

Mobile Motion Tracking Robot Arm

Fall 2015 Senior Design

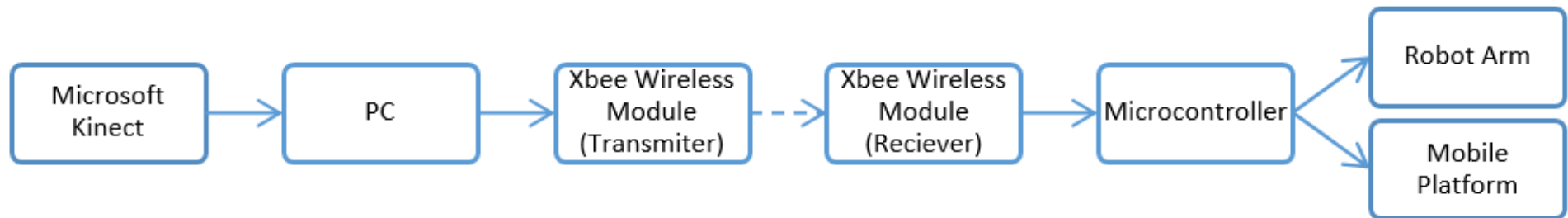
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Overview

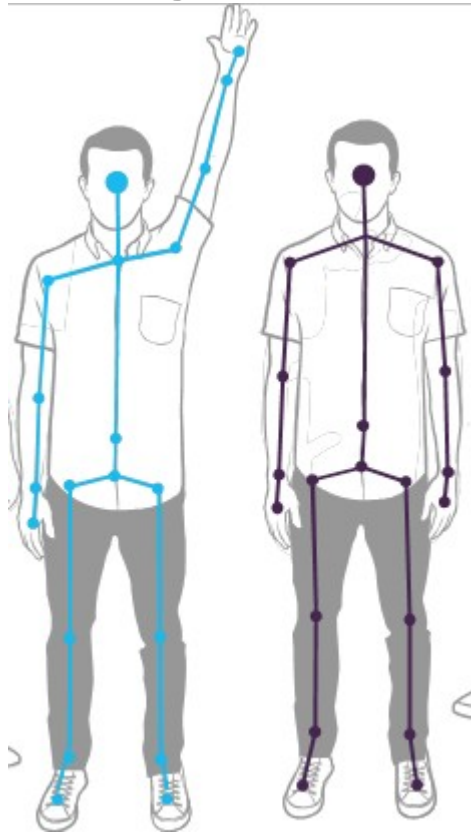
- Microsoft Kinect motion tracking used to control the movement of a robot arm
- Five degrees of freedom
- Robot arm attached to mobile platform controlled by the user
- Wireless communication between computer and microcontroller through XBee modules

Overview



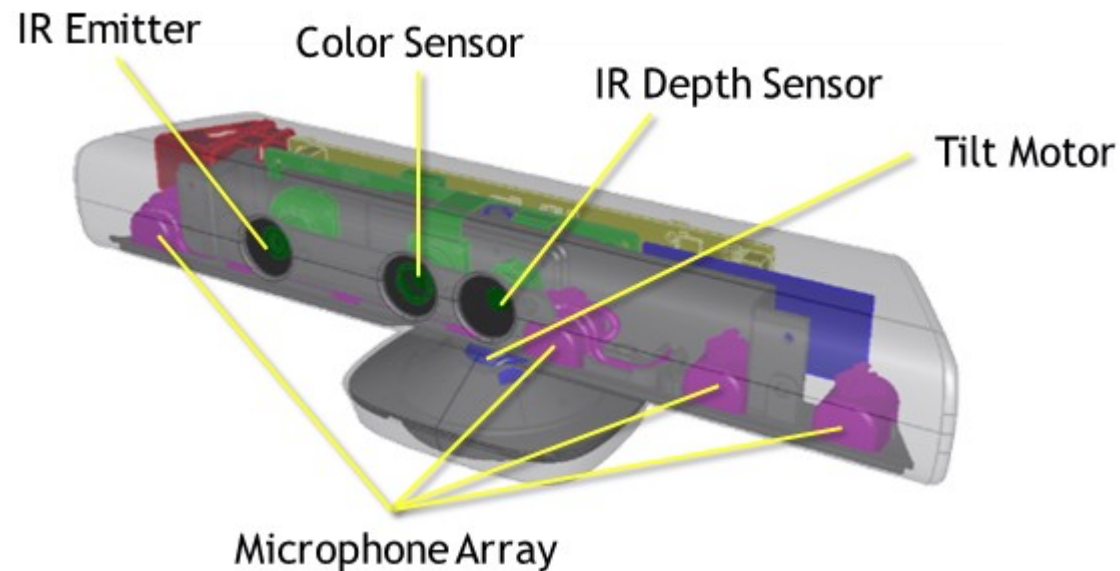
Microsoft Kinect Skeletal Tracking

- Microsoft Kinect uses a technique called structured light to do skeletal tracking



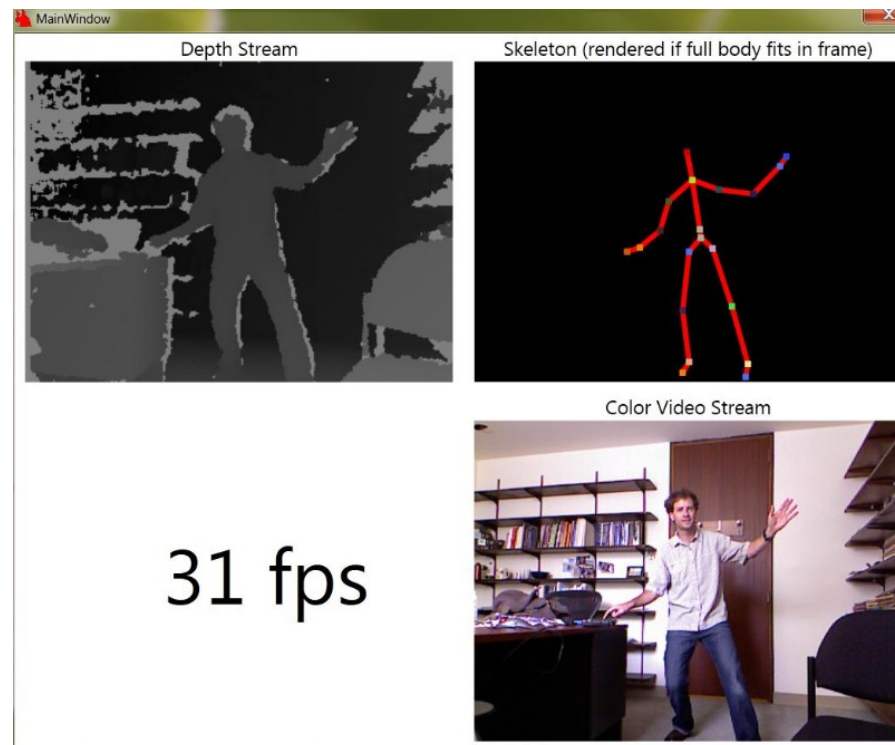
Microsoft Kinect Skeletal Tracking

- IR emitter emits a pattern of infrared light
- IR depth sensor detects light and creates depth map



Microsoft Kinect Skeletal Tracking

- Kinect compares generated depth map to training examples to determine body parts
- Assigns joints based on body parts



Microsoft Kinect Skeletal Tracking

- Microsoft SDK

```
// Enable skeletal tracking  
KinectSensor kinect = null;  
kinect.SkeletonStream.Enable();
```

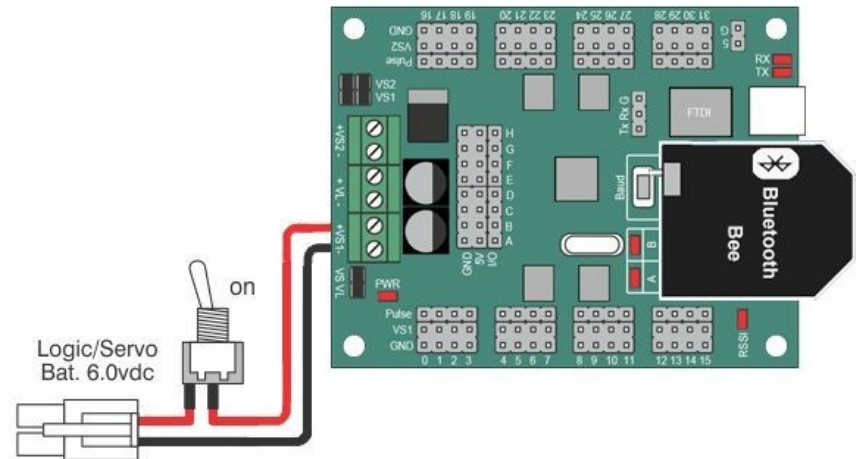
```
// Access skeletal information  
SkeletonFrame skeletonFrame = e.OpenSkeletonFrame();  
skeletonFrame.CopySkeletonDataTo(this.skeletonData);
```

Wireless Data Communication

- Wireless data communication will be done with a Digi International XBee 802.15.4 module
- The XBee transmitter module operates on a 2.4GHz radio frequency to transmit data to a receiver
- The receiver communicates with the microcontroller mounted on the robot
- Xbee module is compatible with our Lynxmotion SSC-32U servo controller

Servo Controller: Lynxmotion SSC-32U

- SSC-32U can control up to 32 servo channels as well as having 8 analog I/O ports
- Bidirectional communication with query commands, synchronized, or “group” moves
- Motion controls can be immediate response, speed controlled, timed motion, or a combination



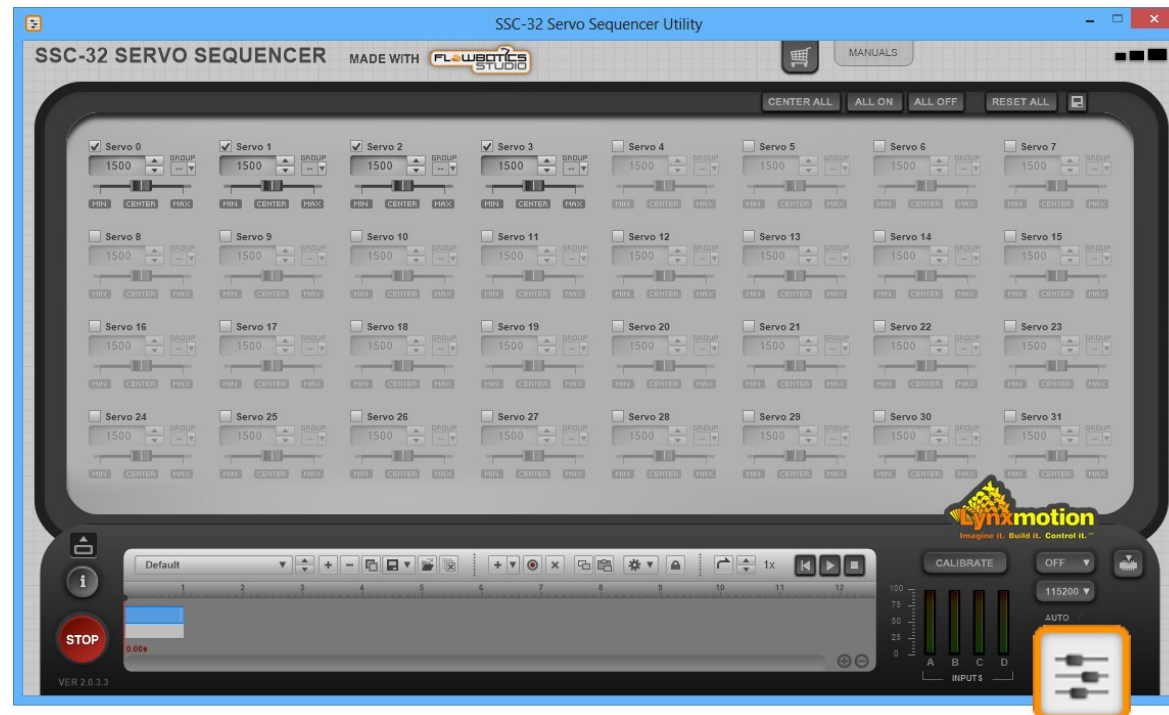
Servo Controller: Lynxmotion SSC-32U

- Group moves allow any combination of servos to begin and end motion simultaneously



SSC-32 Servo Sequencer

- Free utility to manipulate the motion of the arm
- Moves servos, calibrate their positions, store and playback motion sequences
- We will program the utility to control motors based on commands received from XBee module



Alternative

- As an alternative, we can use an Arduino microcontroller to control the SSC-32U server controller
- Program Arduino, sends serial commands to the SSC-32U, which in turn controls the servos

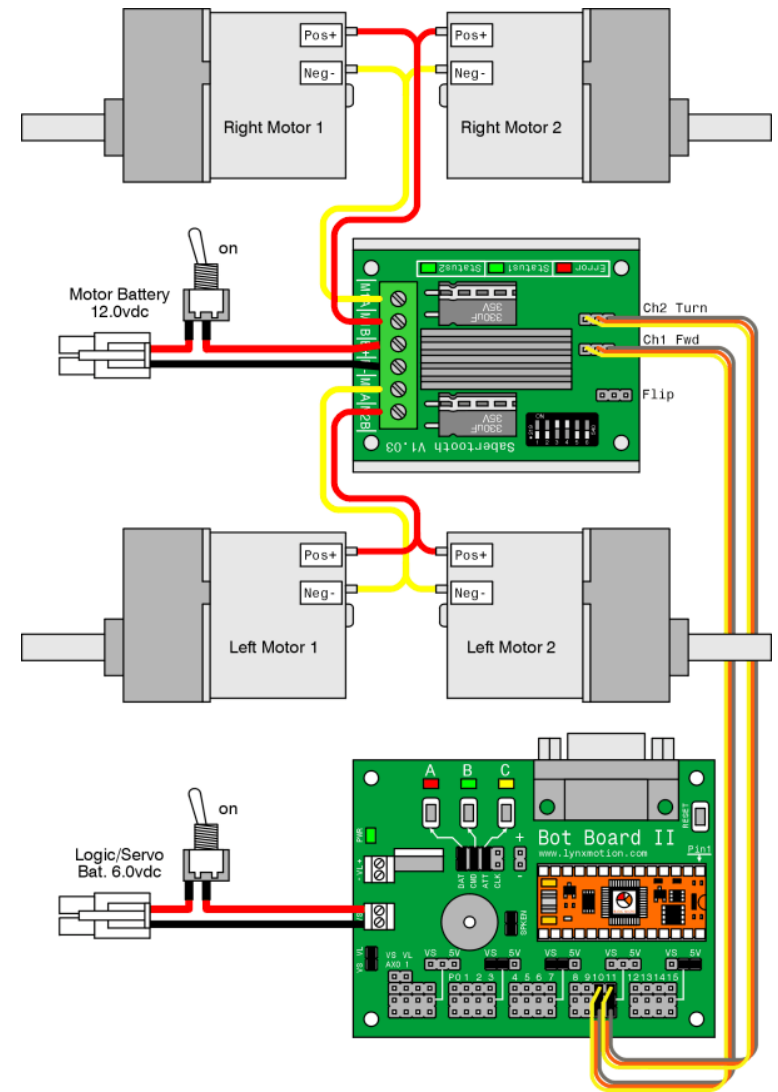
Robot Arm: Lynxmotion AL5D

- Arm has 5 servos, one for each motion
 - 180 degree rotation at the base
 - Forward and backwards
 - Up and down
 - Open and close gripper
 - Rotate gripper at the wrist
- Each servo has three wires. Two for power (voltage and ground), and a pulse signal controlled by the microcontroller to turn servo on/off
- Microcontroller and servos will be powered by a 6.0vdc battery pack



Mobile Platform

- 4WD platform to transport the arm
- Microcontroller will control platform servos through a motor controller
- Motor controller has two channels, turn and forward, that are connected to output pins on microcontroller
- Platform servos powered by 12.0vdc battery



Mobile Platform

- A wireless camera will be attached to the mobile platform to allow the user to monitor the arm from a distance
- The camera will send video over a 2.450GHz radio frequency to a computer
- The camera will be powered by a 9.0vdc battery pack

References

<http://voxcommando.com/forum/index.php?topic=1653.0>

<http://users.dickinson.edu/~jmac/selected-talks/kinect.pdf>

<https://msdn.microsoft.com>

<http://www.lynxmotion.com>

<http://www.digi.com/support/productdetail?pid=3257>

<http://www.instructables.com/id/Controlling-Servos-Using-the-SSC-32-Servo-Controll/>

Questions

