Simultaneous Localization and Mapping (SLAM)

Five areas poised for rapid change

Technology Insights

Five markets Arm considers key for SLAM:

- Navigation
- Advertising
- Retail
- Gaming
- Social

What is SLAM?

Simultaneous Localization and Mapping (SLAM) has the potential to improve and fundamentally change the lives of consumers and businesses in the future. It's a series of complex computations and algorithms that use sensors to construct maps and structures in unknown environments, while localizing a device's position and orientation through cameras and sensors.

About 80 percent of the world's smartphones have cameras and sensors, such as Inertial Measurement Units (IMUs), so SLAM has the potential to be used by billions of people worldwide. The technology can also cross many different areas and devices, such as autonomous vehicles, robots, AR/VR headsets and laptops.

Here are five markets Arm thinks are important for SLAM: navigation, advertising, retail, gaming and social.

Navigation with augmented reality

SLAM greatly improves the accuracy of both outdoor and indoor wayfinding, letting you navigate around a giant shopping center or any large indoor arena on your smartphone without having to ask for directions or look at a physical map.

Since SLAM technology brings a far greater understanding of the physical environment than GPS, it's possible to enhance it with virtual elements. Position and mapping information are available at the software level for developers to exploit; for instance, overlaying an environment with graphics to help users navigate. That can include direction arrows drawn on a street or an indoor corridor, or virtual characters guiding users to their destination.

Advertising in real time and space

Extremely accurate user location, as well as the ability to detect where a smartphone camera is facing, can unlock interesting new advertising possibilities, especially as the map provider can determine what the user is looking at, such as a shop or building, and offer additional information.

For example, if SLAM sees you looking at a sporting goods shop, your device app may suggest products it knows are on sale. Maybe it offers you a further discount too. This could be a game changer for retailers and provide extra value for users.

Ecommerce by drag and drop

SLAM lets consumers use their smartphone to transpose a physical object virtually into a physical environment. A prime example is furniture buying. Just imagine using a smartphone to take a photo of a sofa and then transpose it into your own living room. Instantly, you can tell whether the sofa would fit and look good. The ability of SLAM to provide very accurate measurements makes this possible, with the technology working out the precise dimensions of the environment and the object.

SLAM can also transform online shopping. Online stores can use SLAM to create 3D virtual objects which consumers can drag and drop to decide suitability. If it fits in the virtual world, users know it will fit in their physical space. So, SLAM is not only going to help consumers buy the right items, but it can help reduce the number of products returned. A win for everyone.

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Gaming on the go

SLAM provides the environmental context to make games 'on the go' — often on mobile — even more meaningful and exciting. Dense SLAM is the ultimate goal for gaming as it uses all or almost-all pixels in a frame to provide more accurate graphical representations. This detail offers developers more freedom to be creative, although today's Sparse SLAM, which uses only a small selected subset of the pixels in an image frame, is already a massive upgrade. With SLAM technology, the potential for immersive gaming experiences is truly astonishing, especially on mobile devices.

SLAM can also be used for tracking the user's position and mapping it to the virtual world. In the near future, users should be able to play new types of games on mobile devices that are currently only possible on console and PC. The new generation of all-in-one VR headsets based on mobile SoC are already using this technique.

Social apps expand

SLAM opens up many new possibilities for developers to change the way people use social media and how they share their experiences. For example, SLAM technology could turn a room into a virtual TV studio for live broadcast performances, presenting a whole new range of opportunities for video sharing platforms.

Challenges ahead

Despite these exciting possibilities, there are many system challenges associated with SLAM that have to be addressed if SLAM is to progress as a widespread future technology. Key challenges include:

- The synchronization of data from camera to chip to display.
- New calibration, with camera vendors providing Android interfaces.
- Synchronizing a starting user position for indoor navigation.
- Lack of common standards.

Despite these challenges, SLAM is a long-term growth opportunity for businesses, and Arm continues to work with its partners and ecosystem to provide cohesive solutions and bring SLAM to scale.

Read more about SLAM and engaging with Arm.