



# Hardware implementation of SLAM algorithms: a survey on implementation approaches and platforms

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## Abstract

Simultaneous localization and mapping (SLAM) is an active research topic in machine vision and robotics. It has various applications in many different fields such as mobile robots, augmented and virtual reality, medical imaging, image-guided surgery systems, and unmanned aerial vehicles (UAVs). The computational complexity of SLAM algorithms is very high. Therefore, in many applications, it is necessary to implement them in real-time on platforms with low power consumption and small sizes. This paper reviews the implementation and the performance of SLAM algorithms on various platforms. Although there are various review studies on SLAM algorithms, the studies assessing the hardware implementation of these algorithms are very limited. This study attempts to fill this gap. It is shown that using the hardware–software (HW/SW) co-design approaches over mere Software (SW) or hardware (HW) approaches is currently the primary option for implementing SLAM algorithms on hardware platforms. A combination of a hardware accelerator and a software approach increases the speed of the implementation as well as the performance and the speed of the algorithm. Also, dividing different parts of the algorithm according to the structure and the nature of the algorithm between hardware and software in the HW/SW co-design approaches reduces the resource consumption and the cost. Furthermore, the design of hardware-compatible algorithms is one of the most critical gaps in the implementation of SLAM algorithms on hardware platforms.

**Keywords** Visual SLAM · FPGA · FPGA-SoC · Embedded CPU/GPU · ASIC · Visual odometry · Hardware–software co-design

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# Algorithms And Hardware Implementation Of Real Time

**M Mark**



## **Algorithms And Hardware Implementation Of Real Time:**

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## **Table of Contents Algorithms And Hardware Implementation Of Real Time**

1. Understanding the eBook Algorithms And Hardware Implementation Of Real Time
  - The Rise of Digital Reading Algorithms And Hardware Implementation Of Real Time
  - Advantages of eBooks Over Traditional Books
2. Identifying Algorithms And Hardware Implementation Of Real Time
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Algorithms And Hardware Implementation Of Real Time
  - User-Friendly Interface
4. Exploring eBook Recommendations from Algorithms And Hardware Implementation Of Real Time
  - Personalized Recommendations
  - Algorithms And Hardware Implementation Of Real Time User Reviews and Ratings
  - Algorithms And Hardware Implementation Of Real Time and Bestseller Lists
5. Accessing Algorithms And Hardware Implementation Of Real Time Free and Paid eBooks
  - Algorithms And Hardware Implementation Of Real Time Public Domain eBooks
  - Algorithms And Hardware Implementation Of Real Time eBook Subscription Services
  - Algorithms And Hardware Implementation Of Real Time Budget-Friendly Options

6. Navigating Algorithms And Hardware Implementation Of Real Time eBook Formats
  - ePub, PDF, MOBI, and More
  - Algorithms And Hardware Implementation Of Real Time Compatibility with Devices
  - Algorithms And Hardware Implementation Of Real Time Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Algorithms And Hardware Implementation Of Real Time
  - Highlighting and Note-Taking Algorithms And Hardware Implementation Of Real Time
  - Interactive Elements Algorithms And Hardware Implementation Of Real Time
8. Staying Engaged with Algorithms And Hardware Implementation Of Real Time
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Algorithms And Hardware Implementation Of Real Time
9. Balancing eBooks and Physical Books Algorithms And Hardware Implementation Of Real Time
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Algorithms And Hardware Implementation Of Real Time
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Algorithms And Hardware Implementation Of Real Time
  - Setting Reading Goals Algorithms And Hardware Implementation Of Real Time
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Algorithms And Hardware Implementation Of Real Time
  - Fact-Checking eBook Content of Algorithms And Hardware Implementation Of Real Time
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
14. Embracing eBook Trends
  - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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