

Development of Kinetic Interactive Art Using Dynamixel Control Shadow Mobile

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Abstract: Smart phone is center of mass media. Many digital artists are using smart phone in art work. We developed dynamixel shadow mobile using Smartphone has gyro sensor. The rotation of the motor is controlled by the breath of the audience using sensor. Kinect sensors mounted on structure, recognize the position of the spectator is able to control that depends on eight motors installed in parallel with the vertical motion. Dynamic cell motor, planted a unique ID number was developed to allow control of the rotation and the angle of direct communication to each of the motor. In this research, the rotation of the motor is controlled by the breath of the audience using sensor. Kinect sensors mounted on structure, recognize the position of the spectator is able to control that depends on eight motors installed in parallel with the vertical motion. MaxMSP, Jitter are used to programming. Dynamic cell motor, planted a unique ID number was developed to allow control of the rotation and the angle of direct communication to each of the motor. Kinect image the sensor, making the rotation angle with a value of 0-1023 of the eight motors deeply recognized through the audience's location and video. It was designed to be able to control the length of the line. Further, the audience of the deposit sensor is connected to the Arduino board, the analog data value of 0-254 entered, ligated to the rotational speed of the motor and implemented as a system can be controlled in real time. We implemented the interactive shadow mobile using dynamixel control and kinetic sensor. This task will expand the representation area of interactive art and digital art field.

Key words: Kinetic, interactive art, dynamixel, digital art, motor control, gyro sensor

INTRODUCTION

We developed a 'Shadow Mobile'. It works by dynamixel control. Our research is inspired by the baby mobile. This is a kind of digital art and also kinetic art. Digital art is practice that uses digital technology. Currently, various names have been used to describe the process including computer art and multimedia art and digital art is itself placed under the larger term new media art and art field. What we have implemented is an art and interactive installations using eight motor control and gyro sensor of smart phone. A kinetic sensor mounted on structure, recognizes the position of the spectator is able to control that depends on eight motors installed in parallel with the vertical motion. MaxMSP, Jitter are used to programming. Kinetic image the Sensor, making the rotation angle with a value of 0-1023 of the eight motors deeply recognized through the audience's location and video. It was designed to be able to control the length of the line. Further, the audience of the deposit sensor is connected to the Arduino board, the analog data value of 0-254 entered, ligated to the rotational speed of the motor and implemented as a system can be controlled in real time. Needs the periodical monitoring. Recent, in variety

of digital artworks, smart machines are being used as an important interactive devices. Gyro sensor is a good intuitive interaction elements.

Literature review

Kinetic art works: Kinetic means energy that is in motion. Artists use the energy in kinetic art. So, kinetic art is usually looks like mobile. It moves via. wind, touch or motor. Viewer's perspective of art work have been extending, especially in kinetic art work.

Kinetic art is three-dimensional sculptures. It is almost same with mobiles. Wind, motor or the observer moves each parts of kinetic art. There is also a portion of kinetic art that includes movement or rather movement perceived from only certain angles or sections of the research (Furuta *et al.*, 2010). Motion is important factor in kinetic art. In kinetic art we can see virtual movement. It's style of kinetic art.

Recently, Kinetic Sculpture is an international exhibition events such as the Kinetic Art Fair of the United Kingdom to provide the best immersive degree to visitors as a cultural content that art and technology are fused, focused the attention of people around the world I have received and to (INRIA., 2011), MIT Media lab and

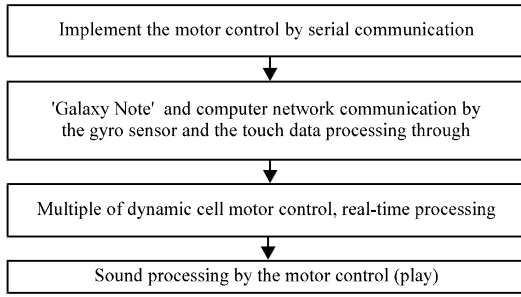


Fig. 1: Motor control implementation



Fig. 2: 'HyperMatrix'

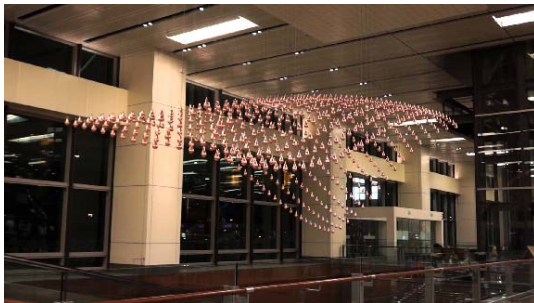


Fig. 3: 'Kinetic Rain'

a number of prominent Engineering Institute are participating in these exhibitions. Figure 1-3 are example of kinetic arts 'HyperMatrix' and 'Kinetic Rain'.

MATERIALS AND METHODS

Implement of art work

Kinetic art: The research is played via. "Galaxy Note". System design of our art work 'Shadow Mobile' is as (Fig. 4).

Many digital artists are using smart phone and smart pad in art work. The interface of digital art accept the audience's five senses mainly sight, hearing and also receive psychological thinking and sensitivity stimulate

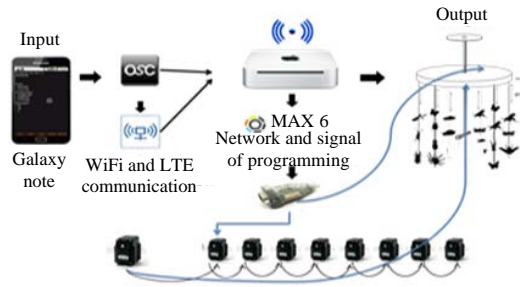


Fig. 4: USB module and computer communication programming

elements. A creation is coming up through the artist's thoughts and process according to these indicating factors of the audience. The audiences experience perceptually from messages of the art work and the communication between the art work and the audience can be completed. Many artists using sensor technology for developing their art works. To communicate with the audience and makes real time feedback between the audience and the art work is the key nowadays. Interactive digital art us not only web camera but also use the most developed technologies to create an art works in a new form. Audiences receive the technology as a participation of the art works. There is an input interface which receives data values through the participation of audiences. Therefore, sensor inside of the interface is also input interface. The place that sensor installed is the place for various technologies are connected. Using various sensors, it is significant to select a correct sensor for the concept of the art work.

MaxMSP, Jitter is used to programming. MAX is a famous visual programming language for digital artists it has been used by composers, performers, researchers and artists to create recordings, performances and installations. Dynamic cell motor, planted a unique ID number and was developed to allow control of the rotation and the angle of direct communication to each of the motor. We used parallel motor communication.

Floor Plan: Floor Plane of 'Shadow Mobile' is as Fig. 5 and 6. In our interactive art work dynamixel is used to control the work. DYNAMIXEL (DXL) is a performance networked actuators for robots developed by a ROBOTIS. It can be used for multi-joint robot systems such as robotic arms, robotic hand, hexapod robot, snake robot, scorpions, pan tilts, kinematic art, animatronics and automation, etc. Figure 6 shows exhibit floor plan include spectators. Spectators can appreciate moving objects, sound and shadow images in the wall. Spectators move work in real-time via. the gyro sensor of the 'Galaxy Note'

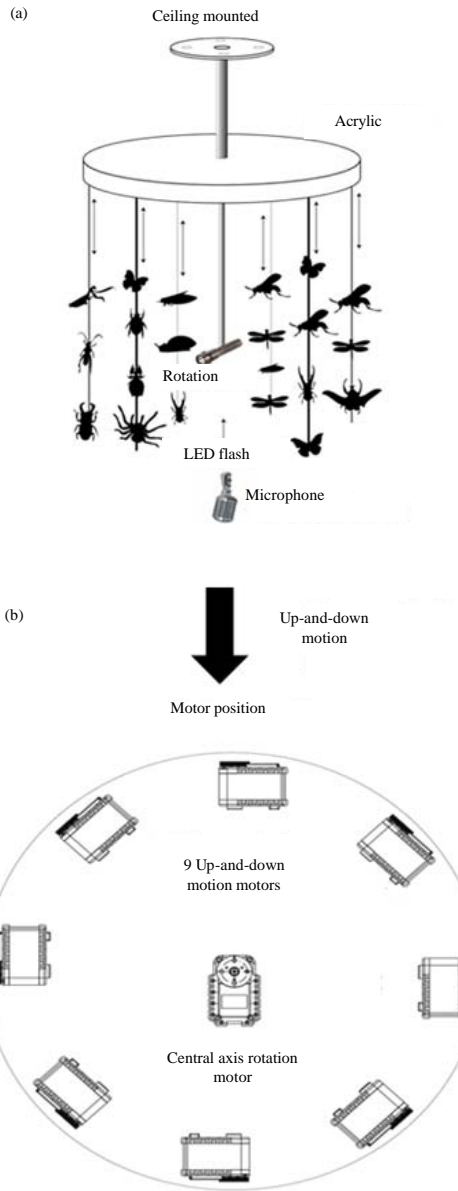


Fig. 5: Floor plan of 'Shadow Mobile'

and appreciate the change of the shadow. Mobile is composed of diverse bugs (Henkelman and Jonsson, 2001).

Software programming: We programmed motor control system. There are 8 motors in our art work. MaxMSP is suitable for these real-time interactive control art works. Figure 7 and 8 indicates 'Galaxy Note' and computer communication programming. Figure 9 indicates USB module and computer communication programming (Mei *et al.*, 2008). Each of the motor forms movements of the entire work. Moves in accordance with the reaction of

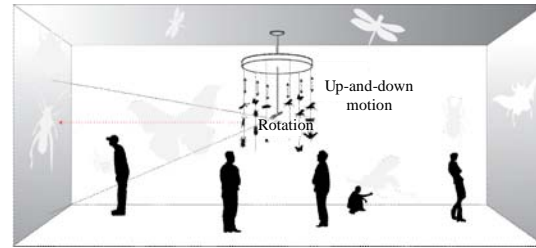


Fig. 6: Floor plan of 'Shadow Mobile' 2

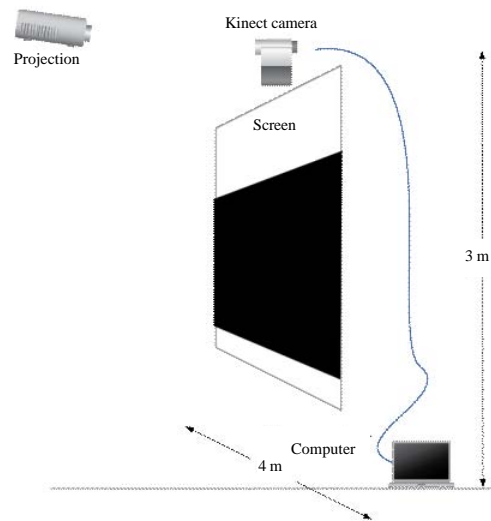


Fig. 7: Flow plan related kinect

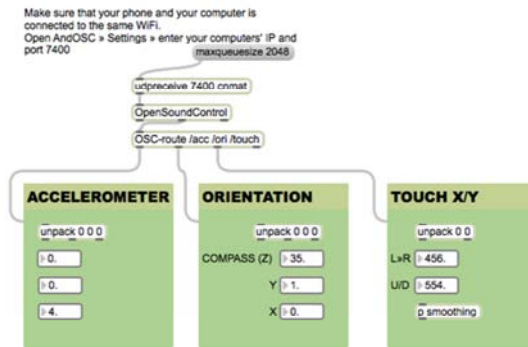


Fig. 8: 'Galaxy Note' and Computer communication programming

the audience, MaxMSP controls these motors in real time. When there is the audience and also there is no audience, Always works is actuated, depending on the situation. 'Galaxy Note' is appreciation tool and also controller in our art work. Smartphone has gyro sensor. In most

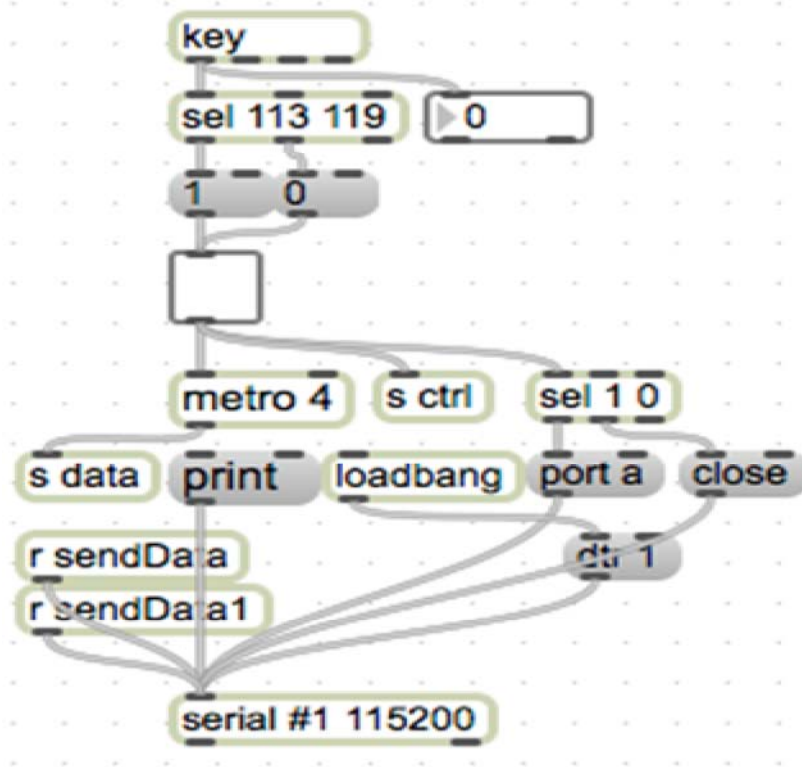


Fig. 9: USB module and computer communication programming

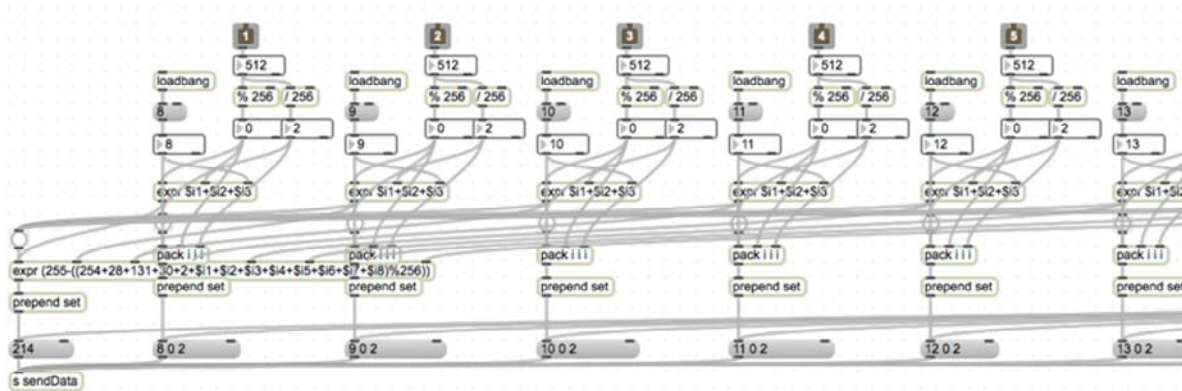


Fig. 10: Parallel control programming

digital gadgets, there are 3 perpendicularly mounted accelerometers and 3 gyros which give complete information about the orientation and motion of the device.

Programming of 'Shadow Mobile' is as Fig. 10 it present the programming of parallel control about 8 motors.

This algorithm processes to multi-dynamixel motor using slope value. Figure 10 shows granted ID to the

motor, movement value for rotating the motor and processing the pitch values to process the power of motor in a multiplex mode.

Figure 11 shows system of the value of the gyro sensor, the Galaxy Note Applications MaxMSP network OSC it shows the communication configuration and programming structure. Figure 12 shows X, Y tilt (gyro sensor) data conversion (scale) by processing algorithm.

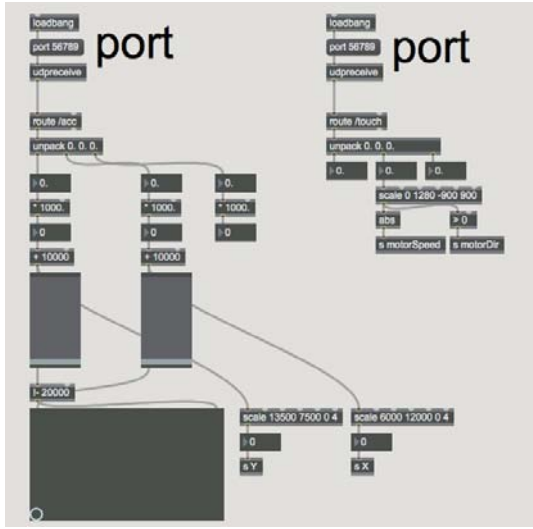


Fig. 11: Gyro sensor network structure

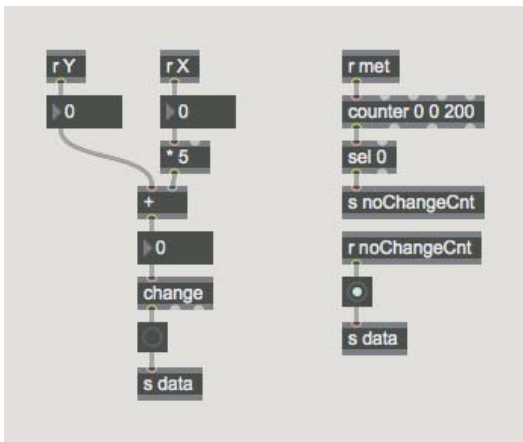


Fig. 12: 'Galaxy Note'

This system is main factor in control this system. One of the reasons is that many of the digital artists to use the smart phone as an interaction tool is also exactly in this system.

Figure 13 shows of the algorithm that rotates automatically little movement when there are no spectators in front of the art work. When there are no spectators it is also presented in the art work.

Figure 14 shows the structure of the algorithm to be processed evenly distribute the value of the gyro sensor data piece in various directions. Through this system when the left side is decreased the right side is processed to rise. While, it is moving by the controller 'Galaxy Note' (Calvo *et al.*, 2007) it moves like the natural mobile hanging on the ceiling.

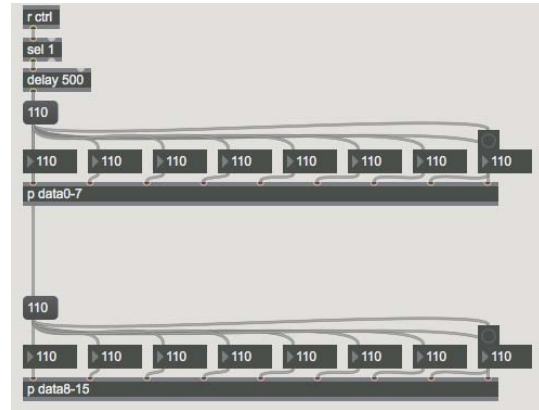


Fig. 13: Rotation system without spectators

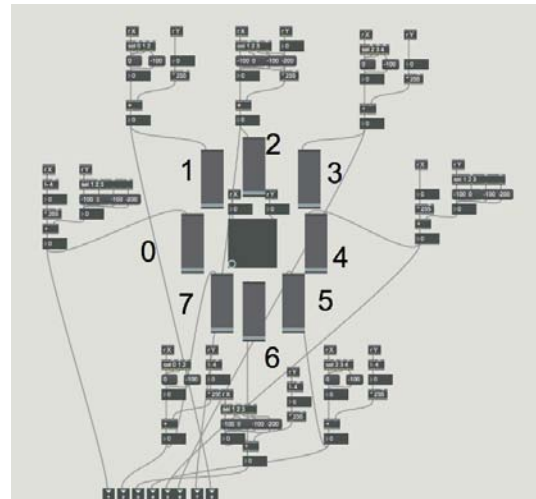


Fig. 14: Gyro sensor and motor control structure

Figure 15 shows motor rotation. The motors located in the outer shell, don't rotate continuous. They have approximately 270° radius of gyration. However, lighting motors rotate continuously through the spectator's touch. Lighting motor's rotation is faster by touch of spectator. Smartphones are good devices with which interactions between humans and systems occur because they are equipped with screens, sensors and telecommunications gadgets (Liu *et al.*, 2014; Yim and Joo, 2015). The nowadays installations used in different type of electro mechanic workshops have the following drawbacks: huge volumes, big costs and there is the necessity of the high qualification staff, great consumption of the active materials and small utilization coefficient, reduced workable, very difficult to be transported, small degree of adaptation, low flexibility

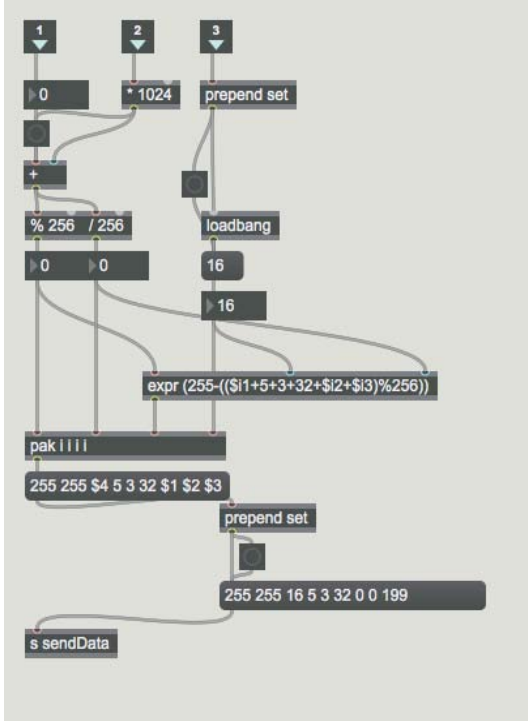


Fig. 15: Motor rotation

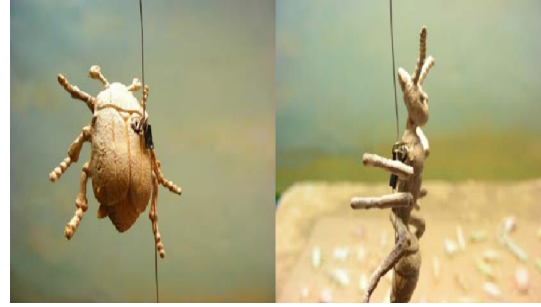


Fig. 17: Installed object (diverse bugs)



Fig. 18: Shadow mobile objects

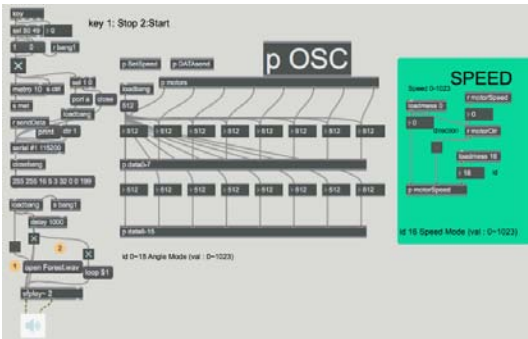


Fig. 16: Implemented system

(Plesca, 2013). Figure 16 shows implemented program. Process of whole system is as follow.

Installed object: Figure 17 and 18 is the hanged object. We used diverse bugs to implement art work. The entire concept of the exhibition that contains this research was ecosystem. We selected the insects it can shows diverse shadows forms for in the components of the ecosystem. Why we choice the bugs to subject of our art work is that the entire ecosystem is the themes of the exhibition we participated.



Fig. 19: Installed 'Galaxy Note' controller

RESULTS AND DISCUSSION

Figure 19 is installed 'Galaxy Note' controller. Spectator can move this controller freely. Figure 20 shows the displayed 'Shadow Mobile' and spectator. The spectator appreciates our art work using touch, sound via. kinetic sensor and smart phone 'Galaxy Note'. Synesthesia is a important concept in our interactive art work. We implemented the interactive shadow mobile



Fig. 20: Installed art work with spectator



Fig. 21: Shadow control



Fig. 22: Shadow Mobile2

using dynamixel control and Kinetic sensor. This task will expand the representation area of interactive art and digital art field. Their object included sensing interaction that in a digital art field had brought together more than

non-sensing digital art. This research's feature is a synesthesia. The audience will see a moving of mobile and shadow (Fig. 21 and 22).

CONCLUSION

In the research, mechanical technic is used to interaction to induce a strong and intuitive artistic immersion of audience. This research and research will give more representation and widen the technical area of digital art.

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