

YOPO: Hardware Design and Equipment List of Our Drone

In this document, we provide a detailed description of the hardware and modules for drone in our method YOLO[1] (You Only Plan Once). The drone is designed to be very compact, with a diagonal wheelbase of 155 mm (Fig. 1). It has a takeoff weight of 850 g and a thrust-to-weight ratio of 4.7, enabling high-speed (Fig. 2) and agile (Fig. 3) flights in cluttered environments. We select the NVIDIA Orin 16G as the onboard computer, which offers ample computational capacity for handling various complex tasks (Fig. 4). The drone is designed modularly, with user-friendly interface connections and convenient flight controller debugging. Furthermore, the structure is stable, and as shown in our early experiment (Fig. 5), the drone successfully reaches its destination after experiencing consecutive lateral collisions at a speed of 6 m/s.



Fig.1 The drone is designed to be compact and modular.



Fig. 2 High-Speed: Achieving 8 m/s high-speed flight in dense forest.



Fig. 3 Agile: Achieving 6 m/s target tracking in dense forest.

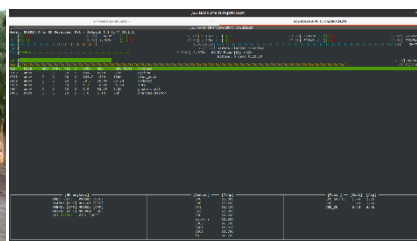




























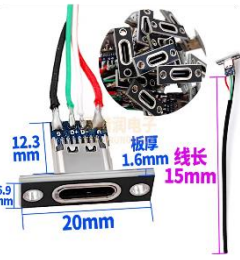


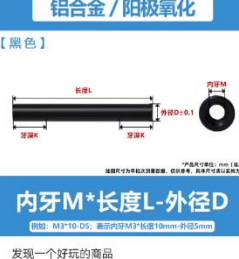
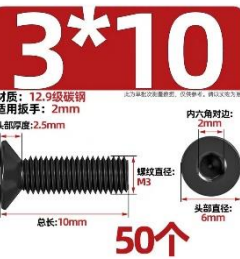
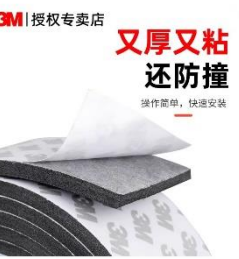
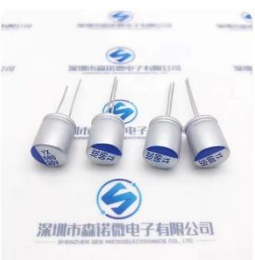
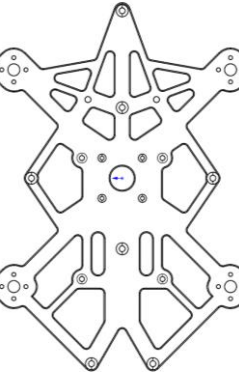
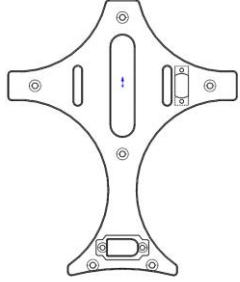
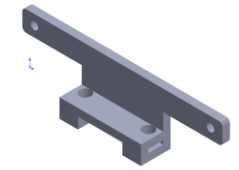
Fig. 4 Ample Computing: Remaining 85% CPU and 75% GPU while running VINS, YOLO, and others.



Fig. 5 Sturdy: The drone successfully reaches the destination after suffering lateral collisions with trees at speeds of over 6 m/s.

The frame of the drone is custom-made from carbon fiber, and the camera mount is 3D printed (The SolidWorks file and frame model can be found in <https://github.com/TJU-Aerial-Robotics/YOLO>). The important modules are listed as follows and some other essentials (e.g., electrical tape, heat shrink tubing, 3M double-sided tape, Velcro strap, M2-M3 screws and nuts, etc.) are omitted for brevity.

<p>Computer Nvidia Orin NX</p>  <p>顶配 Allspark 2-Orin NX 16GB + Wi-Fi Allspark 2 + Wi-Fi模块 发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>RGB-D Camera RealSense D455</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>Flight Controller NxtPX4</p>  <p>赠送4G TF卡 发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>ESC HobbyWing 45A</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 
<p>Motor OddityRC 2006 2150KV</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>Propeller GEMFAN D90-3</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>Battery ACE 1300mah 6S</p>  <p>1300mah 6S 22.2V 95C 发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>Propeller Guard OddityRC XI35 Pro</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 
<p>RC Receiver WFLY RD201W</p>  <p>失控保护 发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>XT60 E1-M</p>  <p>拍1件1只 XT60E1-M 公头 带固定螺丝孔 发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>XT30</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 	<p>Computer Power Cable 18-22 AWG</p>  <p>黑色 发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> 

<p>Camera Type-C Cable</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Serial Cable (4 pin)</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Debugging Cable Female Connector</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Debugging Cable Male Connector</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>
<p>DC-DC Output 12V 5A</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Aluminum Pillar (12mm)</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Various Screw Countersunk & Round</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Shock-Absorbing Foam (For Battery)</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>
<p>Solid-State Capacitor 680μF (More Compact)</p>  <p>发现一个好玩的商品</p> <p>① 保存图片到相册 ② 打开App扫码可见</p> <p>淘</p>	<p>Carbon Fiber Frame (Model See Our Github)</p> 	<p>Carbon Fiber Plate</p> 	<p>3D-Printed Mount</p> 

Finally, if our work benefits your research, we would greatly appreciate it if you could cite our related papers.

[1] J. Lu, X. Zhang, H. Shen, L. Xu and B. Tian, "You Only Plan Once: A Learning-Based One-Stage Planner With Guidance Learning," in *IEEE Robotics and Automation Letters*, vol. 9, no. 7, pp. 6083-6090, July 2024, doi: 10.1109/LRA.2024.3399589.