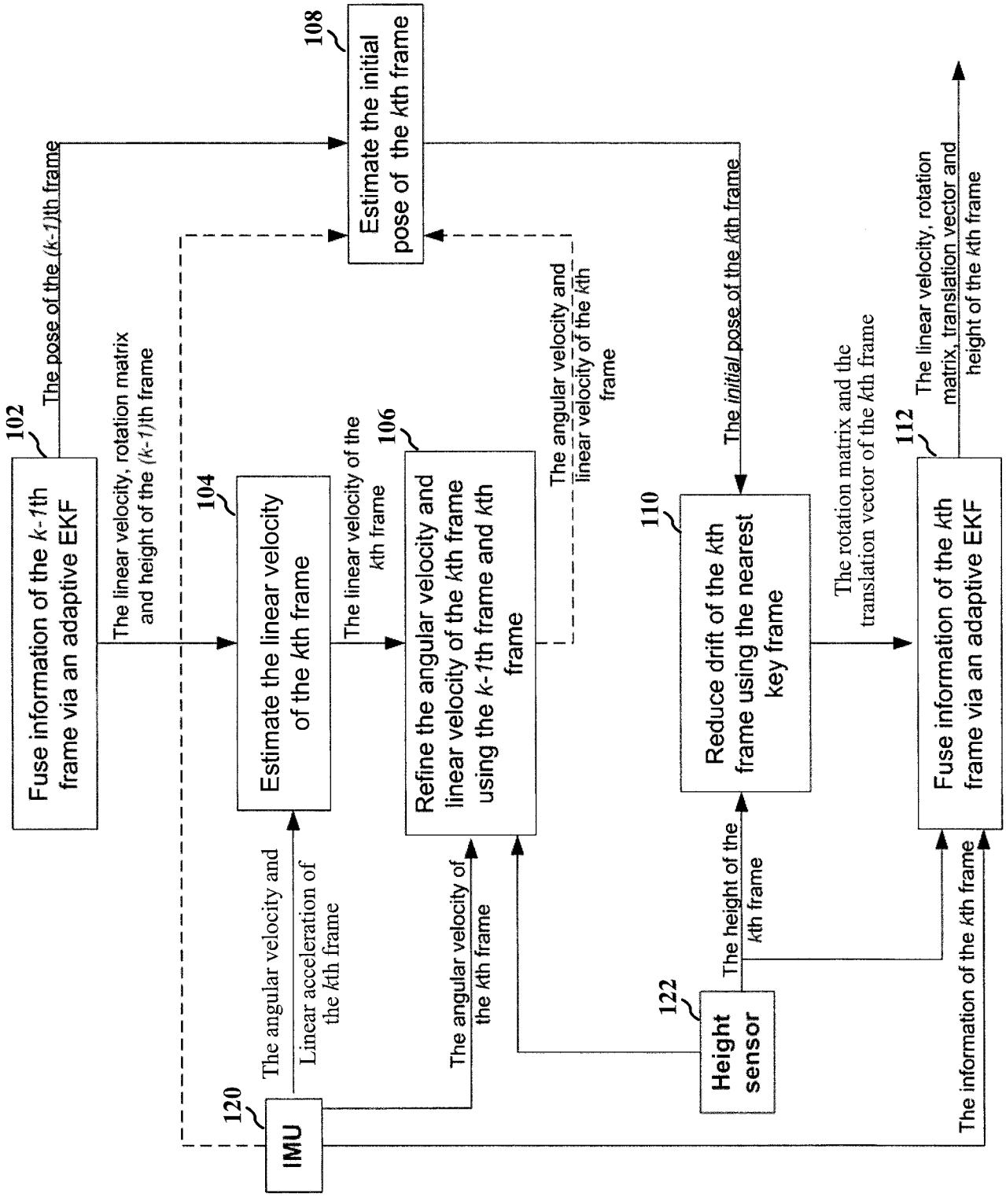

100
102
Fuse information of the k-1th frame via an adaptive EKF
The pose of the (k-1)th frame
The linear velocity, rotation matrix and height of the (k-1)th frame
108
Estimate the initial pose of the kth frame
104
Estimate the linear velocity of the kth frame
The linear velocity of the kth frame
106
Refine the angular velocity and linear velocity of the kth frame using the k-1th frame and kth frame
The angular velocity and linear velocity of the kth frame
The initial pose of the kth frame
110
Reduce drift of the kth frame using the nearest key frame
The rotation matrix and the translation vector of the kth frame
112
Fuse information of the kth frame via an adaptive EKF
The linear velocity, rotation matrix, translation vector and height of the kth frame
The information of the kth frame
120
IMU
The angular velocity and
Linear acceleration of the kth frame
The angular velocity of the kth frame
122
Height sensor
The height of the kth frame

FIG. 1

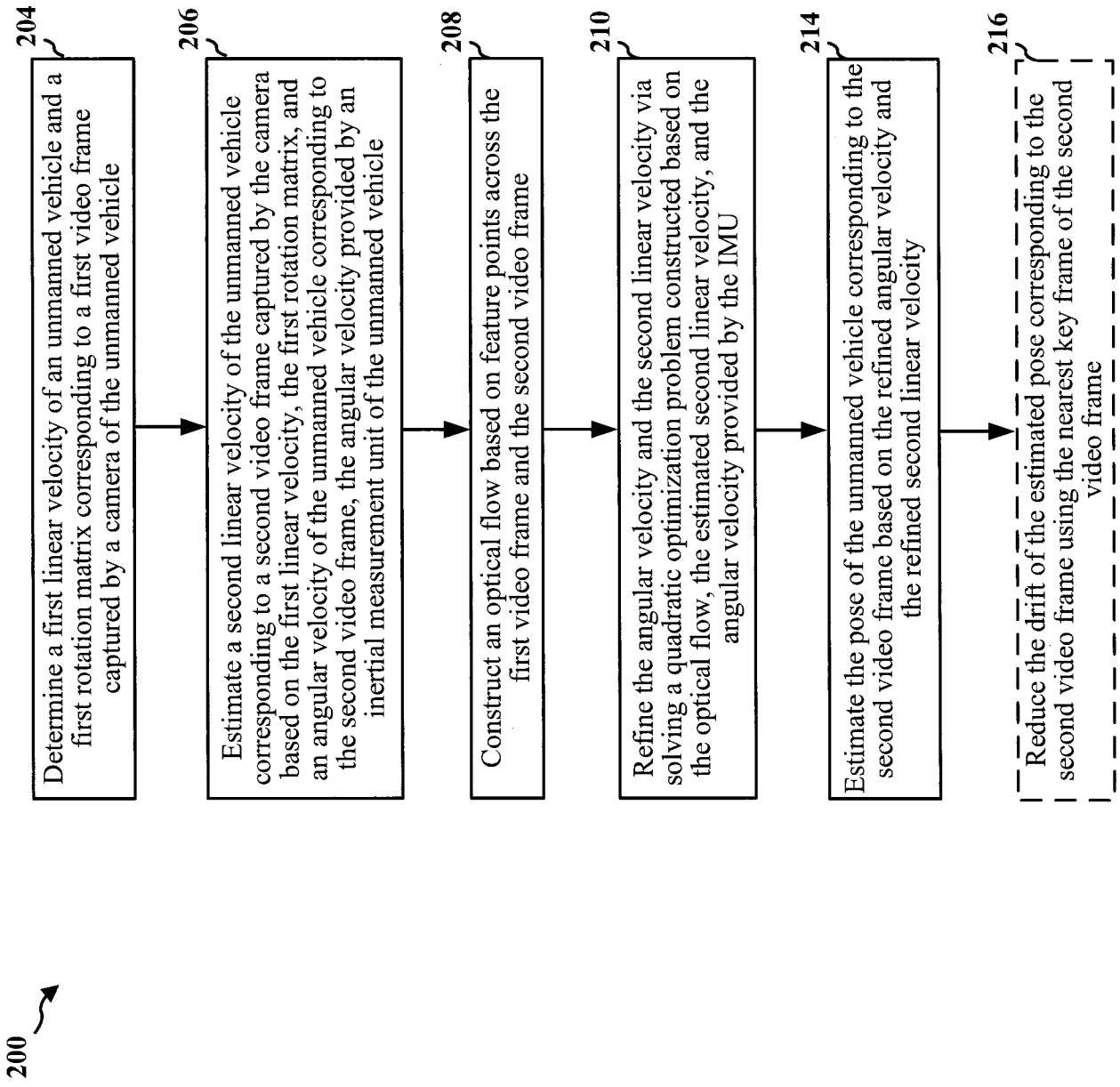

200
204
Determine a first linear velocity of an unmanned vehicle and a first rotation matrix corresponding to a first video frame captured by a camera of the unmanned vehicle
206
Estimate a second linear velocity of the unmanned vehicle corresponding to a second video frame captured by the camera based on the first linear velocity, the first rotation matrix, and an angular velocity of the unmanned vehicle corresponding to the second video frame, the angular velocity provided by an inertial measurement unit of the unmanned vehicle
208
Construct an optical flow based on feature points across the first video frame and the second video frame
210
Refine the angular velocity and the second linear velocity via solving a quadratic optimization problem constructed based on the optical flow, the estimated second linear velocity, and the angular velocity provided by the IMU
214
Estimate the pose of the unmanned vehicle corresponding to the second video frame based on the refined angular velocity and the refined second linear velocity
216
Reduce the drift of the estimated pose corresponding to the second video frame using the nearest key frame of the second video frame

FIG. 2

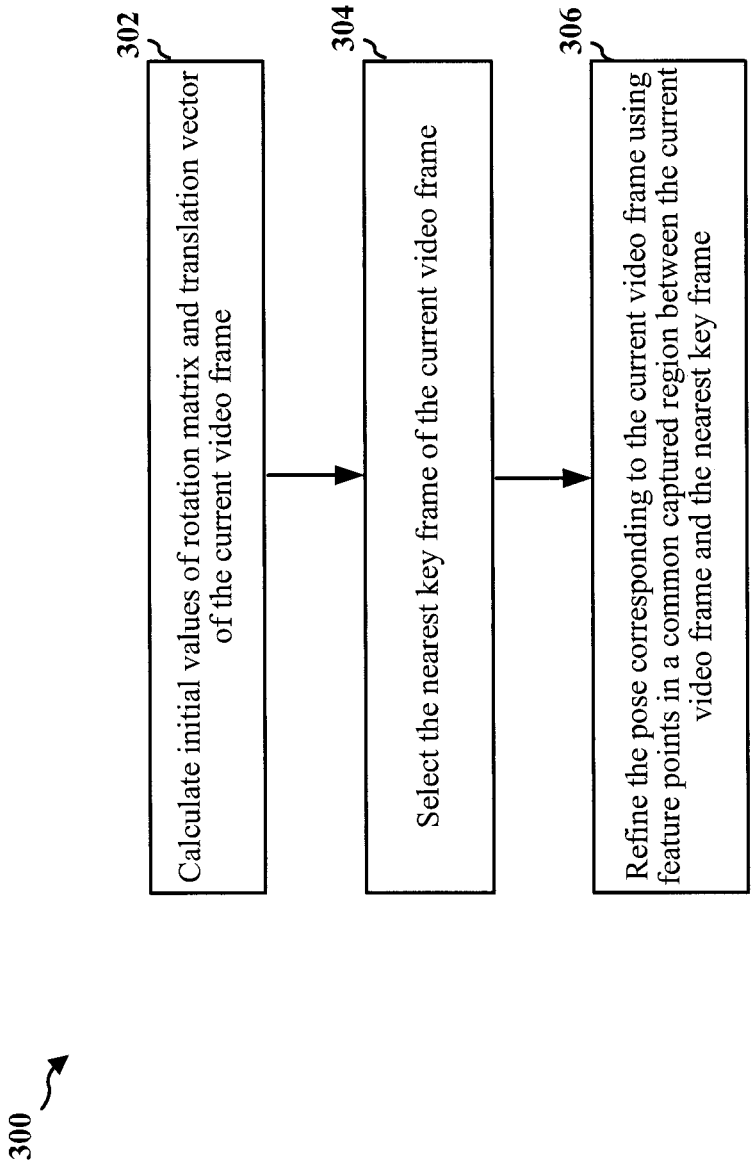

300
302
Calculate initial values of rotation matrix and translation vector of the current video frame
304
Select the nearest key frame of the current video frame
306
Refine the pose corresponding to the current video frame using feature points in a common captured region between the current video frame and the nearest key frame

FIG. 3

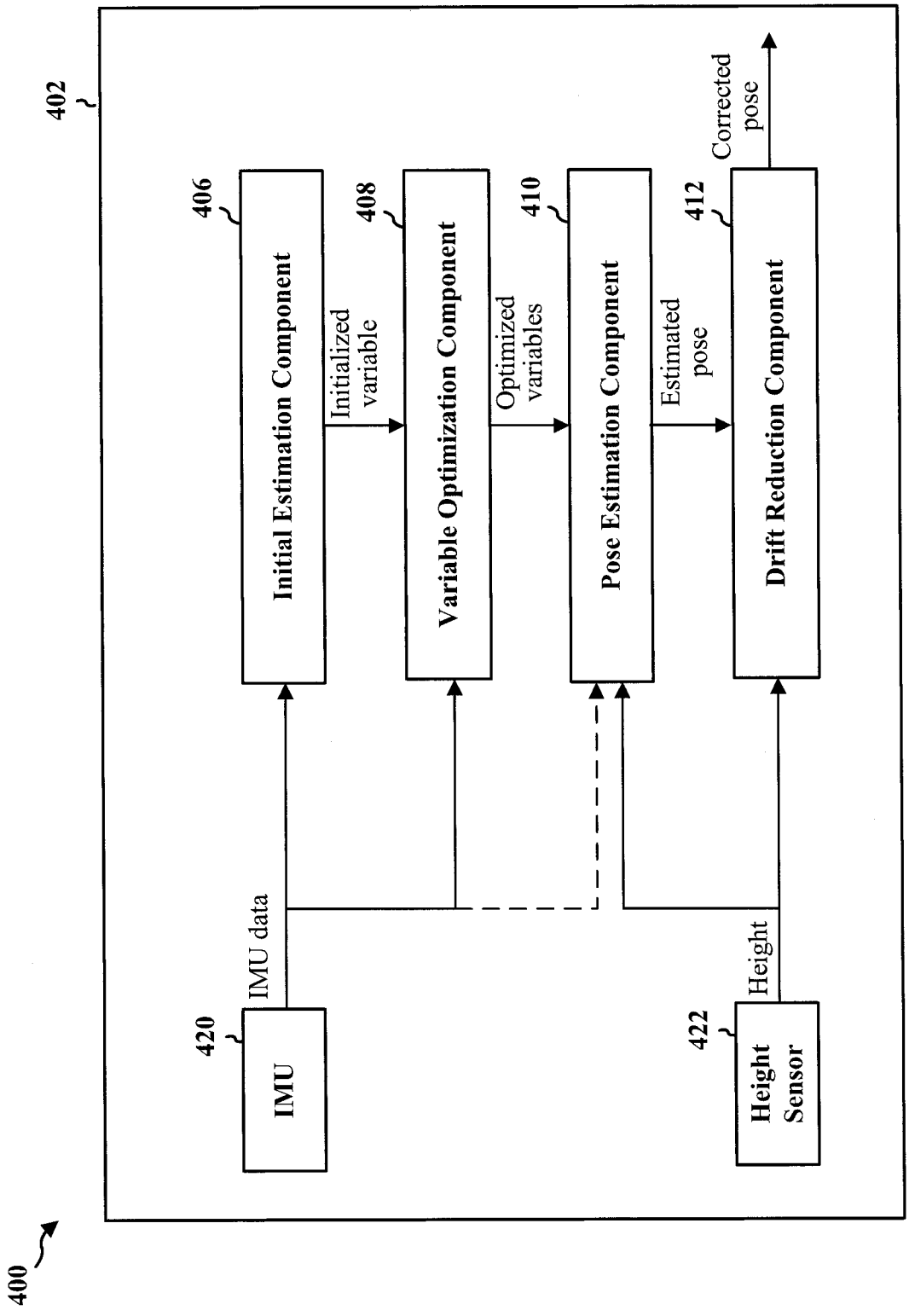

400
402
406
Initial Estimation Component
Initialized variable
408
Variable Optimization Component
Optimized variables
410
Pose Estimation Component
Estimated pose
412
Drift Reduction Component
Corrected pose
420
IMU
IMU data
422
Height Sensor
Height

FIG. 4

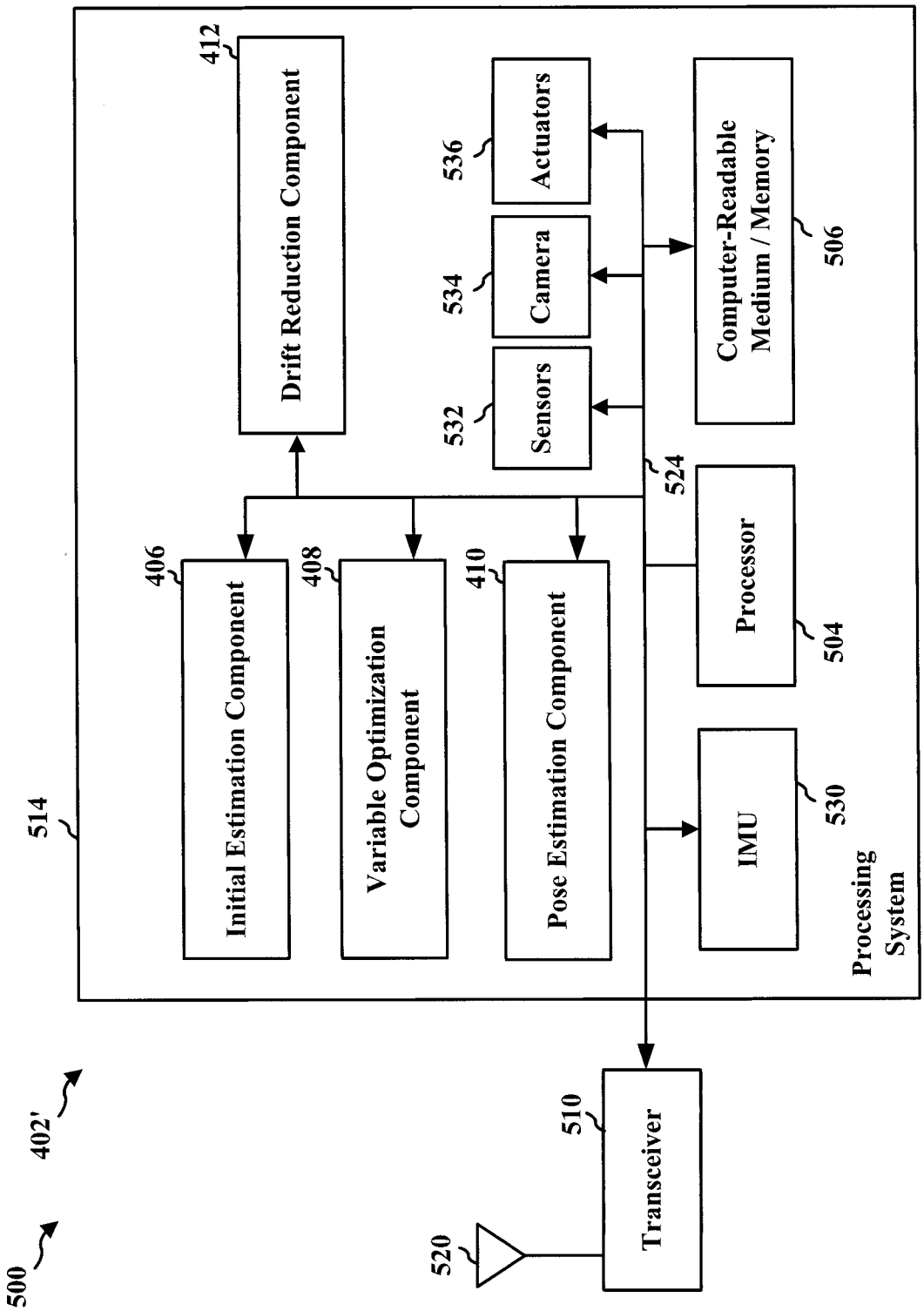

500
402'
514
Processing System
Initial Estimation Component
406
Variable Optimization Component
408
Pose Estimation Component
410
Drift Reduction Component
412
Processor
504
IMU
530
Transceiver
510
520
524
Computer-Readable Medium / Memory
506
Sensors
532
Camera
534
Actuators
536

FIG. 5