Orbital Research
Video Telemetry

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Project Requirements:

• Size 1.25” diameter cylinder .7” long
• Weight under 200g
• Resolution of 640x480 @ 30fps
• Power less than 3.3W
• At least 2min of Telemetry
• Transmit over 1Km @ 1.25Mbps
Video Telemetry System

Camera Requirements:

- 30 FPS
- 640 x 480 Resolution
Camera Solution:

- NTSC Standard
- Resolution 658 x 496
- Weight 1g
- Size 9 x 9 x 11 mm

Camera Solution Cont.

- Wide Angle Lens
- Doubles viewing angle from 55° to 110°
- Does not significantly change weight or dimensions
RX/TX Requirements:

- Data rate > 1.25 Mbps
- 1KM Range
- Transmitter 31.75mm diameter x 17.78mm long cylinder

TX Solutions

- Transmission Module TX5802M
  - 5.8 GHz 200mW=23dB
  - 3.3V-5.0V
  - 24mm x W20mm x H3mm
RX Solution

- RC 305 Receiver
  - 5.8GHZ 8CH  200mW
  - -92dBm receiving sensitivity

Antenna

- 5.8Ghz Circular Polarized Clover Leaf Antenna
  - Circular polarization will basically ignore reflected RF so you won’t experience nearly as much reflected RF interference

- Directional Antenna
Calculations

- Link budget
- Received Power (dBm) = Transmitted Power (dBm) + Gains (dB) - Losses (dB)
- Maximum Path Loss = Transmit power - receiver sensitivity + gains - losses - fade margin

- \( PL = 23 \text{ dBm} \) Transmit power - (-92dBm) receiver sensitivity + 2 dBi Antenna - 7 dB Margin

- Distance = \( 10^{PL-32.45-20 \log(Frequency \text{ in MHz})} \)
- Distance = \( 10^{PL-32.45-20 \log(5800)} = 1.3 \text{km} \)

- That is if Transmitter emitting its stated power, and perfect line of sight between Tx and Rx and disregarding all other losses

Power

- ZIPPY Battery
  - 50mAh 20C
  - 3.7V
  - 19x14x5mm
Visual Perspective

Estimated Cost

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter</td>
<td>$21</td>
</tr>
<tr>
<td>Receiver</td>
<td>$17</td>
</tr>
<tr>
<td>2x Zippy Batteries</td>
<td>$5</td>
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<tr>
<td>Antennas</td>
<td>$21</td>
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<tr>
<td>Camera+Lens</td>
<td>$50</td>
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<tr>
<td><strong>Total Estimated Cost</strong></td>
<td><strong>$114</strong></td>
</tr>
</tbody>
</table>
Design Advantages

- Theoretically meets the range and size requirements
- Cheaper than other alternatives
- 5.8GHz less likely to get interference from other frequencies, it's not used as much as 2.4 GHz

Design Possible Drawbacks

- The antenna does not fit the size restriction of the problem
- 5.8GHz transmitter need a clear line of sight, obstacles might interfere with the signal
- 5.8GHz transmitter signal travel less distance compared to other lower frequencies
- Power limitation of the design restrict a prolonged usage
Possible Alternatives

- The use of different transmitter modules
  - 2.4 Ghz (Travel further than 5.8GHz, but might get interference from Wifi, RC transmitters)
  - 1.3 Ghz (Travel further than both 5.8 and 2.4 and good around objects, but for small size it’s more expensive and might get interference from 2.4GHz)
  - 900 Mhz (Best distance, but might get interference from cell towers)

- Make a new design were a smaller antenna is used that would fit the 1.25 in by 0.7 in cylinder while still getting a 1 km range

Regulations

- Amateur Radio is regulated by the Federal Communications Commission (FCC) under the Communications Act of 1934

- In the US, there are many restrictions on the frequencies that the general public could use. To access the Amateur Frequencies a licence is needed
  - The Technician License
  - The General License
  - The Amateur Extra License

- To be able to test our design we will need to apply for the Technician License, or find a licensed individual to assist us in the testing
Market Potential

- Unmanned aerial systems
- Military applications
- Commercial Drones
- Surveillance systems

Timeline
Questions?