Individual Lab Report-7

By Danendra Singh

Team F: Falcon Eye

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1. Individual Progress:

As my contribution to the MRSD Project for progress review 8, I have successfully integrated the entire system 's network on to a mesh network of access points. Additionally, I have also helped Pratibha in developing the ROS software update to incorporate the new IMU for the AGV.

1.1 System Network Integration:

We procured two Ubiquiti Unifi AC mesh access points(AP) for setting up a mesh network that can handle the data with low-latency from the drone, husky PC and two laptop controllers, all connected through the same wireless network.

Since we are planning to use the mesh network without a DHCP enabled router, we first assigned static IP addresses to both the AP's using the Unifi Controller software. The interface of the software is shown in figure 1.

	ES (0) APS (2) OV	ERVIEW PERFORMANCE C	ONFIG			
BATEWAY/SWITCH	IP ADDRESS	STATUS	MODEL	VERSION	CLIENTS	DOWN
78:8a:20:70:15:5a	192.168.1.6	CONNECTED (100 FDX)	UniFi AP-AC-Mesh	3.7.58.6385	0	0 B
78:8a:20:70:16:ca	192.168.1.5	DISCONNECTED	UniFi AP-AC-Mesh	3.7.58.6385	0	
	78:8a:20:70:15:5a 78:8a:20:70:16:ca	78:8a:20:70:15:5a 192.168.1.6	78:8а:20:70:15:5а 192.168.1.6 Сомнестер (160 FDA) 78:8а:20:70:16:са 192.168.1.5 Рысомнестер	78:8a:20:70:15:5a 192.168.1.6 CONNECTED (180 FDX) UniFi AP-AC-Mesh 78:8a:20:70:16:ca 192.168.1.5 DISCONNECTED UniFi AP-AC-Mesh	78:8a:20:70:15:5a 192.168.1.6 CONNECTED [150 FDX] UniFi AP-AC-Mesh 3.7.58.6385 78:8a:20:70:16:ca 192.168.1.5 DISCONNECTED UniFi AP-AC-Mesh 3.7.58.6385	78:8a:20:70:15:5a 192.168.1.6 CONNECTED (100 FDA) UniFi AP-AC-Mesh 3.7.58.6385 0 78:8a:20:70:16:ca 192.168.1.5 DISCONNECTED UniFi AP-AC-Mesh 3.7.58.6385 0

Figure 1: Unifi Controller Interface

We initially assigned the same IP addresses to both the AP devices. This caused a huge problem as both the AP's were broadcasting the same SSID and IP at the same time and same place. As a result, Bebop drone was losing data packages by sending few packages to one AP and the remaining to the other AP.

After recognizing the problem, we changed the IP address of the other AP device using the controller as shown in figure 2. We kept the SSID and login credentials same for both the devices.

PROPERTIES	<i>=</i> = 1		
CONNECTED (100 FDX			
6 11N/B/G	(Acceptable) 30% Utilized		
46 (48,-1) 11N/A/AC	(Good) 2% Utilized		
RX FRAMES TX FRAMES	INTERFERENCE FREE		
Details Users Guests G	Config Tools		
🗄 GENERAL			
Configure IP			
Static IP	\checkmark		
IP Address	Preferred DNS		
192.168.1.5	192.168.1.0		
Subnet Mask	Alternate DNS		
255.255.255.0			
Gateway	DNS Suffix		
192.168.1.0			
QUEUE CHANGES CANCEL			
H MANAGE DEVICE			

Figure 2: Changed IP configuration of AP.

1.2 Field Testing and Evaluation

To verify the robustness of our system's network, we performed field testing of the network topology with the main three systems i.e. the drone, control laptop and Husky PC connected.

We understood that in an outdoor scenario, the AP device might not be able to find an AC power port to run via the power over ethernet (PoE) Switch device. Hence we, procured two PoE injectors that could be directly powered by a 24V DC battery. The power setup we used for our outdoor AP is shown in figure 3.

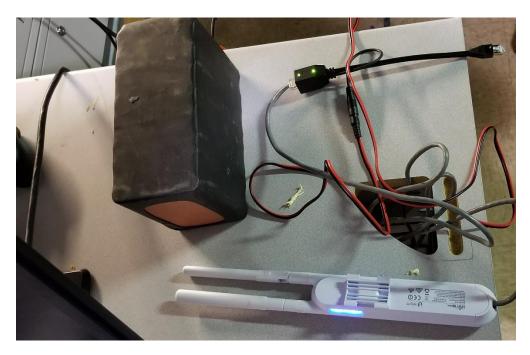


Figure 3: Outdoor Setup for the AP

We recorded a connectivity range of approximately 140m on testing both the devices connected in a mesh network outdoors. The video we received from Bebop was with insignificant lag. Figure 4 shows the data pinging on the drone and figure 5 shows video received from the drone in real time.

Terminal
🔗 🔍 🔿 danendra@danendra-VirtualBox: ~
Q
danendra@danendra-VirtualBox:~\$ ping 192.168.1.100
^[[A^C
192.168.1.100 ping statistics
2 packets transmitted, 0 received, 100% packet loss, time 1000ms
danendra@danendra-VirtualBox:~\$ ping 192.168.1.101
PING 192.168.1.101 (192.168.1.101) 56(84) bytes of data.
64 bytes from 192.168.1.101: icmp_seq=1 ttl=64 time=1018 ms
64 bytes from 192.168.1.101: icmp_seq=2 ttl=64 time=14.5 ms
64 bytes from 192.168.1.101: icmp_seq=3 ttl=64 time=5.51 ms 64 bytes from 192.168.1.101: icmp seq=4 ttl=64 time=6.03 ms
• • • • • • • • • • • • • • • • • • •
64 bytes from 192.168.1.101: icmp_seq=6 ttl=64 time=10.9 ms
64 bytes from 192.168.1.101: icmp_seq=7 ttl=64 time=8.33 ms
64 bytes from 192.168.1.101: icmp_seq=8 ttl=64 time=7.35 ms 64 bytes from 192.168.1.101: icmp seq=9 ttl=64 time=4.27 ms
64 bytes from 192.168.1.101: icmp_seq=10 ttl=64 time=14.0 ms
64 bytes from 192.168.1.101: icmp_seq=11 ttl=64 time=4.76 ms
64 bytes from 192.168.1.101: icmp_seq=12 ttl=64 time=12.4 ms 64 bytes from 192.168.1.101: icmp seq=13 ttl=64 time=5.08 ms
264 bytes from 192.168.1.101: tcmp_seq=15 ttt=64 ttme=5.55 ms

Figure 4: Pinging data from drone

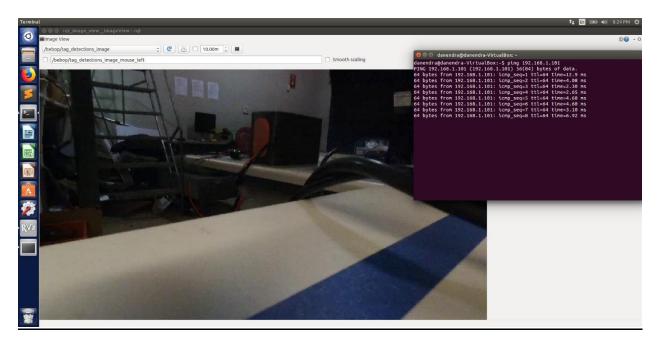


Figure 5: Live Video data from drone

2. Challenges

For this PR, the biggest challenge we faced was the difficulty in syncing work with other teammates. All of us are taking different courses and thus have different deadlines for assignments which makes working together challenging.

We encountered initially a problem of drone not being able to transfer data packets continuously to the control laptop. It randomly got connected and disconnected to the network, thus making us judge the reliability of our network configuration. We soon figured out that we were doing a major blunder by assigning the same static IP addresses to both the AP's. Reassigning each AP device with a different IP solved this problem.

3. Teamwork

Yuchi worked on developing a robust method to detect april tags by eliminating the background glare. We have been able to achieve good improvements in glare rejection using anti-glare aerosol spray.

Pratibha worked to integrate and update IMU data transfer to the Husky's ROS node. Pulkit and Rahul worked on Lidar's point cloud data processing for obstacle registration.

Thus, by defining each member's goal successfully and working together as a strong team, we could achieve all the tasks for the PR-8.

4. Future plans

I am planning to work on updating the software stack of Husky and perform multiple outdoor tests to tweak calibration parameters of the IMU, Pratibha will help me in this. I also will work with Yuchi for developing software on the drone to send commands to Husky for navigation. Pulkit and Rahul will work on integrating the processed obstacle data into husky's navigation stack to enable obstacle avoidance on Husky. Yuchi will work on developing the exploration algorithm for the drone to find and connect the April Tags in the field.