ELEN3007A Group 21 - Assignment 2024:

Application of Bayes' Theorem for Locating a Robot's Position in an Enclosed Area

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Introduction and Background

The assignment consideres that the position of β is known, and after recording N flashes at positions x_k, and inferes or answers the question: *where is the robot*?
The azimuth angles at which the flashes are emmited, at random intervals, are quantified by θ_k which is uniformly distributed distributed. Since θ_k is uniformly distributed, we expect more recordings of x_k near or around α which displays the vertical position underwhich the robot is expected to be. The mean value of x_k is distance away from the assumed value of α.

Assessment Criterion

- Geometry setup of the problem

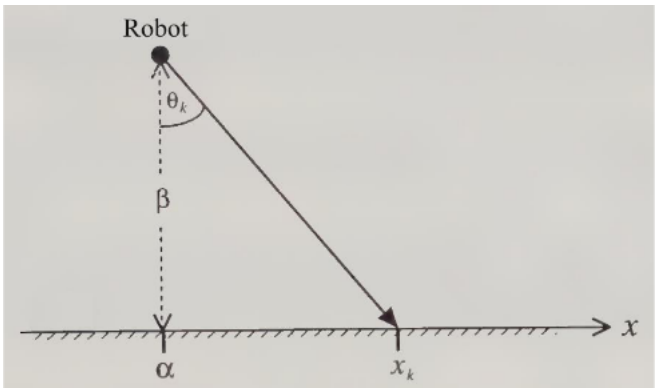

Figure 1: Geometry setup of the problem

- θ_k assumed to be uniform, azimuth angles lying between $-\frac{\pi}{2}$ and $\frac{\pi}{2}$, it has the PDF:

$$p(\theta_k|\alpha, \beta, B) = \frac{1}{\pi} \tag{1}$$

- In order to relate the readings of x_k to θ_k, using elementary trigonometry, the derived expression is

$$\beta tan\theta_k = x_k - \alpha \tag{2}$$

Assignment Answers

1. The given setup of the problem assumes that the photodetectors are placed on the x-axis above which the robot is located. Therefore, the signal comes from one side of the axis. This thus limits the range of the detectors to be within the range of π (that is $-\frac{\pi}{2}$ to $\frac{\pi}{2}$).
2. Second
3. Etc.

Conclusion