

## Background

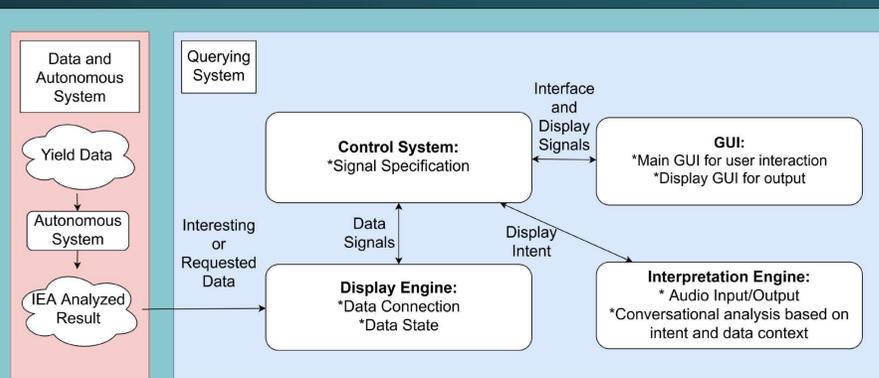
In many industrial manufacturing processes, an underlying goal is to manufacture products with high yield while ensuring financially viable time-to-market. For the semiconductor manufacturing processes, Product Engineers spend significant portions of their time analyzing production data to address sudden yield issues, and/or discover ways to optimize the production yield. Intelligent Engineering Assistant(IEA) is an AI assistant designed to facilitate a Production Engineer's workflow.

## Overview

IEA Linguistics aims to realize a smooth and robust natural-language user interface for the IEA project by implementing features such as the following:

- ❖ Displays for wafer parametrics, lot yield and test bins
- ❖ Specifying an underlying system workflow and state machine to guide user's through data analytics
- ❖ Robustly convert user's speech into intents that allow our system to provide correct data to user (See "Response Quality")

## System Design



## Interpretation Engine Design

### User's Query:

- ❖ The user's speech input request for the system



### Google Speech Recognition:

- ❖ Converts the requested speech into text
- ❖ Produces text for use in daily conversation, not engineering domain



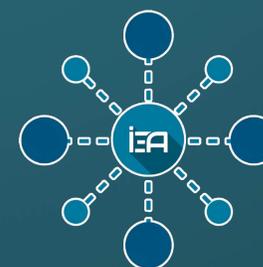
### Text Sanitizer:

- ❖ Changes recognized speech to fit engineering domain e.g. "way for" into "wafer"



### Google Dialogflow:

- ❖ Converts query into a system intent
- ❖ Trained with queries and intents that we define based on the data available and expected user input



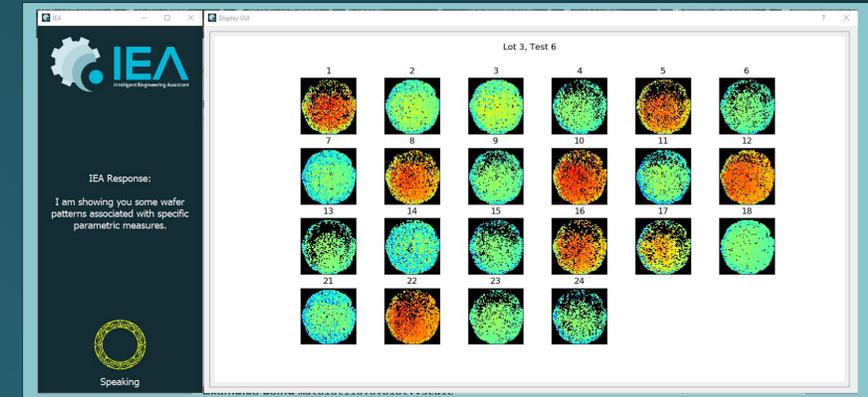
### IEA System State:

- ❖ Finite State Machine that transitions based on intent
- ❖ Allows for the creation of different workflows to be processed by the system and presented to the user

### IEA System Commands:

- ❖ Different abilities of the system such as fetching offsite data and displaying plots for wafer and lot yield tests

## System Interface



After the yellow button is clicked, IEA starts listening for and responding to the user's queries about different data and plots such as the wafer plot seen above.

## Response Quality

To test the quality of the intents that we receive from our trained Dialogflow model, we generated ground truth query and intent pairs and calculated the accuracy of our model. Overall, our total test accuracy was 98.33%, giving us high confidence in our model. The full results are below:

Intent	Query Example	Number of Test Queries	Error Count	Accuracy
Plot Wafer	"What wafers did you find interesting?"	112	0	100%
Plot Lot Yield	"Can you show me the performance of the lots?"	229	2	99.12%
Plot Bin Count	"I want to take a look at the bin count"	277	2	99.28%
Zoom In	"Can you zoom in on the sixth plot?"	164	5	96.95%
Zoom In – Go Back	"Zoom out"	45	0	100%
Go Back	"Can you resume to the previous slide?"	54	4	92.59%
Change Graph Type	"Can you change the graph to a scatterplot instead?"	61	0	100%
Help	"Can you help me out? I don't know what to do from here."	18	3	83.33%
Total	-	960	16	98.33%

