A paraperspective projection is defined as follows. (1) First, a parallel projection along the constant direction $\mathbf{d} = [d_x, d_y, 1]^T$ is applied to map a 3D point $P$ onto a point $P'$ of the frontal plane $\Pi$ (i.e. $\Pi$ is parallel to the image plane), (2) then a perspective projection is employed to map $P'$ to the image point $p$. If the distance between the camera center $C$ and $\Pi$ is $Z_0$, the distance between the camera center $C$ and the image plane is $f$, the CCD scale factor is $s_x$ pixel/unit length and $s_y$ pixel/unit length, the principal point is $(u_0, v_0)$, please derive the 2x4 camera matrix $M$ for this paraperspective projection so that $p = MP$ or $[x, y]^T = M [X, Y, Z, 1]^T$.

![Diagram](image.png)

Figure 1. The paraperspective projection.