

Throw the CANfetti: Open-source CANopen stack



Figure 1: M.52 is able to detect an obstacle, identify it, and take the proper action—all on its own (Source: Scythe Robotics)

Scythe Robotics celebrates its first open-source release. CANfetti is a CANopen stack for complex CANopen communications in a variety of applications for example in the company's 52-inch autonomous robotic mower M.52 for landscaping.

Scythe Robotics, developing advanced, commercial-grade autonomous solutions for the professional landscape industry, announced its first open-source release. CANfetti is a CANopen-compliant stack developed to overcome the limitations of existing libraries. Written and refined over the past several years by Scythe's firmware and software teams, CANfetti significantly lowers the barrier to entry with an open-source, easy-to-use, and production-grade library for robust CANopen communications in fields such as on- and off-road vehicles, industrial devices and, of course, robotics. "Given the complex communication needs across the range of specialized components in Scythe M.52, we knew we'd have to leverage a higher-level CAN protocol," said Matt Quick, lead firmware engineer at Scythe. "A number of our vendors already support CANopen, making it a great fit for us. But as advantageous as CANopen is, the available open-source libraries were frankly a headache to integrate and had severe functional limitations, so we built our own solution."

Self-driving mower for landscaping

Just like the car industry, the transition to electric power is the most prominent shift in landscaping equipment today. Clients are demanding it and local governments are requiring it as consumers and communities pursue greater environmental sustainability in their everyday lives. Technology is rapidly developing to meet these needs, and Scythe is excited to usher in the electric era.

With the company's first commercial mower Scythe M.52 self-driving technology meets commercial-grade

equipment to expand the capacity and performance of landscape crews. M.52 follows contours, tackles slopes, and automatically adjusts striping patterns on its own for a consistently cut. The mower's eight HDR cameras and advanced sensors enable it to identify obstacles on a property and safely navigate around them. And since it's all-electric, M.52 can be charged overnight and run all day with zero emissions and substantially less noise than gas-powered mowers. The mower can handle the demands of commercial mowing, like large-scale areas, sloped landscapes, and constantly changing obstacles. With M.52 on their trucks, landscape crews will be freed up to do higher value work and focus on the details that take a property from good to great. They will also be able to use real-time data from the mower to identify additional service opportunities including adding seasonal color, pruning, and preventive lawn and shrub care. Software updates are included. M.52 is only available as a usage-based rental. While reservation ensures earlier access to M.52 mowing service, it does not represent ownership. This also means there is no equipment to buy. No big up-front costs and latest technology because Scythe handles updates and repairs.

CANfetti for mower robot

The autonomous commercial mower uses a robust, automotive-grade CAN as a backbone of its communications system. To unify the range of specialized components in the mower – like advanced sensors, battery modules, and custom boards – and to handle the complex communica- ▶





Figure 2: Scythe Sight, M.52's computer vision, uses rich visual data from the mower's eight cameras to understand the world around it (Source: Scythe Robotics)

tion needs between them, Scythe knew they have to leverage a higher-level CAN protocol, like CANopen, Devicenet, or DroneCAN.

The Scythe team found the APIs (application programming interface) and designs of current open-source frameworks too constraining for integrating into M.52 in a consistent manner across both firmware and software. To overcome the rigidity of other options, CANfetti introduces the ability to use dynamic Object Dictionary types that allow easier integration of complex runtime behavior. And with a significantly more flexible API, CANfetti provides engineers with a drop-in CANopen stack that doesn't get in the way and simply lets them build their system around it. Most open-source CANopen libraries are no longer actively being developed, with many abandoned libraries sitting in various states of disrepair and becoming rapidly outdated without community or commercial support. CANfetti represents Scythe's first step in its commitment to updating and expanding the open-source firmware ecosystem.

"Creating a much more robust CANopen stack at Scythe allowed us to integrate critical components that weren't previously compatible," said Davis Foster, Scythe's head of hardware. "With CANfetti, we've been able to integrate more sophisticated components – like advanced sensors, battery modules, and motor controllers – into M.52, resulting in much better machine performance. By publishing CANfetti, we hope to support more companies that are building exciting, cutting-edge machines of all kinds and promote innovation across the field of robotics at large." Other open-source frameworks only partially implement the CANopen specification and have architectures that made extension to the rest of the spec a herculean effort, said Scythe on their blog. Not only is CANfetti a cleaner architecture and built using modern C++, but it supports a broader set of CANopen features like block mode which allows users to efficiently transfer larger contiguous blocks of data.

To make it as robust as possible, the company designed CANfetti as a multi-platform CANopen stack that works across a wide range of architecture, from bare metal micro-controllers to multi-threaded Linux systems. Within M.52, CANfetti integrates with these platforms and more. Beyond M.52, CANfetti can be used for applications as diverse as railway logistics, maritime electronics and building automation. "By publishing CANfetti, we hope to help more companies that are building exciting,

cutting-edge machines of all kinds by opening new possibilities for them."

Scythe Robotics provides the commercial landscape industry with commercial-grade, all-electric autonomous equipment solutions for more sustainably maintaining outdoor environments. The company is headquartered in Longmont, Colorado. [Find CANfetti on Github.](#)

Source

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CAN Newsletter Online

In the CAN Newsletter, we already reported about several open-source projects:



CAN Newsletter magazine **CAN FD open-source IP core**

The Faculty of Electrical Engineering (FEE) at Czech Technical University in Prague (CTU) reached another milestone in July 2022. Their CAN FD IP offer is fully supported by a mainline Linux kernel.

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CAN Newsletter magazine **Open-source CANopen protocol stack extended**

CANopennode is a free and open-source CANopen protocol stack available on Github. Recently, it was extended by a CANopen stack example running on STM32 micro-controllers.

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Open source **CAN FD interface for Arduino**

CANFDuino is an open-source project for Arduino. It is available on Crowdsupply as part of the Microchip-Get-Launched design program, using the ATSAMC21G18A micro-controller.

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CAN Newsletter magazine **CAN decoder warns for malicious attacks**

The open-source Sigrok project is a set of drivers and tools. It provides a desktop oscilloscope and logic analyzer UI (user interface) that can control different instruments (from Siglent, Rigol, and others).

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CAN-to-USB adapter **Open-source product supports CAN FD**

CANtact Pro from Linklayer Labs (Canada) is an open-source CAN-to-USB dongle with two integrated CAN FD interfaces (flexible data-rate).

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Open-source **Visualizing CAN data in telematics dashboards**

CSS Electronics have recently enabled to visualize CAN data in free, open-source telematics dashboards.

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cd



PCAN-Diag FD New J1939 Add-in

■ PCAN-Diag FD: CAN & CAN FD Diagnostic Device

The PCAN-Diag FD is a handheld device for the diagnosis of CAN and CAN FD buses at physical and protocol levels.

- High-speed CAN connection (ISO 11898-2)
 - Complies with CAN specifications 2.0 A/B and FD
 - CAN bus connection via D-Sub, 9-pin (CiA® 106)
 - Switchable CAN termination for the connected bus
- Power supply via rechargeable batteries or a supply unit
- Clear listing of the CAN traffic with various information
- Transmitting individual messages or CAN frame sequences
- Configurable, readable CAN ID and data representation
- Recording of incoming CAN messages
- Playback of trace files with optional loop function
- Measurement of the CAN bus load and termination
- Voltage check at the CAN connector for pins 6 and 9

Oscilloscope

- Function specially designed for CAN for a qualitative assessment of the signal course on the CAN bus
- Two independent measurement channels, each with a maximum sample rate of 100 MHz
- Display of the CAN-High and the CAN-Low signals as well as the difference of both signals
- Trigger configuration to various properties of CAN messages like frame start, CAN errors, or CAN ID

Now available with J1939 support

The new J1939 Add-in extends the functional range of the diagnostic device by the support for the SAE J1939 standard. The CAN data traffic is interpreted according to the included J1939 database and is represented in a way that is understandable for the user.

Features

- Representation of J1939 data interpreted according to PG and SP definitions
- SAE J1939 database with all definitions and the included parameters
- Decoding of multi-packet messages with payload data up to 1785 bytes
- Support for address claiming
- Display of DM and DTC diagnostic data

The J1939 Add-in is activated with a device-bound license which can also be purchased afterwards for a PCAN-Diag FD.



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