FORD MOTOR COMPANY

Using AI to Automate and Scale Digital Twin Technology for Advanced Manufacturing

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For over 100 years, **Ford Motor Company** has developed, manufactured, and distributed vehicles worldwide. Today, Ford employs 186,000 employees globally, with revenues expected to exceed $140B in 2021. To maintain its position as a world-class manufacturer, Ford is investing in advanced manufacturing technologies to drive its "Factory of Tomorrow" transformation towards an intelligent and completely connected manufacturing system.

One such disruptive technology is a Factory Digital Twin, a digital representation of plant floor assets and processes. Digital Twins allow for virtual designs and validation, increased plant floor efficiency, and integrated, real-time monitoring. With each asset on the plant floor having maintenance, quality, and live Industrial Internet of Things (IIOT) data, a Digital Twin relies on connected data. Often, these systems were developed independently of each other and operate in silos, making them difficult to integrate. Ford's Master Asset Registry Service (MARS) decodes and connects disparate systems, but the process was highly manual, constraining the Digital Twin's pace of implementation. The Tauber team's goal was to automate this systems integration to drive efficiency and accelerate the implementation timeline. The team pursued a two-pronged solution: Retroactive and Proactive. The Retroactive Solution integrates existing assets in plants while the Proactive Solution designs out the problem by making new assets digital and connected from the moment they are born.

To develop the Retroactive Solution, the team interviewed architects and end-users of various manufacturing systems, mapping the ontology. This was used to develop a multi-layered AI solution architecture, using an Expert System and Machine Learning, designed for Ford's diverse manufacturing systems and plants. The team demonstrated this architecture's viability and scalability by developing a proof-of-concept focused on connecting a machine acceptance system and a maintenance system in Ford's Powertrain plants.

The team also developed a roadmap for the Proactive Solution. This roadmap detailed strategies for creating connected data when assets are born, designing simpler strategies when possible and more nuanced ones when necessary. The team demonstrated this roadmap on custom tooling used in new plants, focusing on the Rouge Electric Vehicle Center, the new plant where the all-electric F-150 Lightning will be manufactured.

The Tauber team's AI solution decreases the labor and time to implement the Digital Twin on new manufacturing lines by 65%, allowing for an accelerated pace of implementation 2.86 times greater than before. This will lead to increased efficiency on the plant floor across Ford's Powertrain plants, directly saving the company $3.64 million from 2022 to 2024, or $1.21 million annually. Additional savings are expected from extending the solution architecture to other manufacturing systems and plants as well as from a reduction in downtime.