Comparing position data generated by AprilTag and a capacitive sensor grid

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Abstract—Autonomous navigation is a key feature for mobile robots to move safely through indoor environments that relies on a precise position estimation. AprilTags are 2D markers that can be used to give a position estimation of mobile robots equipped with a camera in relation to AprilTags. To verify the precision of the position calculation using AprilTags or to calibrate, a manual measurement has to be made. For continuous or repetitive tasks this is time consuming and involves workers which in turn measure with a certain inaccuracy. Researchers tend to use capacitive sensing to detect and localize people in rooms, which are much easier to detect due to their mass and materiality. The position estimation of mobile robots is mostly dependent on either optical or on-board systems, which do not work in poor visibility, or an external check is missing. In this study a Petoi Bittle Dog (MiDOG) as mobile robot has been equipped with a camera and a Raspberry Pi to visualize and process the AprilTags information. A mat equipped with a grid of capacitive sensors is laid out in front of an AprilTag. Both systems independently collect position data. To do so an algorithm to process the camera data is implemented, that uses the camera information and the known dimensions of AprilTags to compare them and give an estimation of the angle and the distance to the AprilTag. In parallel a mat with a grid of capacitive sensors oriented in two directions is placed in front of the AprilTag. The data of each sensor is processed and the highest values in each of the two directions represent the position of the mobile robot. The actual position is manually measured and compared to the position estimated from the AprilTag and the position estimated from the capacitive grid to give an idea of the precision of each system. The proposed method compares an established optical, 3D internal position estimation with AprilTags with a non-optical, 2D, external position estimation with a capacitive sensor mat. To give a better idea of the precision of each technology and to highlight the advantages and disadvantages of each technology a side by side comparison is performed.

Index Terms—Capacitive Sensor, AprilTag, mobile Robot, location estimation

Acknowledgment

References

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