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Slide 1:

- Good afternoon ladies and gentleman.

- Hope you are already having a great day.

- I am kartheek. I am part of the data scientist team at BCAI.

- This is my colleague Prajwal. He is also part of the same team.

- The topic we are about to discuss is on Solving the PCB Design Riddle.

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Slide 2:

- Before getting into the topic, I will take you through the agenda for the keynote.

- We will talk about brief introduction, then the business problem, the approach, some results, a short demo and a key takeaway.

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Slide 3:

- So,...Can someone tell me What is a PCB and what is it used?

- Pause

- Yes, all the answers are valid.

- I will try summarize them.

- PCB stands for Printed Circuit board. It is used in almost all the electronic devices that we use daily (like mobile phones, laptops, projector.. etc)

- This is how a PCB looks like (showing PCB)

- Now, Can someone also tell me what does a PCB do?

- Yes, again all answers are valid.

- To summarize, PCB board holds resistors and capacitors to connect them electrically. This enables it to send power and signal to connect physical devices electrically.

- For example, our mouse, the keyboard, the webcam. All of them has a PCB and all of them are connected to a motherboard for functioning, which is also a PCB.

- I will try to simply the standard process of PCB design and manufacturing.

- We start off with a requirement as a circuit schematic, A circuit schematic can be thought as a blueprint which has the details of components, their placements, the voltage and power details and so on.

- This requirement can be for any product class like motronics/airbags and also from different business units like PS/CC..etc.

- This requirement is given to a layout engineer. Where he uses it to design a product ready pcb using his favorite CAD tool.

- Once the design is ready, they send it to the manufacturing plant to create a physical PCB.

- This process can also be generalized for all the engineering usecases. For any engineering usecase, we have a requirement given to an engineer and then he does the design which will be manufactured.

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Slide 4:

- The entire PCB design process is more complex than it looks. It doesn't only deal with the expertise of CAD tool, but also the layout engineer must be aware of the design principles before Designing a PCB.

- Here are few complications involved in the design process:

- Limited space for the components and functionality. (Less Space used => Less cost)

- Relative component placement to have a good EMC (Electro Magnetic Compatibility) result.

- Cooling areas and power components

- Current and voltage supply. We need to ensure power integrity (supplying power @ right moment.)

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- Today AE team designs the PCBs for the entire bosch world.

- You all must be wondering, since they have the expertise in this, what must be the challenge they are facing?

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Slide 5:

- I will showcase a scenario to explain that.

- A requirement comes to a layout engineer, where he designs the PCB and dumps into the project database.

- In general, several requirements goes to several layout engineers, where they design those PCBs and dumps them into the database.

- Over time, we have 1000's of layouts designed every year. This is not a small number.

- Also, these layout engineers have only expertise in their old projects or projects related to their product classes.

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Slide 6:

- The main aim of AE is use their expertise and try not reinventing the wheel or try not to start a design from scratch.

- The approach they follow is, Use the existing, adapt and reuse.

- But, let's take a scenario:

    - A new requirement comes to a new layout engineer

    - He wants to know the existing housing to adapt and reuse?

    - He either needs to talk to his colleagues to get the knowledge on the existing projects or he needs to query the design database dump.

    - Both these solutions are not feasible and also time consuming.

    - The bottleneck of this approach is, the layout engineer spends ~8h/layout on this process to get his pcb design ready.

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Slide 7:

- This is how it looks as a whole picture.

- He looks through a huge set of projects, to get his relevant project.

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Slide 8:

- This is where BCAI supports AE with an AI Interface to make the process more efficient, fast and intuitive.

- Where, a layout engineer can use the AI Interface to query the database and filter the projects he is looking for.

- Also, a layout engineer with a new requirement, here the requirement looks like this.. the green box represents the housing of the board and the pieces just outside the board are the components that needs to be optimally placed on the board.

- He can use the AI Interface to get a set of relevant housings for the requirement and then select the most relevant housing to place the components on top of them.

- We also enabled the functionality of downloading the placement file which can be used in his CAD tool for finer adjustments.

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Slide 9:

- So, what does this AI Interface have?

- We along with the AE team named this interface as ALICE, which stands for Artificial Intelligence Computing at ELS (Engineering Layout Systems)

- ALICE has a project parser which was written with the support of domain experts to extract the relevant information from the ASCII files such as components, their locations, orientation, net connections, different layer information and so on...

- This information is stored in ALICE database which can be queried easily.

- ALICE also has an AI algorithm for recommendation and component group placement.

- We must all be feeling that AI itself is powerful. What makes it even more powerful is the domain expert feedback. We have enabled a domain feedback to our AI algorithms, where a domain expert can give his feedback on similar layouts and the algorithm over time adapts to the user behavior and gets better and better.

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Slide 10:

- This is a sample result to demonstrate component group placement.

- A layout engineer from ALICE has dragged all his components outside the board to test the algorithm.

- Then he selected a component group (where it has one main component like IC and set of other components that are connected with it.).

- This is how ALICE has placed the component group on the board. And we verified that the layout engineer is on agreement with the result.

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Slide 11:

- We will showcase a short demo of ALICE
- UI: to help layout engineers interact with the system.
- Home page has lot of user and admin functionalities
- Similar search: he can enter a project id to get a set of similar projects
- Explain result:
    - explain input
    - explain image a, image b
    - explain top similar and table of features
    - explain next similar and table of features
    - explain non similar and mark feedback and submit.
- Show feasibility study
- Show list and click on list to see similar projects
- Show CG upload page
- Show CG list, functionalities
- Show CG Main comp list, select one and submit
- Show CG Recommended list, explain full image, explain X, Y, select submit.
- Show placement page, download IDF and open IDF.

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Slide 12:

- AI has an impact on all the industries and sectors. Engineering is no exception.
- With ALICE, we will be able to help 120 WW layout engineers and the potential time saving can be 8000 h/year; i.e. 1m euros p.a.
- So, if we are able to identify the bottleneck in the engineering process, we can use AI to make it efficient. GIVEN THE DATA AVAILABLE.
- This can be achieved much easily with bosch with the level of domain expertise we offer. This can be our USP when compared to the tech giants like Google/Microsoft... etc.
- As our methods of collecting finer level of data improves over time, we will be able to unlock the full potential of big data and algorithmic learning.

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Slide 13:

- Thank you everyone.

- Feel free to drop by at our booth (# 14) for and Q&A.