New Visual Programmer Converter that allows the Hummingbird Duo to Run Untethered

Cristina M. Morales Mojica[1], Dr. Illah R. Nourbakhsh[2]
University of Puerto Rico at Bayamon, Puerto Rico[1]
Carnegie Mellon University, Pittsburgh, Pensilvannia[2]

Motivation

- Allow novice students to use untethered mode by translating Visual Programmer code to Arduino code.
- Learning how to code could be a frustrating process for many novice users.
- Expose students to the code to facilitate the transition of students from novice to intermediate.
- Encourage young students to pursue fields in electronics, programming and robotics.
- Provide a more comfortable environment when using the Hummingbird Duo.
- Easier mobility.

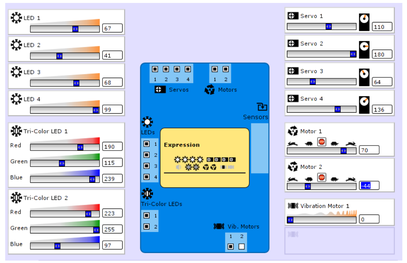
Background

- The Hummingbird is a robotics kit designed for educational purposes.
- The user programs the Hummingbird controller to manipulate components such as LEDs, Motors and Sensors.
- The newly released Hummingbird Duo has integrated an Arduino Leonardo in addition to standard Hummingbird capabilities.
- The Hummingbird Duo can currently be programmed with Visual Programmer or with Arduino code.

Visual Programmer	Arduino Code
Novice Users	Advance Users
Easy to learn	Text language requires user to learn syntax
Limited programming complexity	Can create complex and elaborated programs
Tethered operation	Untethered operation

Visual Programmer components and their conversion

Expressions



```
hummingbird.setLED(2,105);
hummingbird.setLED(1,171);
hummingbird.setLED(4,252);
hummingbird.setLED(3,173);
hummingbird.setServo(1,134);
hummingbird.setServo(3,78);
hummingbird.setServo(4,165);
hummingbird.setServo(2,219);
hummingbird.setVibration(1,0);
hummingbird.setTriColorLED(2,223,255,97);
hummingbird.setTriColorLED(1,190,115,239);
hummingbird.setMotor(2,-112);
hummingbird.setMotor(1,179);
```

Expressions are Visual Programmer's basic unit. It could be interpreted as a "static" robot pose, and when is part of a sequence is displayed as a method.

Counter

```
for(int counter = 0; counter <5; counter++){
        LEDs();
        delay(500);

        Servoat27();
        delay(1000);

}
```

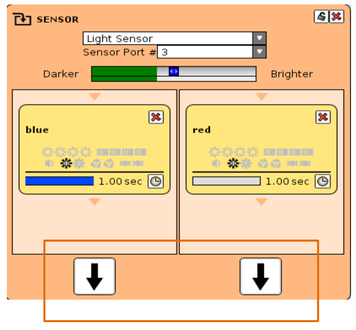
Counters allow the user to repeat a set of components a specified number of times like a *for* loop.

Sequences

```
StartMotor();
delay(1000);
blue();
delay(1000);
//Start Seq: Sequence.xml:
    LED1();
    delay(500);
    Servoat27();
    delay(1000);
    blue();
    delay(1500);
//End Seq: Sequence.xml
```

Sequences are the combination of all the components, including other sequences

Conditional Loops



```
if(hummingbird.readSensorValue(3)<511) {
        blue();
        delay(1000);
}else{
        red();
        delay(1000);
}
```

```
while(true){
   if(hummingbird.readSensorValue(3)<511) {
        blue();
        delay(1000);
   }
   else {
        red();
        delay(1000);
   }
}
```

```
while(hummingbird.readSensorValue(3)<511)
{
        blue();
        delay(1000);
}
        red();
        delay(1000);
```

```
while (hummingbird.readSensorValue(3)>511) {
        red();
        delay(1000);
}
        blue();
        delay(1000);
```

Conditional loops are decision making components that can be set to repeat the elements inside the square by changing the arrows below. The conditional loop can generate four different possibilities that translate to *if-else* statement or *while* statement.

Discussion

Sensor conversion

The values from the Visual Programmer are given in percent format, and a conversion was needed. For potentiometer and distance sensor, a conversion to the opposite equivalent value within a rage was applied, and the range values for distance and temperature were modified.

Limitations

To change the Hummingbird Duo from Arduino Mode back to Hummingbird Mode a firmware burner is needed.

Availability

The converter is available as a standalone application and integrated in the Visual Programmer.

Conclusion

This is a tool for any user that wishes to use the Hummingbird Duo controller in Arduino Mode and does not have the knowledge and/or the time for developing the code.

References

- https://www.kickstarter.com/projects/938274194/hummingbird-duo-a-robotics-kit-for-ages-10-to-110
- http://www.hummingbirdkit.com/learning/software/visual-programmer
- http://www.cmucreatelab.org/projects/Arts_&_Bots
- http://artsandbots.posthaven.com/pages/research