Machine Learning for Motors

A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

What do we mean Machine Learning?

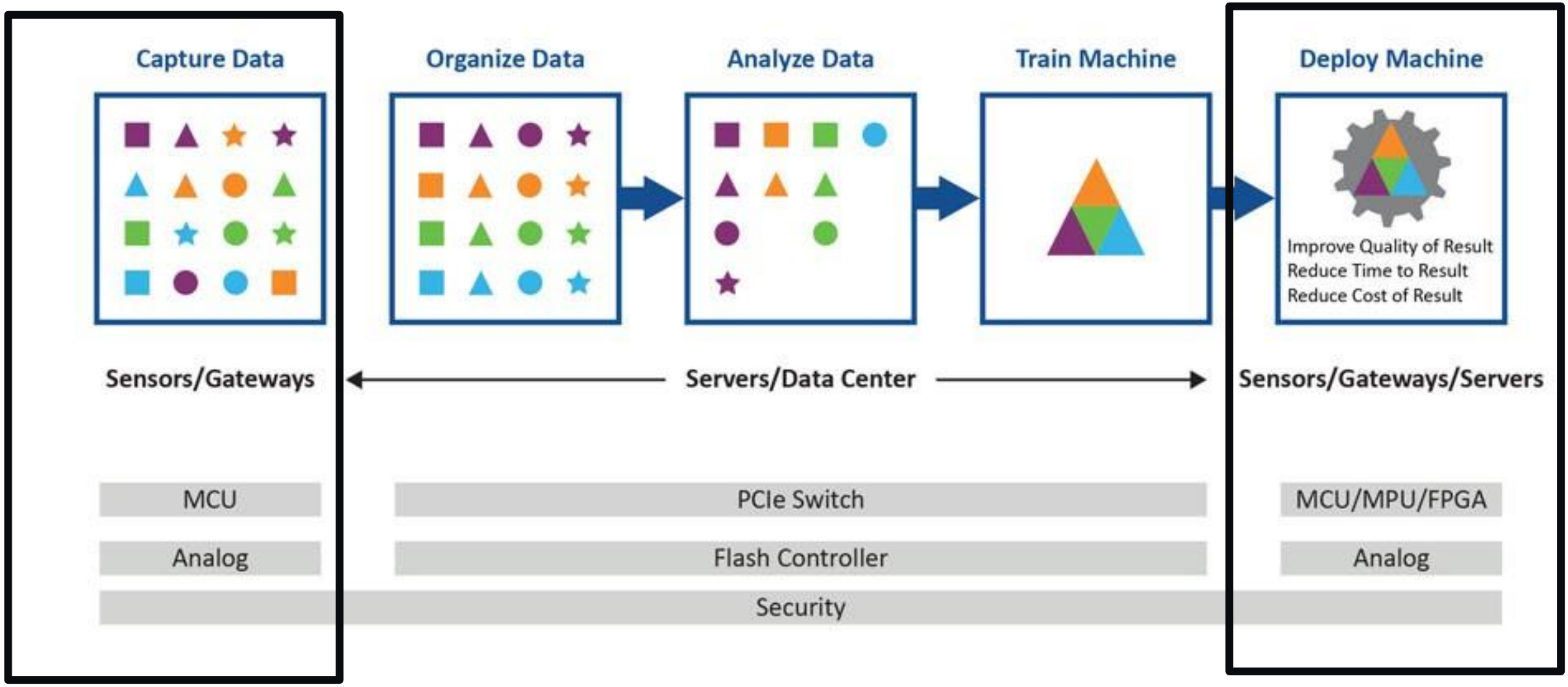
- A program or system that builds and trains a predictive model from input data (Building done on server side).
- The system uses the learned model to make useful predictions from new data (Inference models built with server, runs on MCU/MPU)
- Typically implemented using “neural networks” and generally classified as:
  - Supervised Learning (Only one supported by MCHP right now-labeled data)
  - Unsupervised Learning (Cluster Analysis)
  - Reinforced Learning (Skill acquisition-no dataset, use feedback loop to learn)

Why use Microchip for AIML?

- Only supplier to offer AIML inference models running on 8-bit
- Fully integrated data acquisition tool embedded in MPLAB
- Totally private eco system for building models
- Extremely low cost, easy to use (Auto ML model building)

Machine Learning Flow

Microchip Offers Silicon For Each Step in The Flow



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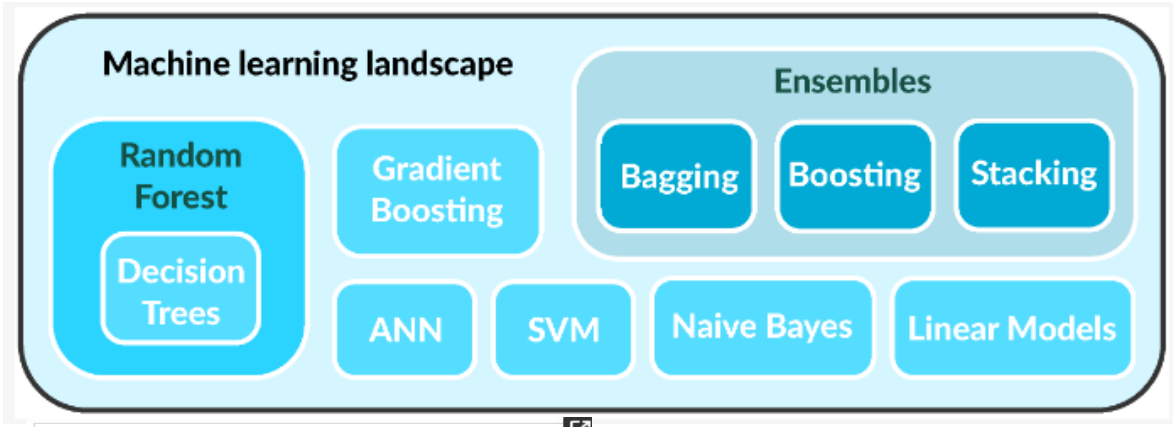
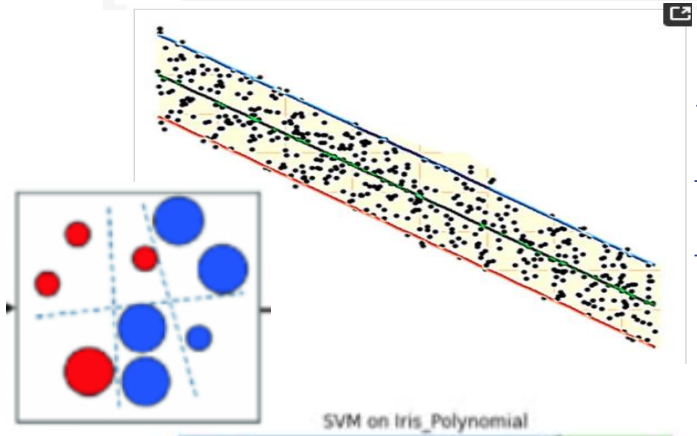
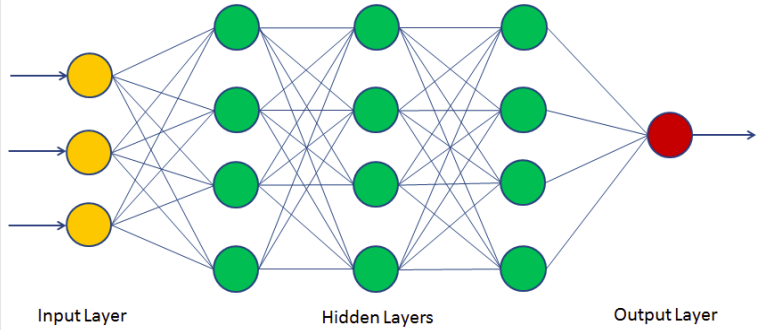
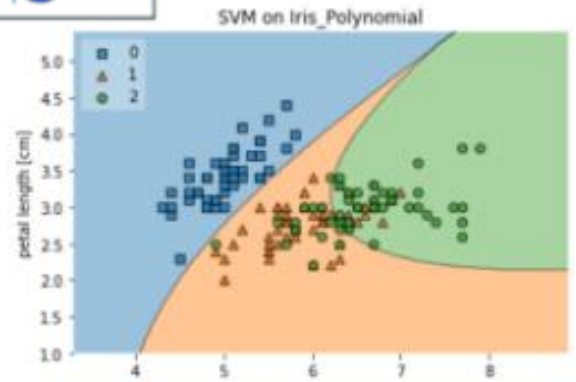
Machine Learning Landscape

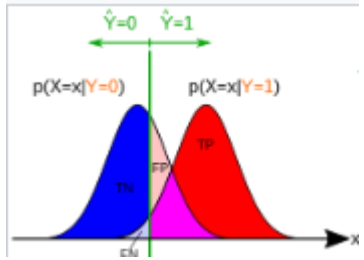
-Random Forest = Decision Tree
-Naive Bayes similar to fuzzy logic
-Artificial Neural Network/ Multi-layer Perceptrons (weights change non-linear activation function)
-Support Vector Machine (linear + high dimensional feature space)
-Gradient boosting can be applied to emphasize stronger predictors

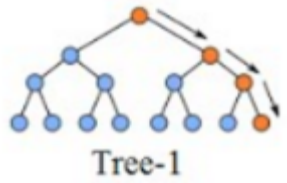




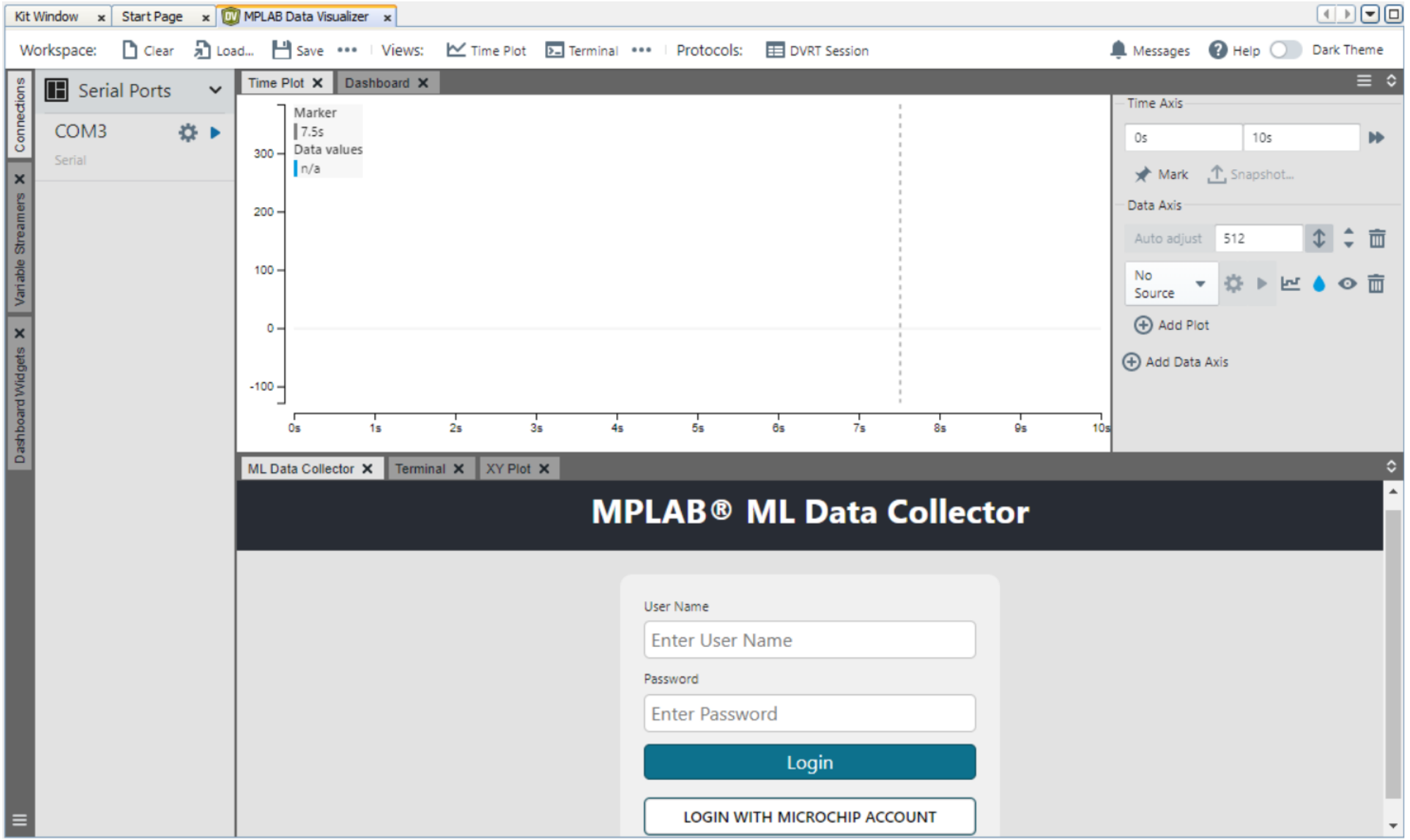








Our Tools Reduces Complexity



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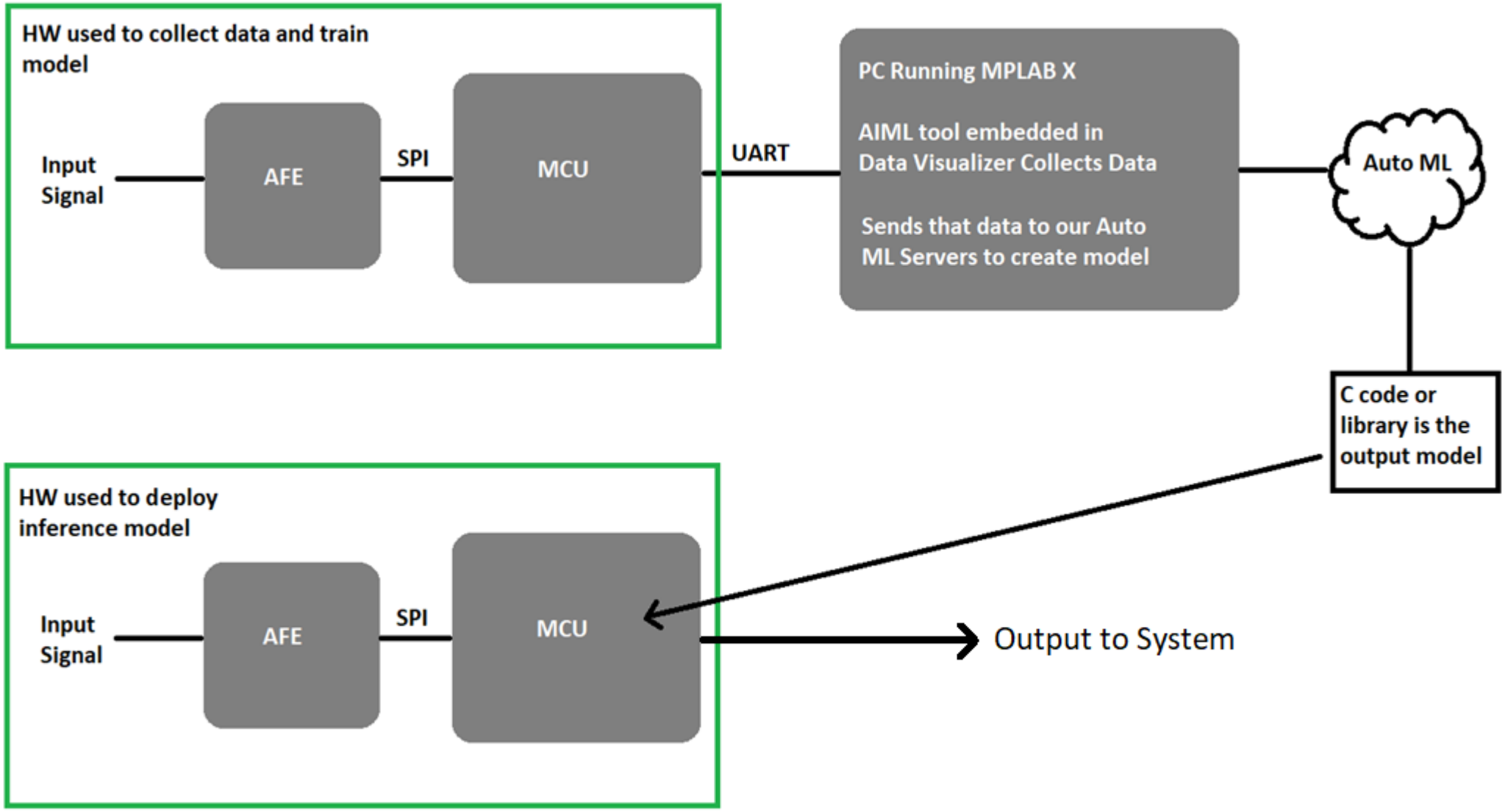
Setup and Process



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Proposed AIML implementation

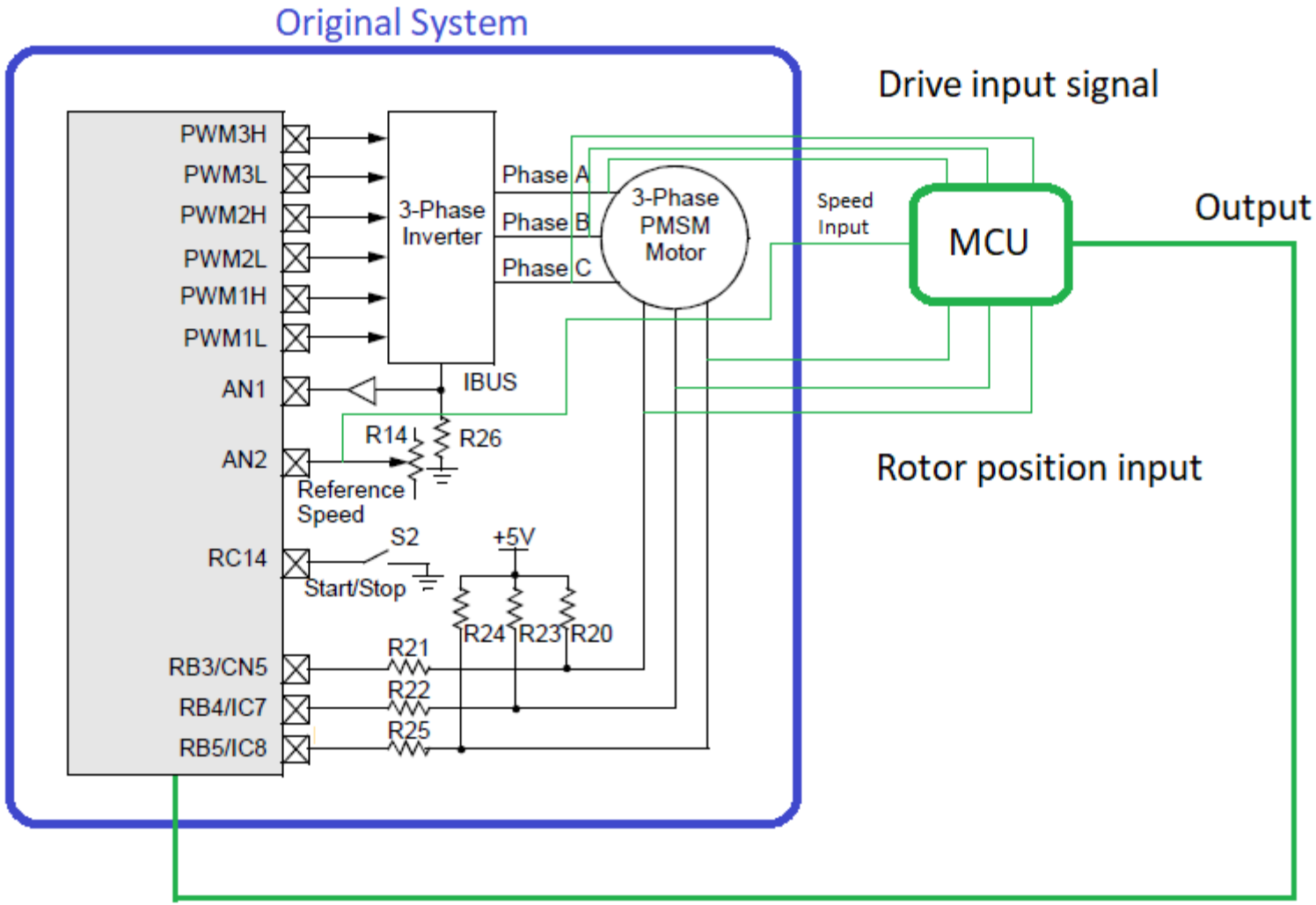
-Inputs: Drive signals, Rotor position, Speed Select
Output: Signal to motor controller

-Using these inputs, we train an AIML model to know when it is drilling or sawing different materials

-The output can be used to stop motor once it has drilled/sawed through, modify drive signals based on detected material, other actions

-Using external 8-bit MCU, we will monitor motor reaction to drive signal to determine mechanical resistance. Based on resistance we will infer the type of material

-Can be used for Trapazoidal, FOC, Sensored and sensor-less motor drives



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Questions?