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Hardware-Accelerated Machine Vision using Field-Programmable Gate Arrays (FPGA)

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Hardware-Accelerated Machine Vision using Field-Programmable Gate Arrays (FPGA)

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Need: Machine vision continues to be a significant element in the suite of technologies used in robotics and embedded systems. While these systems are commonly used in path planning, image processing, environment feedback, or object tracking tasks in mobile and industrial applications, they often consume a significant proportion of the system's processing time. To reduce these processing requirements, hardware acceleration techniques can be implemented in machine vision designs, allowing robotic and embedded systems to react faster to the surrounding environment.

Overview: The development and implementation of a hardware-accelerated vision system for object tracking will be presented. This will include a discussion of the FPGA hardware system architecture, finite state machine logic, VHDL design code, and speedup results. Also, a brief description of suitable applications for the vision system design will be presented.

Major Points:

- Design development and implementation of the hardware-accelerated machine vision system
- Functional results and comparison to a software implementation design

Summary: A hardware-accelerated vision system for object tracking was developed and implemented using FPGAs. Based on Amdahl's Law equation, the final hardware design outperformed a similar software implementation by a factor of 7.7.