AMG Behavior Engine

Product Brief

Adaptive Motion Group, Inc. (AMG) provides smart ecosystems where intelligent systems work in harmony with humans - safely and intuitively by combining multiple behaviors into a coherent system – the AMG Behavior Engine (AMG-BE™). AMG works with customers to design and implement solutions for safety, tracking, smart mobility and connectivity.

AI and robotics have the potential to transform our world, and when it comes to autonomy, the creation and integration of complex behaviors remains a challenge. AMG is focused on solving this problem to create intelligent ecosystems where robots, manned vehicles and humans can work side by side. AMG has accomplished this using custom behavior algorithms and our unique fusion of sensor data and positioning technologies. This creates a safe and efficient robot-readable world. The result is a "GPS of Things" – a framework of connectivity that encompasses and supports a safe collaboration of humans and robots as they increasingly work in close proximity to each other.

The AMG-BE™ software supports autonomy on a variety of vehicle types. The autonomous vehicles proven thus far vary in size and shape from large buses to small lightweight robots. The value of the AMG solution is that the AI software can port easily to different platforms and the optional positioning engine works on any moving entity whether a person, forklift or vehicle.

The core differences between the AMG-BE™ and traditional robot behavior solutions are mainly in the very rapid response and localization of both the robot platform and that of all moving and non-moving objects in the sensor detection range. Our software platform and integration capabilities provide for a clear path to integrating sophisticated behaviors on new and existing autonomous platforms.

The AMG-BE™ provides the following benefits:

- **Safely use AGVs/UGVs in crowded spaces with dynamic obstacles**

- **Recover floor space used for large safety buffer zones**

- **Intelligently traverse facilities for increased operational efficiency**

- **Cost-effectively integrate with existing systems using industry-standard APIs (RESTful, MQTT, ROS)**

- **Connect to, and automatically control (start/stop/pause/resume), mobile platforms**

- **Flexible software platform allows for large assortment of sensors to be integrated**
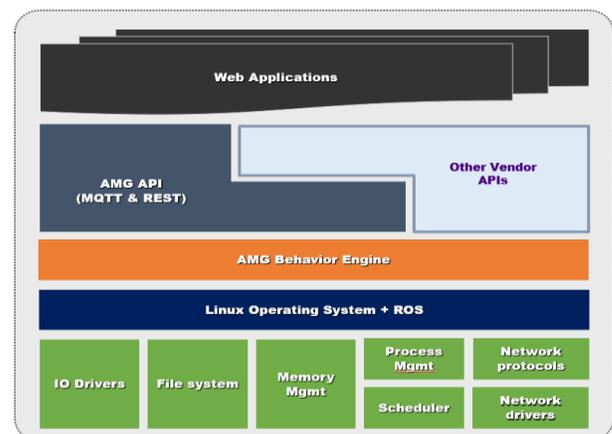
AMG-BE™ Core Platform Stack

One Platform Many Benefits

Smart infrastructure, cities and nations require platform integration from their vendors. Integration requirements are not only among a vendor's offerings, but also between vendor solutions to create seamless internetworked smart systems. Transitioning from limited connectivity, detection and response options to a modular, highly-connected and intelligent platform has been simplified to lower deployment costs, increase ease of operation and shorter training cycles. The result is increased performance and better results – all while lowering costs and increasing safety.

Adaptive Motion Group

Safety, Smart Ecosystems and Deployments

The AMG-BE™ platform is built around the principle of "Start with Safety." Our pedigree comes from two decades of military and energy related robotics in hazardous, complex environments where collision avoidance is a key priority. The AMG-BE software uses a "subsumption architecture" such that the collision avoidance behaviors subsume (e.g. takeover) all other functions. The safety capabilities are based on redundant sensors (lasers, ultrasonic, etc.) placed in multiple locations on autonomous platforms, providing the ability to not only prevent collisions but also safely fit through narrow openings as well as between people. The AMG approach to collision avoidance has been proven in our previous defense work in tunnels, bunkers and caves. The AMG-BE™ allows mobile platforms to move through busy factory floors, crowded parking lots and busy areas crowded with pedestrians.

The AMG-BE™ platform supports smart ecosystems where intelligent systems work in harmony with humans -- safely and intuitively. AMG's work has been covered extensively in China by the media after successful deployment of an autonomous bus system. The AMG-BE™ capability has autonomously transported over a thousand people in Hong Kong. The robustness of the AMG-BE™ autonomous capability is linked to its unparalleled ability to leverage reliable positioning.

System Requirements and Features

SYSTEM REQUIREMENTS	FEATURES
Linux (Ubuntu 16.04 LTS and newer)[1]	Responsive Behavior Engine with adjustable parameters
Drive-by-wire enabled platform	Flexible multi-sensor data acquisition
ROS (Kinetic and newer)[1, 2]	Platform-agnostic (small to large vehicles/devices)
Wireless IP connectivity (cellular, Wi-Fi, etc)	Message-based architecture with dual APIs - REST (GET/POST) and MQTT
x64 computer (2.5GHz or greater)	Module/node-level automatic restart upon failure (including logging)
4GB RAM	Low-level (API) and high-level (web) monitoring and management of all system nodes
120GB HD	Easily integrated/controlled with existing systems (via APIs)
(1) 3D LIDAR (point cloud)	Leverages ROS (Robot Operating System) framework
(1) 2D LiDAR (planar)	iOS, Android, Windows, Linux (**web interface compatibility**)

[1] Ubuntu 16.04 LTS and ROS Kinetic have been fully tested. Newer versions will be tested Q1 2019

[2] ROS will not be required for platform integration and deployment beginning Q2 2019

Web-based client compatibility: