



QCOM AMR Reference Design

Proof-of-Concept Design: Autonomous Mobile Robot (AMR) with Accurate Indoor Positioning and Navigation

Powered by Qualcomm® QCS8550 Processor

Building autonomous mobile robots (AMRs) is a complex and challenging task that requires expertise in various domains, including robotics, artificial intelligence, computer vision, and more. These sophisticated machines must possess the ability to accurately perceive their surroundings, precisely localize themselves within their environment, and efficiently plan their trajectories while meticulously avoiding obstacles and adhering to stringent safety constraints. Furthermore, AMRs generate vast quantities of data from their sensors and interactions, necessitating efficient data collection, storage, management, and analysis to support their perception, localization, planning, and other essential functions.

To effectively address these requirements and expedite the development of AMRs, Arrow, Qualcomm, and einfochips collaborated in creating the **QCOM AMR reference design**. It integrates sensor fusion technology and a triaxial IMU, for safe and effective navigation. STMicroelectronics (STM) motor drivers, coupled with STM power ICs and an ultra-low-power MCU, ensure efficient motion and long battery life. The software stack is built on the Robot Operating System (ROS2) framework. The QCOM AMR reference design accelerates autonomous robot development, backed by Arrow's engineering services for customization and cost-reduction.

Key Enabling Technologies for Indoor Navigation and Mapping

Sensor Fusion - Intel's

RealSense and Inertial
Measurement Unit (IMU)

Edge Computing -

Qualcomm
GPU

Algorithms - Visual

Simultaneous Localization
and Mapping (VSLAM)

Simulation & Scene

Creation - Blender,
and Gazebo



This proof-of-concept AMR can be used as a starting point for mobile robot design for use in laboratories, industry, warehousing, and logistics, transportation, shopping, and entertainment applications.

The diagram illustrates a two-board system architecture, divided into a **Controller Board** and a **Processor Board**.

Controller Board:

- Power Supply:** Includes an AC-DC Adaptor (12V), a 12V Lithium Polymer Battery, a Battery Charger, a Buck-Boost Controller, and Low Noise LDOs.
- Sensor:** Includes a Digital Temp Sensor (STDS7DS2F), a 6-Axis IMU Sensor (LSM6DSOTR), and a One-wire UART.
- Micro-controller:** STM32H7 series.
- Output/Interface:** Includes an OLED Display, Debug USB (CP2102), USB 2.0 (FS), and a CAN Connector.
- Motion Control:** Includes a Motion Controller (STSPIN840DC motor/ L6235- BLDC) and a Motor Encoder.
- Motors:** DC Motors.

Processor Board:

- Power supply:** DC-DC buck Converters.
- Connectors:** Fakra Connector X1, USB 3.0 Type A Connector, USB 2.0 Type A Connector, Ethernet Connector, EIC CSI Connectors, HDMI Connector, USB Type-C, Micro USB Connector, Rpi-CSI Connectors, DMIC, and Micro SD Card.
- Serializers/Converters:** De-serializer MAX9674R GMSL, PCIe to USB Hub uPD720201K8, USB2.0 HUB USB2534, USB to Ethernet uPD720201K8, DSI to HDMI LT9611UXC, UART to USB FT230XQ-R, and PCIe Analog Mux PI3DBS16215Z BBEX.
- Other Components:** RTC (DS1340Z-3+), IMU Sensor (LSM6DSOTR), EEPROM (AT24CS04), Digital Temp Sensor (STDS7DS2F), Wi-Fi/BT, and 5G.
- Central Processor:** QCS8550 SOM.

Inter-board Connections:

- A 12VDC connection from the Controller Board's Power Supply to the Processor Board's Power supply.
- A USB 2.0 connection between the Micro-controller on the Controller Board and the Processor Board.

Product name	Description
QCS8550 SOM	A System-on-Module based on Qualcomm® QCS8550 RAM: 8GB to 16GB LPDDR5x Storage: 128GB to 1TB UFS3.1
STM32H743VIT6	ARM® Cortex®-M7 STM32H7 Microcontroller IC 32-Bit Single-Core 480MHz 2MB (2M x 8) FLASH 100-LQFP (14x14)
STSPIN840	Compact dual brushed DC motor driver
LSM6DSLTR	Accelerometer, Gyroscope, Temperature, 6 Axis Sensor I2C, SPI Output
STTS751-0DP3F	Temperature Sensor Digital, Local -40°C ~ 125°C 11 b 6-UDFN (2x2)
L9616	Automotive High Speed Can Bus Transceiver
LD39100PUR	Linear Voltage Regulator IC Positive Adjustable 1 Output 1A 6-DFN (3x3)
L7981TR	Buck Switching Regulator IC Positive Adjustable 0.6V 1 Output 3A 8-VDFN Exposed Pad

Please contact your Arrow FAEs to get access to this reference design:
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