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Title: Mobile Display Unit for Open-Source Telematics Device

Executive Summary
ISOBlue aims to elevate the data visualization and processing problems for farmers. Tapping directly into the CAN-bus, ISOBlue is an on-machine server that is connected via a local network. ISO-blue aims to give farmers direct access to their data and be able to use it in a way that benefits the management and efficiency of their operation. This project centers around the creation of a display for the ISOBlue system with its main goal being to fill the gap in the equipment industry between manufacturers, equipment, operators, and their data.

Scoping
The goal of this project was to create a display that provides operators the ability to choose what data they can monitor, customize what they see to their needs, and allow cross platform to use between different brand equipment. ISO-Blue hopes to enable a farmer to view and control data without cellular connection that is currently required. This will hopefully open more doors for farmers in rural areas without a high-speed internet connection. ISO-Blue and the wireless display designed within this project will be very valuable and provide a service that is not offered by other currently available products.

Consideration of Global/Social/Cultural/Economic/Environmental Factors
The development of this telematics display working in tandem with the ISO-blue system will allow for many more farmers, managers, and operators to have access to data that will make them more efficient and effective in their work. This should drive economic benefit using better data management throughout the agriculture community. The goal would be to save on inputs, make better investments, and save time because of the greater availability of data which allows for better management and decision making. This could lead to a large environmental impact as there could be savings in pesticide and fertilizer usage.

Learning and Screening
The display for ISOBlue can solve many problems encountered by farmers. Many companies already offer displays; however, the displays are not affordable for those that will help farmers improve their operations. Also, those that are affordable do not really display much and are really limited in capabilities. The team produced a list of constraints and criteria to guide the project:

Constraints
- Needs to use a local network
- Show data and information in live time
- Able to be used on any WIFI capable device
- Connect to the ISOBlue module wirelessly

Criteria
- Cost effective
- Intuitive graphical user interface
- Quickly process the data
- Effective production process

Chosen Solution
This project was coded and implemented in Svelte. The team chose svelte because of its ability to combine languages such as, JavaScript, styling libraries, Python, HTML, and other CSS editing. It also needed to be able to talk with "NATS" which is a connection management software that is already living on the ISOBlue system. The environment of choice needed to be able to implement logic, connect to the ISOBlue's software, and design a user-friendly interface for in field use.

Concept Design and Development
Once it was decided to code our application in Svelte, our biggest issue was figuring out how data flows through the system so that we could connect to the ISOBlue. Improving the way that the user can access the data and use it was one of the biggest goals of the project. Below are examples of how data used to flow though the system and how data can now be accessed.

Old Data Pipeline:
Data flows one way from the tractor to the ISOBlue and is sent to the cloud to be recorded. There is no way to access the data without an internet connection and data visualization is minimal.
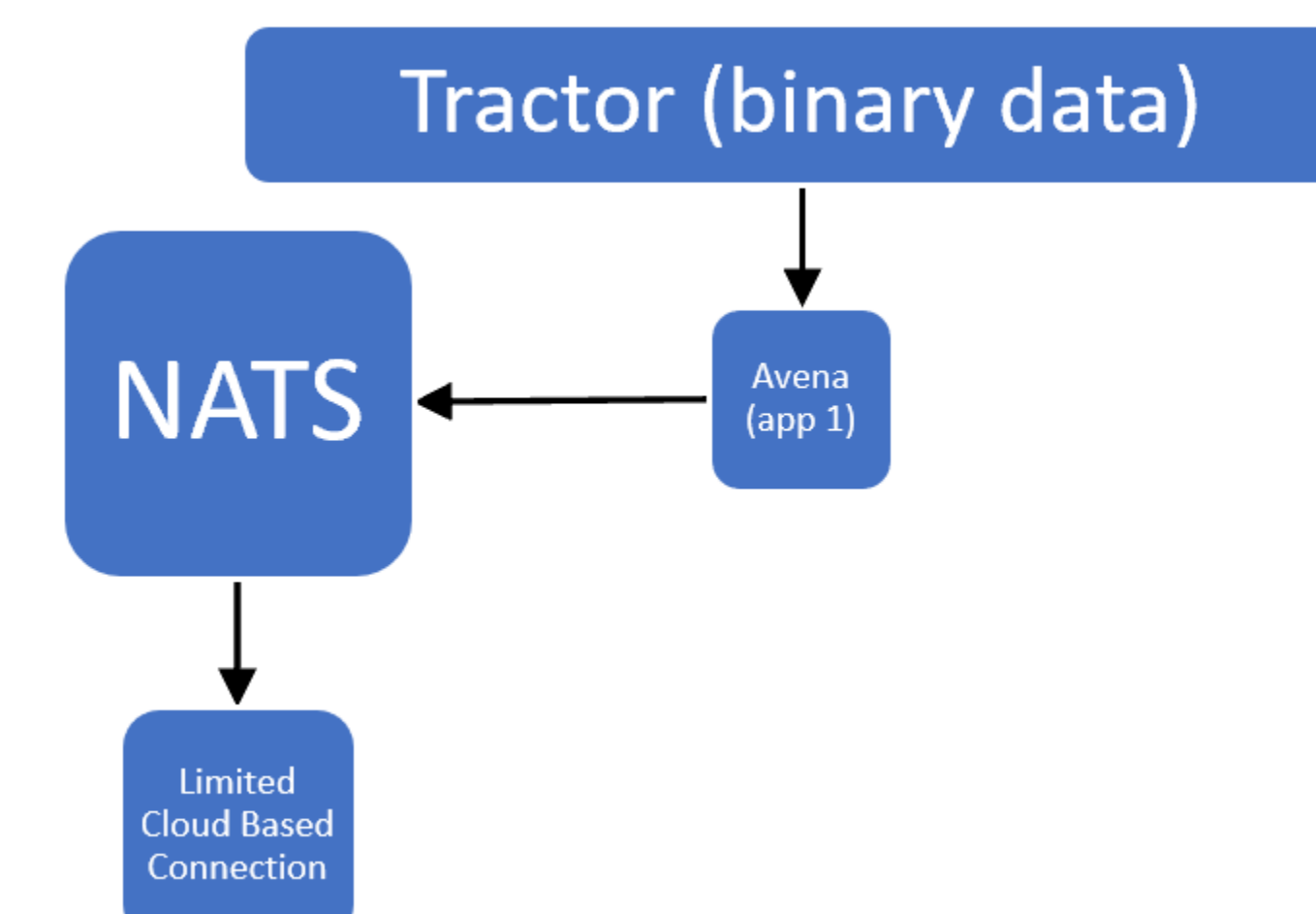
New Data Pipeline:
Data flows one way from the tractor to the ISOBlue like before but then two-way communication is available so that the user can access the data without an internet connection. Data can travel to the cloud or straight to a device.
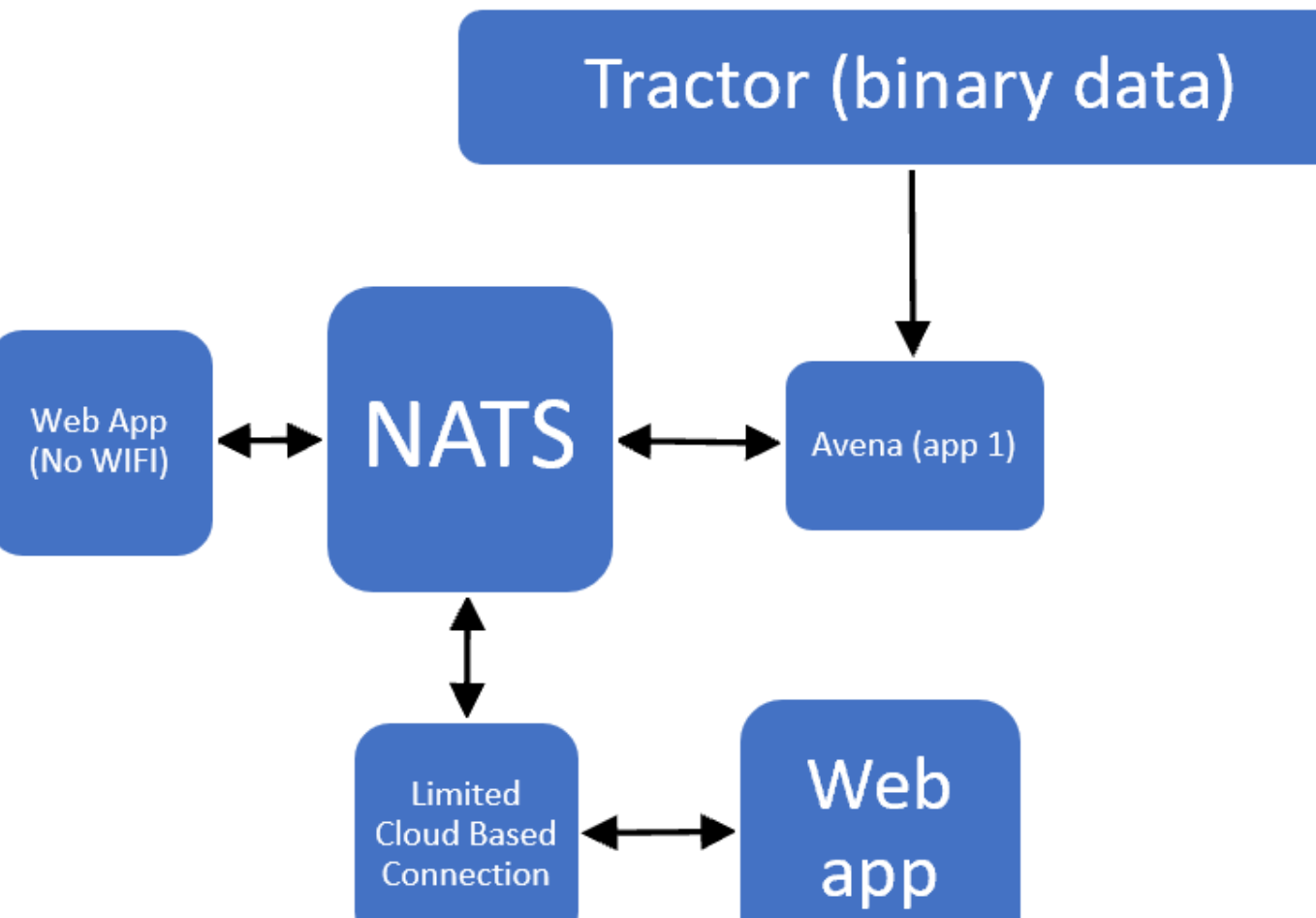
Testing
The ISOBlue test stand is a server running in the Agricultural and Biological Engineering building that is running a loop of a CANBus log 24/7. This allows the team to stream real data from the ISOBlue unit over the internet while they are building the application. The team has been using a skid steer in the ABE building to test the application and make sure that it can understand real time data instead of strictly testing based on the logs from the ISOBlue test stand. The hope with combining both types of testing is that the application will be put through more data sets and different types of machines all while being convenient to test at any time throughout the project.

Customer Feedback
The display was heavily influenced by user feedback after the initial stages of design. After talking with end users several features were added including a "Debugging Page" where advanced users can see the raw data coming across the CANBus. Customer feedback was important in the design process of the project since there are very specific parts of the display that needed to work to make the display useful for the end user. Almost all the buttons and drop downs on the display were made to be "reactive" meaning that they understand what is going on with the rest of the display and update accordingly.

Concept Final Design
The final design of our project utilizes a local WiFi network to communicate between the ISOBlue and the display device without the need for internet connection. There are three main screens, the Main Page, the Advanced Debugging Screen, and a GPS map view screen. Dropdowns within each screen make the views customizable to the task being performed or machine that you are in, and the lists of viewable data update based on what the ISOBlue can see and decode. If an internet connection is available, there is also a drop down that allows the user to see other active ISOBlue machines to remotely view machine data. Below are examples of two of the screens within the app.

ISOBlue Main Page:
The ISOBlue main page allows you to see decoded live time CAN data coming across the CANBus via the ISOBlue module. Six different gauges are available, and the drop-down lists allow you to customize the data seen. The drop-down lists are automatically filtered to show what is available as decoded information from the ISOBlue.
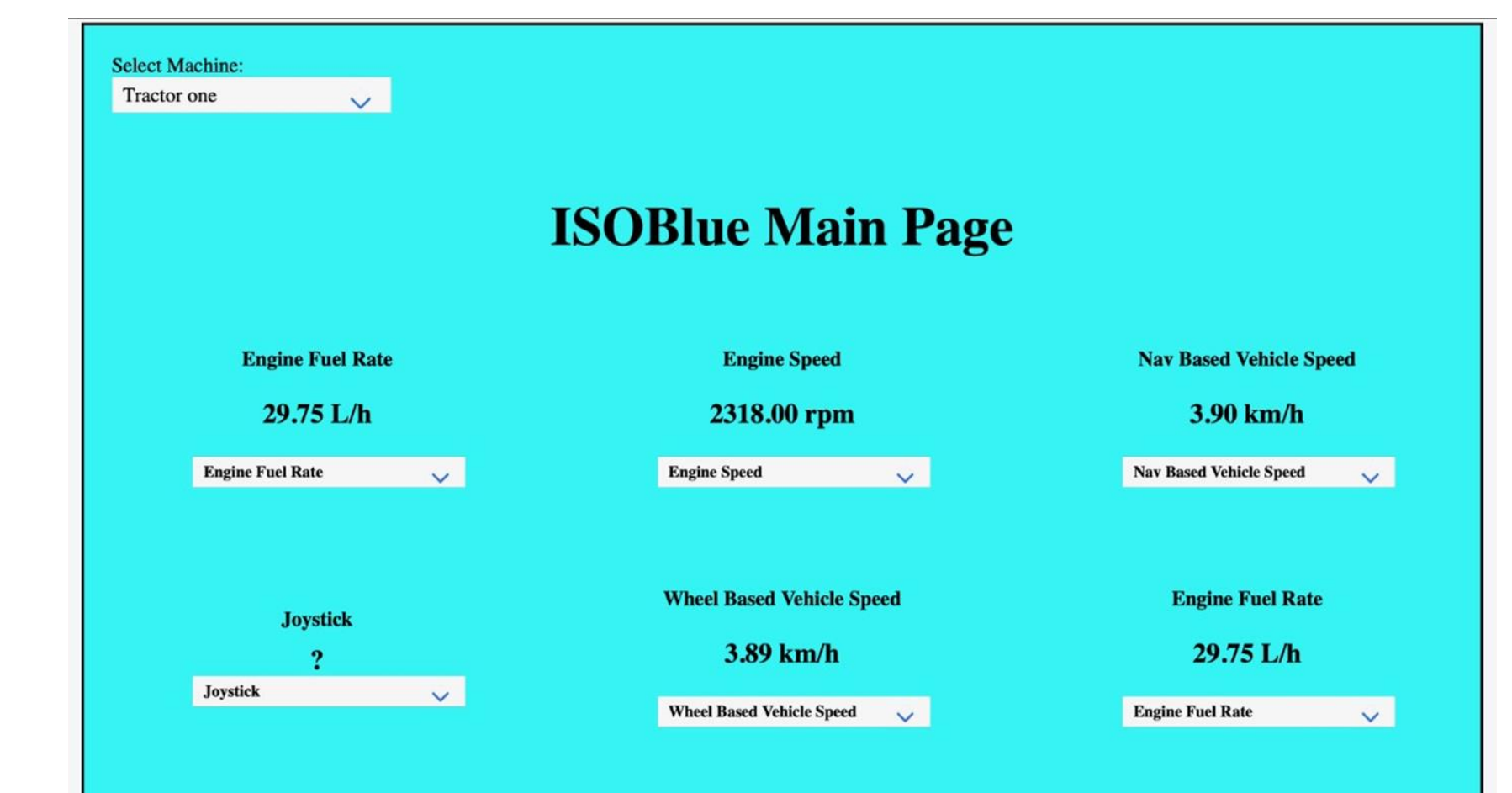
Advanced Debugging Page:
The Advanced Debugging Page allows the user to type in a PGN or select a PGN type from a prefiltered list to see the raw data coming across the CANBus. This page is envisioned to be used by people troubleshooting problems on the CANBus. Data flows in the white box on the screen and can be paused at any time to evaluate the data.
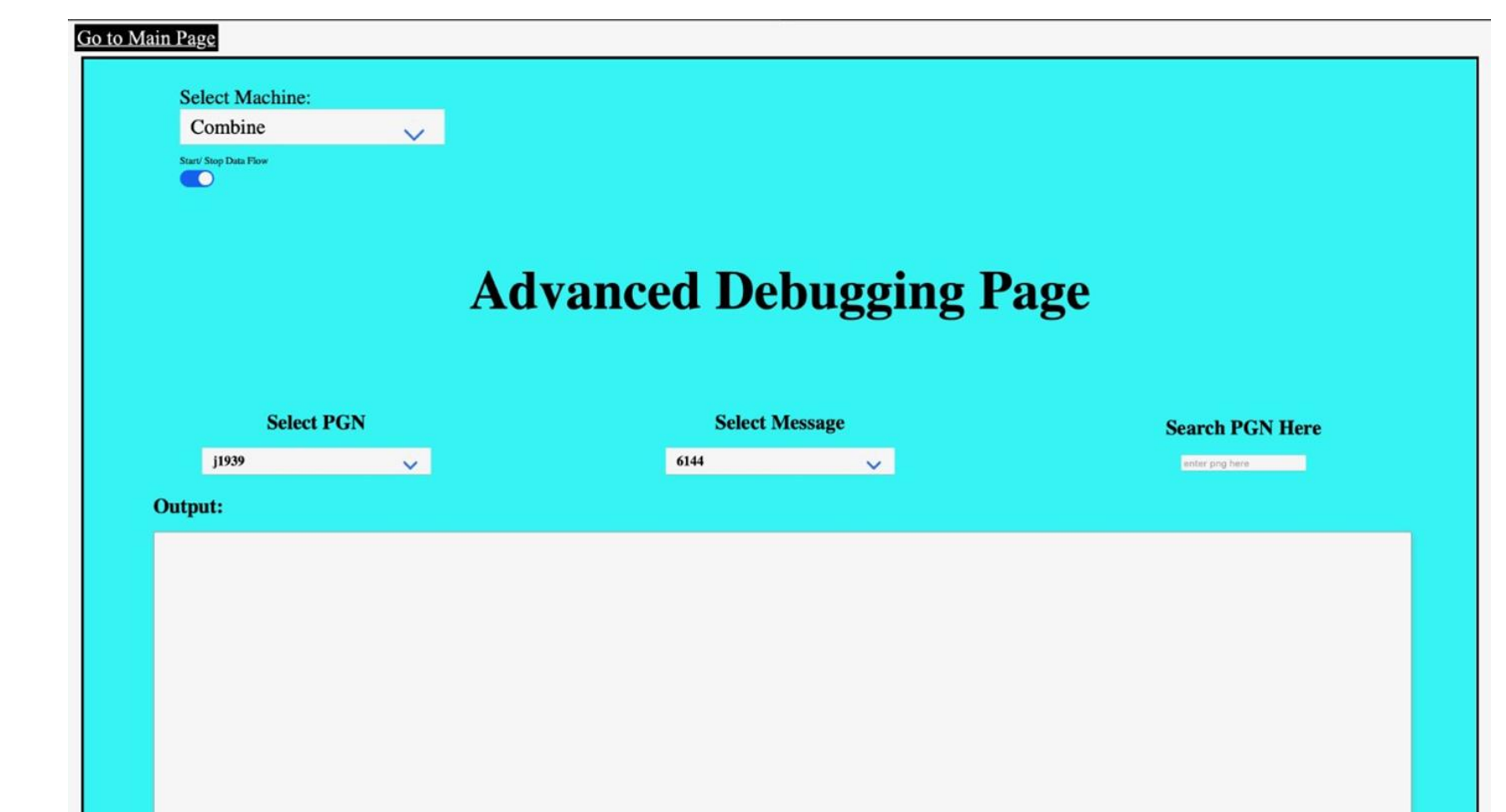
Business Case Analysis
Agriculture is approaching a technological age where data and its owners hold all the power. As agriculture ascends into this age, it is important that farmers understand their data and own their data so that it can be used in ways that will increase productivity and create a more sustainable farm market. ISOBlue aims to do just that, and with a telematic display it will unlock real time viewing of this data to better manage the farm operation. This display will allow for the open-source operability to display and collect whatever data may be relevant and useful for a specific farming practice.

Commercialization and Launch
ISOBlue is an open-source program meaning that anyone access the code and create extensions to the program. This allows for a huge amount of potential for growth and capability in the system. Right now, ISOBlue is mainly used for research purposes but in the future as it gains more and more capability, ISOBlue should be a cheaper and simpler way for people to access machine data.

Conclusion
The telematics device created for this project will be able to bring many people into the digital agricultural world at an affordable price and allow them to have power over their data in a way that has not been previously possible. There are challenges and opportunities that must be considered when creating the application to make this possible, but the ultimate product should greatly improve the ISO-Blue system currently available. This system should be a viable solution for anyone to use in the industry to better understand what the computers on their machinery are thinking and doing as they are running.