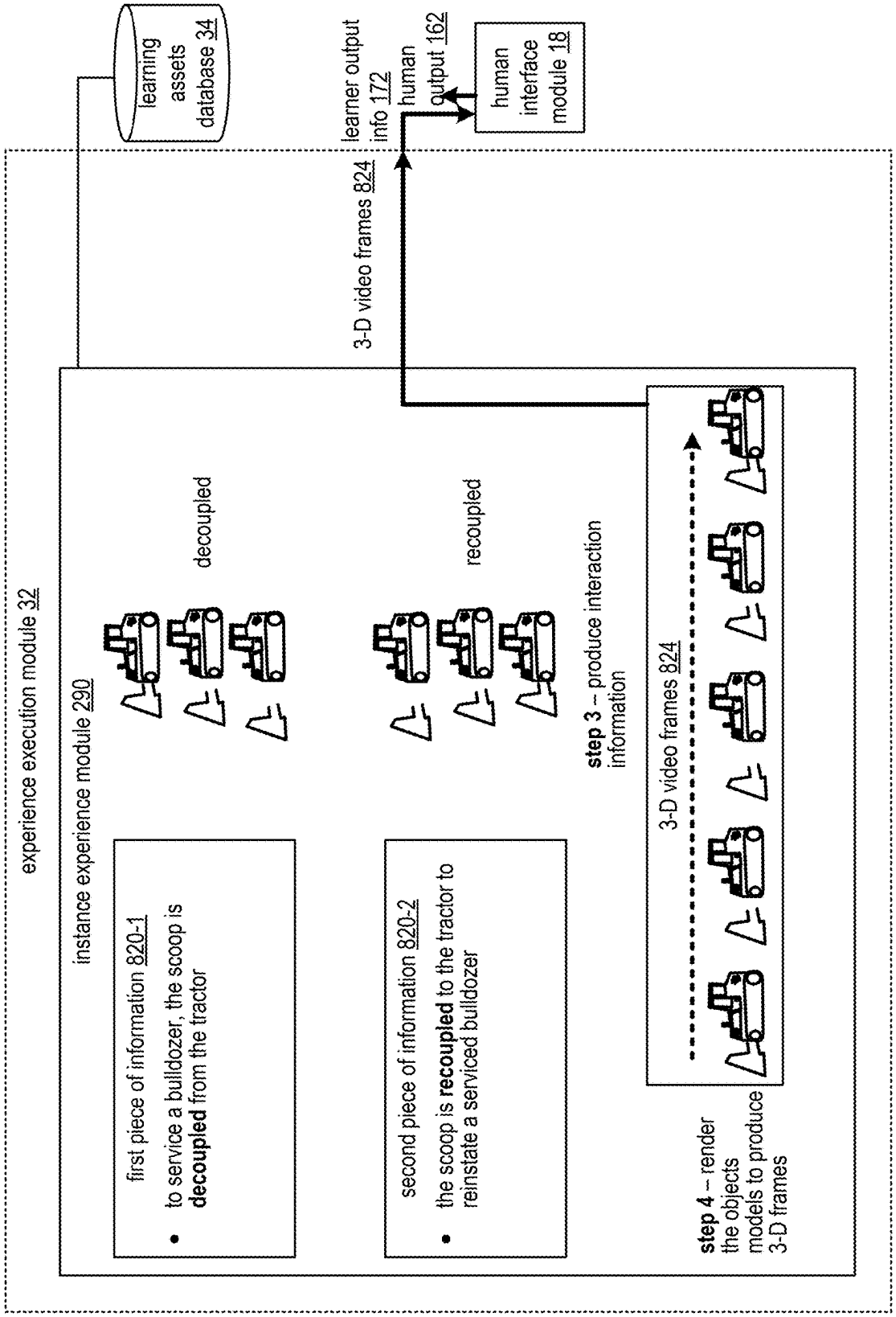

experience execution module 32
learning assets database 34
learner output info 172
human output 162
human interface module 18
3-D video frames 824
instance experience module 290
first piece of information 820-1
• to service a bulldozer, the scoop is **decoupled** from the tractor
decoupled
second piece of information 820-2
• the scoop is **recoupled** to the tractor to reinstate a serviced bulldozer
recoupled
**step 3** – produce interaction information
3-D video frames 824
**step 4** – render the objects models to produce 3-D frames

FIG. 15B

# GENERATING A PROCESS ILLUSTRATION WITHIN A VIRTUAL REALITY ENVIRONMENT

## CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** The present U.S. Utility Patent application claims priority pursuant to 35 U.S.C. § 120 as a continuation of U.S. Utility application Ser. No. 18/111,578, entitled "GENERATING A PROCESS ILLUSTRATION WITHIN A VIRTUAL REALITY ENVIRONMENT," filed Feb. 19, 2023, issuing May 6, 2025 as U.S. Pat. No. 12,293,482, which claims priority pursuant to 35 U.S.C. § 119 (e) to U.S. Provisional Application No. 63/440,314, entitled "GENERATING A PROCESS ILLUSTRATION WITHIN A VIRTUAL REALITY ENVIRONMENT," filed Jan. 20, 2023, expired, all of which are hereby incorporated herein by reference in their entirety and made part of the present U.S. Utility Patent Application for all purposes.

## STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

**[0002]** Not Applicable.

## INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

**[0003]** Not Applicable.

## BACKGROUND OF THE INVENTION

### Technical Field of the Invention

**[0004]** This invention relates generally to computer systems and more particularly to computer systems providing educational, training, and entertainment content.

### Description of Related Art

**[0005]** Computer systems communicate data, process data, and/or store data. Such computer systems include computing devices that range from wireless smart phones, laptops, tablets, personal computers (PC), work stations, personal three-dimensional (3-D) content viewers, and video game devices, to data centers where data servers store and provide access to digital content. Some digital content is utilized to facilitate education, training, and entertainment. Examples of visual content includes electronic books, reference materials, training manuals, classroom coursework, lecture notes, research papers, images, video clips, sensor data, reports, etc.

**[0006]** A variety of educational systems utilize educational tools and techniques. For example, an educator delivers educational content to students via an education tool of a recorded lecture that has built-in feedback prompts (e.g., questions, verification of viewing, etc.). The educator assess a degree of understanding of the educational content and/or overall competence level of a student from responses to the feedback prompts.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

**[0007]** FIG. **1** is a schematic block diagram of an embodiment of a computing system in accordance with the present invention;

**[0008]** FIG. **2**A is a schematic block diagram of an embodiment of a computing entity of a computing system in accordance with the present invention;

**[0009]** FIG. **2**B is a schematic block diagram of an embodiment of a computing device of a computing system in accordance with the present invention;

**[0010]** FIG. **3** is a schematic block diagram of another embodiment of a computing device of a computing system in accordance with the present invention;

**[0011]** FIG. **4** is a schematic block diagram of an embodiment of an environment sensor module of a computing system in accordance with the present invention;

**[0012]** FIG. **5**A is a schematic block diagram of another embodiment of a computing system in accordance with the present invention;

**[0013]** FIG. **5**B is a schematic block diagram of an embodiment of a representation of a learning experience in accordance with the present invention;

**[0014]** FIG. **6** is a schematic block diagram of another embodiment of a representation of a learning experience in accordance with the present invention;

**[0015]** FIG. **7**A is a schematic block diagram of another embodiment of a computing system in accordance with the present invention;

**[0016]** FIG. **7**B is a schematic block diagram of another embodiment of a representation of a learning experience in accordance with the present invention;

**[0017]** FIGS. **8**A-**8**C are schematic block diagrams of another embodiment of a computing system illustrating an example of creating a learning experience in accordance with the present invention;

**[0018]** FIG. **8**D is a logic diagram of an embodiment of a method for creating a learning experience within a computing system in accordance with the present invention;

**[0019]** FIGS. **8**E, **8**F, **8**G, **8**H, **8**J, and **8**K are schematic block diagrams of another embodiment of a computing system illustrating another example of creating a learning experience in accordance with the present invention;

**[0020]** FIG. **9**A is a schematic block diagram of a data structure for a smart contract in accordance with the present invention;

**[0021]** FIGS. **9**B and **9**C are schematic block diagrams of organization of object distributed ledgers in accordance with the present invention;

**[0022]** FIG. **9**D is a schematic block diagram of an embodiment of a blockchain associated with an object distributed ledger in accordance with the present invention;

**[0023]** FIGS. **10**A, **10**B, and **10**C are schematic block diagrams of an embodiment of a computing system illustrating an example of generating a virtual reality environment in accordance with the present invention;

**[0024]** FIGS. **11**A, **11**B, and **11**C are schematic block diagrams of an embodiment of a computing system illustrating an example of generating multiple resolutions of a virtual reality environment in accordance with the present invention;

**[0025]** FIGS. **12**A, **12**B, and **12**C are schematic block diagrams of an embodiment of a computing system illus-

trating an example of updating a virtual reality environment in accordance with the present invention;

**[0026]** FIGS. **13**A and **13**B are schematic block diagrams of an embodiment of a computing system illustrating an example of accessing a virtual reality environment in accordance with the present invention;

**[0027]** FIGS. **14**A, **14**B, and **14**C are schematic block diagrams of an embodiment of a computing system illustrating an example of updating an asset within a virtual reality environment in accordance with the present invention; and

**[0028]** FIGS. **15**A and **15**B are schematic block diagrams of an embodiment of a computing system illustrating an example of generating a process illustration within a virtual reality environment in accordance with the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

**[0029]** FIG. **1** is a schematic block diagram of an embodiment of a computing system **10** that includes a real world environment **12**, an environment sensor module **14**, and environment model database **16**, a human interface module **18**, and a computing entity **20**. The real-world environment **12** includes places **22**, objects **24**, instructors **26-1** through **26**-N, and learners **28-1** through **28**-N. The computing entity **20** includes an experience creation module **30**, an experience execution module **32**, and a learning assets database **34**.

**[0030]** The places **22** includes any area. Examples of places **22** includes a room, an outdoor space, a neighborhood, a city, etc. The objects **24** includes things within the places. Examples of objects **24** includes people, equipment, furniture, personal items, tools, and representations of information (i.e., video recordings, audio recordings, captured text, etc.). The instructors includes any entity (e.g., human or human proxy) imparting knowledge. The learners includes entities trying to gain knowledge and may temporarily serve as an instructor.

**[0031]** In an example of operation of the computing system **10**, the experience creation module **30** receives environment sensor information **38** from the environment sensor module **14** based on environment attributes **36** from the real world environment **12**. The environment sensor information **38** includes time-based information (e.g., static snapshot, continuous streaming) from environment attributes **36** including XYZ position information, place information, and object information (i.e., background, foreground, instructor, learner, etc.). The XYZ position information includes portrayal in a world space industry standard format (e.g., with reference to an absolute position).

**[0032]** The environment attributes **36** includes detectable measures of the real-world environment **12** to facilitate generation of a multi-dimensional (e.g., including time) representation of the real-world environment **12** in a virtual reality and/or augmented reality environment. For example, the environment sensor module **14** produces environment sensor information **38** associated with a medical examination room and a subject human patient (e.g., an MRI). The environment sensor module **14** is discussed in greater detail with reference to FIG. **4**.

**[0033]** Having received the environment sensor information **38**, the experience creation module **30** accesses the environment model database **16** to recover modeled environment information **40**. The modeled environment information **40** includes a synthetic representation of numerous environments (e.g., model places and objects). For example, the modeled environment information **40** includes a 3-D representation of a typical human circulatory system. The models include those that are associated with certain licensing requirements (e.g., copyrights, etc.).

**[0034]** Having received the modeled environment information **40**, the experience creation module **30** receives instructor information **44** from the human interface module **18**, where the human interface module **18** receives human input/output (I/O) **42** from instructor **26-1**. The instructor information **44** includes a representation of an essence of communication with a participant instructor. The human I/O **42** includes detectable fundamental forms of communication with humans or human proxies. The human interface module **18** is discussed in greater detail with reference to FIG. **3**.

**[0035]** Having received the instructor information **44**, the experience creation module **30** interprets the instructor information **44** to identify aspects of a learning experience. A learning experience includes numerous aspects of an encounter between one or more learners and an imparting of knowledge within a representation of a learning environment that includes a place, multiple objects, and one or more instructors. The learning experience further includes an instruction portion (e.g., acts to impart knowledge) and an assessment portion (e.g., further acts and/or receiving of learner input) to determine a level of comprehension of the knowledge by the one or more learners. The learning experience still further includes scoring of the level of comprehension and tallying multiple learning experiences to facilitate higher-level competency accreditations (e.g., certificates, degrees, licenses, training credits, experiences completed successfully, etc.).

**[0036]** As an example of the interpreting of the instructor information **44**, the experience creation module **30** identifies a set of concepts that the instructor desires to impart upon a learner and a set of comprehension verifying questions and associated correct answers. The experience creation module **30** further identifies step-by-step instructor annotations associated with the various objects within the environment of the learning experience for the instruction portion and the assessment portion. For example, the experience creation module **30** identifies positions held by the instructor **26-1** as the instructor narrates a set of concepts associated with the subject patient circulatory system. As a further example, the experience creation module **30** identifies circulatory system questions and correct answers posed by the instructor associated with the narrative.

**[0037]** Having interpreted the instructor information **44**, the experience creation module **30** renders the environment sensor information **38**, the modeled environment information **40**, and the instructor information **44** to produce learning assets information **48** for storage in the learning assets database **34**. The learning assets information **48** includes all things associated with the learning experience to facilitate subsequent recreation. Examples includes the environment, places, objects, instructors, learners, assets, recorded instruction information, learning evaluation information, etc.

**[0038]** Execution of a learning experience for the one or more learners includes a variety of approaches. A first approach includes the experience execution module **32** recovering the learning assets information **48** from the learning assets database **34**, rendering the learning experi-

ence as learner information **46**, and outputting the learner information **46** via the human interface module **18** as further human I/O **42** to one or more of the learners **28-1** through **28**-N. The learner information **46** includes information to be sent to the one or more learners and information received from the one or more learners. For example, the experience execution module **32** outputs learner information **46** associated with the instruction portion for the learner **28-1** and collects learner information **46** from the learner **28-1** that includes submitted assessment answers in response to assessment questions of the assessment portion communicated as further learner information **46** for the learner **28-1**.

**[0039]** A second approach includes the experience execution module **32** rendering the learner information **46** as a combination of live streaming of environment sensor information **38** from the real-world environment **12** along with an augmented reality overlay based on recovered learning asset information **48**. For example, a real world subject human patient in a medical examination room is live streamed as the environment sensor information **38** in combination with a prerecorded instruction portion from the instructor **26-1**.

**[0040]** FIG. **2**A is a schematic block diagram of an embodiment of the computing entity **20** of the computing system **10**. The computing entity **20** includes one or more computing devices **100-1** through **100**-N. A computing device is any electronic device that communicates data, processes data, represents data (e.g., user interface) and/or stores data.

**[0041]** Computing devices include portable computing devices and fixed computing devices. Examples of portable computing devices include an embedded controller, a smart sensor, a social networking device, a gaming device, a smart phone, a laptop computer, a tablet computer, a video game controller, and/or any other portable device that includes a computing core. Examples of fixed computing devices includes a personal computer, a computer server, a cable set-top box, a fixed display device, an appliance, and industrial controller, a video game counsel, a home entertainment controller, a critical infrastructure controller, and/or any type of home, office or cloud computing equipment that includes a computing core.

**[0042]** FIG. **2**B is a schematic block diagram of an embodiment of a computing device **100** of the computing system **10** that includes one or more computing cores **52-1** through **52**-N, a memory module **102**, the human interface module **18**, the environment sensor module **14**, and an I/O module **104**. In alternative embodiments, the human interface module **18**, the environment sensor module **14**, the I/O module **104**, and the memory module **102** may be standalone (e.g., external to the computing device). An embodiment of the computing device **100** will be discussed in greater detail with reference to FIG. **3**.

**[0043]** FIG. **3** is a schematic block diagram of another embodiment of the computing device **100** of the computing system **10** that includes the human interface module **18**, the environment sensor module **14**, the computing core **52-1**, the memory module **102**, and the I/O module **104**. The human interface module **18** includes one or more visual output devices **74** (e.g., video graphics display, 3-D viewer, touchscreen, LED, etc.), one or more visual input devices **80** (e.g., a still image camera, a video camera, a 3-D video camera, photocell, etc.), and one or more audio output devices **78** (e.g., speaker(s), headphone jack, a motor, etc.). The human interface module **18** further includes one or more user input devices **76** (e.g., keypad, keyboard, touchscreen, voice to text, a push button, a microphone, a card reader, a door position switch, a biometric input device, etc.) and one or more motion output devices **106** (e.g., servos, motors, lifts, pumps, actuators, anything to get real-world objects to move).

**[0044]** The computing core **52-1** includes a video graphics module **54**, one or more processing modules **50-1** through **50**-N, a memory controller **56**, one or more main memories **58-1** through **58**-N (e.g., RAM), one or more input/output (I/O) device interface modules **62**, an input/output (I/O) controller **60**, and a peripheral interface **64**. A processing module is as defined at the end of the detailed description.

**[0045]** The memory module **102** includes a memory interface module **70** and one or more memory devices, including flash memory devices **92**, hard drive (HD) memory **94**, solid state (SS) memory **96**, and cloud memory **98**. The cloud memory **98** includes an on-line storage system and an on-line backup system.

**[0046]** The I/O module **104** includes a network interface module **72**, a peripheral device interface module **68**, and a universal serial bus (USB) interface module **66**. Each of the I/O device interface module **62**, the peripheral interface **64**, the memory interface module **70**, the network interface module **72**, the peripheral device interface module **68**, and the USB interface modules **66** includes a combination of hardware (e.g., connectors, wiring, etc.) and operational instructions stored on memory (e.g., driver software) that are executed by one or more of the processing modules **50-1** through **50**-N and/or a processing circuit within the particular module.

**[0047]** The I/O module **104** further includes one or more wireless location modems **84** (e.g., global positioning satellite (GPS), Wi-Fi, angle of arrival, time difference of arrival, signal strength, dedicated wireless location, etc.) and one or more wireless communication modems **86** (e.g., a cellular network transceiver, a wireless data network transceiver, a Wi-Fi transceiver, a Bluetooth transceiver, a 315 MHz transceiver, a zig bee transceiver, a 60 GHz transceiver, etc.). The I/O module **104** further includes a telco interface **108** (e.g., to interface to a public switched telephone network), a wired local area network (LAN) **88** (e.g., optical, electrical), and a wired wide area network (WAN) **90** (e.g., optical, electrical). The I/O module **104** further includes one or more peripheral devices (e.g., peripheral devices **1**-P) and one or more universal serial bus (USB) devices (USB devices **1**-U). In other embodiments, the computing device **100** may include more or less devices and modules than shown in this example embodiment.

**[0048]** FIG. **4** is a schematic block diagram of an embodiment of the environment sensor module **14** of the computing system **10** that includes a sensor interface module **120** to output environment sensor information **150** based on information communicated with a set of sensors. The set of sensors includes a visual sensor **122** (e.g., to the camera, 3-D camera, 360° view camera, a camera array, an optical spectrometer, etc.) and an audio sensor **124** (e.g., a microphone, a microphone array). The set of sensors further includes a motion sensor **126** (e.g., a solid-state Gyro, a vibration detector, a laser motion detector) and a position sensor **128** (e.g., a Hall effect sensor, an image detector, a GPS receiver, a radar system).

**[0049]** The set of sensors further includes a scanning sensor **130** (e.g., CAT scan, MRI, x-ray, ultrasound, radio

scatter, particle detector, laser measure, further radar) and a temperature sensor **132** (e.g., thermometer, thermal coupler). The set of sensors further includes a humidity sensor **134** (resistance based, capacitance based) and an altitude sensor **136** (e.g., pressure based, GPS-based, laser-based).

**[0050]** The set of sensors further includes a biosensor **138** (e.g., enzyme, immuno, microbial) and a chemical sensor **140** (e.g., mass spectrometer, gas, polymer). The set of sensors further includes a magnetic sensor **142** (e.g., Hall effect, piezo electric, coil, magnetic tunnel junction) and any generic sensor **144** (e.g., including a hybrid combination of two or more of the other sensors).

**[0051]** FIG. **5**A is a schematic block diagram of another embodiment of a computing system that includes the environment model database **16**, the human interface module **18**, the instructor **26-1**, the experience creation module **30**, and the learning assets database **34** of FIG. **1**. In an example of operation, the experience creation module **30** obtains modeled environment information **40** from the environment model database **16** and renders a representation of an environment and objects of the modeled environment information **40** to output as instructor output information **160**. The human interface module **18** transforms the instructor output information **160** into human output **162** for presentation to the instructor **26-1**. For example, the human output **162** includes a 3-D visualization and stereo audio output.

**[0052]** In response to the human output **162**, the human interface module **18** receives human input **164** from the instructor **26-1**. For example, the human input **164** includes pointer movement information and human speech associated with a lesson. The human interface module **18** transforms the human input **164** into instructor input information **166**. The instructor input information **166** includes one or more of representations of instructor interactions with objects within the environment and explicit evaluation information (e.g., questions to test for comprehension level, and correct answers to the questions).

**[0053]** Having received the instructor input information **166**, the experience creation module **30** renders a representation of the instructor input information **166** within the environment utilizing the objects of the modeled environment information **40** to produce learning asset information **48** for storage in the learnings assets database **34**. Subsequent access of the learning assets information **48** facilitates a learning experience.

**[0054]** FIG. **5**B is a schematic block diagram of an embodiment of a representation of a learning experience that includes a virtual place **168** and a resulting learning objective **170**. A learning objective represents a portion of an overall learning experience, where the learning objective is associated with at least one major concept of knowledge to be imparted to a learner. The major concept may include several sub-concepts. The makeup of the learning objective is discussed in greater detail with reference to FIG. **6**.

**[0055]** The virtual place **168** includes a representation of an environment (e.g., a place) over a series of time intervals (e.g., time **0**-N). The environment includes a plurality of objects **24-1** through **24**-N. At each time reference, the positions of the objects can change in accordance with the learning experience. For example, the instructor **26-1** of FIG. **5**A interacts with the objects to convey a concept. The sum of the positions of the environment and objects within the virtual place **168** is wrapped into the learning objective **170** for storage and subsequent utilization when executing the learning experience.

**[0056]** FIG. **6** is a schematic block diagram of another embodiment of a representation of a learning experience that includes a plurality of modules **1**-N. Each module includes a set of lessons **1**-N. Each lesson includes a plurality of learning objectives **1**-N. The learning experience typically is played from left to right where learning objectives are sequentially executed in lesson **1** of module **1** followed by learning objectives of lesson **2** of module **1** etc.

**[0057]** As learners access the learning experience during execution, the ordering may be accessed in different ways to suit the needs of the unique learner based on one or more of preferences, experience, previously demonstrated comprehension levels, etc. For example, a particular learner may skip over lesson **1** of module **1** and go right to lesson **2** of module **1** when having previously demonstrated competency of the concepts associated with lesson **1**.

**[0058]** Each learning objective includes indexing information, environment information, asset information, instructor interaction information, and assessment information. The index information includes one or more of categorization information, topics list, instructor identification, author identification, identification of copyrighted materials, keywords, concept titles, prerequisites for access, and links to related learning objectives.

**[0059]** The environment information includes one or more of structure information, environment model information, background information, identifiers of places, and categories of environments. The asset information includes one or more of object identifiers, object information (e.g., modeling information), asset ownership information, asset type descriptors (e.g., 2-D, 3-D). Examples include models of physical objects, stored media such as videos, scans, images, digital representations of text, digital audio, and graphics.

**[0060]** The instructor interaction information includes representations of instructor annotations, actions, motions, gestures, expressions, eye movement information, facial expression information, speech, and speech inflections. The content associated with the instructor interaction information includes overview information, speaker notes, actions associated with assessment information, (e.g., pointing to questions, revealing answers to the questions, motioning related to posing questions) and conditional learning objective execution ordering information (e.g., if the learner does this then take this path, otherwise take another path).

**[0061]** The assessment information includes a summary of desired knowledge to impart, specific questions for a learner, correct answers to the specific questions, multiple-choice question sets, and scoring information associated with writing answers. The assessment information further includes historical interactions by other learners with the learning objective (e.g., where did previous learners look most often within the environment of the learning objective, etc.), historical responses to previous comprehension evaluations, and actions to facilitate when a learner responds with a correct or incorrect answer (e.g., motion stimulus to activate upon an incorrect answer to increase a human stress level).

**[0062]** FIG. **7**A is a schematic block diagram of another embodiment of a computing system that includes the learning assets database **34**, the experience execution module **32**, the human interface module **18**, and the learner **28-1** of FIG. **1**. In an example of operation, the experience execution

module **32** recovers learning asset information **48** from the learning assets database **34** (e.g., in accordance with a selection by the learner **28-1**). The experience execution module **32** renders a group of learning objectives associated with a common lesson within an environment utilizing objects associated with the lesson to produce learner output information **172**. The learner output information **172** includes a representation of a virtual place and objects that includes instructor interactions and learner interactions from a perspective of the learner.

**[0063]** The human interface module **18** transforms the learner output information **172** into human output **162** for conveyance of the learner output information **172** to the learner **28-1**. For example, the human interface module **18** facilitates displaying a 3-D image of the virtual environment to the learner **28-1**.

**[0064]** The human interface module **18** transforms human input **164** from the learner **28-1** to produce learner input information **174**. The learner input information **174** includes representations of learner interactions with objects within the virtual place (e.g., answering comprehension level evaluation questions).

**[0065]** The experience execution module **32** updates the representation of the virtual place by modifying the learner output information **172** based on the learner input information **174** so that the learner **28-1** enjoys representations of interactions caused by the learner within the virtual environment. The experience execution module **32** evaluates the learner input information **174** with regards to evaluation information of the learning objectives to evaluate a comprehension level by the learner **28-1** with regards to the set of learning objectives of the lesson.

**[0066]** FIG. **7**B is a schematic block diagram of another embodiment of a representation of a learning experience that includes the learning objective **170** and the virtual place **168**. In an example of operation, the learning objective **170** is recovered from the learning assets database **34** of FIG. **7**A and rendered to create the virtual place **168** representations of objects **24-1** through **24**-N in the environment from time references zero through N. For example, a first object is the instructor **26-1** of FIG. **5**A, a second object is the learner **28-1** of FIG. **7**A, and the remaining objects are associated with the learning objectives of the lesson, where the objects are manipulated in accordance with annotations of instructions provided by the instructor **26-1**.

**[0067]** The learner **28-1** experiences a unique viewpoint of the environment and gains knowledge from accessing (e.g., playing) the learning experience. The learner **28-1** further manipulates objects within the environment to support learning and assessment of comprehension of objectives of the learning experience.

**[0068]** FIGS. **8**A-**8**C are schematic block diagrams of another embodiment of a computing system illustrating an example of creating a learning experience. The computing system includes the environment model database **16**, the experience creation module **30**, and the learning assets database **34** of FIG. **1**. The experience creation module **30** includes a learning path module **180**, an asset module **182**, an instruction module **184**, and a lesson generation module **186**.

**[0069]** In an example of operation, FIG. **8**A illustrates the learning path module **180** determining a learning path (e.g., structure and ordering of learning objectives to complete towards a goal such as a certificate or degree) to include multiple modules and/or lessons. For example, the learning path module **180** obtains learning path information **194** from the learning assets database **34** and receives learning path structure information **190** and learning objective information **192** (e.g., from an instructor) to generate updated learning path information **196**.

**[0070]** The learning path structure information **190** includes attributes of the learning path and the learning objective information **192** includes a summary of desired knowledge to impart. The updated learning path information **196** is generated to include modifications to the learning path information **194** in accordance with the learning path structure information **190** in the learning objective information **192**.

**[0071]** The asset module **182** determines a collection of common assets for each lesson of the learning path. For example, the asset module **182** receives supporting asset information **198** (e.g., representation information of objects in the virtual space) and modeled asset information **200** from the environment model database **16** to produce lesson asset information **202**. The modeled asset information **200** includes representations of an environment to support the updated learning path information **196** (e.g., modeled places and modeled objects) and the lesson asset information **202** includes a representation of the environment, learning path, the objectives, and the desired knowledge to impart.

**[0072]** FIG. **8**B further illustrates the example of operation where the instruction module **184** outputs a representation of the lesson asset information **202** as instructor output information **160**. The instructor output information **160** includes a representation of the environment and the asset so far to be experienced by an instructor who is about to input interactions with the environment to impart the desired knowledge.

**[0073]** The instruction module **184** receives instructor input information **166** from the instructor in response to the instructor output information **160**. The instructor input information **166** includes interactions from the instructor to facilitate imparting of the knowledge (e.g., instructor annotations, pointer movements, highlighting, text notes, and speech) and testing of comprehension of the knowledge (e.g., valuation information such as questions and correct answers). The instruction module **184** obtains assessment information (e.g., comprehension test points, questions, correct answers to the questions) for each learning objective based on the lesson asset information **202** and produces instruction information **204** (e.g., representation of instructor interactions with objects within the virtual place, evaluation information).

**[0074]** FIG. **8**C further illustrates the example of operation where the lesson generation module **186** renders (e.g., as a multidimensional representation) the objects associated with each lesson (e.g., assets of the environment) within the environment in accordance with the instructor interactions for the instruction portion and the assessment portion of the learning experience. Each object is assigned a relative position in XYZ world space within the environment to produce the lesson rendering.

**[0075]** The lesson generation module **186** outputs the rendering as a lesson package **206** for storage in the learning assets database **34**. The lesson package **206** includes everything required to replay the lesson for a subsequent learner (e.g., representation of the environment, the objects, the interactions of the instructor during both the instruction and evaluation portions, questions to test comprehension, correct

answers to the questions, a scoring approach for evaluating comprehension, all of the learning objective information associated with each learning objective of the lesson).

**[0076]** FIG. **8**D is a logic diagram of an embodiment of a method for creating a learning experience within a computing system (e.g., the computing system **10** of FIG. **1**). In particular, a method is presented in conjunction with one or more functions and features described in conjunction with FIGS. **1**-**7**B, and also FIGS. **8**A-**8**C. The method includes step **220** where a processing module of one or more processing modules of one or more computing devices within the computing system determines updated learning path information based on learning path information, learning path structure information, and learning objective information. For example, the processing module combines a previous learning path with obtained learning path structure information in accordance with learning objective information to produce the updated learning path information (i.e., specifics for a series of learning objectives of a lesson).

**[0077]** The method continues at step **222** where the processing module determines lesson asset information based on the updated learning path information, supporting asset information, and modeled asset information. For example, the processing module combines assets of the supporting asset information (e.g., received from an instructor) with assets and a place of the modeled asset information in accordance with the updated learning path information to produce the lesson asset information. The processing module selects assets as appropriate for each learning objective (e.g., to facilitate the imparting of knowledge based on a predetermination and/or historical results).

**[0078]** The method continues at step **224** where the processing module obtains instructor input information. For example, the processing module outputs a representation of the lesson asset information as instructor output information and captures instructor input information for each lesson in response to the instructor output information. Further obtain asset information for each learning objective (e.g., extract from the instructor input information).

**[0079]** The method continues at step **226** where the processing module generates instruction information based on the instructor input information. For example, the processing module combines instructor gestures and further environment manipulations based on the assessment information to produce the instruction information.

**[0080]** The method continues at step **228** where the processing module renders, for each lesson, a multidimensional representation of environment and objects of the lesson asset information utilizing the instruction information to produce a lesson package. For example, the processing module generates the multidimensional representation of the environment that includes the objects and the instructor interactions of the instruction information to produce the lesson package. For instance, the processing module includes a 3-D rendering of a place, background objects, recorded objects, and the instructor in a relative position XYZ world space over time.

**[0081]** The method continues at step **230** where the processing module facilitates storage of the lesson package. For example, the processing module indexes the one or more lesson packages of the one or more lessons of the learning path to produce indexing information (e.g., title, author, instructor identifier, topic area, etc.). The processing module stores the indexed lesson package as learning asset information in a learning assets database.

**[0082]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0083]** FIGS. **8**E, **8**F, **8**G, **8**H, **8**J, and **8**K are schematic block diagrams of another embodiment of a computing system illustrating another example of a method to create a learning experience. The embodiment includes creating a multi-disciplined learning tool regarding a topic. The multi-disciplined aspect of the learning tool includes both disciplines of learning and any form/format of presentation of content regarding the topic. For example, a first discipline includes mechanical systems, a second discipline includes electrical systems, and a third discipline includes fluid systems when the topic includes operation of a combustion based engine. The computing system includes the environment model database **16** of FIG. **1**, the learning assets database **34** of FIG. **1**, and the experience creation module **30** of FIG. **1**.

**[0084]** FIG. **8**E illustrates the example of operation where the experience creation module **30** creates a first-pass of a first learning object **700-1** for a first piece of information regarding the topic to include a first set of knowledge bullet-points **702-1** regarding the first piece of information. The creating includes utilizing guidance from an instructor and/or reusing previous knowledge bullet-points for a related topic. For example, the experience creation module **30** extracts the bullet-points from one or more of learning path structure information **190** and learning objective information **192** when utilizing the guidance from the instructor. As another example, the experience creation module **30** extracts the bullet-points from learning path information **194** retrieved from the learning assets database **34** when utilizing previous knowledge bullet-points for the related topic.

**[0085]** Each piece of information is to impart additional knowledge related to the topic. The additional knowledge of the piece of information includes a characterization of learnable material by most learners in just a few minutes. As a specific example, the first piece of information includes "4 cycle engine intake cycles" when the topic includes "how a 4 cycle engine works."

**[0086]** Each of the knowledge bullet-points are to impart knowledge associated with the associated piece of information in a logical (e.g., sequential) and knowledge building fashion. As a specific example, the experience creation module **30** creates the first set of knowledge bullet-points **702-1** based on instructor input to include a first bullet-point "intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston" and a second bullet-point "compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder" when the first piece of information includes the "4 cycle engine intake cycles."

**[0087]** FIG. **8**F further illustrates the example of operation where the experience creation module **30** creates a first-pass of a second learning object **700-2** for a second piece of information regarding the topic to include a second set of knowledge bullet-points **702-2** regarding the second piece of information. As a specific example, the experience creation module **30** creates the second set of knowledge bullet-points **702-2** based on the instructor input to include a first bullet-point "power stroke: spark plug ignites air/fuel mixture pushing piston" and a second bullet-point "exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes" when the second piece of information includes "4 cycle engine outtake cycles."

**[0088]** FIG. **8**G further illustrates the example of operation where the experience creation module **30** obtains illustrative assets **704** based on the first and second set of knowledge bullet-points **702-1** and **702-2**. The illustrative assets **704** depicts one or more aspects regarding the topic pertaining to the first and second pieces of information. Examples of illustrative assets includes background environments, objects within the environment (e.g., things, tools), where the objects and the environment are represented by multi-dimensional models (e.g., 3-D model) utilizing a variety of representation formats including video, scans, images, text, audio, graphics etc.

**[0089]** The obtaining of the illustrative assets **704** includes a variety of approaches. A first approach includes interpreting instructor input information to identify the illustrative asset. For example, the experience creation module **30** interprets instructor input information to identify a cylinder asset.

**[0090]** A second approach includes identifying a first object of the first and second set of knowledge bullet-points as an illustrative asset. For example, the experience creation module **30** identifies the piston object from both the first and second set of knowledge bullet-points.

**[0091]** A third approach includes determining the illustrative assets **704** based on the first object of the first and second set of knowledge bullet-points. For example, the experience creation module **30** accesses the environment model database **16** to extract information about an asset from one or more of supporting asset information **198** and modeled asset information **200** for a sparkplug when interpreting the first and second set of knowledge bullet-points.

**[0092]** FIG. **8**H further illustrates the example of operation where the experience creation module **30** creates a second-pass of the first learning object **700-1** to further include first descriptive assets **706-1** regarding the first piece of information based on the first set of knowledge bullet-points **702-1** and the illustrative assets **704**. Descriptive assets include instruction information that utilizes the illustrative asset **704** to impart knowledge and subsequently test for knowledge retention. The embodiments of the descriptive assets includes multiple disciplines and multiple dimensions to provide improved learning by utilizing multiple senses of a learner. Examples of the instruction information includes annotations, actions, motions, gestures, expressions, recorded speech, speech inflection information, review information, speaker notes, and assessment information.

**[0093]** The creating the second-pass of the first learning object **700-1** includes generating a representation of the illustrative assets **704** based on a first knowledge bullet-point of the first set of knowledge bullet-points **702-1**. For example, the experience creation module **30** renders 3-D frames of a 3-D model of the cylinder, the piston, the spark plug, the intake valve, and the exhaust valve in motion when performing the intake stroke where the intake valve opens and the air/fuel mixture is pulled into the cylinder by the piston.

**[0094]** The creating of the second-pass of the first learning object **700-1** further includes generating the first descriptive assets **706-1** utilizing the representation of the illustrative assets **704**. For example, the experience creation module **30** renders 3-D frames of the 3-D models of the various engine parts without necessarily illustrating the first set of knowledge bullet-points **702-1**.

**[0095]** In an embodiment where the experience creation module **30** generates the representation of the illustrative assets **704**, the experience creation module **30** outputs the representation of the illustrative asset **704** as instructor output information **160** to an instructor. For example, the 3-D model of the cylinder and associated parts.

**[0096]** The experience creation module **30** receives instructor input information **166** in response to the instructor output information **160**. For example, the instructor input information **166** includes instructor annotations to help explain the intake stroke (e.g., instructor speech, instructor pointer motions). The experience creation module **30** interprets the instructor input information **166** to produce the first descriptive assets **706-1**. For example, the renderings of the engine parts include the intake stroke as annotated by the instructor.

**[0097]** FIG. **8**J further illustrates the example of operation where the experience creation module **30** creates a second-pass of the second learning object **700-2** to further include second descriptive assets **706-2** regarding the second piece of information based on the second set of knowledge bullet-points **702-2** and the illustrative assets **704**. For example, the experience creation module **30** creates 3-D renderings of the power stroke and the exhaust stroke as annotated by the instructor based on further instructor input information **166**.

**[0098]** FIG. **8**K further illustrates the example of operation where the experience creation module **30** links the second-passes of the first and second learning objects **700-1** and **700-2** together to form at least a portion of the multi-disciplined learning tool. For example, the experience creation module **30** aggregates the first learning object **700-1** and the second learning object **700-2** to produce a lesson package **206** for storage in the learning assets database **34**.

**[0099]** In an embodiment, the linking of the second-passes of the first and second learning objects **700-1** and **700-2** together to form the at least the portion of the multi-disciplined learning tool includes generating index information for the second-passes of first and second learning objects to indicate sharing of the illustrative asset **704**. For example, the experience creation module **30** generates the index information to identify the first learning object **700-1** and the second learning object **700-2** as related to the same topic.

**[0100]** The linking further includes facilitating storage of the index information and the first and second learning objects **700-1** and **700-2** in the learning assets database **34** to enable subsequent utilization of the multi-disciplined learning tool. For example, the experience creation module **30** aggregates the first learning object **700-1**, the second learning object **700-2**, and the index information to produce the lesson package **206** for storage in the learning assets database **34**.

**[0101]** The method described above with reference to FIGS. **8**E-**8**K in conjunction with the experience creation module **30** can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices including various embodiments of the computing entity **20** of FIG. **2**A. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing entities of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0102]** FIG. **9**A is a schematic block diagram of a data structure for a smart contract **300** that includes object information **302** and license terms **304**. The object information **302** includes object basics (e.g., including links to blockchains and electronic assets), available license terms, and available patent terms. FIG. **9**A illustrates examples of each category of the object information **302**. Examples of an object of the object information **302** that are associated with training and education offerings include a university course, an education curriculum, an education degree, a training program, a training session, a lesson, a lesson package, and a learning object. Examples of the object of the object information **302** that are associated with a student include a person, a group of students, a class, people that work for a common employer, etc.

**[0103]** The license terms **304** includes licensee information, agreed license terms, and agreed payment terms. FIG. **9**A further illustrates examples of each of the categories of the license terms **304**.

**[0104]** FIGS. **9**B and **9**C are schematic block diagrams of organization of object distributed ledgers. FIG. **9**B illustrates an example where a single blockchain serves as the object distributed ledger linking a series of blocks of the blockchain, where each block is associated with a different license (e.g., use of training) for a training object associated with a non-fungible token. FIG. **9**C illustrates another example where a first blockchain links a series of blocks of different non-fungible tokens for different sets of training object licenses. Each block forms a blockchain of its own where each further block of its own is associated with a different license for the set of training objects of the non-fungible token.

**[0105]** FIG. **9**D is a schematic block diagram of an embodiment of content blockchain of an object distributed ledger, where the content includes the smart contract as previously discussed. The content blockchain includes a plurality of blocks **2**-**4**. Each block includes a header section and a transaction section. The header section includes one or more of a nonce, a hash of a preceding block of the blockchain, where the preceding block was under control of a preceding device (e.g., a broker computing device, a user computing device, a blockchain node computing device, etc.) in a chain of control of the blockchain, and a hash of a current block (e.g., a current transaction section), where the current block is under control of a current device in the chain of control of the blockchain.

**[0106]** The transaction section includes one or more of a public key of the current device, a signature of the preceding device, smart contract content, change of control from the preceding device to the current device, and content information from the previous block as received by the previous device plus content added by the previous device when transferring the current block to the current device.

**[0107]** FIG. **9**D further includes devices **2**-**3** to facilitate illustration of generation of the blockchain. Each device includes a hash function, a signature function, and storage for a public/private key pair generated by the device.

**[0108]** An example of operation of the generating of the blockchain, when the device **2** has control of the blockchain and is passing control of the blockchain to the device **3** (e.g., the device **3** is transacting a transfer of content from device **2**), the device **2** obtains the device **3** public key from device **3**, performs a hash function **2** over the device **3** public key and the transaction **2** to produce a hashing resultant (e.g., preceding transaction to device **2**) and performs a signature function **2** over the hashing resultant utilizing a device **2** private key to produce a device **2** signature.

**[0109]** Having produced the device **2** signature, the device **2** generates the transaction **3** to include the device **3** public key, the device **2** signature, device **3** content request to **2** information, and the previous content plus content from device **2**. The device **3** content request to device **2** information includes one or more of a detailed content request, a query request, background content, and specific instructions from device **3** to device **2** for access to a patent license. The previous content plus content from device **2** includes one or more of content from an original source, content from any subsequent source after the original source, an identifier of a source of content, a serial number of the content, an expiration date of the content, content utilization rules, and results of previous blockchain validations.

**[0110]** Having produced the transaction **3** section of the block **3** a processing module (e.g., of the device **2**, of the device **3**, of a transaction mining server, of another server), generates the header section by performing a hashing function over the transaction section **3** to produce a transaction **3** hash, performing the hashing function over the preceding block (e.g., block **2**) to produce a block **2** hash. The performing of the hashing function may include generating a nonce such that when performing the hashing function to include the nonce of the header section, a desired characteristic of the resulting hash is achieved (e.g., a desired number of preceding zeros is produced in the resulting hash).

**[0111]** Having produced the block **3**, the device **2** sends the block **3** to the device **3**, where the device **3** initiates control of the blockchain. Having received the block **3**, the device **3** validates the received block **3**. The validating includes one or more of verifying the device **2** signature over the preceding transaction section (e.g., transaction **2**) and the device **3** public key utilizing the device **2** public key (e.g., a re-created signature function result compares favorably to device **2** signature) and verifying that an extracted device **3** public key of the transaction **3** compares favorably to the device **3** public key held by the device **3**. The device **3** considers the received block **3** validated when the verifications are favorable (e.g., the authenticity of the associated content is trusted).

**[0112]** FIGS. **10**A, **10**B, and **10**C are schematic block diagrams of an embodiment of a computing system illustrating an example of generating a virtual reality environment. The computing system includes the human interface

module **18** of FIG. **1**, the experience creation module **30** of FIG. **1**, the learning assets database **34** FIG. **1**, and the environment model database **16** of FIG. **1**.

**[0113]** FIG. **10**A illustrates an example method of operation of the generating the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations. At least some of the object representations are associated with corresponding three dimensional (3-D) physical objects. The interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations. A first set of object representations of the group of object representations is associated with a first piece of information regarding the topic. A second set of object representations of the group of object representations is associated with a second piece of information regarding the topic,

**[0114]** A first step of the example method of operation includes the experience creation module **30** obtaining the first and second pieces of information for the topic. The obtaining includes creating first and second sets of knowledge bullet-points of a plurality of learning objects for the topic. A first learning object of the plurality of learning objects includes a first set of knowledge bullet-points for a first piece of information regarding the topic. A second learning object of the plurality of learning objects includes a second set of knowledge bullet-points for a second piece of information regarding the topic. For example, the experience creation module **30** receives instructor input information **166**, through an appropriate user interface, from the human interface module **18** in response to human input **164** from an instructor when the topic is how a four stroke internal combustion engine operates. The experience creation module **30** interprets instructor input information **166** to generate the first set of knowledge bullet-points **702-1** to include "intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston; compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder."

**[0115]** The experience creation module **30** interprets further instructor input information **166** to generate the second set of knowledge bullet-points **702-2**. For example, the experience creation module **30** generates the second set of knowledge bullet-points to include "power stroke: sparkplug ignites air/fuel mixture pushing piston; exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes".

**[0116]** A second step of the example method of operation includes the experience creation module **30** identifying a set of common illustrative assets as illustrative assets **704** based on the first and second set of object representations. The set of common illustrative assets belongs to the first and second sets of object representations and depict one or more aspects regarding the topic pertaining to the first and second pieces of information.

**[0117]** The identifying the set of common illustrative assets includes a variety of approaches. A first approach includes interpreting instructor input information to identify the common illustrative assets. For example, the experience creation module **30** interprets instructor input information **166** to extract the common illustrative assets.

**[0118]** A second approach includes identifying a common object representation of the first and second sets of object representations as the set of common illustrative assets. For example, the experience creation module **30** determines that the piston asset is common to both the first and second sets of object representations. As another example, the experience creation module **30** interprets the first and second set of knowledge bullet-points to identify common objects to produce the illustrative asset **704**. For instance, the experience creation module **30** generates the illustrative asset **704** to include cylinder, piston, sparkplug, intake valve, exhaust valve.

**[0119]** A third step of the example method of operation includes the experience creation module **30** obtaining object representations for the topic by determining a preliminary set of lesson assets **705** based on the first and second learning objects so far and modeled asset information **200**. The preliminary set of lesson assets includes a first descriptive asset associated with the first set of knowledge bullet-points and a second descriptive asset associated with the second set of knowledge bullet-points. The first learning object further includes a first descriptive asset regarding the first piece of information based on the first set of knowledge bullet-points and illustrative assets **704**. The second learning object further includes a second descriptive asset regarding the second piece of information based on the second set of knowledge bullet-points and the common illustrative assets.

**[0120]** For example, the experience creation module **30** determines the preliminary set of lesson asset **705** to include instructions for each of the four strokes (e.g., part of the bullet-points). The preliminary set of lesson asset **705** further includes engine depiction assets for each of the four strokes that utilize the common illustrative assets **704** and utilize models of the internal combustion engine from the modeled asset information **200**.

**[0121]** Alternatively, or in addition to, the experience creation module **30** produces the object representations via a series of sub-steps. A first sub-step includes the experience creation module outputting a representation of a set of common illustrative assets as instructor output information. For example, descriptions of the cylinder, the piston, the spark plug, the intake valve, and the exhaust valve.

**[0122]** A second sub-step includes receiving instructor input information **166** in response to the instructor output information. For example, the instructor input information **166** includes guidance with regards to how the common illustrative assets operate together to produce the four strokes of the engine.

**[0123]** A third sub-step includes interpreting the instructor input information **166** to produce at least some of the group of object representations as the preliminary set of lesson assets **705**. For example, the experience creation module **30** generates the preliminary set of lesson assets **705** to include instruction information for each of the four strokes utilizing the common illustrative assets.

**[0124]** Further alternatively, or further in addition to, the experience creation module **30** produces the group of object representations via a series of operations. A first operation includes the experience creation module **30** interpreting the first set of knowledge bullet points of the topic to produce the first piece of information regarding the topic. For example, the experience creation module **30** interprets the intake and compression strokes bullet points to produce the first piece of information with regards to preparing the cylinder for firing.

**[0125]** A second operation includes the experience creation module **30** obtaining the first set of object represen-

tations based on the first piece of information regarding the topic. For example, the experience creation module **30** identifies the first set of object representations from modeled asset information **200** from the environment model database **16** based on the first piece of information for preparing the cylinder for firing.

**[0126]** A third operation includes the experience creation module **30** interpreting the second set of knowledge bullet points of the topic to produce the second piece of information regarding the topic. For example, the experience creation module **30** interprets the power and exhaust strokes bullet points to produce the second piece of information with regards to firing the cylinder.

**[0127]** A fourth operation includes the experience creation module **30** obtaining the second set of object representations based on the second piece of information regarding the topic. For example, the experience creation module **30** identifies the second set of object representations from the modeled asset information **200** based on the second piece of information for firing the cylinder.

**[0128]** FIG. **10**B further illustrates the example method of operation for generating the virtual reality environment where a fourth step includes the experience creation module **30** determining a priority asset **707** of the set of common illustrative assets. The priority asset is associated with an importance status level that is greater than an importance status threshold level with regards to the topic. The priority assets are associated with a focus of the lesson package of the virtual reality environment and are considered to be of higher importance than other assets. For example, the experience creation module **30** identifies the piston object as the priority asset when the piston is included in each of the bullet-points.

**[0129]** The determining the priority asset of the set of common illustrative assets includes a series of sub-steps. A first sub-step includes determining a first importance status level of a first common illustrative asset of the set of common illustrative assets for example, the experience creation module **30** interprets modeled asset information **200** with regards to the piston object to reveal the first importance status level of the piston object.

**[0130]** A second sub-step includes comparing the first importance status level to the importance status threshold level with regards to the topic. For example, the experience creation module **30** interprets the modeled asset information **200** with regards to the topic to reveal the importance status threshold level with regards to the engine operation topic. The experience creation module **30** compares the importance status level of the piston to the importance status level threshold with regards to the engine topic.

**[0131]** A third sub-step includes establishing the first common illustrative asset as the priority asset when the first importance status level is greater than the importance status threshold level with regards to the topic. For example, the experience creation module **30** establishes the piston asset as the priority asset when the importance status level of the piston is greater than the importance status threshold level.

**[0132]** Having established the priority asset, a fifth step of the example method of operation of generating the virtual reality environment includes the experience creation module **30** rendering the priority asset utilizing a first level of resolution to produce a set of priority asset video frames. The first level resolution includes a higher than others resolution level to produce an improved representation of the priority piston object to promote improved information retention. For example, the experience creation module **30** renders the priority piston object with a higher resolution level than others to produce the set of priority asset video frames with regards to the piston.

**[0133]** The fifth step of the example method of operation further includes the experience creation module **30** selecting a subset of the set of priority asset video frames to produce a common portion of video frames for the virtual reality environment with regards to the first and second sets of object representations to reduce duplicative rendering. For example, the experience creation module **30** selects certain frames of the priority asset video frames that are expected to be utilized to represent both the first and second pieces of information such that re-rendering of those frames is unnecessary to abate unnecessary utilization of processing power of the experience creation module **30**.

**[0134]** The selecting the subset of the set of priority asset video frames to produce the common portion of video frames for the virtual reality environment with regards to the first and second sets of object representations includes a series of sub-steps. A first sub-step includes the experience creation module **30** identifying a first priority asset video frame of the set of priority asset video frames that represents a first aspect of the first set of object representations. For example, the experience creation module **30** identifies a frame of the piston within the cylinder of the first set of object representations.

**[0135]** A second sub-step includes the experience creation module **30** identifying a second priority asset video frame of the set of priority asset video frames that represents a second aspect of the second set of object representations. For example, the experience creation module **30** identifies another piston frame once again within the cylinder of the second set of object representations.

**[0136]** A third sub-step includes the experience creation module **30** establishing the common portion of video frames to include the first priority asset video frame when more than a minimum threshold number of pixels of the first and second priority asset video frames are the same. For example, the experience creation module compares pixels of the frame of the piston with pixels of the other piston frame and establishes the common portion of the video frames to include the frame of the piston when more than the minimum threshold number of pixels of the comparison of the same.

**[0137]** The fifth step of the example method of operation further includes the experience creation module **30** rendering another representation of the first set of object representations utilizing a second level of resolution to produce a first remaining portion of the video frames for the virtual reality environment with regards to the first set of object representations. The second level of resolution is a lower video resolution level than the first level of resolution. The lower resolution level is suitable for less important aspects of the virtual reality environment with regards to information retention. Utilizing a lower resolution can help to save processing power in both the creation of the video frames and the subsequent displaying of the video frames. The remaining portion of the video frames with regards to the first set of object representations is associated with further aspects that are not covered by the priority asset video frames. For, the experience creation module **30** renders the other representation of the first set of object representations

utilizing the second level resolution to produce the first remaining portion of video frames associated with the spark plug, the valves opening and closing, and the piston moving through the cylinder during the preparation to fire of the intake and compression strokes.

**[0138]** The fifth step of the example method of operation further includes the experience creation module **30** rendering another representation of the second set of object representations utilizing the second level of resolution to produce a second remaining portion of the video frames for the virtual reality environment with regards to the second set of object representations. For example, the experience creation module **30** renders the other representation of the second set of object representations utilizing the second-level resolution to produce the second remaining portion of video frames with regards to the spark plug firing, the valves opening and closing, and the piston moving through the cylinder during the firing and exhaust strokes.

**[0139]** FIG. **10**C further illustrates the example method of operation of the generating the virtual reality environment, where, having produced video frames for the virtual reality environment, a sixth step includes the experience creation module **30** linking the common portion, the first remaining portion, and the second remaining portion of the video frames to produce the virtual reality environment. For example, the experience creation module **30** creates a set of lesson assets **711** from the video frames and the preliminary set of lesson assets. For instance, the experience creation module **30** combines the preliminary set of lesson assets with the video frames of the common portion, the first remaining portion, and the second remaining portion to produce the set of lesson asset **711** as the virtual reality environment. Alternatively, or in addition to, the experience creation module **30** combines the preliminary set of lesson assets with the video frames to produce a lesson package **206** for storage in the learning assets database **34**.

**[0140]** Having generated the set of lesson assets **711**, a seventh step of the example method of operation to generate the virtual reality environment includes the experience creation module **30** outputting the set of lesson asset **711** as a lesson package **206** for interactive consumption. For example, the experience creation module **30** utilizes the high-resolution video frames and the low resolution video frames for the objects to generate the lesson asset video frames **713**. Having generated the lesson asset video frames **713**, the experience creation module **30** outputs learner output information **172** to the human interface module **18**, where the learner output information **172** includes the lesson asset video frames **713**. The human interface module **18** outputs human output **162** to a student to interactively consume the lesson package.

**[0141]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0142]** FIGS. **11**A, **11**B, and **11**C are schematic block diagrams of an embodiment of a computing system illustrating an example of generating multiple resolutions of a virtual reality environment. The computing system includes the human interface module **18** of FIG. **1**, the experience creation module **30** of FIG. **1**, the experience execution module **32** of FIG. **1** (e.g., of FIG. **11**C), the learning assets database **34** FIG. **1**, and the environment model database **16** of FIG. **1**.

**[0143]** FIG. **11**A illustrates an example method of operation of the generating of the multiple resolutions of the virtual reality environment where a first step includes the experience creation module **30** generating the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations. At least some of the object representations are associated with corresponding three dimensional (3-D) physical objects. The interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations. A first set of object representations of the group of object representations is associated with a first piece of information regarding a topic. A second set of object representations of the group of object representations is associated with a second piece of information regarding the topic.

**[0144]** A first step of the example method of operation includes the experience creation module **30** obtaining the first and second pieces of information for the topic. The obtaining includes creating first and second sets of knowledge bullet-points of a plurality of learning objects for the topic. A first learning object of the plurality of learning objects includes a first set of knowledge bullet-points for a first piece of information regarding the topic. A second learning object of the plurality of learning objects includes a second set of knowledge bullet-points for a second piece of information regarding the topic. For example, the experience creation module **30** receives instructor input information **166**, through an appropriate user interface, from the human interface module **18** in response to human input **164** from an instructor when the topic is how a four stroke internal combustion engine operates. The experience creation module **30** interprets instructor input information **166** to generate the first set of knowledge bullet-points **702-1** to include "intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston; compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder."

**[0145]** The experience creation module **30** interprets further instructor input information **166** to generate the second set of knowledge bullet-points **702-2**. For example, the experience creation module **30** generates the second set of knowledge bullet-points to include "power stroke: sparkplug ignites air/fuel mixture pushing piston; exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes".

**[0146]** A second step of the example method of operation includes the experience creation module **30** obtaining object representations for the topic by determining a preliminary set of lesson assets **705** based on the first and second learning objects so far and modeled asset information **200**. The preliminary set of lesson assets includes a first descriptive asset associated with the first set of knowledge bullet-

points and a second descriptive asset associated with the second set of knowledge bullet-points. The first learning object further includes a first descriptive asset regarding the first piece of information based on the first set of knowledge bullet-points and illustrative assets **704**. The second learning object further includes a second descriptive asset regarding the second piece of information based on the second set of knowledge bullet-points and the common illustrative assets.

**[0147]** For example, the experience creation module **30** determines the preliminary set of lesson asset **705** to include instructions for each of the four strokes (e.g., part of the bullet-points). The preliminary set of lesson asset **705** further includes engine depiction assets for each of the four strokes that utilize the common illustrative assets **704** and utilize models of the internal combustion engine from the modeled asset information **200**.

**[0148]** Alternatively, or in addition to, the experience creation module **30** produces the object representations via a series of sub-steps. A first sub-step includes the experience creation module outputting a representation of a set of common illustrative assets as instructor output information. For example, descriptions of the cylinder, the piston, the spark plug, the intake valve, and the exhaust valve.

**[0149]** A second sub-step includes receiving instructor input information **166** in response to the instructor output information. For example, the instructor input information **166** includes guidance with regards to how the common illustrative assets operate together to produce the four strokes of the engine.

**[0150]** A third sub-step includes interpreting the instructor input information **166** to produce at least some of the group of object representations as the preliminary set of lesson assets **705**. For example, the experience creation module **30** generates the preliminary set of lesson assets **705** to include instruction information for each of the four strokes utilizing the common illustrative assets.

**[0151]** Further alternatively, or further in addition to, the experience creation module **30** produces the group of object representations via a series of operations. A first operation includes the experience creation module **30** interpreting the first set of knowledge bullet points of the topic to produce the first piece of information regarding the topic. For example, the experience creation module **30** interprets the intake and compression strokes bullet points to produce the first piece of information with regards to preparing the cylinder for firing.

**[0152]** A second operation includes the experience creation module **30** obtaining the first set of object representations based on the first piece of information regarding the topic. For example, the experience creation module **30** identifies the first set of object representations from modeled asset information **200** from the environment model database **16** based on the first piece of information for preparing the cylinder for firing.

**[0153]** A third operation includes the experience creation module **30** interpreting the second set of knowledge bullet points of the topic to produce the second piece of information regarding the topic. For example, the experience creation module **30** interprets the power and exhaust strokes bullet points to produce the second piece of information with regards to firing the cylinder.

**[0154]** A fourth operation includes the experience creation module **30** obtaining the second set of object representations based on the second piece of information regarding the topic. For example, the experience creation module **30** identifies the second set of object representations from the modeled asset information **200** based on the second piece of information for firing the cylinder.

**[0155]** Having obtained the object representations for the topic, a third step of the example method of operation includes the experience creation module **30** identifying a set of common illustrative assets as illustrative assets **704** based on the first and second set of object representations. The set of common illustrative assets belongs to the first and second sets of object representations and depict one or more aspects regarding the topic pertaining to the first and second pieces of information.

**[0156]** The identifying the set of common illustrative assets includes a variety of approaches. A first approach includes interpreting instructor input information to identify the common illustrative assets. For example, the experience creation module **30** interprets instructor input information **166** to extract the common illustrative assets.

**[0157]** A second approach includes identifying a common object representation of the first and second sets of object representations as the set of common illustrative assets. For example, the experience creation module **30** determines that the piston asset is common to both the first and second sets of object representations. As another example, the experience creation module **30** interprets the first and second set of knowledge bullet-points to identify common objects to produce the illustrative asset **704**. For instance, the experience creation module **30** generates the illustrative asset **704** to include cylinder, piston, sparkplug, intake valve, exhaust valve.

**[0158]** FIG. **11**B further illustrates the example method of operation of the generating of the multiple resolutions of the virtual reality environment, where, having produced the set of common illustrative assets, a fourth step includes the experience creation module **30** producing the first level resolution video frames for the virtual reality environment. The producing of the first level of resolution of the virtual reality environment includes a series of operations. A first operation includes rendering the set of common illustrative assets utilizing a first level of resolution to produce a set of common illustrative assets video frames. For example, the experience creation module **30** renders, utilizing the first level of resolution, object representations for the cylinder, the piston, the valves, and the spark plug to produce a preliminary set of asset video frames **709**.

**[0159]** A second operation includes selecting a subset of the set of common illustrative assets video frames to produce a common portion of video frames for the virtual reality environment with regards to the first and second sets of object representations to reduce duplicative rendering. The selecting the subset of the set of common illustrative assets video frames to produce the common portion of video frames for the virtual reality environment with regards to the first and second sets of object representations includes a series of sub-steps. A first sub-step includes identifying a first priority asset video frame of the set of common illustrative assets video frames that represents a first aspect of the first set of object representations. For instance, a frame of the piston. A second sub-step includes identifying a second priority asset video frame of the set of priority asset video frames that represents a second aspect of the second set of object representations. For instance, another frame of the piston. A third sub-step includes establishing the common

portion of video frames to include the first priority asset video frame when more than a minimum threshold number of pixels of the first and second priority asset video frames are the same. For instance, the first priority asset video frame is established when it is substantially the same as the second priority asset video frame.

**[0160]** A third operation of the producing of the first level of resolution of the virtual reality environment includes rendering another representation of the first set of object representations utilizing the first level of resolution to produce a first remaining portion of the video frames for the virtual reality environment with regards to the first set of object representations. For example, the experience creation module **30** renders another portion of the first set of object representations that was not included in the set of common illustrative assets.

**[0161]** A fourth operation includes rendering another representation of the second set of object representations utilizing the first level of resolution to produce a second remaining portion of the video frames for the virtual reality environment with regards to the second set of object representations. For example, the experience creation module **30** renders another portion of the second set of object representations that was not included in the set of common illustrative assets.

**[0162]** Having produced the first level resolution video frames, a fifth step of the example method of operation includes linking the common portion, the first remaining portion, and the second remaining portion of the video frames to produce a first level of resolution of the virtual reality environment. For example, the experience creation module aggregates in order the common portion of video frames, the first remaining portion of video frames, and the second remaining portion of the video frames to produce the first level of resolution of the virtual reality environment.

**[0163]** As another example, the experience creation module **30** creates a set of lesson assets **711** from the video frames and the preliminary set of lesson assets. For instance, the experience creation module **30** combines the preliminary set of lesson assets with the video frames of the common portion, the first remaining portion, and the second remaining portion to produce the set of lesson asset **711** as the virtual reality environment. Alternatively, or in addition to, the experience creation module **30** combines the preliminary set of lesson assets with the video frames to produce a lesson package **206** for storage in the learning assets database **34**.

**[0164]** Having produced the first level of resolution of the virtual reality environment, the experience creation module **30** outputs a representation of the first level of resolution of the virtual reality environment to at least one of a learning asset database and a human interface module. For example, the experience creation module **30** outputs the lesson package **206** to the learning assets database **34** for storage where the lesson package **206** includes the first level resolution of the virtual reality environment. As another example, the experience creation module **30** outputs learner output information **170** to via the human interface module **18** as human output **162** for interactive consumption, where the learner output information **172** includes the first level resolution of the virtual reality environment.

**[0165]** FIG. **11**C further illustrates the example method of operation of the generating of the multiple resolutions of the virtual reality environment, where, having produced, linked, and output the first resolution video frames, a sixth step of the example method of operation includes generating a second level of resolution of the virtual reality environment based on a priority asset **707** of the set of common illustrative assets. The second level of resolution is a higher video resolution level than the first level of resolution.

**[0166]** The sixth step includes determining the priority asset of the set of common illustrative assets. The determining the priority asset includes a series of sub-steps. A first sub-step includes determining a first importance status level of a first common illustrative asset of the set of common illustrative assets for example, the experience creation module **30** interprets modeled asset information **200** with regards to the piston object to reveal the first importance status level of the piston object.

**[0167]** A second sub-step includes comparing the first importance status level to the importance status threshold level with regards to the topic. For example, the experience creation module **30** interprets the modeled asset information **200** with regards to the topic to reveal the importance status threshold level with regards to the engine operation topic. The experience creation module **30** compares the importance status level of the piston to the importance status level threshold with regards to the engine topic.

**[0168]** A third sub-step includes establishing the first common illustrative asset as the priority asset when the first importance status level is greater than the importance status threshold level with regards to the topic. For example, the experience creation module **30** establishes the piston asset as the priority asset when the importance status level of the piston is greater than the importance status threshold level.

**[0169]** The sixth step of the example method of operation further includes the experience creation module **30** generating the second level of resolution of the virtual reality environment based on the priority asset of the set of common illustrative assets by a series of sub-steps. A first sub-step includes determining the priority asset **707** of the set of common illustrative assets as discussed above. The priority asset is associated with the importance status level that is greater than the importance status threshold level with regards to the topic.

**[0170]** A second sub-step includes rendering the priority asset utilizing the second level of resolution to produce a set of priority asset video frames **715**. For example, the experience creation module **30** renders the object representation of the piston to produce the set of priority asset video frames that realize the higher second level of resolution.

**[0171]** A third sub-step includes selecting a subset of the set of priority asset video frames to produce an updated common portion of video frames for the virtual reality environment with regards to the first and second sets of object representations. For example, the experience execution module **32** selects video frames of the piston that are associated with improved learning when the higher resolution is utilized. For instance, when the fuel explodes in the cylinder above the piston during the power stroke to push the piston into the cylinder is an important aspect of the operation of the piston and the enhanced high-resolution of the second resolution level can help facilitate improved learning.

**[0172]** The sixth step of the example method of operation further includes the experience execution module **32** linking the updated common portion, the first remaining portion, and the second remaining portion of the video frames to produce the second level of resolution of the virtual reality

environment. For example, the experience execution module **32** aggregates all the video frames to produce lesson asset video frames **713** as part of the lesson package **206**.

**[0173]** Having produced the second level of resolution of the virtual reality environment, the experience execution module **32** outputs a representation of the second level of resolution of the virtual reality environment to at least one of the learning asset database and the human interface module. For example, the experience execution module **32** stores the lesson package **206** and the learning assets database **34**, where the lesson package **206** includes the second level of resolution of the virtual reality environment. As another example, the experience execution module **32** outputs learner output information **170** to via the human interface module **18** as human output **162** for interactive consumption, where the learner output information **172** includes the second level of resolution of the virtual reality environment.

**[0174]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0175]** FIGS. **12**A, **12**B, and **12**C are schematic block diagrams of an embodiment of a computing system illustrating an example of updating a virtual reality environment. The computing system includes the human interface module **18** of FIG. **1**, the experience creation module **30** of FIG. **1**, the learning assets database **34** FIG. **1**, and the environment model database **16** of FIG. **1**.

**[0176]** FIG. **12**A illustrates an example method of operation of the updating a virtual reality environment includes the experience creation module **30** generating the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations. At least some of the object representations are associated with corresponding three dimensional (3-D) physical objects. The interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations. A first set of object representations of the group of object representations is associated with a first piece of information regarding a topic. A second set of object representations of the group of object representations is associated with a second piece of information regarding the topic.

**[0177]** A first step of the example method of operation includes the experience creation module **30** obtaining the first and second pieces of information for the topic. The obtaining includes creating first and second sets of knowledge bullet-points of a plurality of learning objects for the topic. A first learning object of the plurality of learning objects includes a first set of knowledge bullet-points for a first piece of information regarding the topic. A second learning object of the plurality of learning objects includes a second set of knowledge bullet-points for a second piece of information regarding the topic. For example, the experience creation module **30** receives instructor input information **166** as previously discussed with reference to FIG. **11**A, through an appropriate user interface, from the human interface module **18** in response to human input **164** from an instructor when the topic is how a four stroke internal combustion engine operates. The experience creation module **30** interprets instructor input information **166** to generate the first set of knowledge bullet-points **702-1** to include "intake stroke: intake valve opens, air/fuel mixture pulled into cylinder by piston; compression stroke: intake valve closes, piston compresses air/fuel mixture in cylinder."

**[0178]** The experience creation module **30** interprets further instructor input information **166** to generate the second set of knowledge bullet-points **702-2**. For example, the experience creation module **30** generates the second set of knowledge bullet-points to include "power stroke: sparkplug ignites air/fuel mixture pushing piston; exhaust stroke: exhaust valve opens and piston pushes exhaust out of cylinder, exhaust valve closes".

**[0179]** A second step of the example method of operation includes the experience creation module **30** obtaining object representations for the topic by determining a set of lesson assets **711** based on the first and second learning objects. The set of lesson assets includes a first descriptive asset associated with the first set of knowledge bullet-points and a second descriptive asset associated with the second set of knowledge bullet-points. The first learning object further includes a first descriptive asset regarding the first piece of information based on the first set of knowledge bullet-points. The second learning object further includes a second descriptive asset regarding the second piece of information based on the second set of knowledge bullet-points.

**[0180]** For example, the experience creation module **30** determines the set of lesson asset **711** to include instructions for each of the four strokes (e.g., part of the bullet-points). The set of lesson asset **711** further includes engine depiction assets for each of the four strokes and that utilize models of the internal combustion engine.

**[0181]** Alternatively, or in addition to, the experience creation module **30** produces the group of object representations via a series of operations. A first operation includes the experience creation module **30** interpreting the first set of knowledge bullet points of the topic to produce the first piece of information regarding the topic. For example, the experience creation module **30** interprets the intake and compression strokes bullet points to produce the first piece of information with regards to preparing the cylinder for firing.

**[0182]** A second operation includes the experience creation module **30** obtaining the first set of object representations based on the first piece of information regarding the topic. For example, the experience creation module **30** identifies the first set of object representations from modeled asset information from the environment model database **16** based on the first piece of information for preparing the cylinder for firing.

**[0183]** A third operation includes the experience creation module **30** interpreting the second set of knowledge bullet points of the topic to produce the second piece of information regarding the topic. For example, the experience cre-

ation module **30** interprets the power and exhaust strokes bullet points to produce the second piece of information with regards to firing the cylinder.

**[0184]** A fourth operation includes the experience creation module **30** obtaining the second set of object representations based on the second piece of information regarding the topic. For example, the experience creation module **30** identifies the second set of object representations from the modeled asset information based on the second piece of information for firing the cylinder.

**[0185]** Having obtained the object representations for the topic, a third step of the example method of operation includes obtaining a first conveyance effectiveness level for a first portrayal of the first set of object representations within the virtual reality environment with regards to the first piece of information. The obtaining the first conveyance effectiveness level for the first portrayal of the first set of object representations within the virtual reality environment with regards to the first piece of information includes a series of sub-steps.

**[0186]** A first sub-step includes interpreting learner input information with regards to perceptions of effectiveness for the first portrayal of the first set of object representations within the virtual reality environment to produce student population feedback. For example, an effectiveness evaluation module **728** of the experience creation module **30** interprets learner input information **174** from the human interface module **18** to produce student population feedback. The human interface module **18** receives human input **164** that includes the student population feedback. The feedback includes student perceptions of effectiveness of the lesson package (e.g., overall, for portions).

**[0187]** Having produced the student population feedback, the effectiveness evaluation module **728** generates effectiveness information **730-1** through **730-4** for each of the four strokes of the four stroke engine lesson package based on the student population feedback. For example, the effectiveness evaluation module **728** produces the effectiveness information **730-1** for the intake stroke, where most students indicated that the instruction information and representative video frames effectively conveyed the operation of the engine during the intake stroke. As another example, the effectiveness evaluation module **728** produces the effectiveness information **730-3** for the power stroke, where most students indicated that the instruction information and representative video frames did not effectively convey the operation of the engine during the power stroke.

**[0188]** A second sub-step of obtaining the first conveyance effectiveness level includes interpreting environment sensor information with regards to further perceptions of the effectiveness for the first portrayal of the first set of object representations within the virtual reality environment to produce general population feedback. For example, the effectiveness evaluation module **728** receives environment sensor information **38** from the environment sensor module **14**, where the environment sensor information **38** includes general population feedback with regards to effectiveness. In a similar fashion, the effectiveness evaluation module **728** evaluates the environment sensor information **38** to produce the effectiveness information **730-1** through **730-4**.

**[0189]** A third sub-step of obtaining the first conveyance effectiveness level includes evaluating at least one of the student population feedback and the general population feedback to produce the first conveyance effectiveness level for the first portrayal of the first set of object representations. For example, the effectiveness evaluation module **728** utilizes the student population feedback when available. As another example, the effectiveness evaluation module **728** utilizes the general population feedback when it is available. As yet another example, the effectiveness evaluation module **728** utilizes both the student population feedback and the general population feedback when they are both available.

**[0190]** FIG. **12**B further illustrates the example method of operation for the updating of the virtual reality environment where, when the first conveyance effectiveness level is less than a minimum conveyance effectiveness threshold level, a fourth step includes the experience creation module **30** determining an updated first set of object representations based on the first set of object representations and the first conveyance effectiveness level. The determining the updated first set of object representations based on the first set of object representations and the first conveyance effectiveness level includes a series of sub-steps. A first sub-step includes identifying a deficiency associated with the first conveyance effectiveness level. For example, an effectiveness enhancement module **732** of the experience creation module **30** identifies the examples from the feedback, as recovered history associated with lesson package **206** from the learning assets database **34**, such when the students indicated that the instruction information and representative video frames did not effectively convey the operation of the engine during the power stroke.

**[0191]** A second sub-step includes modifying the first set of object representations to address the deficiency to produce the updated first set of object representations. For example, the effectiveness enhancement module **732** utilizes modeled asset information **200** from the environment model database **16** to produce the updated first set of object to use second level frames for the piston associated with the second through fourth strokes based on the effectiveness information **730-1** through **730-4**. For instance, the effectiveness enhancement module **732** produces no changes for the first stroke to produce enhancement information **734-1** and replaces object representations for video frames for the piston in the second through fourth strokes with the second level frames of the piston to produce enhancement information **734-2** through **734-4** (e.g., more detailed pistons and an explosion representation for the power stroke).

**[0192]** Having produced the updated first set of object representations, a fifth step of the example method of operation includes rendering a representation of the updated first set of object representations to produce a first portion of video frames for a second portrayal of the first set of object representations for the virtual reality environment. Having produced the first portion of video frames for the second portrayal of the first set of object representations, the effectiveness enhancement module **732** renders a representation of the second set of object representations to produce the second portion of video frames for the second portrayal of the second set of object representations for the virtual reality environment. For example, the effectiveness enhancement module **732** renders the updated first set of object representations to produce the first portion of video frames for the second portrayal of the first set of object representations to include the enhancement information **734-1** through **734-2**, that includes enhance piston video frames, and renders the representation of the second set of object representations to produce the second portion of video frames to include

enhancement information **734-3** through **734-4**, that includes a video frame of the explosion during the power stroke.

**[0193]** FIG. **12**C further illustrates the example method of operation where a sixth step includes the experience creation module **30** linking the first portion of the video frames with a second portion of video frames for a second portrayal of the second set of object representations for the virtual reality environment to produce the virtual reality environment. For example, the experience creation module **30** uses the video frames from the enhanced information **734-1** through **734-4** to replace corresponding frames of the first portrayal to produce lesson asset video frames **713** as the second portrayal.

**[0194]** Having produced the lesson asset video frames **713**, the experience creation module **30** integrates the lesson asset video frames **713** with the lesson package **206** to produce the updated lesson package **206** for storage in the learning assets database **34**. Alternatively, the experience creation module **30** outputs a representation of the virtual reality environment to at least one of the learning assets database **34** and the human interface module **18** associated with another student to experience interactive consumption with an improved conveyance effectiveness level.

**[0195]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0196]** FIGS. **13**A and **13**B are schematic block diagrams of an embodiment of a computing system illustrating an example of accessing a virtual reality environment. The computing system includes the experience execution module **32** of FIG. **1**, the learning assets database **34** FIG. **1**, and the human interface module **18** of FIG. **1**.

**[0197]** FIG. **13**A illustrates an example method of operation of the accessing the virtual reality environment that includes generating the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations. At least some of the object representations are associated with corresponding three dimensional (3-D) physical objects. The interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations. A first set of object representations of the group of object representations is associated with a first piece of information regarding a topic. A second set of object representations of the group of object representations is associated with a second piece of information regarding the topic.

**[0198]** The generating the virtual reality environment includes determining the group of object representations utilizing a series of sub-steps. A first sub-step includes the experience execution module **32** interpreting a first set of knowledge bullet points of the topic to produce the first piece of information regarding the topic. For example, the experience execution module **32** interprets a lesson package **206** recovered from the learning assets database with regards to a lesson timeline **740** to identify the first set of knowledge bullet points that are associated with a bulldozer.

**[0199]** A second sub-step includes the experience execution module **32** obtaining the first set of object representations based on the first piece of information regarding the topic. For example, the experience execution module **32** further interprets the lesson package **206** to extract object representations for various aspects of the bulldozer.

**[0200]** A third sub-step includes the experience execution module **32** interpreting a second set of knowledge bullet points of the topic to produce the second piece of information regarding the topic. For example, the experience execution module **32** further interprets the lesson package **206** to identify the second set of knowledge bullet points that are associated with a truck.

**[0201]** A fourth sub-step includes the experience execution module **32** obtaining the second set of object representations based on the second piece of information regarding the topic. For example, the experience execution module **32** further interprets the lesson package **206** to extract object representations for various aspects of the truck.

**[0202]** In an embodiment, the interpreting of the lesson package **206** further includes identifying priority assets for the lesson timeline **740**. For example, the experience execution module **32** interprets the lesson package **206** to identify priority assets based on one or more of a predetermination, a user input, a major asset identification algorithm output, and an impact level metric. For example, the experience execution module **32** identifies the bulldozer, the truck, and a bridge as the set of priority assets of the lesson package when each are associated with indicators of high-priority.

**[0203]** Having identified the priority assets, the experience execution module **32** identifies lesson time frames for the set of priority assets. For example, the experience execution module **32** interprets video frames of the lesson package **206** to identify time codes associated with a portion of the lesson package associated with a first representation of each of the priority assets. For example, the experience execution module **34** identifies a timecode of 0:10.0 associated with a first portrayal of the bulldozer, a timecode of 01:25.4 associated with a first portrayal of the truck, and a timecode of 3:03.1 associated with the first portrayal of the bridge.

**[0204]** Having determined the lesson time frames, a second step of the example method of operation to access the virtual reality environment includes rendering a representation of the first set of object representations and the second set of object representations to produce first portrayal 3-D video frames of the first piece of information for the virtual reality environment. The first portrayal 3-D video frames include a second cue associated with the second set of object representations.

**[0205]** The rendering the representation of the first set of object representations and the second set of object representations to produce the first portrayal 3-D video frames of the first piece of information for the virtual reality environment includes a series of sub-steps. A first sub-step includes the experience execution module **32** rendering the representation of the first set of object representations to produce first object 3-D video frames. For example, the experience

execution module **32** renders the representation of the bulldozer to produce the first object 3-D video frames.

**[0206]** A second sub-step includes the experience execution module **32** rendering the representation of the second set of object representations to produce second object 3-D video frames. For example, the experience execution module **32** renders the representation of the truck to produce the second object 3-D video frames.

**[0207]** A third sub-step includes the experience execution module **32** overlaying a representation of a portion of the second object 3-D video frames over the first object 3-D video frames to produce the first portrayal 3-D video frames of the first piece of information. The overlaying the representation of the portion of the second object 3-D video frames over the first object 3-D video frames to produce the first portrayal 3-D video frames of the first piece of information includes a series of further steps. A first further step includes the experience execution module **32** generating the representation of the portion of the second object 3-D video frames to produce the second cue associated with the second set of object representations. The second cue includes one or more of an icon, a priority asset icon, a scaled image capture, a highlighted object, a flashing object, a color shifted object, text, a time reference, a video loop, an outline, a shadow image, a stick figure, an avatar, and a video scroll bar. For example, the expense execution module **32** produces a small icon of the truck (e.g., as compared to size of images of the bulldozer) as the second cue.

**[0208]** A second further step includes the experience execution module **32** integrating the second cue with the first object 3-D video frames to produce the first portrayal 3-D video frames of the first piece of information. For example, the experience execution module **32** generates the first portrayal 3D video frames to include the bulldozer and the small icon of the truck to serve as the second cue to enable subsequent selection of the virtual reality environment associated with the truck.

**[0209]** Having generated the first portrayal 3-D video frames, the experience execution module **32** updates the lesson package **206** to include at least one representation of the first portrayal 3-D video frames to produce lesson asset video frames **713**. For example, the experience execution module **32** generates the lesson asset video frames **713** to include small icons of the truck and bridge to be portrayed during a portion of the lesson package associated with the bulldozer. As another example, the experience execution module **32** generates the video scrollbar at to include time relative icons of the bulldozer in the bridge for another portion of the lesson package associated with the truck. As yet another example, the experience execution module **32** generates the lesson asset video frames **713** to include a blinking icon of the truck and a shadowed icon of the bulldozer for yet another portion of the lesson package associated with the bridge.

**[0210]** Having updated the lesson package **206**, the experience execution module outputs learner output information **172** to the human interface module **18** where the learner output information **172** includes the lesson asset video frames **713**. The human interface module **18** outputs human output **162** to a student, where the human output **162** includes the lesson asset video frames **713** such that the student can select one of the priority assets to facilitate immediately moving to the portion of the lesson package associated with that selected priority asset.

**[0211]** Having generated the first portrayal 3-D video frames, a third step of the example method operation to access the virtual reality environment includes determining whether the second piece of information has been selected based on the second cue. The determining whether the second piece of information has been selected based on the second cue includes series of sub-steps. A first sub-step includes the experience execution module **32** interpreting learner input information **174** with regards to portrayal of the second cue within the virtual reality environment to produce student feedback. For example, the human interface module **18** receives human input **164** from the student to select the second cue and the human interface module **18** outputs the learner input information **174** to the experience execution module **32** to indicate the selection of the second cue.

**[0212]** A second sub-step includes indicating that the second piece of information has been selected when the student feedback includes an activation of the second cue. For example, the experience execution module **32** indicates that the second piece of information has been selected when the selection of the second cue has been activated by the student.

**[0213]** FIG. **13**B further illustrates the example method of operation for the accessing the virtual reality environment where, when the second piece of information has been selected, a fourth step includes rendering another representation of the second set of object representations and the first set of object representations to produce second portrayal 3-D video frames of the second piece of information for the virtual reality environment. The second portrayal 3-D video frames include a first cue associated with the first set of object representations. For example, the experience execution module **32** renders the object representations associated with the truck for the second piece of information along with the object representations associated with the bulldozer to produce a first cue such that the student can subsequently redirect the lesson timeline **740** and resulting lesson asset video frames **713** back to the first piece of information associated with the bulldozer.

**[0214]** Having produced lesson asset video frames **713**, a fifth step of the example method of operation includes outputting the second portrayal 3-D video frames. For example, the outputting includes the experience execution module **32** outputting a representation of the virtual reality environment to at least one of the learning asset database **34** (e.g., as an updated lesson package **206**) and the human interface module **18** as further learner output information **172** representing the lesson asset video frames **713**.

**[0215]** In an embodiment, the selection of the priority asset and cues includes one or more of a user input selection, where a majority of students jump to now, where this particular student should jump to that is best for them based on one or more of their learning history and capability level. For example, while outputting lesson asset video frames **713** to the student via the human interface module **18** (e.g., outputting the learner output information **172** for representation by the human interface module **18** as human output **162**) the portion of the lesson package associated with the bulldozer, the experience execution module **32** determines to jump to the portion associated with the truck based on interpreting learner input information **174** from the human interface module **18**, where the student provided human

input **164** to the human interface module **18** indicating that they need to learn more about the truck.

**[0216]** Alternatively, or in addition to, the experience execution module **32** changes the cue after jumping. For example, changing from small icons along the video scroll-bar to flashing icons dropped onto a primary portion of the rendering, or any other possible representation of objects of a topic based on a cue.

**[0217]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0218]** FIGS. **14**A, **14**B, and **14**C are schematic block diagrams of an embodiment of a computing system illustrating an example of updating an asset within a virtual reality environment. The computing system includes the experience execution module **32** of FIG. **1**, the learning assets database **34** of FIG. **1**, and the human interface module **18** of FIG. **1**. The experience execution module **32** includes an instance experience module **290** and a learning assessment module **330**.

**[0219]** FIG. **14**A illustrates an example method of operation of the updating of the asset within a virtual reality environment where a first step includes the experience execution module **32** generating the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations. At least some of the object representations are associated with corresponding three dimensional (3-D) physical objects. The interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations. A first set of object representations of the group of object representations is associated with a first piece of information regarding the topic, wherein a second set of object representations of the group of object representations is associated with a second piece of information regarding the topic.

**[0220]** The generating the virtual reality environment includes the instance experience module **290** rendering an assessment asset for the first set of object representations to produce first portrayal 3-D video frames for the first piece of information within the virtual reality environment. A subset of the first portrayal 3-D video frames include a representation of the assessment asset. For example, the instance experience module **290** renders the assessment asset to produce assessment asset video frames **800**.

**[0221]** The rendering of the assessment asset includes the instance experience module **290** selecting an object representation of the first set of object representations to produce the assessment asset based on one or more of a test question, a previous response to the test question, an experience level, a requirement for a certification level, a performance level, and a learning acceptability level. For example, the instance experience module **290** selects the scoop of a bulldozer as the assessment asset (e.g., along with text to ask a question: what is the scoop?) When learning asset information **48** of a lesson package **206** from the learning assets database **34** indicates that the scoop is associated with a test question and the learning acceptability level of a student associated with the human interface module **18** indicates that the test question is appropriate.

**[0222]** Having selected the scoop as the assessment asset, the instance experience module **290** renders a representation of the scoop along with the first set of object representations associated with the bulldozer to produce the first portrayal 3-D video frames when the first piece of information is associated with how the scoop is associated with the bulldozer.

**[0223]** Having generated the virtual reality environment, a second step of the example method of operation includes the experience execution module **32** outputting a representation of the virtual reality environment to at least one of the learning asset database **34** (e.g., as an updated lesson package **206**) and the human interface module **18** as learner output information **172** from assessment asset video frames **800**.

**[0224]** FIG. **14**B further illustrates the example method of operation of the updating of the asset within the virtual reality environment where a third step includes the experience execution module **32** obtaining a first conveyance effectiveness level with regards to the first piece of information based on the first portrayal 3-D video frames within the virtual reality environment. The obtaining the first conveyance effectiveness level with regards to the first piece of information based on the first portrayal 3-D video frames within the virtual reality environment includes a series of sub-steps.

**[0225]** A first sub-step includes interpreting learner input information with regards to perceptions of effectiveness for the first portrayal 3-D video frames within the virtual reality environment to produce an assessment response **802**. For example, the learning assessment module **330** extracts an assessment response **802** from learner input information **174** from the human interface module **18**. The human interface module **18** receives human input **164** that includes the student answer to a question with regards to the scoop. For instance, the student selects the door object incorrectly instead of the scoop.

**[0226]** A second sub-step of the obtaining of the first conveyance effectiveness level includes evaluating the assessment response **802** to produce the first conveyance effectiveness level. For example, the learning assessment module **330** compares the door answer to a stored correct answer associated with the test question for the scoop to identify the answer as incorrect. Having identified the answer is incorrect, the learning assessment module **330** establishes the first conveyance effectiveness level at a level below a minimum conveyance effectiveness threshold level.

**[0227]** As another example, the learning assessment module **330** interprets the assessment response **802** to identify a second answer that includes the actual scoop of the bulldozer as a desired performance aspect (e.g., the scoop as the correct answer). When identifying a correct answer, the learning assessment module **330** establishes the first conveyance effectiveness level at a level above the minimum conveyance effectiveness threshold level.

**[0228]** FIG. **14**C further illustrates the example method of operation to update the assessment asset within the virtual reality environment where, when the first conveyance effectiveness level is less than a minimum conveyance effectiveness threshold level, a fourth step of the example method of operation includes the experience execution module **32** rendering an updated first set of object representations based on the first set of object representations and the first conveyance effectiveness level to produce updated first portrayal 3-D video frames. The updated first portrayal 3-D video frames are for the first piece of information within the virtual reality environment (e.g., the scoop of the bulldozer).

**[0229]** The rendering the updated first set of object representations based on the first set of object representations and the first conveyance effectiveness level to produce updated the first portrayal 3-D video frames for the first piece of information within the virtual reality environment includes a series of sub-steps. A first sub-step includes identifying a deficiency associated with the first conveyance effectiveness level. For example, the learning assessment module **330** identifies the incorrect answer with regards to identifying the scoop of the bulldozer as the deficiency.

**[0230]** A second sub-step includes modifying the first set of object representations to address the deficiency to produce the updated first set of object representations. For example, the learning assessment module **330** modifies the representation of the scoop (e.g., increasing its size relative to the rest of the bulldozer, making it flash, changing its color, providing a highlight, or any other mechanism to draw attention to the scoop as the scoop). In an instance, the modifying of the representation of the scoop is to make clear what portion of the bulldozer is the scoop and not the door.

**[0231]** The learning assessment module **330** generates updated learning objects **812** from the modified representation of the scoop and the rest of the objects of the first set of object representations (e.g., of the bulldozer).

**[0232]** Having produced the updated first set of object representations, the learning assessment module **330** provides a rendering within the virtual reality environment as learner output **172** to the human interface module **18**. In an embodiment, the learning assessment module **330** provides an update to the lesson package **206** for storage in the learning assets database **34**, where the updating includes the updated learning objects **812** and renderings of the virtual reality environment.

**[0233]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0234]** FIGS. **15**A and **15**B are schematic block diagrams of an embodiment of a computing system illustrating an example of generating of a process illustration within a virtual reality environment. The computing system includes the experience execution module **32** of FIG. **1**, the learning assets database **34** of FIG. **1**, and the human interface module **18** of FIG. **1**. The experience execution module **32** includes the instance experience module **290** of FIG. **14**A. The process illustration pertains to a process. The process includes one or more of a series of steps, a method, a procedure of any type, assembly instructions, disassembly instructions, a diagnostic procedure etc. For example, the virtual reality environment is generated to portray a procedure to service a bulldozer.

**[0235]** FIG. **15**A illustrates the example method of operation of the generating of the process illustration within the virtual reality environment. The experience execution module **32** generates the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations. At least some of the object representations are associated with corresponding three dimensional (3-D) physical objects. The interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations. A first set of object representations of the group of object representations is associated with a first piece of information regarding the topic. A second set of object representations of the group of object representations is associated with a second piece of information regarding the topic.

**[0236]** A first step of the example method of operation includes the experience execution module **32** generating the virtual reality environment by identifying the 3-D physical objects corresponding to the group of object representations. The identifying the 3-D physical objects corresponding to the group of object representations includes a variety of approaches. A first approach includes interpreting a set of 3-D models associated with a physical system to identify the 3-D physical objects. For example, the instance experience module **290** interprets a set of 3-D models associated with a bulldozer object to identify the 3-D physical objects to include a scoop object and a tractor object. A second approach includes interpreting a multistep procedure associated with the physical system to identify the 3-D physical objects. For example, the instance experience module **290** interprets a multistep procedure associated with servicing the bulldozer to identify the scoop and tractor 3-D physical objects.

**[0237]** The identifying further includes interpreting a stored model. For example, the instance experience module **290** interprets learning asset information **48** of a lesson package **206** retrieved from the learning assets database **34** to produce the identified 3-D physical objects.

**[0238]** The identifying further includes interpreting text associated with the process to be represented in the virtual reality environment. The text includes verbiage and/or interpretations of images to produce text associated with the process (e.g., such as textual instructions). For example, the instance experience module **290** interprets the first piece of information **820-1** and the second piece of information a **20-2** to identify the 3-D physical objects. For instance, the instance experience module **290** identifies a bulldozer, a scoop, and a tractor as the 3-D physical objects that are common to the first and second pieces of information.

**[0239]** Having identified the 3-D physical objects, a second step of the example method of operation includes the experience execution module **32** obtaining the group of object representations for the 3-D physical objects. The

obtaining the group of object representations for the 3-D physical objects includes a series of sub-steps. A first sub-step includes interpreting a first set of knowledge bullet points associated with the multistep procedure to produce the first piece of information regarding the topic. For example, the instance experience module **290** interprets a first bullet point of "to service a bulldozer, the scoop is decoupled from the tractor" to produce the first piece of information **820-1**.

**[0240]** A second sub-step includes obtaining the first set of object representations for the set of 3-D models based on the first piece of information regarding the topic. For example, the instance experience module **290** obtains the first set of object representations for the set of 3-D models of the scoop and tractor based on the first piece of information regarding the topic.

**[0241]** A third sub-step includes interpreting a second set of knowledge bullet points associated with the multistep procedure to produce the second piece of information regarding the topic. For example, the instance experience module **290** interprets a second bullet point of "the scoop is recoupled to the tractor to reinstate a serviced bulldozer" to produce the second piece of information **820-2**.

**[0242]** A fourth sub-step includes obtaining the second set of object representations for the set of 3-D models based on the second piece of information regarding the topic. For example, the instance experience module **290** obtains the second set of object representations for the set of 3-D models of the scoop and tractor based on the second piece of information regarding the topic.

**[0243]** The obtaining further includes extracting a 3-D model from a record associated with each 3-D physical object. For instance, the instance experience module **290** extracts 3-D models for the scoop, the tractor, and the bulldozer from the learning assets information **48** to produce object models **822**.

**[0244]** The obtaining further includes generating the 3-D model. For instance, the instance experience module **290** generates the 3D model for the scoop based on data associated with the scoop (e.g., further interpreted from the learning asset information **48**, extracted from a query response from another computing entity). The data includes physical aspects of the scoop, limitations on movement of the scoop, and interaction information with regards to other associated objects (e.g., the tractor and in particular how the scoop and the tractor couple).

**[0245]** FIG. **15**B further illustrates the example method of operation of the generating of the process illustration within the virtual reality environment where a third step includes the experience execution module **32** interpreting the first piece of information and the second piece of information to produce the interaction information. The interpreting includes a series of sub-steps. A first sub-step includes identifying a set of steps of the multistep procedure based on the first piece of information and the second piece of information. For example, the instance experience module **290** interprets the first piece of information **820-1** to extract the term "decoupled" as a process step and further interprets the second piece of information **820-2** to extract the term "recoupled" as another process step.

**[0246]** A second sub-step includes interpreting the set of steps in accordance with 3-D models of the at least some of the object representations to produce the position information of the at least some of the object representations as the interaction information of the at least some of the object representations. For example, the instance experience module **290** maps the decoupled step to interaction between the scoop and the tractor where the two objects are separated. As another example, the instance experience module **290** maps the recoupled step to further interaction between the scoop and the tractor where the two objects are brought back together.

**[0247]** Having produced the interaction information, a fourth step of the example method of operation to generate the process illustration within the virtual reality environment includes the experience execution module **32** rendering the group of object representations in accordance with the interaction information to produce 3-D video frames **824** portraying the first piece of information and the second piece of information within the virtual reality environment. The rendering the group of object representations includes a series of sub-steps.

**[0248]** A first sub-step includes the instance experience module **290** rendering the representation of the first set of object representations to produce first object 3-D video frames. A second sub-step includes the instance experience module **290** rendering the representation of the second set of object representations to produce second object 3-D video frames. A third sub-step includes the instance experience module **290** overlaying a representation of a portion of the second object 3-D video frames over the first object 3-D video frames to produce the 3-D video frames portraying the first piece of information and the second piece of information.

**[0249]** For example, the instance experience module **290** renders the object models for the scoop and the tractor for the decoupling interaction to produce the first portion of the 3-D video frames **824** associated with the scoop being detached from the tractor to enable servicing of the tractor.

**[0250]** As another example, the instance experience module **290** renders the object models for the decoupled scoop and decoupled tractor for the re-coupling interaction to produce a second portion of the 3-D video frames **824** associated with the scoop and the tractor being reattached subsequent to the surfacing of the tractor to reinstate the serviced bulldozer.

**[0251]** Alternatively, or in addition to, having produced the 3-D video frames **824**, the instance experience module **290** outputs the 3-D video frames **824** as learner output information **172** to the human interface module **18**. The human interface module **18** outputs human output **162** (e.g., frames for display) based on the learner output information **172**.

**[0252]** The method described above in conjunction with the processing module can alternatively be performed by other modules of the computing system **10** of FIG. **1** or by other devices. In addition, at least one memory section (e.g., a computer readable memory, a non-transitory computer readable storage medium, a non-transitory computer readable memory organized into a first memory element, a second memory element, a third memory element, a fourth element section, a fifth memory element, a sixth memory element, etc.) that stores operational instructions can, when executed by one or more processing modules of the one or more computing devices of the computing system **10**, cause the one or more computing devices to perform any or all of the method steps described above.

**[0253]** It is noted that terminologies as may be used herein such as bit stream, stream, signal sequence, etc. (or their equivalents) have been used interchangeably to describe digital information whose content corresponds to any of a number of desired types (e.g., data, video, speech, text, graphics, audio, etc. any of which may generally be referred to as 'data').

**[0254]** As may be used herein, the terms "substantially" and "approximately" provides an industry-accepted tolerance for its corresponding term and/or relativity between items. For some industries, an industry-accepted tolerance is less than one percent and, for other industries, the industry-accepted tolerance is 10 percent or more. Other examples of industry-accepted tolerance range from less than one percent to fifty percent. Industry-accepted tolerances correspond to, but are not limited to, component values, integrated circuit process variations, temperature variations, rise and fall times, thermal noise, dimensions, signaling errors, dropped packets, temperatures, pressures, material compositions, and/or performance metrics. Within an industry, tolerance variances of accepted tolerances may be more or less than a percentage level (e.g., dimension tolerance of less than +/−1%). Some relativity between items may range from a difference of less than a percentage level to a few percent. Other relativity between items may range from a difference of a few percent to magnitude of differences.

**[0255]** As may also be used herein, the term(s) "configured to", "operably coupled to", "coupled to", and/or "coupling" includes direct coupling between items and/or indirect coupling between items via an intervening item (e.g., an item includes, but is not limited to, a component, an element, a circuit, and/or a module) where, for an example of indirect coupling, the intervening item does not modify the information of a signal but may adjust its current level, voltage level, and/or power level. As may further be used herein, inferred coupling (i.e., where one element is coupled to another element by inference) includes direct and indirect coupling between two items in the same manner as "coupled to".

**[0256]** As may even further be used herein, the term "configured to", "operable to", "coupled to", or "operably coupled to" indicates that an item includes one or more of power connections, input(s), output(s), etc., to perform, when activated, one or more its corresponding functions and may further include inferred coupling to one or more other items. As may still further be used herein, the term "associated with", includes direct and/or indirect coupling of separate items and/or one item being embedded within another item.

**[0257]** As may be used herein, the term "compares favorably", indicates that a comparison between two or more items, signals, etc., provides a desired relationship. For example, when the desired relationship is that signal **1** has a greater magnitude than signal **2**, a favorable comparison may be achieved when the magnitude of signal **1** is greater than that of signal **2** or when the magnitude of signal **2** is less than that of signal **1**. As may be used herein, the term "compares unfavorably", indicates that a comparison between two or more items, signals, etc., fails to provide the desired relationship.

**[0258]** As may be used herein, one or more claims may include, in a specific form of this generic form, the phrase "at least one of a, b, and c" or of this generic form "at least one of a, b, or c", with more or less elements than "a", "b", and "c". In either phrasing, the phrases are to be interpreted identically. In particular, "at least one of a, b, and c" is equivalent to "at least one of a, b, or c" and shall mean a, b, and/or c. As an example, it means: "a" only, "b" only, "c" only, "a" and "b", "a" and "c", "b" and "c", and/or "a", "b", and "c".

**[0259]** As may also be used herein, the terms "processing module", "processing circuit", "processor", "processing circuitry", and/or "processing unit" may be a single processing device or a plurality of processing devices. Such a processing device may be a microprocessor, micro-controller, digital signal processor, microcomputer, central processing unit, field programmable gate array, programmable logic device, state machine, logic circuitry, analog circuitry, digital circuitry, and/or any device that manipulates signals (analog and/or digital) based on hard coding of the circuitry and/or operational instructions. The processing module, module, processing circuit, processing circuitry, and/or processing unit may be, or further include, memory and/or an integrated memory element, which may be a single memory device, a plurality of memory devices, and/or embedded circuitry of another processing module, module, processing circuit, processing circuitry, and/or processing unit. Such a memory device may be a read-only memory, random access memory, volatile memory, non-volatile memory, static memory, dynamic memory, flash memory, cache memory, and/or any device that stores digital information. Note that if the processing module, module, processing circuit, processing circuitry, and/or processing unit includes more than one processing device, the processing devices may be centrally located (e.g., directly coupled together via a wired and/or wireless bus structure) or may be distributedly located (e.g., cloud computing via indirect coupling via a local area network and/or a wide area network). Further note that if the processing module, module, processing circuit, processing circuitry and/or processing unit implements one or more of its functions via a state machine, analog circuitry, digital circuitry, and/or logic circuitry, the memory and/or memory element storing the corresponding operational instructions may be embedded within, or external to, the circuitry comprising the state machine, analog circuitry, digital circuitry, and/or logic circuitry. Still further note that, the memory element may store, and the processing module, module, processing circuit, processing circuitry and/or processing unit executes, hard coded and/or operational instructions corresponding to at least some of the steps and/or functions illustrated in one or more of the Figures. Such a memory device or memory element can be included in an article of manufacture.

**[0260]** One or more embodiments have been described above with the aid of method steps illustrating the performance of specified functions and relationships thereof. The boundaries and sequence of these functional building blocks and method steps have been arbitrarily defined herein for convenience of description. Alternate boundaries and sequences can be defined so long as the specified functions and relationships are appropriately performed. Any such alternate boundaries or sequences are thus within the scope and spirit of the claims. Further, the boundaries of these functional building blocks have been arbitrarily defined for convenience of description. Alternate boundaries could be defined as long as the certain significant functions are appropriately performed. Similarly, flow diagram blocks

may also have been arbitrarily defined herein to illustrate certain significant functionality.

**[0261]** To the extent used, the flow diagram block boundaries and sequence could have been defined otherwise and still perform the certain significant functionality. Such alternate definitions of both functional building blocks and flow diagram blocks and sequences are thus within the scope and spirit of the claims. One of average skill in the art will also recognize that the functional building blocks, and other illustrative blocks, modules and components herein, can be implemented as illustrated or by discrete components, application specific integrated circuits, processors executing appropriate software and the like or any combination thereof.

**[0262]** In addition, a flow diagram may include a "start" and/or "continue" indication. The "start" and "continue" indications reflect that the steps presented can optionally be incorporated in or otherwise used in conjunction with one or more other routines. In addition, a flow diagram may include an "end" and/or "continue" indication. The "end" and/or "continue" indications reflect that the steps presented can end as described and shown or optionally be incorporated in or otherwise used in conjunction with one or more other routines. In this context, "start" indicates the beginning of the first step presented and may be preceded by other activities not specifically shown. Further, the "continue" indication reflects that the steps presented may be performed multiple times and/or may be succeeded by other activities not specifically shown. Further, while a flow diagram indicates a particular ordering of steps, other orderings are likewise possible provided that the principles of causality are maintained.

**[0263]** The one or more embodiments are used herein to illustrate one or more aspects, one or more features, one or more concepts, and/or one or more examples. A physical embodiment of an apparatus, an article of manufacture, a machine, and/or of a process may include one or more of the aspects, features, concepts, examples, etc. described with reference to one or more of the embodiments discussed herein. Further, from figure to figure, the embodiments may incorporate the same or similarly named functions, steps, modules, etc. that may use the same or different reference numbers and, as such, the functions, steps, modules, etc. may be the same or similar functions, steps, modules, etc. or different ones.

**[0264]** Unless specifically stated to the contra, signals to, from, and/or between elements in a figure of any of the figures presented herein may be analog or digital, continuous time or discrete time, and single-ended or differential. For instance, if a signal path is shown as a single-ended path, it also represents a differential signal path. Similarly, if a signal path is shown as a differential path, it also represents a single-ended signal path. While one or more particular architectures are described herein, other architectures can likewise be implemented that use one or more data buses not expressly shown, direct connectivity between elements, and/or indirect coupling between other elements as recognized by one of average skill in the art.

**[0265]** The term "module" is used in the description of one or more of the embodiments. A module implements one or more functions via a device such as a processor or other processing device or other hardware that may include or operate in association with a memory that stores operational instructions. A module may operate independently and/or in conjunction with software and/or firmware. As also used herein, a module may contain one or more sub-modules, each of which may be one or more modules.

**[0266]** As may further be used herein, a computer readable memory includes one or more memory elements. A memory element may be a separate memory device, multiple memory devices, or a set of memory locations within a memory device. Such a memory device may be a read-only memory, random access memory, volatile memory, non-volatile memory, static memory, dynamic memory, flash memory, cache memory, a quantum register or other quantum memory and/or any other device that stores data in a non-transitory manner. Furthermore, the memory device may be in a form of a solid-state memory, a hard drive memory or other disk storage, cloud memory, thumb drive, server memory, computing device memory, and/or other non-transitory medium for storing data. The storage of data includes temporary storage (i.e., data is lost when power is removed from the memory element) and/or persistent storage (i.e., data is retained when power is removed from the memory element). As used herein, a transitory medium shall mean one or more of: (a) a wired or wireless medium for the transportation of data as a signal from one computing device to another computing device for temporary storage or persistent storage; (b) a wired or wireless medium for the transportation of data as a signal within a computing device from one element of the computing device to another element of the computing device for temporary storage or persistent storage; (c) a wired or wireless medium for the transportation of data as a signal from one computing device to another computing device for processing the data by the other computing device; and (d) a wired or wireless medium for the transportation of data as a signal within a computing device from one element of the computing device to another element of the computing device for processing the data by the other element of the computing device. As may be used herein, a non-transitory computer readable memory is substantially equivalent to a computer readable memory. A non-transitory computer readable memory can also be referred to as a non-transitory computer readable storage medium.

**[0267]** While particular combinations of various functions and features of the one or more embodiments have been expressly described herein, other combinations of these features and functions are likewise possible. The present disclosure is not limited by the particular examples.

What is claimed is:

**1**. A method for producing a virtual reality environment regarding a topic, the method comprises:

generating, by a computing entity, the virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations, wherein at least some of the object representations are associated with corresponding three dimensional (3-D) physical objects, wherein the interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations, wherein a first set of object representations of the group of object representations is associated with a first piece of information regarding the topic, wherein a second set of object representations of the group of object representations is associated with a second piece of

information regarding the topic, wherein the generating the virtual reality environment includes:

obtaining, by the computing entity, the group of object representations for the 3-D physical objects;

interpreting, by the computing entity, the first piece of information and the second piece of information to produce the interaction information; and

rendering, by the computing entity, the group of object representations in accordance with the interaction information to produce 3-D video frames portraying the first piece of information and the second piece of information within the virtual reality environment.

**2**. The method of claim **1** further comprises:

outputting, by the computing entity, a representation of the virtual reality environment to at least one of a learning asset database and a human interface module.

**3**. The method of claim **1** further comprises one or more of:

interpreting a set of 3-D models associated with a physical system to identify the 3-D physical objects; and

interpreting a multistep procedure associated with the physical system to identify the 3-D physical objects.

**4**. The method of claim **3**, wherein the obtaining the group of object representations for the 3-D physical objects comprises:

interpreting a first set of knowledge bullet points associated with the multistep procedure to produce the first piece of information regarding the topic;

obtaining the first set of object representations for the set of 3-D models based on the first piece of information regarding the topic;

interpreting a second set of knowledge bullet points associated with the multistep procedure to produce the second piece of information regarding the topic; and

obtaining the second set of object representations for the set of 3-D models based on the second piece of information regarding the topic.

**5**. The method of claim **1**, wherein the interpreting the first piece of information and the second piece of information to produce the interaction information comprises one or more of:

identifying a set of steps of a multistep procedure based on the first piece of information and the second piece of information; and

interpreting the set of steps in accordance with 3-D models of the at least some of the object representations to produce the position information of the at least some of the object representations as the interaction information of the at least some of the object representations.

**6**. The method of claim **1**, wherein the rendering the group of object representations in accordance with the interaction information to produce the 3-D video frames portraying the first piece of information and the second piece of information within the virtual reality environment comprises:

rendering the representation of the first set of object representations to produce first object 3-D video frames;

rendering the representation of the second set of object representations to produce second object 3-D video frames; and

overlaying a representation of a portion of the second object 3-D video frames over the first object 3-D video frames to produce the 3-D video frames portraying the first piece of information and the second piece of information.

**7**. A computing device comprises:

an interface;

a local memory; and

a processing module operably coupled to the interface and the local memory, wherein the local memory stores operational instructions that, when executed by the processing module, causes the computing device to:

generate a virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations, wherein at least some of the object representations are associated with corresponding three dimensional (3-D) physical objects, wherein the interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations, wherein a first set of object representations of the group of object representations is associated with a first piece of information regarding a topic, wherein a second set of object representations of the group of object representations is associated with a second piece of information regarding the topic, wherein the processing module functions to generate the virtual reality environment by:

obtaining, via the interface, the group of object representations for the 3-D physical objects;

interpreting the first piece of information and the second piece of information to produce the interaction information; and

rendering the group of object representations in accordance with the interaction information to produce 3-D video frames portraying the first piece of information and the second piece of information within the virtual reality environment.

**8**. The computing device of claim **7**, wherein the processing module further functions to:

output, via the interface, a representation of the virtual reality environment to at least one of a learning asset database and a human interface module.

**9**. The computing device of claim **7**, wherein the processing module further functions to:

interpret a set of 3-D models associated with a physical system to identify the 3-D physical objects; and

interpret a multistep procedure associated with the physical system to identify the 3-D physical objects.

**10**. The computing device of claim **9**, wherein the processing module functions to obtain the group of object representations for the 3-D physical objects by:

interpreting a first set of knowledge bullet points associated with the multistep procedure to produce the first piece of information regarding the topic;

obtaining, via the interface, the first set of object representations for the set of 3-D models based on the first piece of information regarding the topic;

interpreting a second set of knowledge bullet points associated with the multistep procedure to produce the second piece of information regarding the topic; and

obtaining, via the interface, the second set of object representations for the set of 3-D models based on the second piece of information regarding the topic.

**11**. The computing device of claim **7**, wherein the processing module functions to interpret the first piece of information and the second piece of information to produce the interaction information by one or more of:

identifying a set of steps of a multistep procedure based on the first piece of information and the second piece of information; and

interpreting the set of steps in accordance with 3-D models of the at least some of the object representations to produce the position information of the at least some of the object representations as the interaction information of the at least some of the object representations.

**12**. The computing device of claim **7**, wherein the processing module functions to render the group of object representations in accordance with the interaction information to produce the 3-D video frames portraying the first piece of information and the second piece of information within the virtual reality environment by:

rendering the representation of the first set of object representations to produce first object 3-D video frames;

rendering the representation of the second set of object representations to produce second object 3-D video frames; and

overlaying a representation of a portion of the second object 3-D video frames over the first object 3-D video frames to produce the 3-D video frames portraying the first piece of information and the second piece of information.

**13**. A non-transitory computer readable memory comprising:

a first memory element that stores operational instructions that, when executed by a processing module, causes the processing module to:

generate a virtual reality environment utilizing a group of object representations in accordance with interaction information for at least some of the object representations of the group of object representations, wherein at least some of the object representations are associated with corresponding three dimensional (3-D) physical objects, wherein the interaction information includes 3-D models and position information for the at least some of the object representations of the group of object representations, wherein a first set of object representations of the group of object representations is associated with a first piece of information regarding a topic, wherein a second set of object representations of the group of object representations is associated with a second piece of information regarding the topic, wherein the processing module functions to generate the virtual reality environment by:

obtaining the group of object representations for the 3-D physical objects;

a second memory element that stores operational instructions that, when executed by the processing module, causes the processing module to further generate the virtual reality environment by:

interpreting the first piece of information and the second piece of information to produce the interaction information; and

a third memory element that stores operational instructions that, when executed by the processing module, causes the processing module to further generate the virtual reality environment by:

rendering the group of object representations in accordance with the interaction information to produce 3-D video frames portraying the first piece of information and the second piece of information within the virtual reality environment.

**14**. The non-transitory computer readable memory of claim **13** further comprises:

a fourth memory element stores operational instructions that, when executed by the processing module, causes the processing module to:

output a representation of the virtual reality environment to at least one of a learning asset database and a human interface module.

**15**. The non-transitory computer readable memory of claim **13** further comprises:

a fifth memory element stores operational instructions that, when executed by the processing module, causes the processing module to:

interpret a set of 3-D models associated with a physical system to identify the 3-D physical objects; and

interpret a multistep procedure associated with the physical system to identify the 3-D physical objects.

**16**. The non-transitory computer readable memory of claim **15**, wherein the processing module functions to execute the operational instructions stored by the first memory element to cause the processing module to obtain the group of object representations for the 3-D physical objects by:

interpreting a first set of knowledge bullet points associated with the multistep procedure to produce the first piece of information regarding the topic;

obtaining the first set of object representations for the set of 3-D models based on the first piece of information regarding the topic;

interpreting a second set of knowledge bullet points associated with the multistep procedure to produce the second piece of information regarding the topic; and

obtaining the second set of object representations for the set of 3-D models based on the second piece of information regarding the topic.

**17**. The non-transitory computer readable memory of claim **13**, wherein the processing module functions to execute the operational instructions stored by the second memory element to cause the processing module to interpret the first piece of information and the second piece of information to produce the interaction information by one or more of:

identifying a set of steps of a multistep procedure based on the first piece of information and the second piece of information; and

interpreting the set of steps in accordance with 3-D models of the at least some of the object representations to produce the position information of the at least some of the object representations as the interaction information of the at least some of the object representations.

**18**. The non-transitory computer readable memory of claim **13**, wherein the processing module functions to execute the operational instructions stored by the third memory element to cause the processing module to render the group of object representations in accordance with the interaction information to produce the 3-D video frames

portraying the first piece of information and the second piece of information within the virtual reality environment by:

rendering the representation of the first set of object representations to produce first object 3-D video frames;

rendering the representation of the second set of object representations to produce second object 3-D video frames; and

overlaying a representation of a portion of the second object 3-D video frames over the first object 3-D video frames to produce the 3-D video frames portraying the first piece of information and the second piece of information.

* * * * *