

SYSTEM AND METHOD TO SIMULATE
ANATOMICAL FEATURES IN AN ENTERTAINMENT
FIGURE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to and the benefit of U.S. Provisional Application No. 63/528,584, entitled “SYSTEM AND METHOD TO SIMULATE ANATOMICAL FEATURES IN AN ENTERTAINMENT FIGURE”, filed on July 24, 2023, the disclosure of which is hereby incorporated by reference in its entirety herein.

BACKGROUND

[0002] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present disclosure. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be noted that these statements are to be read in this light and not as admissions of prior art.

[0003] Amusement parks may include various features to provide a unique experience to guests. For example, an amusement park may have various rides and shows that entertain guests. Furthermore, the amusement park may have show effects and props that may create a desirable environment or atmosphere for guests. Such features may include entertainment figures (e.g., animated characters, animated figures) that may interact with guests. For instance, the entertainment figures may speak, wave, walk, express emotion, or perform any other suitable actions.

BRIEF DESCRIPTION

[0004] A summary of certain embodiments disclosed herein is set forth below. It should be noted that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that

may not be set forth below.

[0005] In an embodiment, a system includes an animated figure. The system also includes a set of tubes disposed in a portion of the animated figure. The system also includes at least one membrane that defines at least one chamber. The at least one chamber is disposed about the set of tubes. The system also includes a first pump fluidly coupled to the set of tubes. The first pump is configured to inflate each tube of the set of tubes, deflate each tube of the set of tubes, or a combination thereof. The system also includes a second pump fluidly coupled to the at least one chamber. The second pump is configured to inflate each chamber of the at least one chamber, deflate each chamber of the at least one chamber, or a combination thereof.

[0006] In an embodiment, a system includes an animated figure. The system also includes at least one tube disposed in a portion of the animated figure. The system also includes at least one membrane that defines at least one chamber disposed about the at least one tube. The system also includes a first pump system fluidly coupled to the at least one tube. The first pump system is configured to inflate the at least one tube, deflate the at least one tube, or a combination thereof. The system also includes a second pump system fluidly coupled to the at least one chamber. The second pump system is configured to inflate the at least one chamber, deflate the at least one chamber, or a combination thereof. The system also includes a control system. The control system includes a memory configured to store instructions. The control system also includes one or more processors. The one or more processors are configured to execute the instructions to control the first pump system, the second pump system, or a combination thereof.

[0007] In an embodiment, a method for providing an effect for a portion of an animated figure includes receiving instructions for adding the effect to the portion of the animated figure. The method also includes controlling a first pump system to adjust a set of tubes disposed in the portion based on the instructions. The method also includes controlling a second pump system to adjust a set of chambers disposed about the set of tubes based on the instructions.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] These and other features, aspects, and advantages of the present disclosure will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0009] FIG. 1 is a schematic view of an amusement park having an entertainment figure, in accordance with an aspect of the present disclosure;

[0010] FIG. 2 is a schematic view of an entertainment figure system that may be used to operate the entertainment figure of FIG. 1, in accordance with an aspect of the present disclosure;

[0011] FIG. 3 is a schematic view of the entertainment figure system of FIG. 2 that may be used to operate the entertainment figure to provide effects of anatomical features in a neck portion of the entertainment figure, in accordance with an aspect of the present disclosure;

[0012] FIG. 4 is a schematic view of the entertainment figure system of FIG. 2 that may be used to operate the entertainment figure to provide effects of anatomical features in various portions of a body of the entertainment figure, in accordance with an aspect of the present disclosure; and

[0013] FIG. 5 is a flowchart of a method employed to operate the entertainment figure system of FIG. 2, in accordance with an aspect of the present disclosure.

DETAILED DESCRIPTION

[0014] One or more specific embodiments will be described below. In an effort to provide a concise description of these embodiments, not all features of an actual implementation are described in the specification. It should be noted that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints,

which may vary from one implementation to another. Moreover, it should be note that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0015] When introducing elements of various embodiments of the present disclosure, the articles “a,” “an,” “the,” and “said” are intended to mean that there are one or more of the elements. The terms “comprising,” “including,” and “having” are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0016] The present disclosure relates to systems and methods that may be implemented in any of a variety of venues (e.g., environments). To facilitate discussion, certain examples are described in context of an amusement park; however, it should be appreciated that the systems and methods described herein may be implemented in theatres, stadiums, hotels, restaurants, any indoor entertainment facilities, any outdoor entertainment facilities, and so forth. As may be appreciated, the amusement park may include various features to entertain guests. For instance, the amusement park may include attractions, such as rides or shows. The amusement park may also include props and show effects to provide unique experiences for the guests. Such props and show effects may include an entertainment figure (e.g., an animated character, an animated figure). As used herein, an entertainment figure refers to any suitable physical prop that uses a mechanical feature to move or change a surface that is visible to at least one of the guests. In an example, the entertainment figure may include an automated or remotely-controlled machine (e.g., a robot). In another example, the entertainment figure may include a suit wearable by a person and equipped with a mechanical feature. In any case, the mechanical feature of the entertainment figure may perform a unique function, such as an automated action. The entertainment figure may interact with the guests to provide an interactive entertainment experience for the guests, and the mechanical feature may enhance the experience for the guests.

[0017] Without the disclosed embodiments, it may be difficult to control certain aspects of the entertainment figure and/or to emulate a realistic representation, thereby

limiting the experience provided by the entertainment figure. It is now recognized that it would be desirable to mimic movement and/or protrusion of anatomical features (e.g., muscles and/or veins) in one or more portions of the entertainment figure, such as in a neck portion of the entertainment figure, to portray a more realistic representation (e.g., emotion). Accordingly, embodiments of the present disclosure are directed to systems and methods for controlling appearance of the one or more portions of the entertainment figure, such as the neck portion of the entertainment figure.

[0018] In an embodiment, a set of expandable tubes (e.g., pneumatic tubes) is disposed in the neck portion of the entertainment figure, which are configured to mimic the muscles and/or the veins in the neck portion of a human or other creature (e.g., dog, horse, dinosaur). The neck portion of the entertainment figure may also include one or more chambers enclosed by a flexible membrane, wherein the one or more chambers are disposed about (e.g., exterior to) the expandable tubes. The one or more chambers are configured to contact (e.g., tighten) against the expandable tubes, thereby giving the appearance of a strained neck (e.g., strained skin). The entertainment figure may include one or more manifolds and valves configured to selectively expand and/or contract the expandable tubes and/or the one or more chambers. The commands sent to the manifolds and/or the valves may be generated based on a video recording of the muscles in the neck portion of the human or the other creature. In this way, the entertainment figure may closely emulate the appearance of the neck of the human or the other creature, thereby enabling the entertainment figure to appear more realistically. It should be recognized that the entertainment figure may be used for a variety of purposes. For example, additionally or alternatively to being used for entertainment, the entertainment figure may be used for advertisement, as an educational tool, as a greeter, and/or for other non-entertainment purposes.

[0019] Turning now to the drawings, FIG. 1 is a schematic view of an embodiment of an amusement park 50 that includes features to entertain a guest 52. The amusement park 50 may include a ride 54, which may be a roller coaster, a water ride, a drop tower, a motion simulator, and the like. The amusement park 50 may additionally or alternatively include a show 56, such as a theatrical show, a performance, a concert, and so forth. Moreover, the amusement park 50 may include an additional site 58, which may be a

food vendor (e.g., restaurant), a merchandise store, a hotel, or any other suitable site 58. The guest 52 may move through the amusement park 50, such as via a pathway 60, to navigate anywhere within the amusement park 50, including to the ride 54, the show 56, and/or the additional site 58. Furthermore, the amusement park 50 may include an entertainment figure 62 (e.g., an animated character, an animated figure), which may interact with the guest 52. It should be noted that the entertainment figure 62 may also be at any suitable location within or outside of the amusement park 50.

[0020] In an embodiment, the entertainment figure 62 may be entirely electromechanical, such as a robot that is programmed to move automatically or via remote control (e.g., not worn by or manually moved via contact with a user or operator). In an additional or alternative embodiment, the entertainment figure 62 may be partially electromechanical and certain functions of the entertainment figure 62 may be enabled manually via contact with a user or operator. For instance, the entertainment figure 62 may include a suit that is wearable by a person and has electromechanical components (e.g., a headgear with mechanically driven facial features), in which the electromechanical components may perform certain functions (e.g., movement of the facial features), but the person may manually orient or position the mechanical components (e.g., by moving their head). In this way, the entertainment figure 62 may include various features and/or may perform at least certain functions without manual assistance, such as to represent a character that may not be enabled by mere movement of a person.

[0021] In an embodiment, the entertainment figure 62 may include or be communicatively coupled with a control system 64 (e.g., an electronic controller; an automation controller, such as a programmable-logic controller [PLC]), which may operate the entertainment figure 62, such as by causing at least certain portions of the entertainment figure 62 to move. The control system 64 may include a memory 66 and a processor 68, such as a microprocessor. The memory 66 may include volatile memory, such as random access memory (RAM), and/or non-volatile memory, such as read-only memory (ROM), optical drives, hard disc drives, solid-state drives, or any other non-transitory computer-readable medium that includes instructions to operate the

entertainment figure 62. The processor 68 may include one or more application specific integrated circuits (ASICs), one or more field programmable gate arrays (FPGAs), one or more general purpose processors, or any combination thereof, configured to execute the instructions stored in the memory 66 to cause the entertainment figure 62 to operate accordingly. By way of example, the control system 64 may cause a part of the entertainment figure 62 to move relative to another part of the entertainment figure 62. It should be appreciated that the processor 68 may represent one or more processors, and the control system 64 may represent one or more computing systems. For example, the control system 64 may represent a distributed computing system that includes multiple computing systems that each include one or more processors that are programmed to carry out various functions and operations described herein (e.g., control of the entertainment figure 62, image processing, model generating).

[0022] The entertainment figure 62 may interact with the guest 52 to provide a unique experience to the guest 52. As an example, the entertainment figure 62 may provide a realistic representation of a character, such as by speaking with the guest 52. For instance, while the guest 52 is navigating through the amusement park 50, the entertainment figure 62 may provide entertainment to the guest 52 outside of the ride 54, the show 56, or the additional site 58. Additionally or alternatively, the entertainment figure 62 may interact with the guest 52 within the ride 54, the show 56, and/or the additional site 58 to provide further entertainment to the guest 52. Indeed, the entertainment figure 62 may be positioned at any suitable location and/or may move to a particular location 50 to entertain the guest 52 (and additional guests).

[0023] FIG. 2 is a schematic view of an embodiment of an entertainment figure system 100, which may be used to operate the entertainment figure 62. The entertainment figure system 100 includes the entertainment figure 62, the control system 64, and an entertainment figure model 102 (e.g., database containing entertainment figure model). As shown, the entertainment figure 62 may include pumps 104 and 106 (e.g., air compressors; first and second pumps), manifolds 108 and 110 (e.g., first and second manifolds), chambers 112, membranes 113, expandable tubes 114 (e.g., pneumatic tubes), sensors 116, and valves 117 and 119 (e.g., pressure control valves, flowrate

control valves; first and second valves).

[0024] As shown, the membranes 113 include (e.g., are disposed about; defines) the chambers 112 (e.g., each of the membranes 113 includes a respective one of the chambers 112). The manifold 108 is coupled (e.g., fluidly coupled) to the pump 104, the valves 117, and the chambers 112. Together, any combination of the manifold 108, the pump 104, the valves 117, and/or the chambers 112 may be considered or referred to as a chamber pump assembly or system. Additionally, the manifold 110 is coupled to the pump 106, the valves 119, and the expandable tubes 114. Together, any combination of the manifold 110, the pump 106, the valves 119, and/or the expandable tubes 114 may be considered or referred to as a pneumatic tube pump assembly or system. In an embodiment, the membranes 113 are composed of a flexible (e.g., elastomeric) material (e.g., silicone, rubber, latex). In this manner, the membranes 113 may be configured to expand and/or contract in response to a respective increase and/or decrease of pressure of fluid disposed in the chambers 112. In an embodiment, the expandable tubes 114 are composed of a flexible and semi-rigid material (e.g., polyvinyl chloride [PVC], nylon) configured to radially expand and/or contract in response a respective increase and/or decrease of the pressure of the fluid disposed in the expandable tubes 114.

[0025] In the illustrated embodiment, the control system 64 is communicatively coupled to the entertainment figure model 102, the pumps 104 and 106, the manifolds 108 and 110, the sensors 116, and the valves 117 and 119. In an embodiment, the pumps 104 and 106 may be fluidly coupled to the manifolds 108 and 110, respectively. In an embodiment, the chambers 112 and/or the membranes 113 may be coupled (e.g., mechanically coupled) to the expandable tubes 114. For example, the expandable tubes 114 may be disposed within one or more channels of the chambers 112 and/or the expandable tubes 114 may be disposed against the membranes 113 (e.g., covered by the chambers 112 and the membranes 113 relative to an exterior surface of the entertainment figure 62).

[0026] In the illustrated embodiment, the entertainment figure system 100 may

also include a sensor 118 disposed outside of the entertainment figure 62. The sensor 118 may be configured to sense a passive quality (e.g., height, hair color, presence), an active quality (e.g., gesture, motion), or a combination thereof, of one or more guests (e.g., the guest 52 of FIG. 1) that enter into a sensing area (e.g., field of view) of the sensor 118. In an embodiment, the sensor 118 may be configured to sense respective devices carried by the one or more guests (e.g., mobile phones, wearable bands, toys; via radiofrequency communication) within the sensing area of the sensor 118 to thereby detect the one or more guests. In response to the sensor 118 detecting the one or more guests, the sensor 118 may be configured to send a signal to the control system 64. In response to receiving the signal from the sensor 118, the control system 64 may be configured to send one or more commands to the pumps 104 and 106, the manifolds 108 and 110, the valves 117 and 119, or a combination thereof to operate these components in a coordinated manner to mimic anatomical features (e.g., muscles and/or veins) of a human or other creature.

[0027] Further, the control system 64 may send the one or more commands to the pumps 104 and 106, the manifolds 108 and 110, the valves 117 and 119, or a combination thereof to operate these components in a coordinated manner along with additional commands to various other components (e.g., actuators, speakers, displays, projectors) of the entertainment figure 62. In this way, the control system 64 may cause the entertainment figure 62 to carry out an act (e.g., series of visual and/or audible effects; a performance) for the one or more guests, such as via the one or more commands that cause changes in the chambers 112 and the expandable tubes 114 to simulate changes in muscles and/or veins of the entertainment figure 62, movement of a mouth of the entertainment figure 62, and audio effects that correspond to the movement of the mouth of the entertainment figure 62 to simulate spoken words by the entertainment figure 62.

[0028] In an embodiment, an outlet of the pump 104 is fluidly coupled to an inlet of the manifold 108. The manifold 108 may include one or more outlets fluidly coupled to the inlet of the manifold 108. The manifold 108 may be

configured to direct a fluid (e.g., air, hydraulic fluid) provided by the pump 104 from the inlet of the manifold 108 to the one or more outlets of the manifold 108. The one or more outlets of the manifold 108 may each be fluidly coupled to the chambers 112, such that the chambers 112 expand in response to receiving the fluid from the manifold 108. It should be recognized that the fluid may be any compressible fluid including air or hydraulic fluid. The chambers 112 are discussed in more detail herein.

[0029] In an embodiment, an outlet of the pump 106 is fluidly coupled to an inlet of the manifold 110. The manifold 110 may include one or more outlets fluidly coupled to the inlet of the manifold 110. The manifold 110 may be configured to direct a fluid (e.g., air, hydraulic fluid) provided by the pump 106 from the inlet of the manifold 110 to the one or more outlets of the manifold 110. The one or more outlets of the manifold 110 may each be fluidly coupled to the expandable tubes 114, such that the expandable tubes 114 expand in response to receiving the fluid from the manifold 110. The expandable tubes 114 are discussed in more detail herein. It should be appreciated that the entertainment figure system 100 may have any suitable number, combination, and/or arrangement of components to provide the fluid and withdraw the fluid from the chambers 112 and the expandable tubes 114 in a coordinated manner to provide various visual effects described herein.

[0030] FIG. 3 is a schematic view of an embodiment of the entertainment figure system 100 that may be used to operate the entertainment figure 62. As shown, the entertainment figure 62 includes the chambers 112 (e.g., chambers 150, 152, 154), the expandable tubes 114 (e.g., expandable tubes 156, 158, 160), valves 117 (e.g., valves 162, 164, 166), and valves 119 (e.g., valves 168, 170, 172) disposed inside a neck portion 174 (e.g., below a head portion; between a head portion and a torso portion) of the entertainment figure 62. The expandable tubes 114 may be disposed within the chambers 112 (e.g., disposed within interior channels), disposed behind the chambers 112 (e.g., within an inner cavity relative to an exterior surface of the entertainment figure 62), or a combination thereof, such that the chambers 112 are disposed about the expandable tubes 114 (e.g., to

surround the expandable tubes 114 and/or positioned over the expandable tubes relative to the exterior surface of the entertainment figure 62). In an embodiment, there may be more or fewer of the chambers 112 and/or the expandable tubes 114 than shown in the illustrated embodiment. Further, the chambers 112 and/or the expandable tubes 114 may be at any of a variety of orientations and/or positions within the neck portion 174 of the entertainment figure 62.

[0031] As shown, the entertainment figure 62 also includes the pumps 104 and 106, as well as the manifolds 108 and 110 and the valves 117 and 119 disposed inside an interior portion 163 (e.g., body) of the entertainment figure 62. In an embodiment, the pumps 104 and 106, the manifolds 108 and 110, and/or the valves 117 and 119 may be disposed outside (e.g., beneath, behind) the entertainment figure 62. The entertainment figure 62 also includes the sensors 116 disposed in the interior portion 163 of the entertainment figure 62. As discussed herein, the sensors 116 may be configured to send one or more signals to the control system 64 indicative of a pressure of the fluid in the chambers 112 and/or a pressure of the fluid in the expandable tubes 114. The sensors 116 may also include a sensor configured to send a signal indicative of a status of the pumps 104 and 106 and/or the manifolds 108 and 110 and/or the valves 117 and 119 to the control system 64.

[0032] In an embodiment, the pump 106 and the manifold 110 may be coupled (e.g., fluidly coupled) to each pneumatic tube of the expandable tubes 114. The pump 106 may be configured to increase the pressure of the expandable tubes 114 (e.g., inflate), decrease the pressure of the expandable tubes 114 (e.g., deflate), or a combination thereof. In this manner, the expandable tubes 114 may be configured to expand and/or contract in response to an operation of the pump 106. In an embodiment, one or more pumps 106 may be used for inflating and deflating the expandable tubes 114. For example, one pump may be used for inflating the expandable tubes 114 and another pump may be used for deflating the expandable tubes 114. It should be appreciated that a variety of other techniques are envisioned, such as a release valve to allow the fluid to release from the expandable tubes 114 as a pressure in the chambers 112 increases and drives the fluid from the expandable tubes 114.

[0033] In an embodiment, the pump 106 and the manifold 110 are configured to inflate at least one pneumatic tube of the expandable tubes 114. For example, the pump 106 and the manifold 110 may be configured to (e.g., concurrently) inflate multiple expandable tubes of the expandable tubes 114. The pump 106 and the manifold 110 may be configured to deflate at least one pneumatic tube of the expandable tubes 114. For example, the pump 106 and the manifold 110 may be configured to (e.g., concurrently) deflate multiple expandable tubes of the expandable tubes 114. The pump 106 and the manifold 110 may be configured to (e.g., concurrently) inflate at least one pneumatic tube of the expandable tubes 114 and deflate at least one pneumatic tube of the expandable tubes 114. In another embodiment, the pump 106 may provide a substantially constant positive pressure or negative pressure (e.g., vacuum) such that the valves 119 are configured to control the pressure of the fluid disposed in the expandable tubes 114. For example, the control system 64 may be configured to control the valves 119 to control the pressure of the fluid disposed in the expandable tubes 114.

[0034] In an embodiment, the pump 104, the manifold 108, and the valves 117 may be coupled (e.g., fluidly coupled) to each chamber of the chambers 112. The pump 104 and/or the valves 117 may be configured to increase the pressure of the chambers 112 (e.g., inflate), decrease the pressure of the chambers 112 (e.g., deflate), or a combination thereof. In this manner, the chambers 112 are configured to expand and/or contract in response to an operation of the pump 104. In an embodiment, one or more pumps 104 may be used for inflating and deflating the chambers 112. For example, one pump may be used for inflating the chambers 112 and another pump may be used for deflating the chambers 112.

[0035] In an embodiment, the pump 104 and the manifold 108 are configured to inflate at least one chamber of the chambers 112. For example, the pump 104 and the manifold 108 may be configured to (e.g., concurrently) inflate multiple chambers of the chambers 112. The pump 104 and the manifold 108 may be configured to deflate at least one chamber of the chambers 112. For example, the pump 103 and the manifold 108 may be configured to (e.g., concurrently) deflate

multiple chambers of the chambers 112. The pump 104 and the manifold 108 may be configured to (e.g., concurrently) deflate at least one chamber of the chambers 112 and deflate at least one chamber of the chambers 112. In another embodiment, the pump 104 may provide a constant positive pressure or negative pressure (e.g., vacuum) such that the valves 117 are configured to control the pressure of the fluid disposed in the chambers 112. For example, the control system 64 may be configured to control the valves 117 to control the pressure of the fluid disposed in the chambers 112.

[0036] In an embodiment, the control system 64 may be configured to control the pumps 104 and 106, the manifolds 108 and 110, the valves 117 and 119, or a combination thereof, to control the pressure of the fluid disposed inside the chambers 112 and/or the expandable tubes 114, respectively. For example, the control system 64 may be configured to decrease the pressure of (e.g., deflate) the chambers 112 while increasing the pressure of (e.g., inflate) the expandable tubes 114. In this manner, a contour (e.g., shape, outline) of the expandable tubes 114 may become visible (e.g., appear) from beneath the chambers 112 at an exterior surface 167 of the neck portion 174 of the entertainment figure 62 in response to an inflation of the expandable tubes 114, a deflation of the chambers 112, or a combination thereof.

[0037] In an embodiment, the entertainment figure system 100 includes a camera 176 configured to capture one or more images of a neck portion 178 of a person 180 (e.g., an actor) and send the one or more images to the control system 64 (or another device, such as a computing device or system). In response to receiving the one or more images of the neck portion 178 from the camera 176, the control system 64 may be configured to detect, via a machine learning algorithm, one or more anatomical features, such as muscles, arteries, and/or veins, in the neck portion 178 of the person 180. Additionally or alternatively, the control system 64 may be configured to determine one or more characteristics (e.g., position, velocity, orientation) of the one or more anatomical features via a machine learning algorithm (e.g., neural network, support vector machine). In an embodiment, the

one or more images captured by the camera 176 may be first converted to a data type readable by the control system 64 and/or stored in a separate database before being read by the control system 64. Additionally or alternatively, the camera 176 may be configured to send the one or more images to the control system 64 or a separate database in near real-time.

[0038] In an embodiment, the control system 64 may be configured to control the pumps 104 and 106, the manifolds 108 and 110, the valves 117 and 119, or a combination thereof based on the one or more images (e.g., image data) captured by the camera 176. For example, the camera 176 may sense the front portion 172 of the neck portion 178 of the person 180, generate one or more images, and send the one or more images to the control system 64.

[0039] In an embodiment, the control system 64 may be configured to generate instructions (e.g., models) for the pumps 104 and 106, the manifolds 108 and 110, and/or the valves 117 and 119 based on detection of one or more characteristics of the neck portion 178 of the person 180 (e.g., via the captured images) and a timestamp at which the detected characteristic occurs. In an embodiment, the control system 64 may be configured to send the instructions to the pumps 104 and 106, the manifolds 108 and 110, and/or the valves 117 and 119, while the camera 176 concurrently captures one or more images. Additionally or alternatively, the control system 64 may be configured to store the instructions in a database and/or the memory 66, and send the instructions at a later time.

[0040] In an embodiment, the control system 64 may be configured to receive the one or more images from the camera 176, which may include an effect (e.g., muscle strain, bulging neck muscles) of the person 180. The control system 64 may be configured to generate instructions (e.g., models, acts), which may include commanded states associated with the expandable tubes 114, the chambers 112, or a combination thereof, based on the one or more images. For example, the commanded states of the expandable tubes 114 may include a commanded characteristic (e.g., radius, pressure) associated with the expandable tubes 114. The commanded states of the chambers 112 may include a commanded characteristic

(e.g., size, pressure) of the chambers 112, such that the chambers 112 reflect a size and/or shape of the neck portion 178 of the person 180.

[0041] Then, the control system 64 may be configured to control the expandable tubes 114, the chambers 112, or a combination thereof based on the generated the instructions. For example, the control system 64 may be configured to command the pump 104 and/or the valves 117 to inflate the chambers 112 to the commanded pressure. Additionally, the control system 64 may be configured to command the pump 106 and/or the valves 119 to inflate the chambers 112 and/or the expandable tubes 114 to provide the commanded characteristic. In an embodiment, the control system 64 may be configured to receive a feedback signal indicative of a monitored characteristic of the chambers 112 and/or the expandable tubes 114. The control system 64 may be configured to use the feedback signal to control the monitored characteristic of the chambers 112 and/or the expandable tubes 114 via a control algorithm.

[0042] In an embodiment, the control system 64 may be configured to generate the instructions, which may include commanded states associated with the expandable tubes 114, the chambers 112, or a combination thereof. The control system 64 may be configured to control the pumps 104 and 106, the manifold 108 and 110, the valves 117 and 119, or a combination thereof based on the instructions. In an embodiment, the control system 64 may be configured to inflate/deflate a portion of the chambers 112. For example, the instructions may include decreasing the size of the chamber 150 while concurrently maintaining the sizes of the chambers 152 and 154 in order to give the appearance of straining the side of the neck portion 174. To execute these instructions, the control system 64 may be configured to control the manifold 108 and/or the valves 117 to block a flow of the fluid to the chambers 152 and 154, while maintaining the flow of the fluid to the chamber 150. Additionally or alternatively, the control system 64 may be configured to inflate/deflate a portion of the expandable tubes 114. For example, the instructions may include decreasing the size of the pneumatic tube 156 while concurrently increasing the sizes of the pneumatic tube 158 and 160. To execute

these instructions, the control system 64 may be configured to control the manifold 110 and/or the valves 119 to block a flow of the fluid to the expandable tubes 158 and 160, while maintaining the flow of the fluid to the pneumatic tube 156.

[0043] In an embodiment, the control system 64 may be configured to generate the instructions, which may include commanded states associated with the expandable tubes 114, the chambers 112, or a combination thereof. The control system 64 may be configured to control the valves 117, the valves 119, or a combination thereof based on the instructions. For example, the instructions may include decreasing the size of the pneumatic tube 156 while concurrently increasing the sizes of the pneumatic tube 158 and 160 over a period of time. To execute these instructions, the control system 64 may be configured to control the valve 162 to decrease a flowrate of the fluid to the pneumatic tube 156, while concurrently controlling the valves 164 and 166 to increase flowrates of the fluid to the expandable tubes 158 and 160, respectively. In an embodiment, the valves 117 and 119 may include flow control valves, pressure relief valves, or a combination thereof.

[0044] In an embodiment, the control system 64 may be configured to control the pumps 104 and 106, the manifolds 108 and 110, the valves 117 and 119, or a combination thereof, to decrease the pressure of (e.g., deflate) the chambers 112 while concurrently increasing the pressure of (e.g., inflate) the expandable tubes 114. In this manner, a contour (e.g., shape, outline) of the expandable tubes 114 may become visible (e.g., appear) from beneath the chambers 112 from an exterior surface 167 of the neck portion 174 of the entertainment figure 62 in response to an inflation of the expandable tubes 114, a deflation of the chambers 112, or a combination thereof, so as to mimic one or more protruding anatomical features (e.g., muscles, veins) in the neck portion 174 of the entertainment figure 62. In an embodiment, the control system 64 may be configured to deflate the chambers 112 while concurrently inflating the expandable tubes 114 based on images captured from the camera 176. For example, the control system 64 may be configured to deflate the chambers 112 disposed in a first portion of the neck portion 174 while

concurrently inflating the expandable tubes 114 disposed in the first portion of the neck portion 174. The control system 64 may be configured to subsequently deflate the chambers 112 disposed in a second portion of the neck portion 174 while concurrently inflating the expandable tubes 114 disposed in the second portion of the neck portion 174.

[0045] In an embodiment, the control system 64 may be configured to receive a signal from the sensor 118, which may include a passive quality associated with a guest (e.g., height, hair color), an active quality associated with the guest (e.g., a motion, a gesture), presence of a device associated with the guest, or a combination thereof. The control system 64 may be configured to control the expandable tubes 114, the chambers 112, or a combination thereof based on the signal. For example, the control system 64 may be configured to detect, via the sensor 118, an audible noise made by one or more guest. Specifically, the control system 64 may be configured to detect one or more words spoken by the one or more guests (e.g., keywords, phrases). In response to one or more words spoken by the guest, the control system 64 may be configured to control the expandable tubes 114, the chambers 112, or the combination thereof to provide an effect (e.g., visual, emotional effect) to the neck portion 174 of the entertainment figure 62. As described herein, the effect to the neck portion 174 of the entertainment figure 62 may be carried out in conjunction with other visual and/or audible effects, so as to provide an act to entertain the one or more guests and/or to provide overall movement of a body of the entertainment figure 62, movement of a face of the entertainment figure 62, audio played via a speaker associated with the animated figure 62, background effects (e.g., displays, other animated figures, ride vehicles), and so forth in a coordinated manner.

[0046] FIG. 4 is a schematic view of an embodiment of the entertainment figure system 100 that may be used to operate the entertainment figure 62. As shown, the entertainment figure 62 includes one or more chambers 112 and one or more expandable tubes 114 disposed throughout one or more body portions 220 of the entertainment figure 62. As shown, the chambers 112 and/or the expandable tubes 114 may be disposed in arm

portions 222 (e.g., arm portions 224 and 226), leg portions 228 (e.g., leg portions 230 and 232), chest portions 234 (e.g., chest portions 236 and 238), or a combination thereof, within the entertainment figure 62. As discussed herein, the chambers 112 and the expandable tubes 114 are fluidly coupled to the pumps 104 and 106, the manifolds 108 and 110, and the valves 117 and 119, respectively. As shown, the pumps 104 and 106, the manifolds 108 and 110, and the valves 117 and 119 are disposed outside of the entertainment figure 62, though they may also be disposed in an interior portion 163 of the entertainment figure 62.

[0047] In an embodiment, the membranes 113 and/or the expandable tubes 114 may be coupled to a mechanical actuator 240. The mechanical actuator 240 may be coupled to an exterior portion 242 (e.g., exterior surface; limb, such as an arm or a leg; extending portion, such as a tail or a wing) of the entertainment figure 62. In response to and/or in conjunction with (e.g., simultaneously) an inflation and/or deflation of the membranes 113 and/or the expandable tubes 114, the mechanical actuator 240 may be actuated (e.g., mechanically, electrically) to cause a movement of the exterior portion 242 of the entertainment figure 62. In this manner, the exterior portion 242 of the entertainment figure 62 may move (e.g., slide, bulge, twist, pivot; relative to other portions of the entertainment figure 62 and/or an environment) in response to and/or in conjunction with an inflation and/or deflation of the membranes 113 and/or the expandable tubes 114.

[0048] In the illustrated embodiment, the camera 176 is configured to capture images of one or more body portions 220 of the person 180. As discussed herein, the camera 176 may be configured to send the captured images to the control system 64 (or another device, such as a computing device or system). In an embodiment, the control system 64 may be configured, via a machine learning algorithm, to detect a certain characteristic (e.g., protruding veins) of a particular body portion 220 based on the captured images. In an embodiment, the machine learning algorithm may be iteratively trained using training data. For example, the training data may include images (e.g., randomly generated images) of the body portions 220, one or more metrics (e.g., position, dimensional measurements) associated with each a particular body portion, and/or the type of body portion 220 (e.g., arm portions 222, leg portion 228, chest portions 236).

[0049] In an embodiment, the control system 64 may be configured to generate instructions (e.g., models) for the pumps 104 and 106, the manifolds 108 and 110, and/or the valves 117 and 119 based on detection of one or more characteristics of one or more body portions 220 of the person 180 (e.g., via the captured images) and a timestamp at which the detected characteristic occurs. In an embodiment, the control system 64 may be configured to send the instructions to the pumps 104 and 106, the manifolds 108 and 110, and/or the valves 117 and 119, while the camera 176 concurrently captures one or more images. Additionally or alternatively, the control system 64 may be configured to store the instructions in a database and/or the memory 66, and send the instructions at a later time.

[0050] In an embodiment, the control system 64 may be configured to control one or more types of body portions 220 concurrently and based on the instructions. For example, the control system 64 may be configured to control the chambers 112 and/or the expandable tubes 114 disposed within the arm portions 222, while concurrently controlling the chambers 112 and/or the expandable tubes 114 disposed within the leg portions 228. Additionally or alternatively, the control system 64 may be configured to control one or more individual body portions 220 of the same type (e.g., or different types) concurrently. For example, the control system 64 may be configured to control the chambers 112 and/or the expandable tubes 114 disposed within the arm portion 224, while concurrently controlling the chambers 112 and/or the expandable tubes 114 disposed within the arm portion 226.

[0051] In an embodiment, the control system 64 may be configured to receive a signal from the sensor 118, which may include a passive quality associated with a guest (e.g., height, hair color), an active quality associated with the guest (e.g., a motion, a gesture), presence of a device associated with the guest, or a combination thereof. The control system 64 may be configured to control the expandable tubes 114, the chambers 112, or a combination thereof, disposed in one or more body portions 220 (e.g., of the same or different types) based on the signal. For example, the control system 64 may be configured to detect, via the sensor 118, one or more words spoken by the one or more guests (e.g., keywords, phrases) and or one or

more gestures and/or motions made by the one or more guests. In response to detecting the one or more words and/or the one or more gestures and/or motions of the one or more guests, the control system 64 may be configured to control the chambers 112, the expandable tubes 114, or the combination thereof, of the arm portion 226, the leg portion 230, and the chest portion 236. It should be appreciated that the chambers 112 and/or the expandable tubes 114 of any combination of body portions 220 may be controlled (e.g. activated) in response to receiving the signal from the sensor 118.

[0052] In an embodiment, the control system 64 may be configured to control at least one pneumatic tube 114 independently of the remaining expandable tubes 114. For example, the control system 64 may be configured to expand the pneumatic tube 156, while contracting the expandable tubes 158 and 160. In this manner, the control system 64 may be configured to move a portion of the expandable tubes 114, thereby giving the appearance that a portion of the anatomical features (e.g., muscles) disposed in the one or more body portions 220 of the entertainment figure 62 are moving.

[0053] In an embodiment, the control system 64 may be configured to control at least one chamber 112 independently of the remaining chambers 112. For example, the control system 64 may be configured to expand the chamber 150, while contracting the chambers 152 and 154. In this manner, the control system 64 may be configured to move a portion of the chambers 112, thereby giving the appearance that a portion (e.g., section) of the skin (e.g., outer layer) of the one or more body portions 220 of the entertainment figure 62 are strained (e.g., tightened).

[0054] FIG. 5 is a flowchart of an embodiment of a method 250 that may be employed to operate the entertainment figure system 100 of FIG. 2. In block 252 of the method 250, the control system 64 may be configured to receive instructions for adding an effect to the neck portion 174 of the entertainment figure 62. For example, the control system 64 may receive instructions (e.g., models, commanded states, trajectories) associated with the pumps 104 and 106 (e.g., commanded pump speed), the manifolds 108 and 110 (e.g.,

commanded opened/closed manifold outlets), and/or the valves 117 and 119 (e.g., commanded flowrate, commanded valve position).

[0055] In block 254, the control system 64 may be configured to control the pump 106 to adjust the expandable tubes 114 based on the instructions. For example, the control system 64 may be configured to send a signal to the pump 106 including instructions for changing one or more operations of the pump 106. For example, the instructions may include changing a pump speed, a flowrate of the fluid being pumped, or the like. In an embodiment, the instructions may include a direction of an impeller of the pump 106. In response to the pump 106 receiving the instructions, the pump 106 may adjust the expandable tubes 114. For example, the pump 106 may increase the flowrate of the fluid into the expandable tubes 114, thereby causing a radial expansion of the expandable tubes 114.

[0056] In block 256, the control system 64 may be configured to control the pump 104 to adjust the chambers 112 disposed about the expandable tubes 114 based on the instructions. For example, the control system 64 may be configured to send a signal to the pump 104 including instructions for changing one or more operations of the pump 104. For example, the instructions may include changing a pump speed, a flowrate of the liquid being pumped, or the like. In an embodiment, the instructions may include a direction of an impeller of the pump 104. In response to the pump 104 receiving the instructions, the pump 104 may adjust the chambers 112. For example, the pump 104 may apply a vacuum pressure to the fluid in the chambers 112, thereby causing a deflation of the chambers 112. As described herein, inflation of the expandable tubes 114 and deflation of the chambers 112 concurrently may provide enhanced contours along the neck portion 174 of the entertainment figure 162. However, various sequences and/or combinations of inflation and deflation of the expandable tubes 114 and the chambers 112 may be carried out (e.g., according to the instructions, based on one or more images) to mimic various anatomical features (e.g., muscles and/or veins) of the entertainment figure 62 (e.g., as part of an act).

[0057] In an embodiment, the control system 64 may be configured to receive instructions including commanded states associated with the expandable tubes 114, the

chambers 112, or a combination thereof. For example, the commanded states may include one or more quantities associated with the chambers 112 and/or the expandable tubes 114 (e.g., dimensions, Euclidean positions). The control system 64 may be configured to control the chambers 112 and/or the expandable tubes 114 based on the instructions (e.g., commanded states). For example, the control system 64 may be configured to control the chambers 112 and/or the expandable tubes 114 to expand and/or contract to a commanded shape (e.g., size). The control system 64 may be configured to receive feedback of a monitored state of the chambers 112 and/or expandable tubes 114 via the sensors 116 (e.g., cameras, distance sensors). Additionally or alternatively, the control system 64 may be configured to use the feedback in a control algorithm (e.g., proportional-integral-derivative controller, adaptive controller, visual servoing) to determine an error value, which may be used to determine a controlled variable (e.g., pump speed, valve position).

[0058] In an embodiment, the control system 64 may be configured to receive instructions including commanded states associated with the pumps 104 and 106, the manifolds 108 and 110, the valves 117 and 119, or a combination thereof. For example, the commanded states may include one or more quantities associated with the manifolds 108 and 110 and/or the valves 117 and 119 (e.g., open/close commands for manifolds, commanded valve position). The control system 64 may be configured to control the manifolds 108 and 110 and/or the valves 117 and 119 based on the instructions (e.g., commanded states). For example, the control system 64 may be configured to control the manifolds 108 and 110 by selecting which outlets of each of the manifolds are open or closed (e.g., via valves internal to the manifolds 108 and 110). Additionally, the control system 64 may be configured to control the valves 117 and 119 may controlling a position of the valves, thereby adjusting a flowrate of the fluid flowing through each of the valves. In an embodiment, the control system 64 may be configured to control the valves 117 and 119 to adjust which outlets of each of the manifolds are open or closed (e.g., the valves 117 and 119 may represent or be the valves internal to the manifolds 108 and 110; the valves 117 and 119 may be external to the manifolds 108 and 110, but operate in conjunction with the manifolds 108 and 110 to selectively open and close the outlets of each of the manifolds 108 and 110). The control system 64 may be configured to receive feedback of a monitored state of the manifolds 108 and 110 and/or the valves 117 and 119 via the sensors 116 (e.g.,

encoders, switches). Additionally or alternatively, the control system 64 may be configured to use the feedback in a control algorithm (e.g., proportional-integral-derivative controller, adaptive controller, optimal controller) to determine an error value, which may be used to determine a controlled variable (e.g., valve position).

[0059] While only certain features of the disclosure have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the disclosure. Further, features shown and described with reference to FIGS. 1-5 may be combined in any suitable manner. For example, the method 250 of FIG. 5 may be utilized to adjust the chambers 112 and/or the expandable tubes 114 in body portions (e.g., the body portions 222, 228, 234 in FIG. 4) of the entertainment figure 62 other than the neck portion 174 of the entertainment figure 62. Further, the control system 64 may generate instructions to adjust the chambers 112 and/or the expandable tubes 114 in the body portions (e.g., the body portions 222, 228, 234 in FIG. 4) of the entertainment figure 62 and the neck portion 174 of the entertainment figure 62 (e.g., concurrently; in a coordinated manner; as part of an act). Further, the one or more images that capture the person 180 (e.g., the actor) may be utilized to generate instructions to control an entertainment figure that represents another type of creature (e.g., dog, horse, dinosaur) and/or the camera 176 may be operated to capture one or more images of another type of creature (e.g., an actor; dog, horse) to generate instructions to control the entertainment figure that represents another type of creature.

[0060] The techniques presented and claimed herein are referenced and applied to material objects and concrete examples of a practical nature that demonstrably improve the present technical field and, as such, are not abstract, intangible or purely theoretical. Further, if any claims appended to the end of this specification contain one or more elements designated as “means for [perform]ing [a function]...” or “step for [perform]ing [a function]...”, it is intended that such elements are to be interpreted under 35 U.S.C. 112(f). However, for any claims containing elements designated in any other manner, it is intended that such elements are not to be interpreted under 35 U.S.C. 112(f).

CLAIMS:

1. A system, comprising:
 - an animated figure;
 - a set of tubes disposed in a portion of the animated figure;
 - at least one membrane that defines at least one chamber, the at least one chamber disposed about the set of tubes;
 - a first pump fluidly coupled to the set of tubes, the first pump configured to inflate each tube of the set of tubes, deflate each tube of the set of tubes, or a combination thereof;
 - and
 - a second pump fluidly coupled to the at least one chamber, the second pump configured to inflate each chamber of the at least one chamber, deflate each chamber of the at least one chamber, or a combination thereof.
2. The system of claim 1, wherein a contour of the set of tubes is configured to appear from beneath the at least one chamber at an exterior surface of the portion of the animated figure in response to an inflation of the set of tubes, a deflation of the at least one chamber, or a combination thereof.
3. The system of claim 1, wherein at least one tube of the set of tubes is configured to actuate independently of one or more remaining tubes of the set of tubes.
4. The system of claim 1, wherein the at least one chamber, the set of tubes, or a combination thereof is coupled to an actuator configured to produce a movement of an external portion of the animated figure.
5. The system of claim 1, wherein the at least one chamber comprises a set of chambers, and the system comprises:
 - a first manifold fluidly coupled to the first pump and the set of tubes;
 - a second manifold fluidly coupled to the second pump and the set of chambers;
 - or a combination thereof.

6. The system of claim 5, wherein each chamber of the set of chambers is configured to actuate independently of one or more remaining chambers of the set of chambers.
7. The system of claim 1, wherein the at least one chamber, the set of tubes, or a combination thereof is configured to be inflated with a gas.
8. The system of claim 1, wherein the at least one chamber, the set of tubes, or a combination thereof is configured to be inflated with a hydraulic fluid.
9. The system of claim 1, wherein the portion of the animated figure comprises a neck portion.
10. A system, comprising:
an animated figure;
at least one tube disposed in a portion of the animated figure;
at least one membrane that defines at least one chamber disposed about the at least one tube;
a first pump system fluidly coupled to the at least one tube, the first pump system configured to inflate the at least one tube, deflate the at least one tube, or a combination thereof;
a second pump system fluidly coupled to the at least one chamber, the second pump system configured to inflate the at least one chamber, deflate the at least one chamber, or a combination thereof; and
a control system, comprising:
a memory configured to store instructions; and
one or more processors configured to execute the instructions to control the first pump system, the second pump system, or a combination thereof.
11. The system of claim 10, wherein a contour of the at least one tube is configured to appear from beneath the at least one chamber at an exterior surface of the portion of the

animated figure in response to an inflation of the at least one tube, a deflation of the at least one chamber, or a combination thereof.

12. The system of claim 10, wherein each tube of the at least one tube is configured to expand in response to a first operation of the first pump system, wherein each chamber of the at least one chamber is configured to expand, via the at least one membrane, in response to a second operation of the second pump system.

13. The system of claim 10, wherein the one or more processors are configured to:
receive one or more images from a camera, wherein the one or more images are indicative of an effect of a corresponding portion of an actor; and
generate the instructions comprising commanded states associated with the at least one tube, the at least one chamber, or a combination thereof, based on the one or more images.

14. The system of claim 10, wherein the at least one tube comprises a set of tubes and the at least one chamber comprises a set of chambers, wherein the one or more processors are configured to execute the instructions to:
control a first pump, a first manifold, and/or a first set of valves of the first pump system; and
control a second pump, a second manifold, and/or a second set of valves of the second pump system.

15. The system of claim 10, wherein the at least one tube comprises a set of tubes and the at least one chamber comprises a set of chambers, wherein the one or more processors are configured to execute the instructions to control the first pump system and the second pump system in a coordinated manner to:
at a first time, concurrently cause a first tube of the set of tubes to expand and a first chamber of the set of chambers to deflate, wherein the first chamber is disposed about the first tube; and
at a second time, concurrently cause a second tube of the set of tubes to expand and a second

chamber of the set of chambers to deflate, wherein the second chamber is disposed about the second tube.

16. A method for providing an effect for a portion of an animated figure, the method comprising:

- receiving, via a processor, instructions for adding the effect to the portion of the animated figure;

- controlling, via the processor, a first pump system to adjust a set of tubes disposed in the portion based on the instructions; and

- controlling, via the processor, a second pump system to adjust a set of chambers disposed about the set of tubes based on the instructions.

17. The method of claim 16, comprising:

- receiving, via the processor, the instructions comprising first commanded states associated with the set of tubes, the set of chambers, or a combination thereof; and

- controlling, via the processor, the first pump system, the second pump system, or a combination thereof based on the instructions.

18. The method of claim 17, comprising:

- receiving, via the processor, sensor data from one or sensors associated with the first pump system and the second pump system;

- receiving, via the processor, the instructions comprising second commanded states associated with the first pump system, the second pump system, or a combination thereof;

- receiving, via the processor, sensor data from one or more sensors associated with the first pump system, the second pump system, or a combination thereof; and

- controlling, via the processor, the first pump system and the second pump system, or a combination thereof based on the instructions and the sensor data.

19. The method of claim 17, wherein controlling the set of tubes, the set of chambers, or the combination thereof based on the instructions comprises:

- controlling, via the processor, at least one tube of the set of tubes independently of

remaining tubes of the set of tubes;

controlling, via the processor, at least one chamber of the set of chambers independently of remaining chambers of the set of chambers;
or a combination thereof.

20. The method of claim 16, comprising:

controlling, via the processor, the first pump system to adjust the set of tubes and
controlling, via the processor, the second pump system to adjust the set of chambers disposed about the set of tubes in a coordinated manner based on the instructions to mimic changes in anatomical features in the portion of the animated figure during a performance of the animated figure.