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**SAMPLING FREQUENCY**

Sampling Frequency: The sampling frequency (or sampling rate) is the number of times per second that a continuous analog signal is measured to convert it into a discrete digital signal. It is usually expressed in Hertz (Hz). For example, a sampling frequency of 44.1 kHz means that the signal is sampled 44,100 times per second. Sampling is a crucial process in digital signal processing because it allows us to represent analog signals digitally. The quality of the digital signal largely depends on the s ampling frequency:

* Higher sampling frequencies allow for more accurate representation of the original analog signal but require more storage and processing power.
* Lower sampling frequencies reduce data size but can lead to loss of information if the signal isn’t sampled often enough.

**Nyquist Theorem**

To accurately reconstruct a continuous signal from its samples, the sampling frequency must be at least twice the highest frequency component of the signal.

**IMPLEMENTATION PROCESS**

Frequency Detection

Check Power Level for Target

Frequencies (f1 & f2)

│ - Thresholding

Frequency Analysis (FFT)

Convert into frequency domain

Signal processing Block

ADC Conversion

Sampling rate: 22050 Hz

Microphone / Audio Input │

Dual-Frequency

Activation Check

If f1 AND f2 - detected above thresholds - Trigger Action

System Activation

**SELECTION OF SAMPLING FREQUENCY**

For an embedded system where power efficiency is important, **22050 Hz** is likely the best choice, as it captures the necessary frequency for activation without the additional processing and power costs associated with higher sampling rates. This rate allows your system to reliably detect the security or activation signal while optimizing for energy and processing efficiency.