

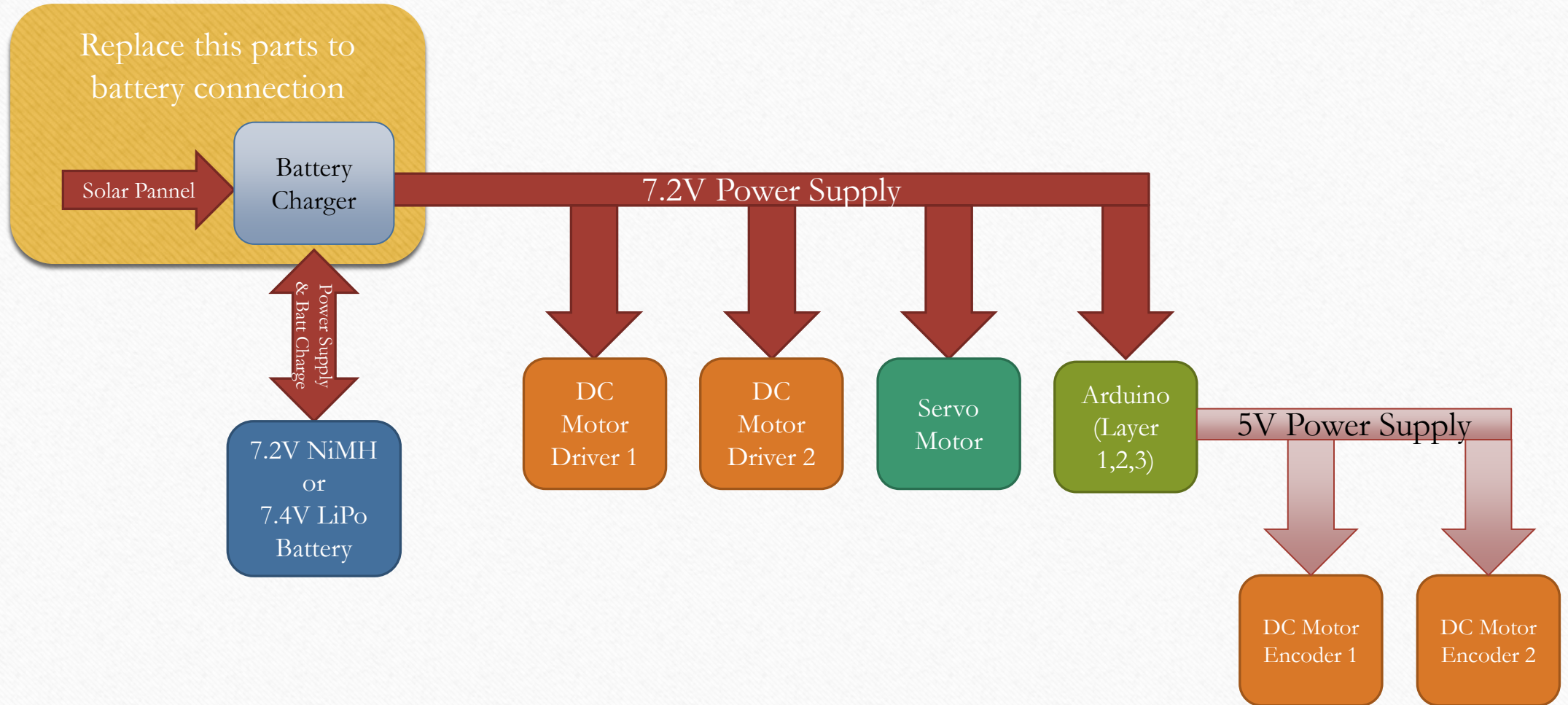
# Scale model design

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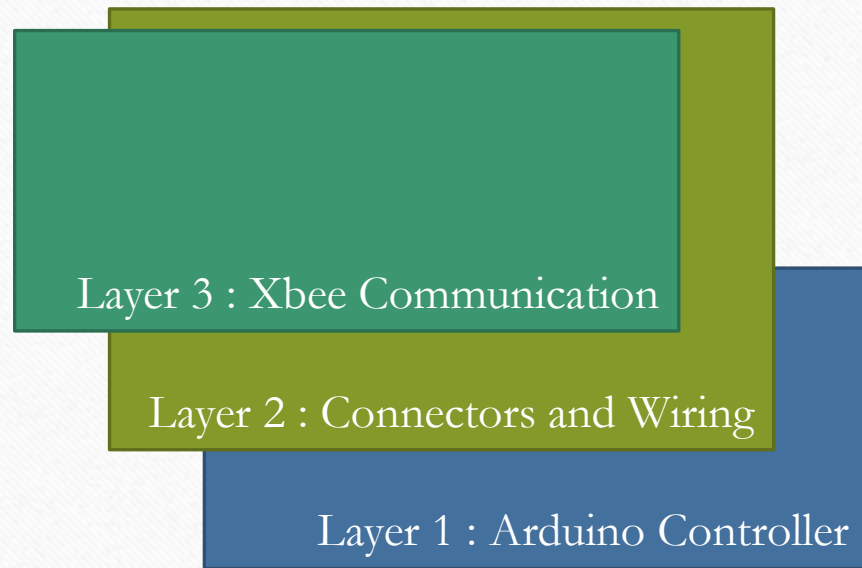
Korean Electronics Team



# Power Distribution for Control System



# Arduino Layer 1,2,3



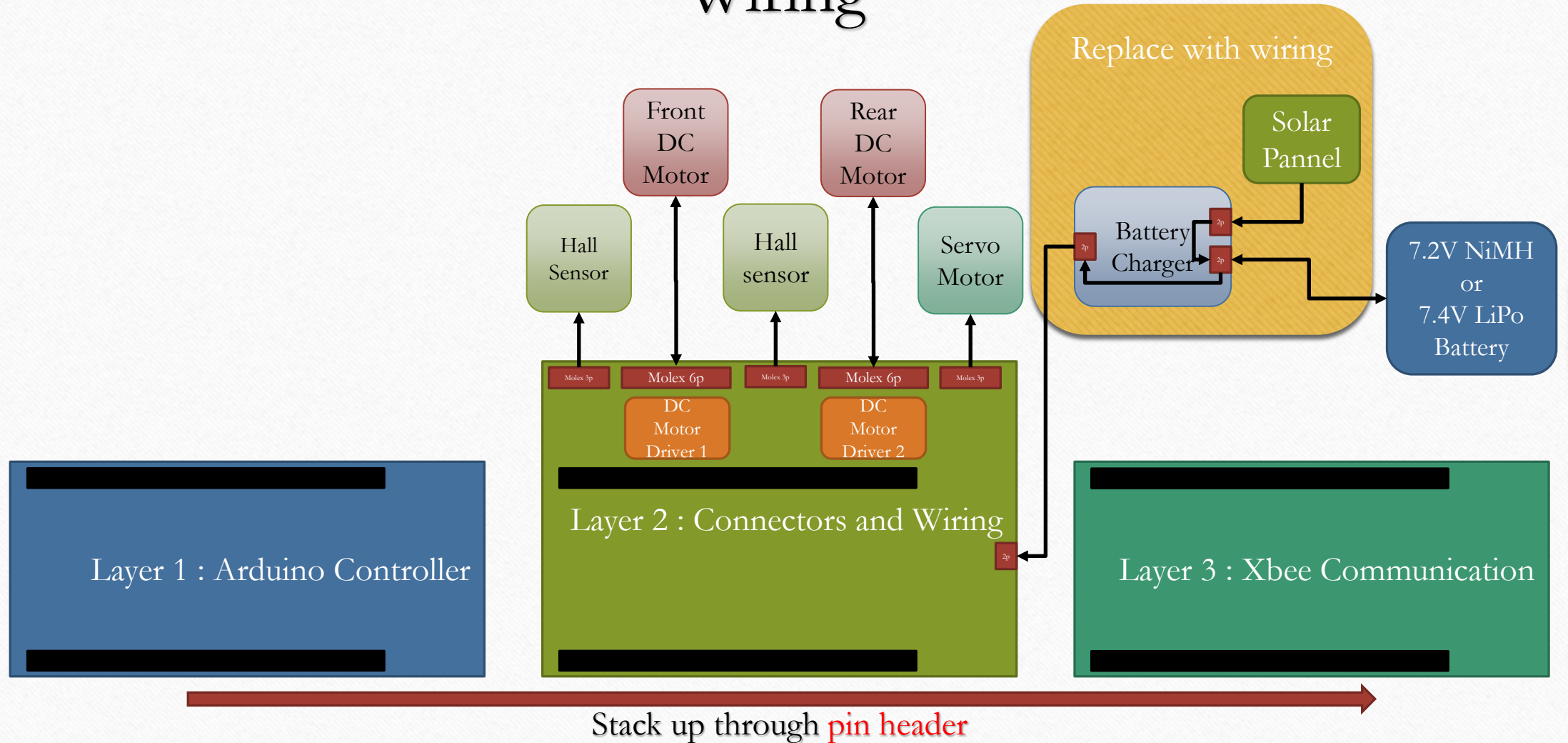
Layer 1 : Arduino Uno board

Layer 2 : Larger than layer 1 and 3 because of space for connectors and DC motor drivers.

Layer 3 : Xbee shield board. Topmost position is suitable for wireless communication board.



# Wiring



# Interrupts and peripherals

Interrupts : Timer Interrupt for control frequency 20Hz

USART Rx Interrupt for xbee communication

External Interrupt for 2 of hall sensors and 2 of encoders  
(1 Ext INT and 3 PCINT)

Peripherals : PWM for servo Motor

2 PWM for 2 of DC motor driver enable(speed control)

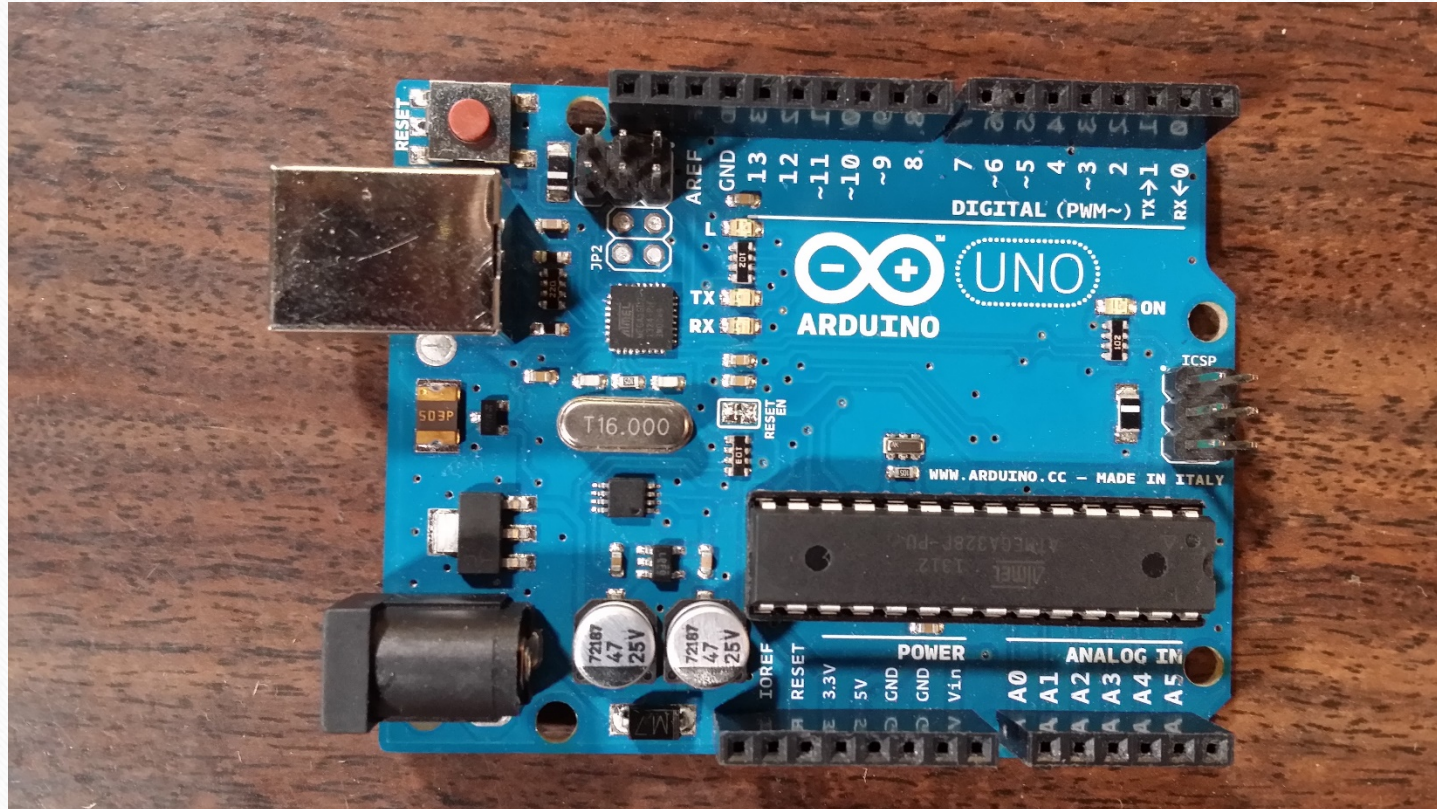
2 Digital output for 2 of DC motor driver phase(directions)

2 Digital input for 2 of encoder direction

USART for xbee communication

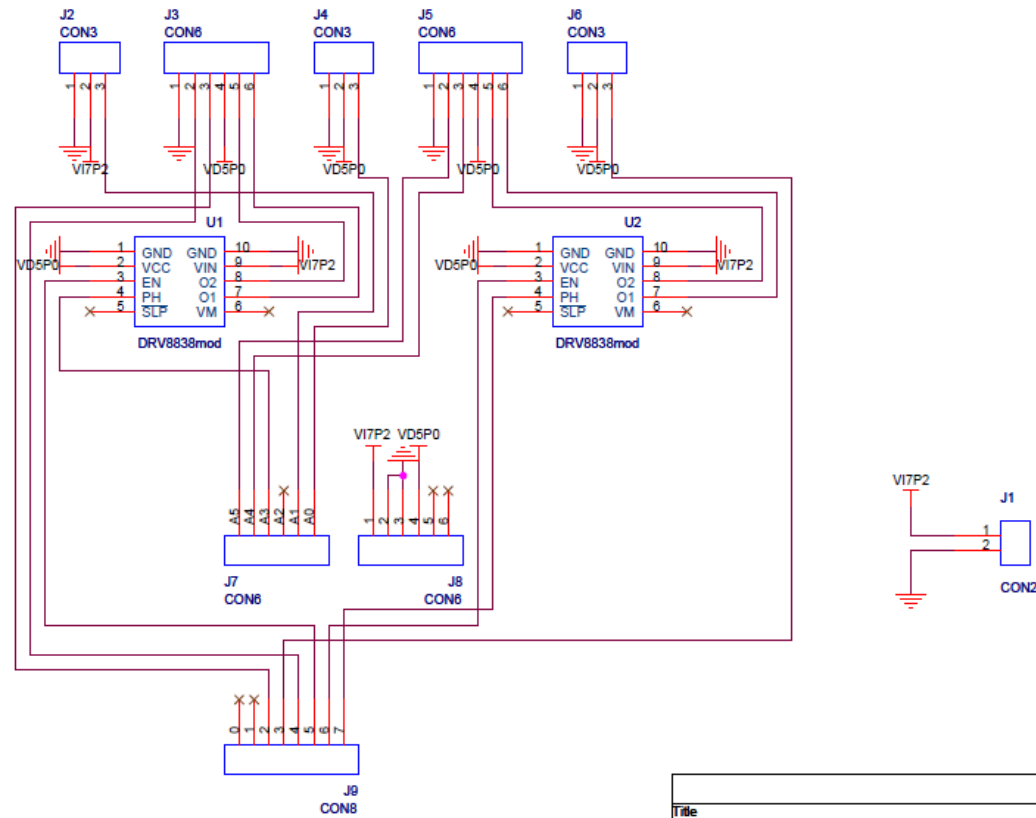


# The circuit for layer 1 (Arduino Uno)

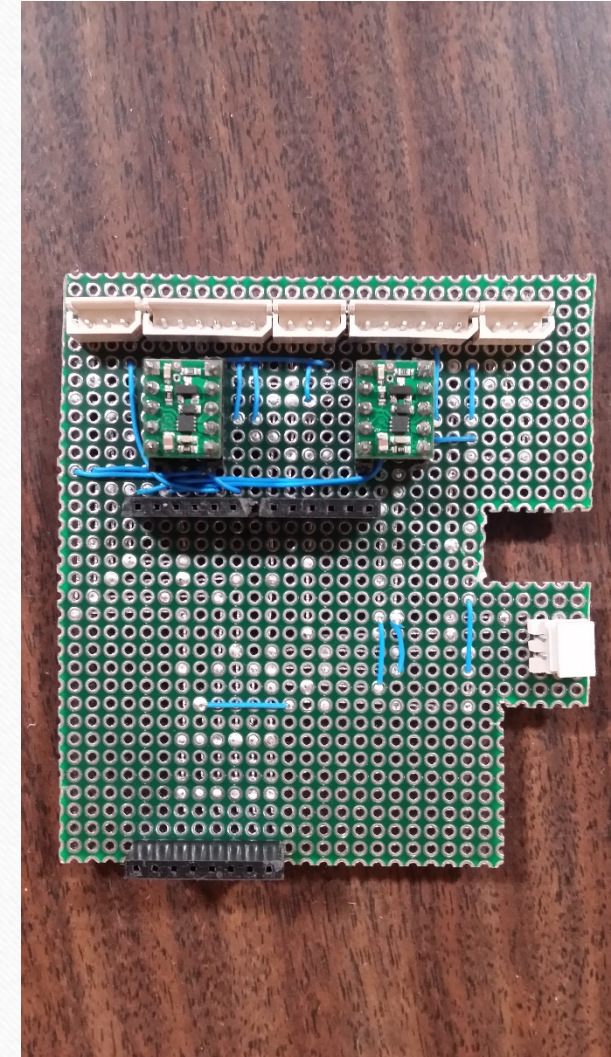




# The circuit for layer 2

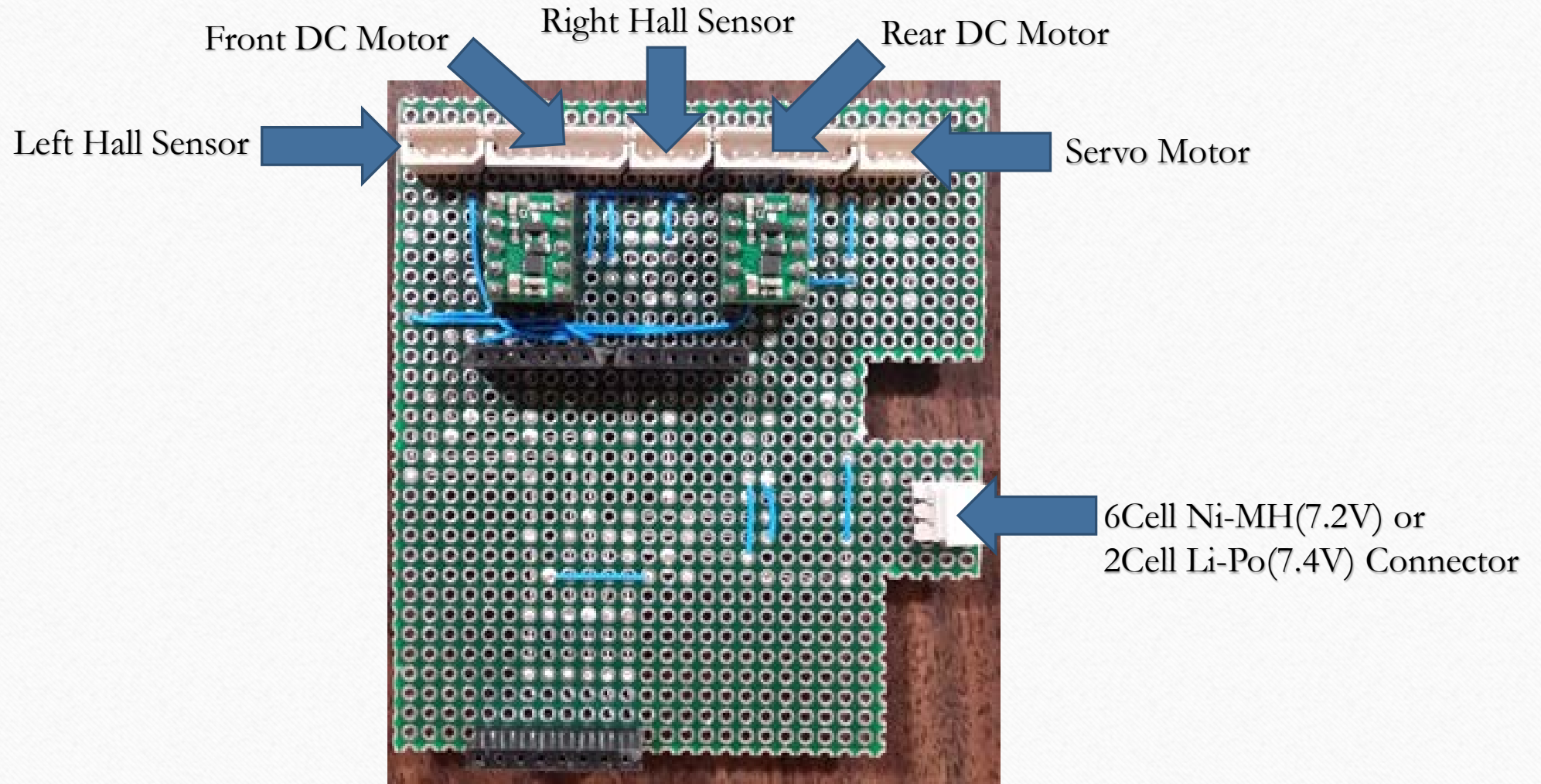


|         |                          |              |
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| Title   |                          |              |
| <Title> |                          |              |
| Size    | Document Number          | Rev          |
| A       | <Doc>                    | <Rev>        |
| Date:   | Wednesday, July 29, 2015 | Sheet 1 of 1 |



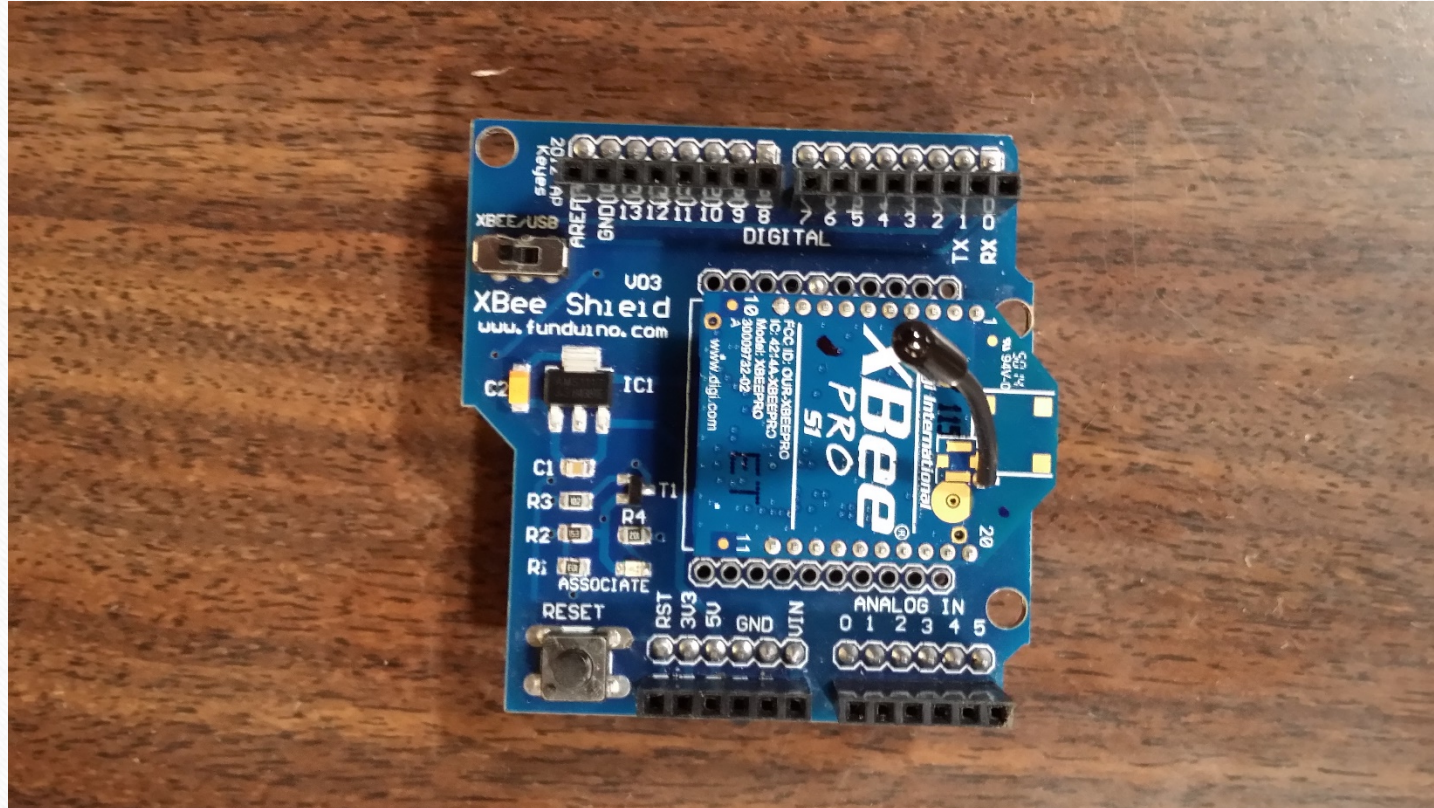


## The circuit for layer 2



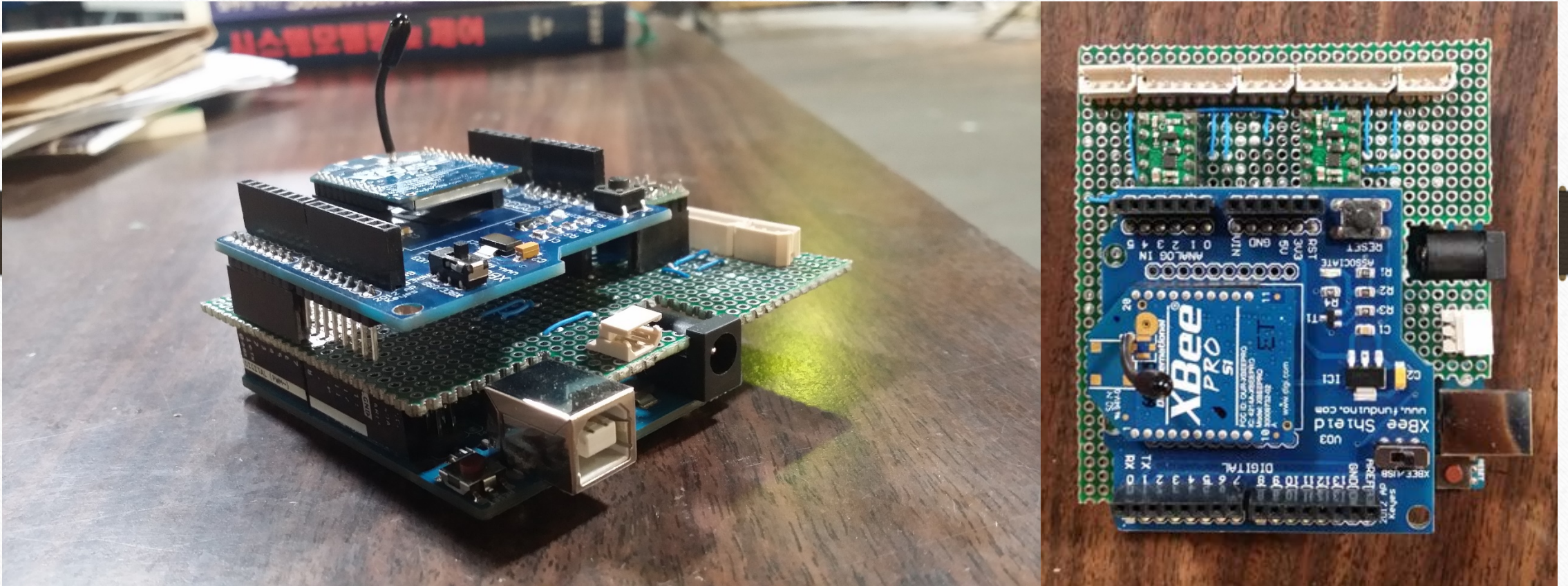


## The circuit for layer 3 (The XBee shield)



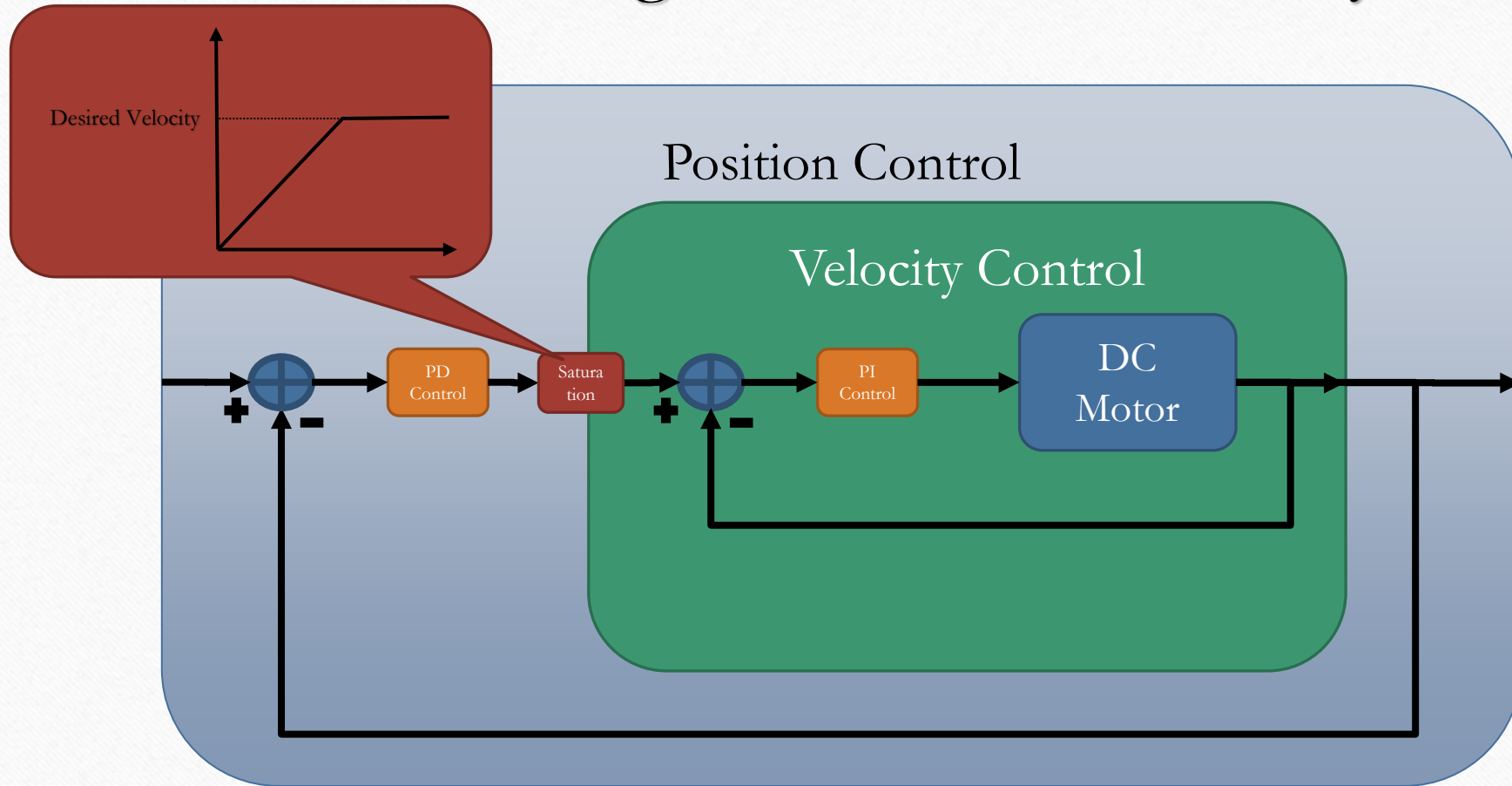


# The control system



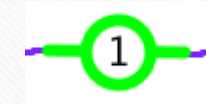
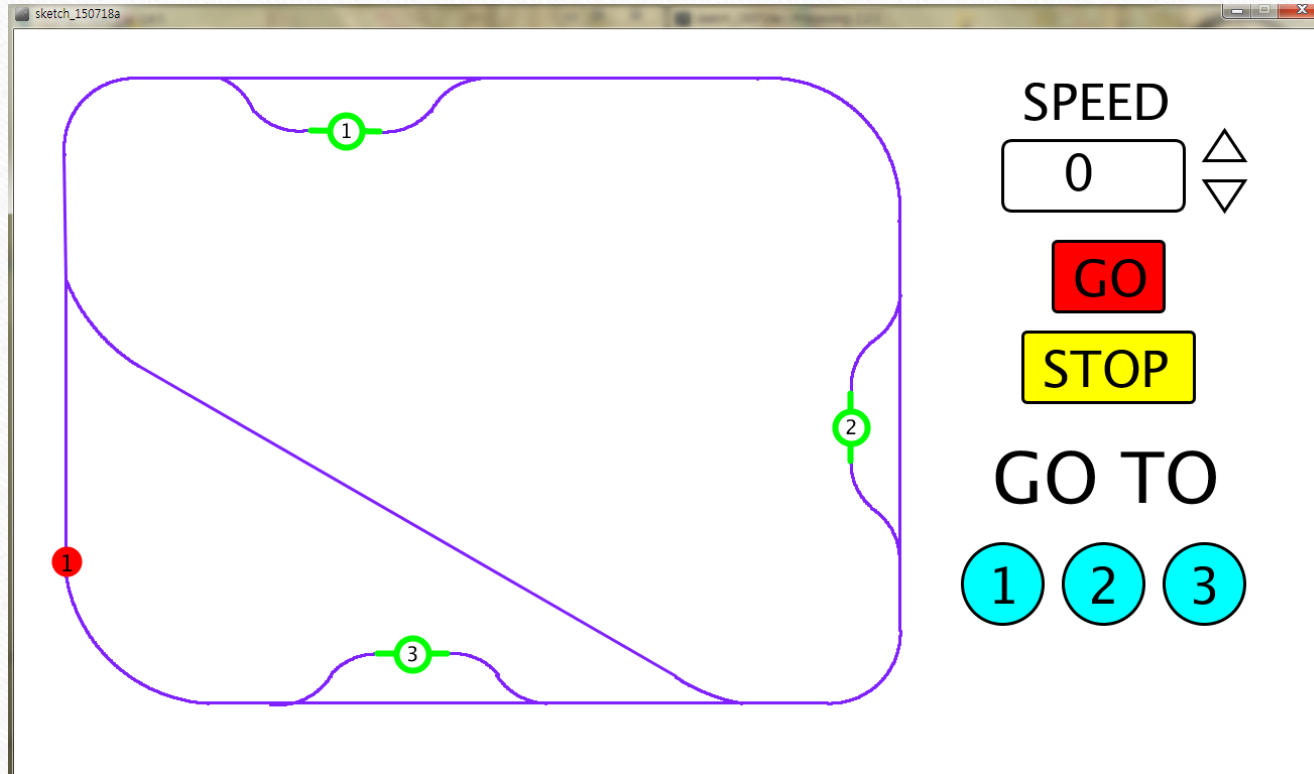


# The block diagram for the control system





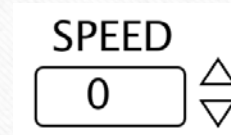
# The PC program



Station 1



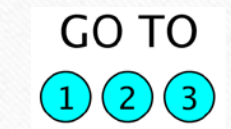
Position of pod 1



Speed Control



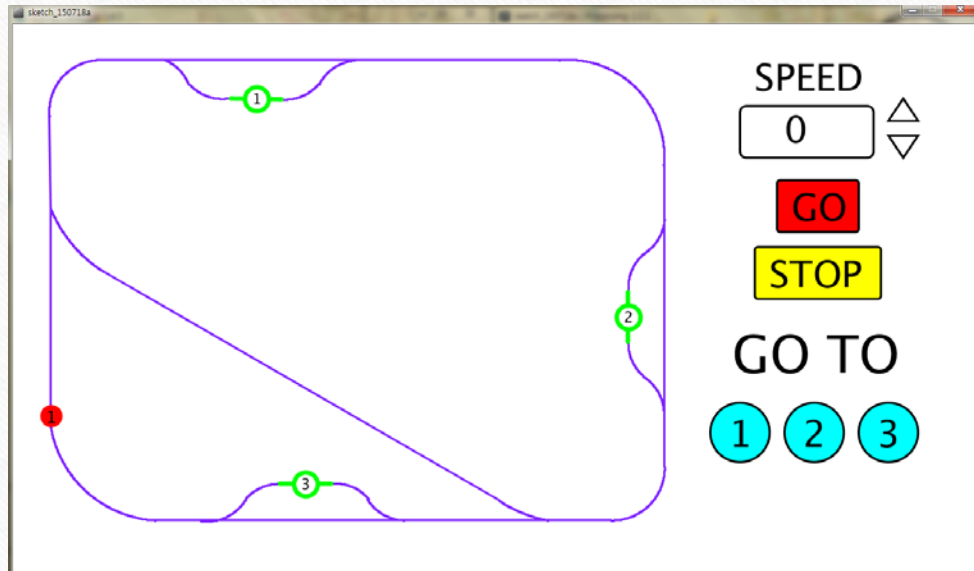
Start and stop button



Move to station button



# The communication system



  
XBee  
communication  






# The communication protocol

| STX   | Receiver | Sender | Message Type | Payload |       |          |          | Check sum | ETX   |
|-------|----------|--------|--------------|---------|-------|----------|----------|-----------|-------|
| 1byte | 1byte    | 1byte  | 1byte        | 1byte   | 1byte | 2byte    | 2byte    | 1byte     | 1byte |
| 0x61  | ID       | ID     | Type         | Switch  | Track | Position | Velocity | Status    | CS    |
|       |          |        |              |         |       |          |          |           | 0x62  |

Data for check sum

ID

| Integer | Device  |
|---------|---------|
| 0       | Main    |
| 1       | pod 0   |
| 2       | pod 1   |
| ⋮       | ⋮       |
| 255     | pod 254 |

Message Type

| Integer | Send by | Message type | Description         |
|---------|---------|--------------|---------------------|
| 0x00    | Main    | Status       | Initial Status      |
| 0x01    | Main    | Status       | Set Speed, Distance |
| 0x02    | Main    | Call         | Move to Station     |
| 0x03    | Pod     | Status       | Local Information   |
| 0x04    |         | (Reserved)   |                     |
|         |         | (Reserved)   |                     |
|         |         | (Reserved)   |                     |
| 0xfe    | Main    | Emergency    | Emergency Go        |
| 0xff    | Main    | Emergency    | Emergency Stop      |



# The communication protocol(continued)

Payload<sup>43</sup>

-Message Type 0x00 (Initial Status)<sup>43</sup>

|                      |                     |                        |                        |                      |
|----------------------|---------------------|------------------------|------------------------|----------------------|
| 1byte <sup>43</sup>  | 1byte <sup>43</sup> | 2byte <sup>43</sup>    | 2byte <sup>43</sup>    | 1byte <sup>43</sup>  |
| Switch <sup>43</sup> | Track <sup>43</sup> | Position <sup>43</sup> | Velocity <sup>43</sup> | Status <sup>43</sup> |

-Message Type 0x01 (Set Speed, Distance)<sup>43</sup>

|                      |                     |                        |                        |                      |
|----------------------|---------------------|------------------------|------------------------|----------------------|
| 1byte <sup>43</sup>  | 1byte <sup>43</sup> | 2byte <sup>43</sup>    | 2byte <sup>43</sup>    | 1byte <sup>43</sup>  |
| Switch <sup>43</sup> | Track <sup>43</sup> | Position <sup>43</sup> | Velocity <sup>43</sup> | Status <sup>43</sup> |

-Message Type 0x02 (Move to Station)<sup>43</sup>

|                      |                     |                        |                        |                      |
|----------------------|---------------------|------------------------|------------------------|----------------------|
| 1byte <sup>43</sup>  | 1byte <sup>43</sup> | 2byte <sup>43</sup>    | 2byte <sup>43</sup>    | 1byte <sup>43</sup>  |
| Switch <sup>43</sup> | Track <sup>43</sup> | Position <sup>43</sup> | Velocity <sup>43</sup> | Status <sup>43</sup> |

-Message Type 0x03 (Local Information)<sup>43</sup>

|                      |                     |                        |                        |                      |
|----------------------|---------------------|------------------------|------------------------|----------------------|
| 1byte <sup>43</sup>  | 1byte <sup>43</sup> | 2byte <sup>43</sup>    | 2byte <sup>43</sup>    | 1byte <sup>43</sup>  |
| Switch <sup>43</sup> | Track <sup>43</sup> | Position <sup>43</sup> | Velocity <sup>43</sup> | Status <sup>43</sup> |

-Message Type 0xFE (Emergency Go)<sup>43</sup>

|                      |                     |                        |                        |                      |
|----------------------|---------------------|------------------------|------------------------|----------------------|
| 1byte <sup>43</sup>  | 1byte <sup>43</sup> | 2byte <sup>43</sup>    | 2byte <sup>43</sup>    | 1byte <sup>43</sup>  |
| Switch <sup>43</sup> | Track <sup>43</sup> | Position <sup>43</sup> | Velocity <sup>43</sup> | Status <sup>43</sup> |

-Message Type 0xFF (Emergency Stop)<sup>43</sup>

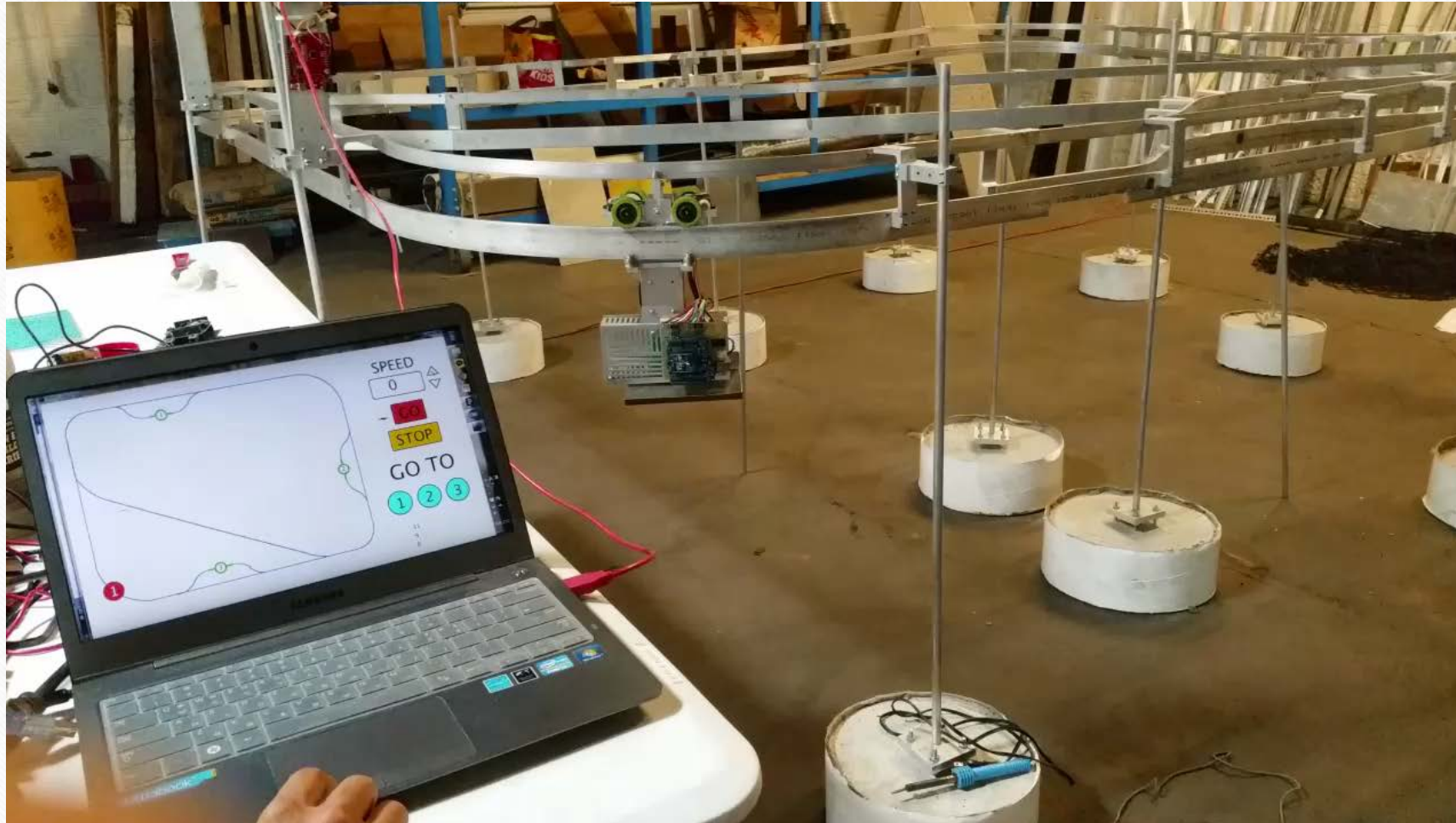
|                      |                     |                        |                        |                      |
|----------------------|---------------------|------------------------|------------------------|----------------------|
| 1byte <sup>43</sup>  | 1byte <sup>43</sup> | 2byte <sup>43</sup>    | 2byte <sup>43</sup>    | 1byte <sup>43</sup>  |
| Switch <sup>43</sup> | Track <sup>43</sup> | Position <sup>43</sup> | Velocity <sup>43</sup> | Status <sup>43</sup> |



Don't Care<sup>43</sup>



# The demonstration(1 min 44 sec)





Q&A

Thank you!