Review on Animatronics

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Abstract— Animatronics is one of the sub branch of robotics. It includes the functionality of robots and real life animation. It is used to emulate humans or animals[1][2]. It is used in movies for special effects and theme parks. Animatronic figures are often powered by pneumatics, hydraulics, or by electrical means, and can be implemented using both computer control and human control. Motion actuators are often used to imitate muscle movements and create realistic motions in limbs. Figures are covered with body shells and flexible skins made of hard and soft plastic materials, and finished with details like colors, hair and feathers and other components to make the figure more realistic.

I. HISTORY

The making of Animatronics began by the clock makers. Many years ago there were mechanical clocks with animated characters. It moved according to the time of the clock and also created sounds. These clock were large. The Germans created affordable clocks popularly known as the cuckoo clocks[figure 1]. It consisted of a mechanical bird which popped out on specific times such as an hour after.

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The modern era of animatronics was started by Walt Disney. Disney saw animatronics as a novelty that would attract visitors to his World's Fair displays and later his movies and theme parks. He also recognized that the figures could replace actors and actresses in repetitive shows, giving audiences consistent shows that were always on schedule. As was typical with Walt Disney, he pushed the limits of technology at the time in order to achieve his vision. The first animatronic figure he created was the 9" tall "dancing man" figure that used older rotating cam technology to create the movement of the figure. It was very primitive by today's Disney standards, but it got the ball rolling. Disney and his team of WED imagineers soon developed the Enchanted Tiki birds[Figure 2] for the attraction at Disneyland (1963) and the first human animatronic figure in the form of Abraham Lincoln for the 1964 World's Fair.

Figure 1. Cuckoo clock

Figure 2. Tiki room

Today the most advanced animatronics are still at Disney Parks now located throughout the world. The Walt Disney World in Florida, with 4 amusement parks and more animatronic figures located at Downtown Disney, has the most animatronic figures available for viewing by guests. Disney's most advanced figures, like the Roy Rogers figure that can lasso a rope in EPCOT, are more lifelike than figures created at any other time. Movement and control of the animatronic figures is amazing. The next generation of Disney animatronics looks to be figures that are more interactive with the audience. Figures like Mr. Potato Head at the Toy Story Mania attraction look to capture the imagination of the audience in a new way.

II. GOAL OF ANIMATRONICS

[3]The animatronics technology is aimed to achieve the efficient degrees of freedom to mimic human and animals with their facial expressions and actions of every movement. This technology includes CAD software package in designing the speculation. It uses face tracking software to develop the movements and
behaviors of the human. This software is used to develop the eye motion, eye brow motion, mouth motion, neck motion, hand motion, leg motion and corresponding degrees of freedom to the robots.

III. DESIGN PROCESS

The design process consists of major 5 processes - a) Design b) Sculpting c) Modelling d) Armature fabrication e) Costuming and f) Programming. We are going to discuss it in brief.

A) Design

Designing is used to create a base drawing or base sketch of the bot to be made. It could be made on paper[Figure 3] or can also be created by high-end computer design softwares such as CAD or Blender[Figure 4]

![Figure 3. On paper drawing of bots](image1)

![Figure 4. Animatronic bot design created by Blender software](image2)

B) Sculpting

Creation of animatronic characters typically involves some form of sculpture. The sculpture not only needs to be lifelike or accurate to the model concept, but the design of the final flexible pieces created from the sculpture need to move accurately. This takes more skill than a traditional sculpture. Choosing the right clay to make a flexible head or other parts is important. Wax-based clay, also known as plastalina clay, is used most often for sculpting human-size animatronic figure models. Wax-based clay works well because it is very stiff and does not air dry. It can also be removed from the final casting, although the original clay sculpture is destroyed. For large character sculpture, WED clay (named after Walter Elias Disney) is sometimes used for professional animatronic sculptures.

![Figure 5. Sculpture by clay](image3)

C) Modelling

The molding department takes the form created by the sculptor and creates the molds that will ultimately produce the character skins. Molds can be soft or hard, single or multiple pieces, and reusable or non-reusable. To get the sculptor’s exact interpretation, mold making is both an art form and an elaborate technical process. The process can be very time-consuming and complicated. In simple terms it is giving details to the sculpture.

![Figure 6. Modelling](image4)

D) Armature fabrication

Meanwhile, various body armatures are being created and are assembled in the welding metal-fabricating areas. Each of the robot’s movements axis points must have an industrial-rated bearing to provide action and long life. Each individual part requires a custom design and fabrication. These artisans are combining both art and technology to achieve realistic, lifelike moves. As the armature takes shape, the actuators, valves, flow
controls and hoses are installed by the animation department. The technicians select those components carefully in order to ensure the durability and long life. As it’s assembled, each robotic move is individually tested and adjusted to get that perfect movement.

Figure 7. Armature fabrication

E) Costuming

This is the process which in true sense differentiates an Animatronic bot from a normal one. It is a process of giving outer fabrication or a skin-like look to make the bot look more realistic and life-like. Some materials used are Latex, Silicone, Polyurethane, Plaster.

Figure 8. Costuming

F) Programming

Finally, if it is an animated character the electronic wizard move in to connect the control system into valve assembly in the preparation for programming. Programming is the final step, and for some animations it is the most rewarding. Programming can be done either at the manufacturing facility or at the final installation site. In programming, all the individual moves are coordinated into complex animated actions and nuances that bring the character to “life.”

IV. FUTURE SCOPE

Between 2009 and 2025, it is expected that Animatronics would be used on a very high scale. The entertainment industry is adopting new means of amusing the public, creating realistic interactions between people and objects of imagination. Robots are becoming more prestigious and most sought after technology by many people and industries. Scientists and engineers are constantly improving these synthetic organisms, achieving a new level of sophistication every year. We can expect clones of humans in the future too. As these machines continue to evolve, entertainment will be revolutionized; the future robots would have the ability to entertain humans even in their very own homes. Later to be equipped with artificial intelligence, these mobile robots would be capable of thinking and reasoning just like a human, establishing an even closer connection between man and machine.

V. ADVANTAGES

1) Machines have lower working cost than people.
2) It can do anything that man and animals can’t do.
3) It make the bridge of communication between man and machine easier.

VI. DISADVANTAGES

1) It’s made up of complex systems, so it’s difficult to make, handle and use it.
2) It consumes more power.
3) Can be misused or hacked into.

VII. CONCLUSION

We can conclude that the technology is very beneficial in several industries and is here to stay. If used properly it would be a boon to mankind.

References