ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 7, Issue, 7, pp. 12355-12358, July, 2016

International Journal of Recent Scientific Research

Research Article

USE OF MECHATRONICS IN MUSEUM EXHIBIT DEVELOPMENT

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ARTICLE INFO

Article History:

Received 05th March, 2016
Received in revised form 21st May, 2016
Accepted 06th June, 2016
Published online 28th July, 2016

Key Words:

Mechatronics, Animatronics, Robotics, Exhibit, Museum

ABSTRACT

This Paper mainly focuses on the use of Mechatronics systems in museum exhibit development and interfacing the exhibit-visitor interaction. It shows how the Robotics & Animatronics techniques can be used in different museums for making interactive exhibits. As an example to the interfacing process, I have developed one model – a Mini 2D plotter using Arduino Uno R3. Basically, this model is a plotting machine, but it showcases what way a basic Mechatronics technique is applied to interface an input command with the output result.

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INTRODUCTION

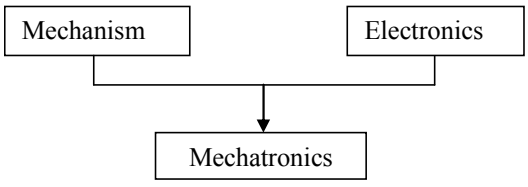
For a very long time, Mechanical Engineering has been running the world with its tools & contrivances. Interfacing between electrical and mechanical engineering has helped in the energy conversion methods and eased the creation of mechanical systems. With the advent of electronics and computer science, a dramatic enhancement was made possible in the electro-mechanical system, and such integration of the engineering systems brought about a new technique known as ***Mechatronics***. The revolutionary introduction of the microprocessor in the early 80s has changed the paradigm of mechanical design forever. It has expanded Mechatronics to the level of intelligent control and autonomous decision making. Mechatronics has evolved as a discipline of Engineering of its terms over the years. It has been amplifying the life of a human being.

In this field, day by day, technological advancement makes our life easier. In our everyday lives, we are associated with different kinds of modern Mechatronics Systems and benefitted in many ways. So, whenever a visitor visits a museum, be it an Archaeological, Art or Science & Technological, his expectation for the level of interaction with its exhibits will undoubtedly be high in order to have an effective, immersive and enjoyable learning experience. With a view to fulfilling this expectation of the visitors, there should be proper use and application of modern Mechatronics systems in the museum field, particularly in the areas of development, display technique and visitation of & interaction with the exhibits/exhibitions of the museums.

What is Mechatronics?

Simply Mechatronics can be defined as the application of electronics and computer technology to control the motions of mechanical systems.

It is nothing but the integration of mechanical, electronics, control and computer engineering to develop products, processes, and systems which have greater flexibility, quickly redesign and the ability of reprogramming.



Mechatronics –A new paradigm for museum exhibit development

We know exhibit an object or collection of objects on public display in an art gallery or museum or trade fair through which visitor can learn something or get fun. The visitor can gain experience through edutainment & infotainment.

When visitors visit Museum & experience the exhibit, most of them not only gather information & fun but also observe the construction behind the exhibit. Now visitors are already using the smart system or devices in their daily life. Their expectation

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level for interfacing with exhibit becomes high. For example, now car motion is controlled by the mind which is more attractive than wireless control.

Due to rapid development in a different field, new technologies are coming, our life getting easier. Shopping mall, cinema hall Zoo & Park are the competitor of the museum. The museum competitors are using their system which is more technologically upgraded & advance by using mechatronics. So to grapes the maximum visitor we have to make more interactive exhibit using the mechatronic system.

It is not like that we are not using mechatronics earlier if we see the exhibit development history we have to integrate mechanically, electronics & computer to make an interactive exhibit. Due to paradigm shifting of technology in each field we just need to change the way of exhibit making & also we have to adopt new devices. With the application of mechatronics, we can build the smart museum.

Application of Mechatronics in Museum Exhibit Development

Here I will consider some museums where Robotics & Animatronics techniques are used for museum Exhibit.

Use of Robotics in Museum Exhibit Development

Grand Rapid Public Museums (USA)

The larger-than-life-size animated robots include a chameleon, a rhinoceros, a giant squid with 18-foot tentacles and a platypus. Also featured are a house fly with a 10-foot wingspread, a grasshopper, a bat and a giraffe whose head and neck alone stretch 9 feet tall. Machinery in the robot animals simulates the body parts of their real-life counterparts

Figure 1 Robot Zoo Exhibit

Jewish Museum, Berlin, Germany

There is an industrial robot which writes a Torah. It does not use digital printing techniques to do this. It adopts the human act of writing. It uses pen & ink. There is an 80-meter roll of paper .it writes the speed of a human a total of 304,805 Hebrew letters.

The De Young Museum, San Francisco, USA

Two telepresence robots that offer a virtual tour of the museum's galleries. it will give benefit to the visitors those who are paralyzed, home bounded & physically handicapped

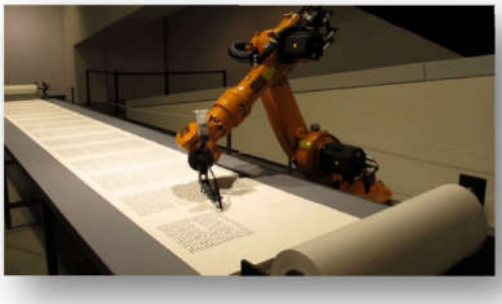


Figure 2 Robot writing Torah

Figure 3 Telepresence Robot

Museum of Science & Industry, Chicago, USA

On 21st may 2015, the Museum of Science & industry in Chicago launched robot revolution exhibition. One of the exhibit is the robot playing card with the visitor.

Figure 4 Robot playing Card

Museum of Mathematics, Newyork, USA

There are two dozen small growing robots who react to the presence of visitor & can communicate each other. In this museum swarm robots are present for teaching kids & adult mathematics.

Figure 5 Swarm Robot Exhibit

Use of Animatronics in Museum Exhibit Development

The Chisholmtrail Museum

The museum wanted to tell this Story from Mr. Chisholm's perspective. An animatronic figure was created so visitors could sit and listen to the story of how Mr. Chisholm established the trail.

Figure 6 Chislom Exhibit

The Wonders of Wildlife Museum

Campfire friend Sitting on a log, his position is very relaxed. one arm is resting on his leg, the other is poking the fire with a stick. The leg on which the one armrests moves back and forth when the figure leans side to side.

Figure 7 Campifire Exhibit

Evolution of Life Gallery, Science City, Kolkata

In this gallery where exhibits are made using animatronics (Mechanical Animation) technique & there is proper application of mechatronics in exhibition display. Here sitting on the car visitor can visit the gallery. This car is the example of mechatronics system

Figure 8 PLC based embedded system in the car in evolution of life Gallery

Figure 9 Maintenance Work

Mechatronics Model- Mini 2d Plotter Using Arduino Uno R3

This mechatronics model is plotting machine. We can use this plotter not only in exhibit development but also as an exhibit.

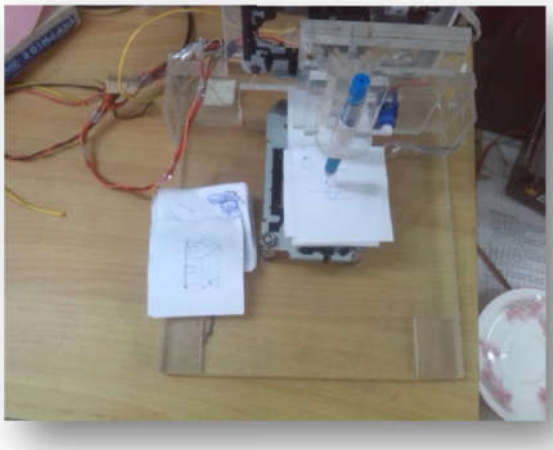
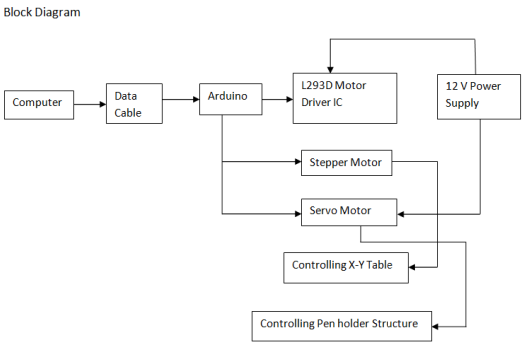


Figure 10 Sample drawing of plotter



Electronics Component

- Arduino Uno R3
- Tower Pro SG90 9g Servo Motor
- L293D motor driver IC
- Two bipolar steeper motor
- 5 V Battery Set/SMPS power supply

Mechanical component

- DVD writer Mechanism
- Perspex structure(Thickness 11 mm)
- 3 inch bolt 4 pcs with nut
- Attachment for pen movement

Future Scope of Work

Mechatronics promises considerable potential in the development of exhibits / exhibitions by using new devices and techniques. For example,

- To involve visitor physically and emotionally, one can build different animatronics movement characters.
- Gesture interactivity with the exhibits so that visitor can enjoy more.
- Recently, there are a lot of developments on mind-controlled activities. It is very important because earlier in wireless data transmission, variation of data was between 0 and 1, but in mind-controlled activities, the variation is large.
- For the mechatronics Model:
- One can extend this model for building the proper user interface. Instead of using Arduino Uno R3, one can use *Beagle board* or *Raspberry pi*.
- For developing the proper user interface, one can develop software in Visual Basic or Android app.
- For curvature or pure circle drawing, one can modify the whole mechanical structure.

CONCLUSION

Due to converge in technology many new devices & Products are coming day by day .we can say mechatronics a rapid paradigm shift in the museum field. From the study, I have found Mechatronics play a vital role in the Museum Exhibit Development & Exhibition Display. In developed country, there are lots of new technology by which they are building more interactive & advance exhibit.

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How to cite this article:

Sk Sakil Amed and Parijat Chakra Borty.2016, Use of Mechatronics In Museum Exhibit Development. *Int J Recent Sci Res.* 7(7), pp. 12355-12358.