LED mini - Lidar for MAV

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background

There is large need for measurement of Industrial dust comes out from a factory, etc at range of several hundred meters. Lidar can obtain dust distribution easily and remotely. LED mini lidar for short-distance has been developed in our prior study.

LED

LED rump is tough to static electricity and not required heat release system, so the LED lidar can be miniaturized, and it is suitable for field measurement.

Whirlwind

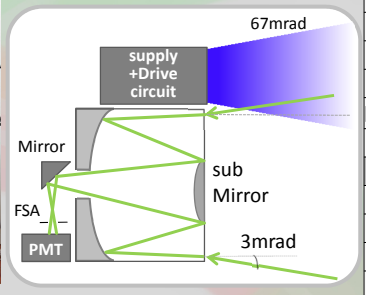
Fast airflows such as dust devil on mars and whirlwind at the earth want to be visualized. The first-step LED lidar can not capture such fast airflow.

purpose

Purpose is to capture the fast of air movement by the lidar. We have developed LED lidar to measure the near field in a short time. In order to capture the atmosphere directly We downsized and lighted the LED lidar, to mount it to MAV (Micro Air Vehicle).

MAV Lidar

We made the LED mini lidar for MAV. It is the Biaxial type, system size and weighs are about 100mm cube and < 1kg including the optical transmitter and receiver unit. The LED beam divergence is 67mrad. The receivers field of view is 3mrad. The wide beam divergence and the narrow field of view enable us to adjust optical axes easily.



Transmitter	
Light source	LED
Wave length	385nm
Pulse width	10ns
Pulse power	750mW
Beam size	30mm ϕ
Beam divergence	67mrad
Repetition rate	500kHz
Receiver	
Type	Cassegrain
Aperture	100mm ϕ
Tube length	100mm
Field of view	3mrad

Measurements of the atmosphere and hard target

We evaluated the near-range atmosphere and building wall echos by integrating time of 0.2 ~ 200 seconds. As a result, by integrating time of 0.2seconds, the building echo of 20m and the near range atmospheric echo up to 30m were confirmed. The atmosphere measurement reached approximately 60m by integrating time of 200 seconds.

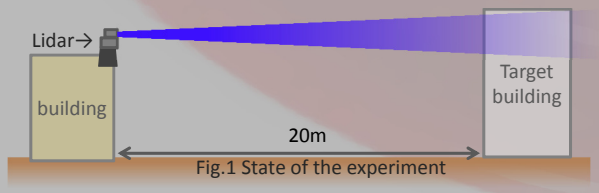


Fig.1 State of the experiment

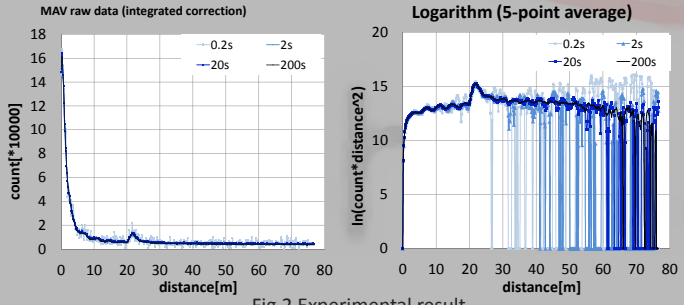


Fig.2 Experimental result

Measurements of approaching smoke

We evaluated the approaching smoke echos by integrating time of 2 seconds as shown in Figure 3 below. Interval for discharging the smoke was 15 seconds, wind speed was 0.3m.

As a result, smoke echo of 16m, its interval of 15[s] and echo speed of 0.3[m/s] were confirmed in blue line. As shown in yellow line in Fig.4, the layer structure was also observed.

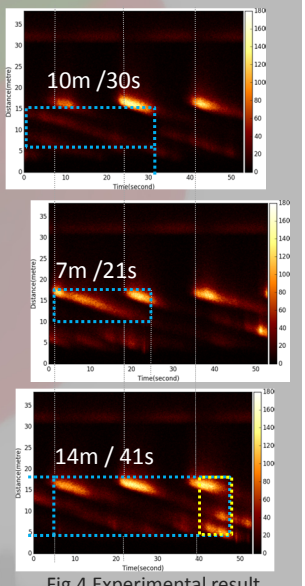


Fig.4 Experimental result

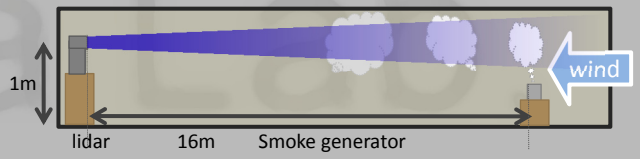


Fig.3 State of the experiment

Conclusion

We have developed the minitualized LED lidar for MAV to capture the fast air flow. We evaluated the near-range atmosphere and hard target and approaching smoke echos by integrating time of 0.2 ~ 200 seconds. In the near future, we will confirm quantitative and analytical measurement of the moving target such as smoke, and whirlwind.