



Chapter 07

Flowchart of Single-camera Measurement (Theme 2)

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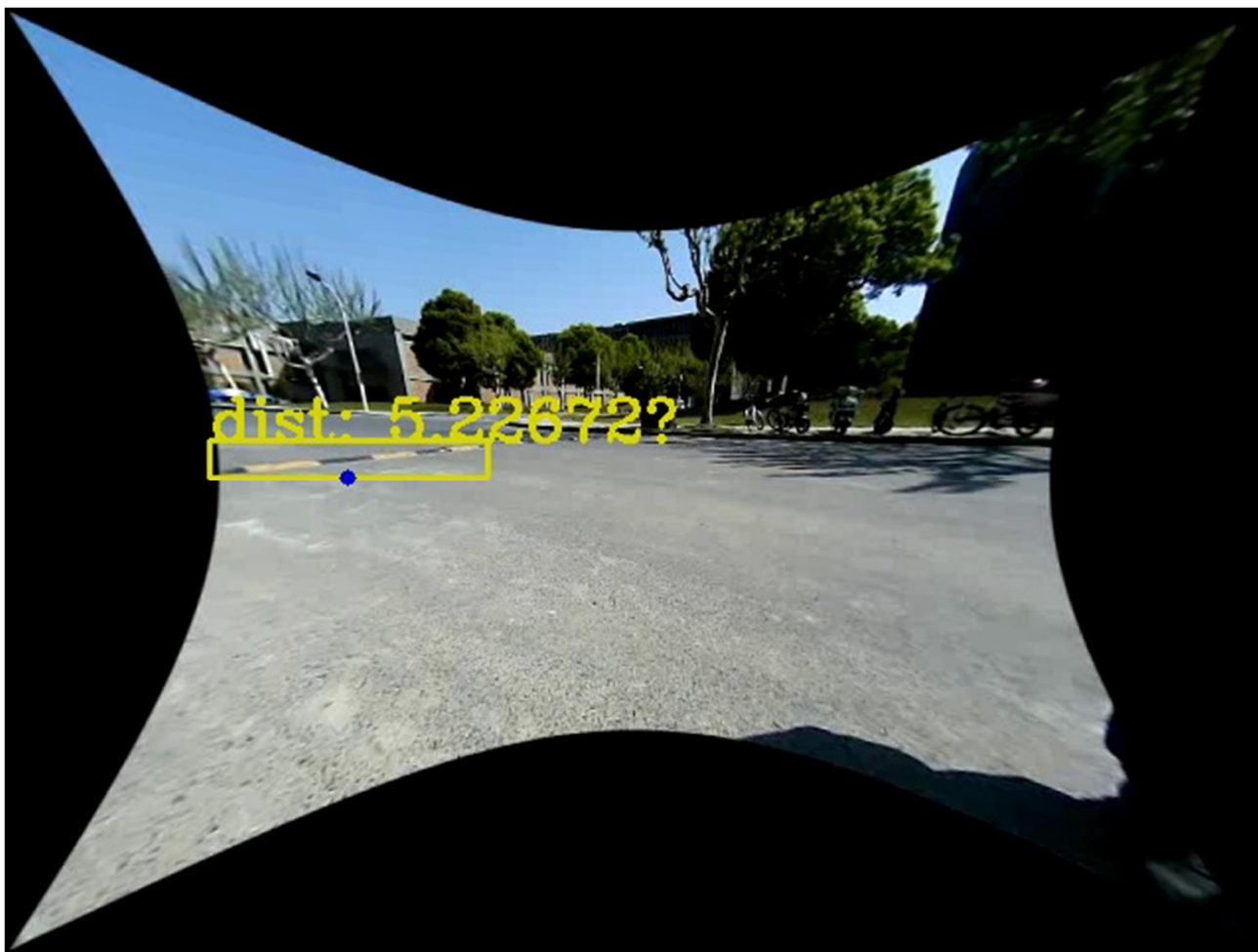
Problem definition of single-camera measurement



Can you tell me the diameter of the coin shown in the image?



Problem definition of single-camera measurement



- ❑ In this demo, the system detects persons and speed-bumps and outputs their horizon distances to the robot
- ❑ Only one camera is used

How to achieve this goal?



Problem definition of single-camera measurement

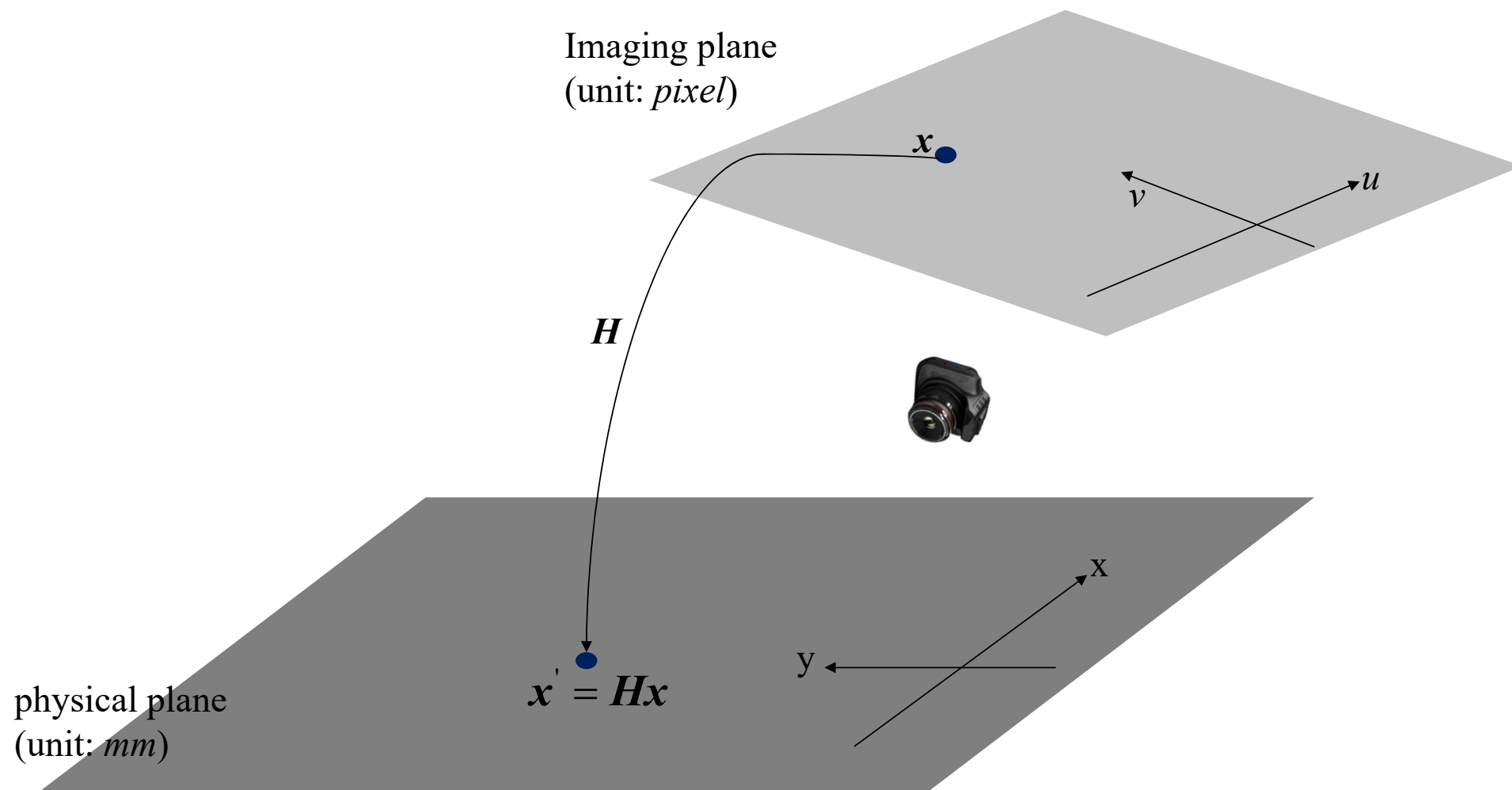
- To solve the aforementioned two problems, we need to have some assumptions
 - The object to be measured should locate on a (physical) plane
 - The imaging plane and the physical plane satisfy projective transformation, i.e., the **imaging process should satisfy the ideal pin-hole camera model**



There is a projective transformation matrix H linking the physical plane and the imaging plane. For a point \mathbf{x} on the imaging plane, we can get its position on the physical plane as $H\mathbf{x}$



Problem definition of single-camera measurement



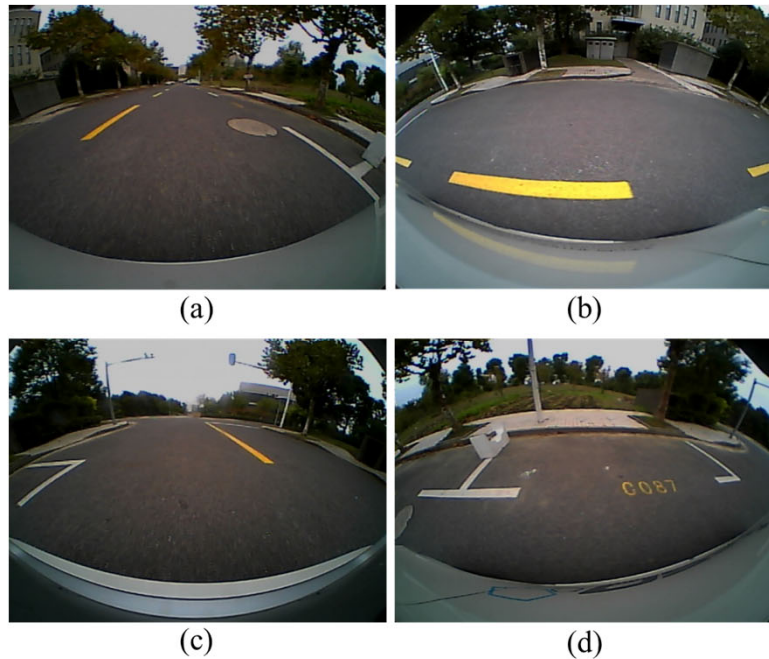


Steps for achieving single-camera measurement

- ✓ Calibrate the camera to get its intrinsic parameters
- ✓ With the intrinsic parameters, un-distort the images to **make the imaging process satisfy the ideal pin-hole imaging model**
- ✓ With a set of marker-points (their positions on the physical plane are known, and their images on the imaging plane are also known), get H
- ✓ With H , for any point on the imaging plane, we can get its position on the physical plane



Steps for achieving single-camera measurement



(e)

Image is of the size 600×600
 $\Leftrightarrow 10m \times 10m$ physical region

- ✓ With H , to go one step further, we can generate the bird's-eye view of the physical plane, which is very useful to perform detection and measurement of plane objects
- ✓ The geometric transformation between the physical plane and its bird's-eye view is a similarity transformation



Steps for achieving single-camera measurement

基于视觉的 泊车位检测

同济大学软件学院
计算视觉课题组

张林 李曦媛 黄君豪 李林申





Contents of this theme

- ✓ To study the camera calibration algorithm, we need to have some knowledge about projective geometry, which will be introduced in Chapter 8
- ✓ Camera calibration is a non-linear least-squares problem; Chapter 9 will formally define such a kind of problem and the algorithms to solve it
- ✓ Imaging model and the camera calibration algorithm will be detailed in Chapter 10
- ✓ In Chapter 11, we will learn how to generate the bird's-eye view for the physical plane



Contents of this theme

