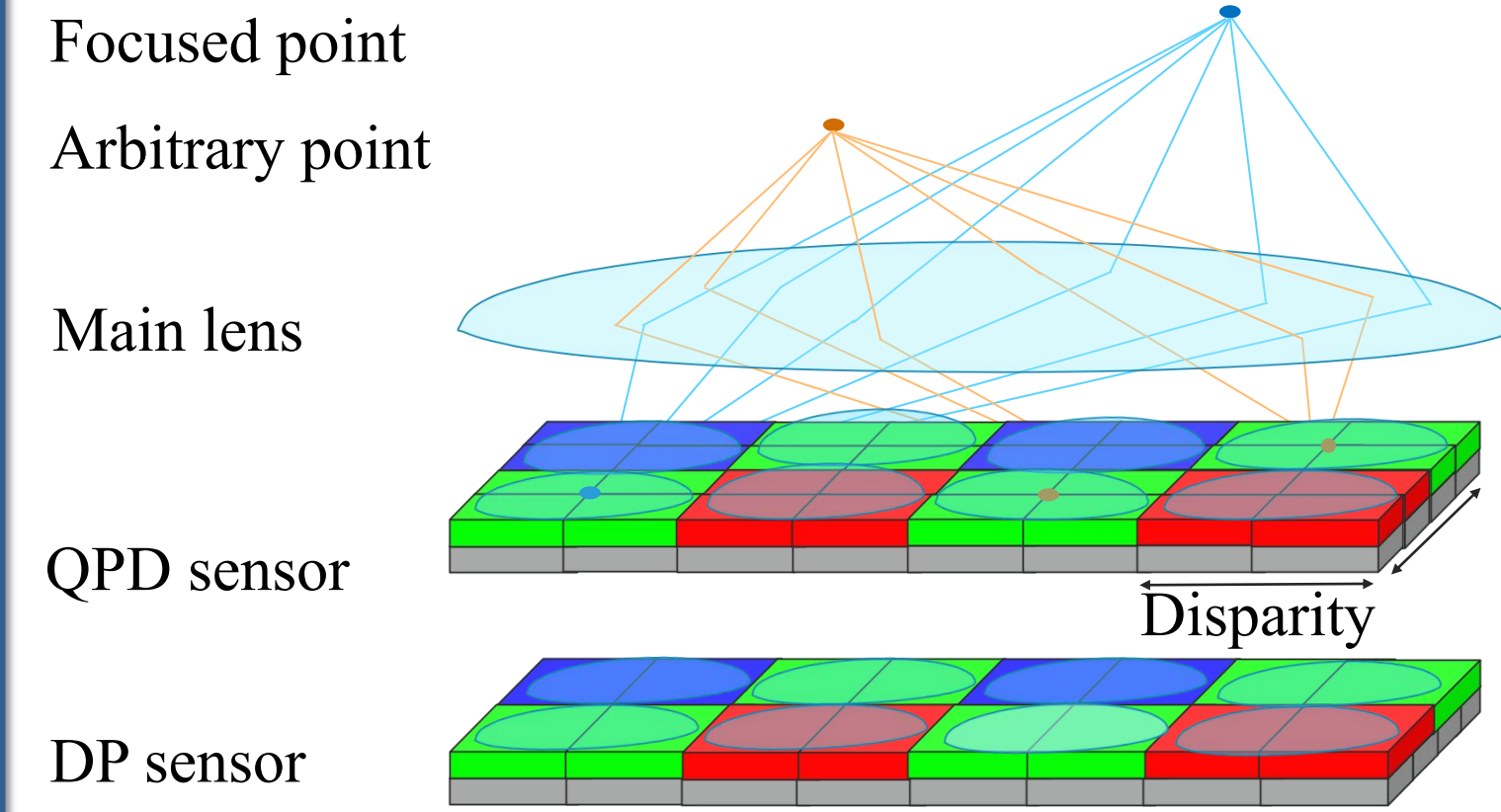


Introduction

- QPD sensors advance upon DP technology by integrating four same-color pixels under one on-chip lens. We explore disparity estimation utilizing a QPD sensor, which are widely adopted in mobile devices, such as the **OV50A** and **OV50H**.

QPD camera formulation

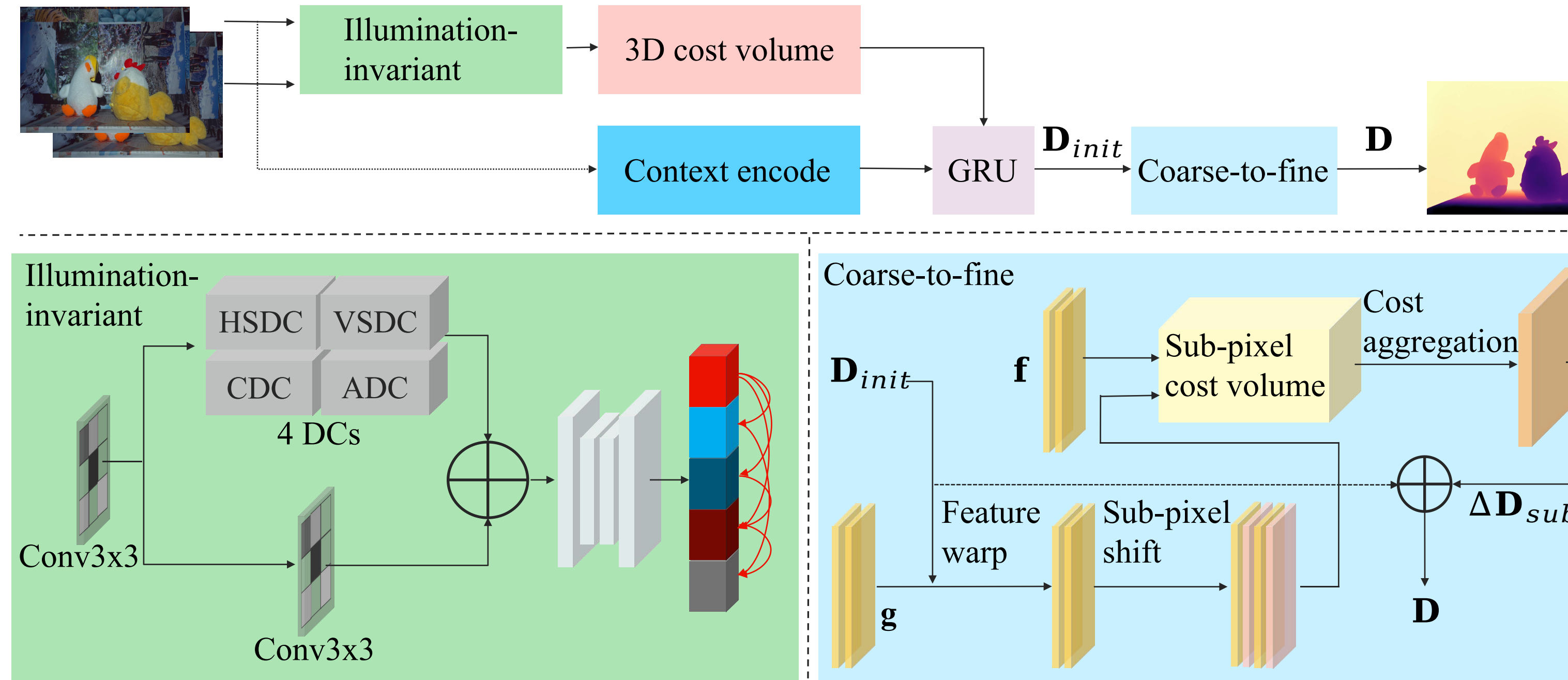


Why QPD sensors?

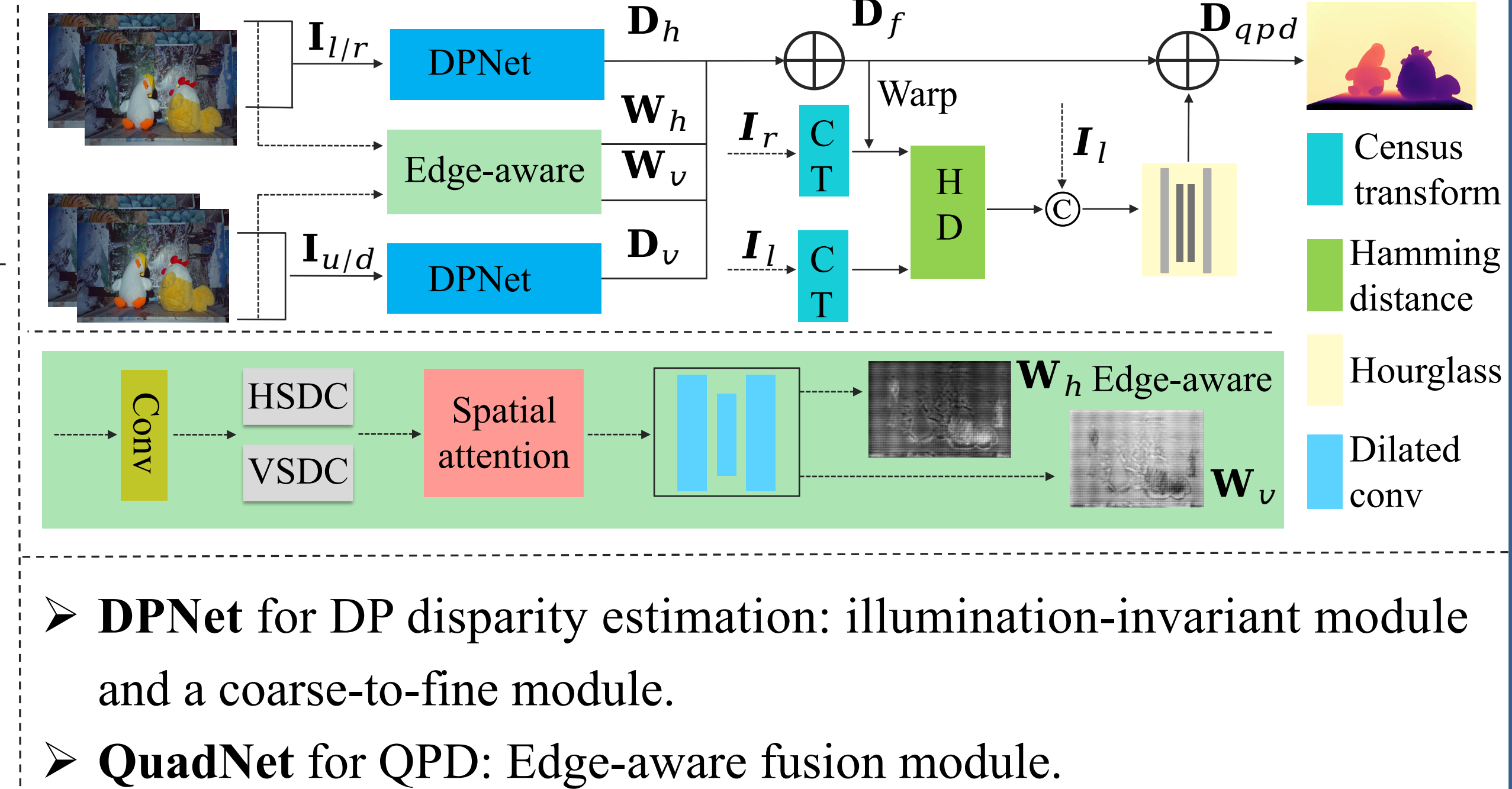
- Monocular Depth: relative depth**
Single camera, but scale ambiguity.
- Stereo matching: absolute depth**
Higher accuracy, but requires dual-camera setup.
- QPD sensors: disparity/absolute depth**
Single camera, high precision within the range.

Method

DPNet

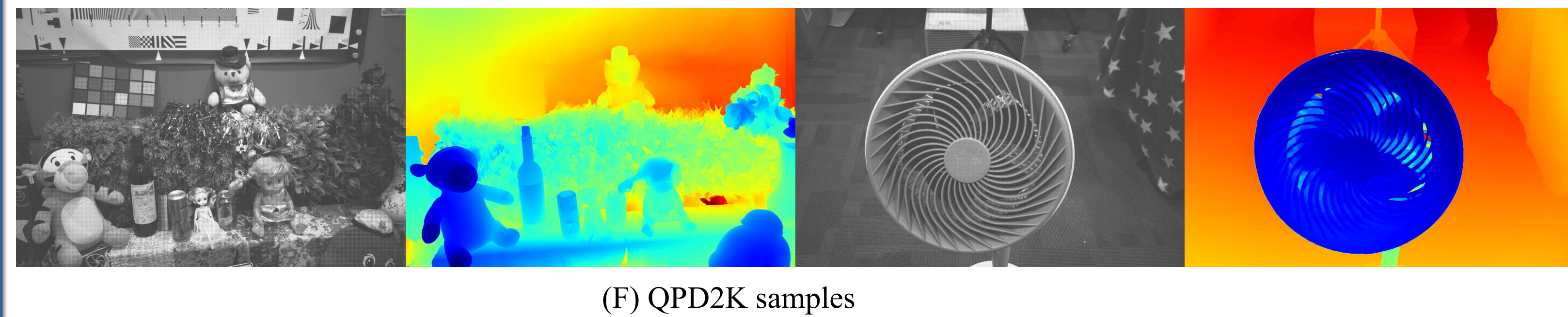
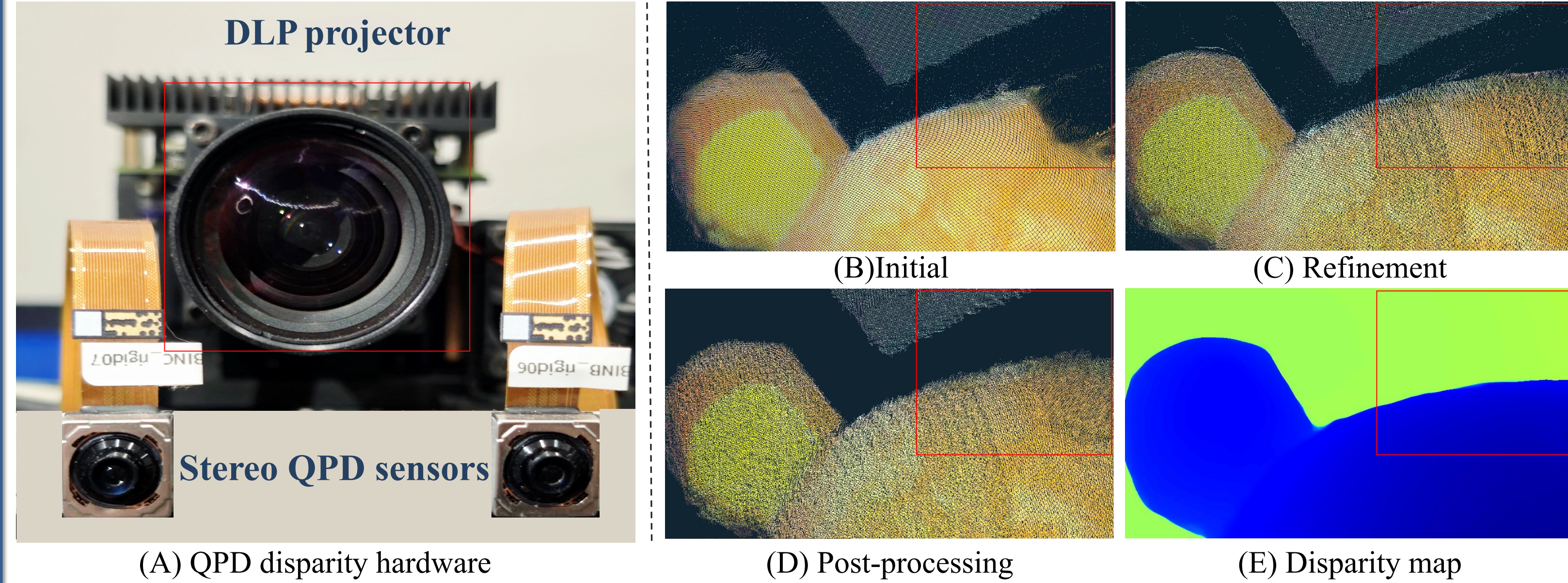


QuadNet



QPD2K

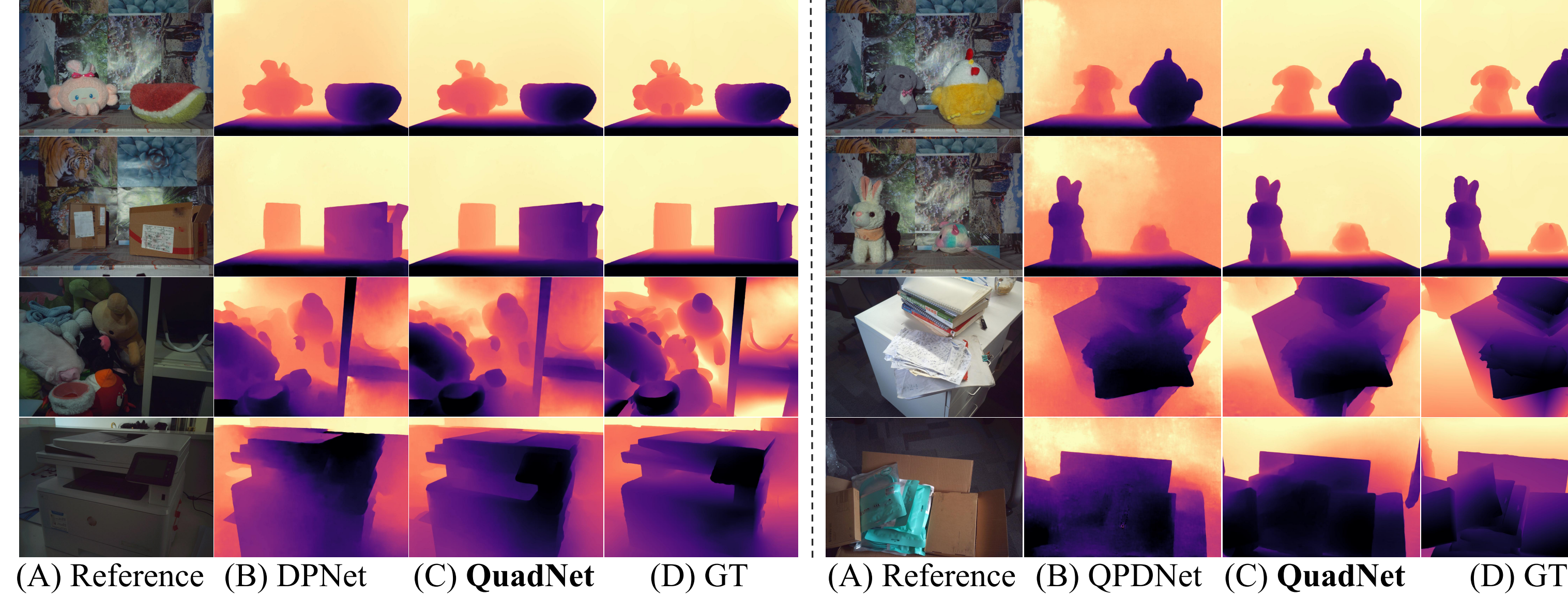
QPD2K pipeline



- Hardware:** OmniVision OV50A QPD sensor, TI DLP4710.
- Method:** Acquire depth information via structured-light and calibrate the disparity.
- Summary:** 2,100 QPD images(3000*2000 pixels) and corresponding disparity maps.

Results

QPD2K



Method	bad 0.3↓	bad 0.5↓	bad 1↓	epe↓
DPdisp [33]	0.969	0.943	0.779	1.670
SFBD [18]	0.927	0.870	0.367	1.105
CCA [28]	0.925	0.874	0.496	1.356
IEGV-Stereo [43]	0.926	0.877	0.739	1.719
QPDNet [41]	0.909	0.837	0.337	0.979
Mc-stereo [5]	0.478	0.334	0.181	0.675
S-RAFT [39]	0.438	0.285	0.038	0.345
S-IEGV [39]	0.437	0.293	0.089	0.386
DLNR [50]	0.329	0.189	0.034	0.272
DPNet (Ours)	0.273	0.160	0.033	0.238
QuadNet (Ours)	0.229	0.114	0.017	0.201

Applications

Mobile phone

- Single image restoration: Disparity-based deblurring/deraining.
- Single camera bokeh: Bokeh rendering via depth estimation.

Automobiles: DMS/Parking (auxiliary depth estimation).

Healthcare: Endoscope (single camera navigation).



Contribution

- We introduce the **first QPD real-world disparity dataset**, which contains 2,100 QPD images and corresponding disparity maps, denoted as QPD2K.
- We propose **DPNet** for DP disparity estimation and **QuadNet** for QPD disparity estimation, with three novel modules fully considering the characteristics of QPD sensors.