IFB Industries Limited, Goa

Development of Decision support system for connected washing machine

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Background

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Customer feedback gathered over the years.

One program is used for all the washes.

Washes mixed laundry without segregation

1400 RPM – Numbers are Scary

No Knowledge on how it effects wash quality

60 ^{0} C used for Jeans

Wool program used for rough Cloths

Most users find it difficult to choose program, temperature, spin speed and other options.

Solution: Develop a user friendly interactive system that will help users select appropriate programs in case of uncertainty.

Opportunity:

Once the machine is connected with Bluetooth we get access to faster hardware, touch screen, internet etc. through the smart phone

Outcome

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- This idea was transcended to Android and iOS app that was used for controlling IFB Senorita Smart Washing machine.

Brief Introduction

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- The IFB group celebrates over four decades of technical excellence, leading technology solutions that have touched people's lives
- IFB Launched first connected washing machine that can connect with Smartphone via Bluetooth.

1989 – India's First Front loader washing machine

2002 – India's First Digital washing machine

2013 – India's First Connected washing machine

Algorithm design approach

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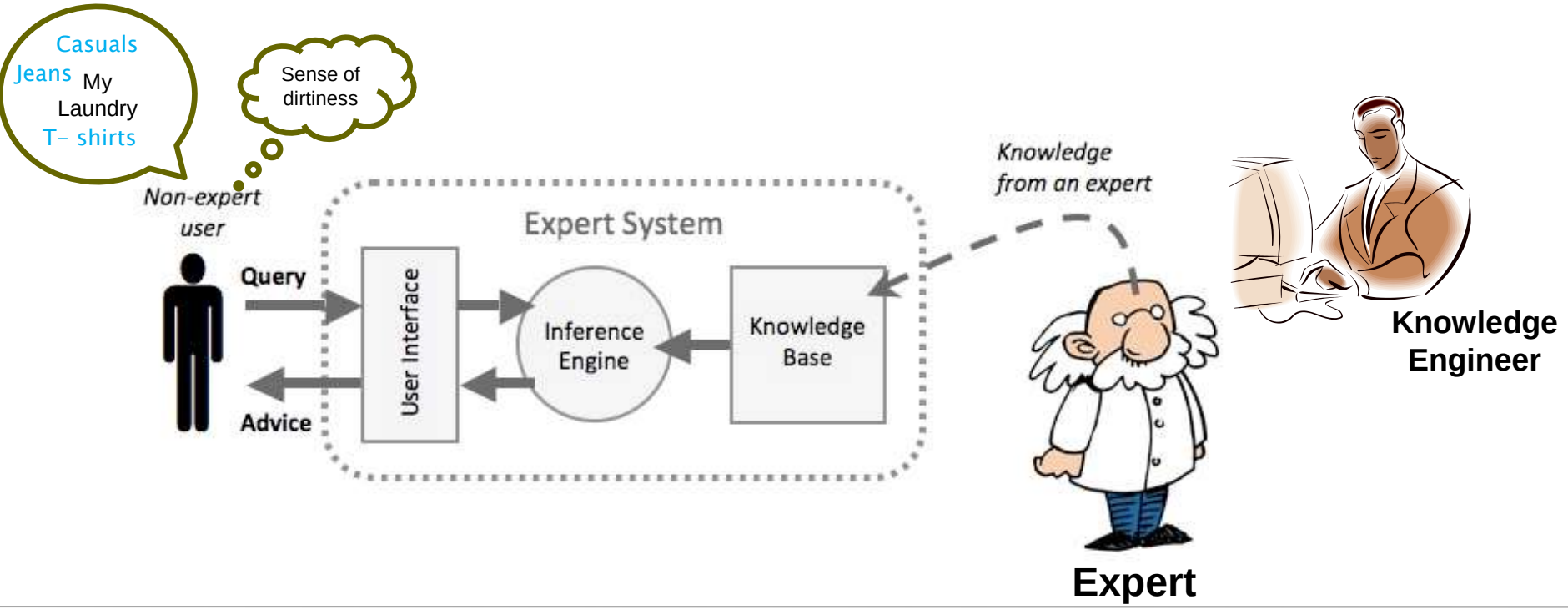
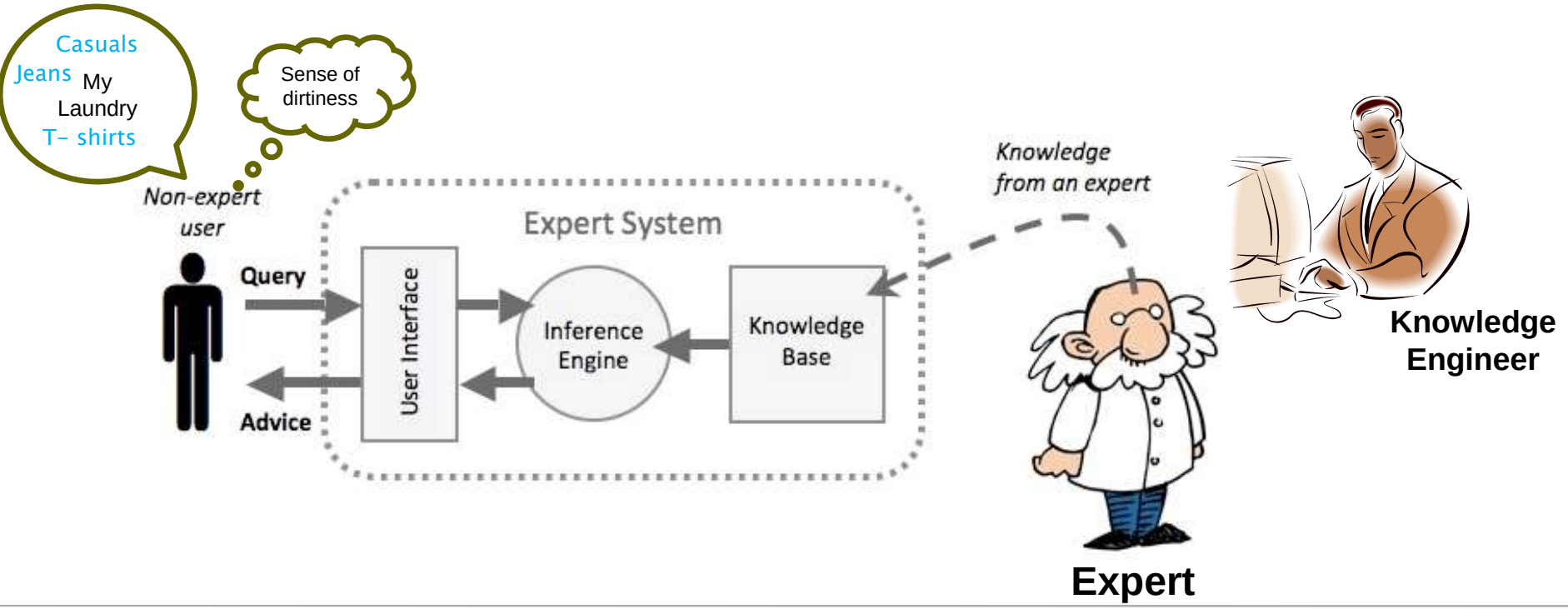
- Rule Based System or Expert System is a computer program that solve problems within a specialized domain that ordinarily requires human expertise.
- We decided to capture the reasoning of R&D Engineer (Expert), who designed the wash programs and use it to suggest appropriate programs for user operating the washing machine.



Algorithm design approach

- Decision trees are known for mirroring human decision making more closely than other approaches. This way experts can validate the algorithm as it is easily interpretable.
- However, since the query and response in our use cases were fuzzy in nature, we preferred fuzzy inference engine for classification.

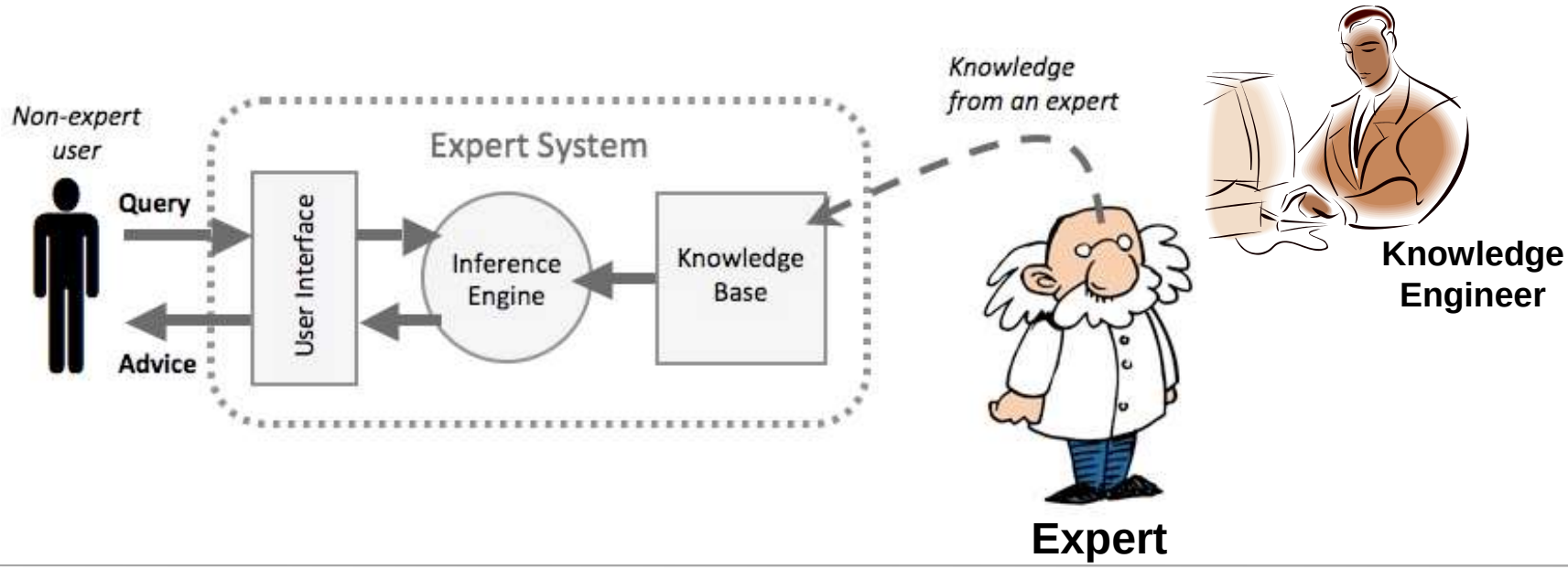


Challenges

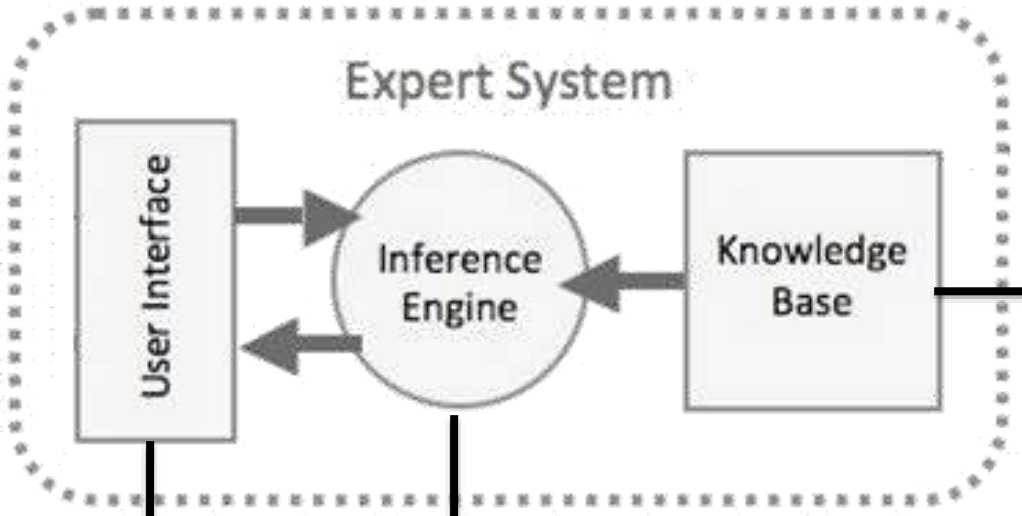
Challenge was to integrate user-centered UI design with the design of Inference Engine from the concept phase unto the final product

Limitations

- The design of the knowledge base depended solely on the domain expertise.
- If the user interface relays inappropriate interpretation of user query, then the rest of the system cannot give suitable suggestion.

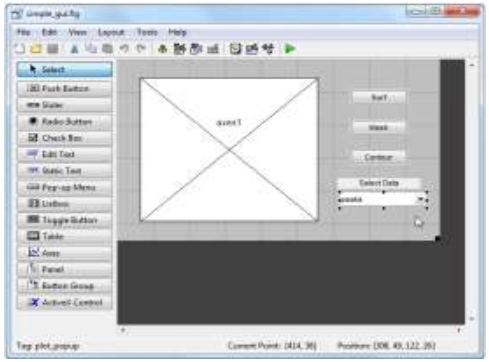


Tools Used



Interview with domain expert

MATLAB GUI



Fuzzy Logic Designer

Tools Used

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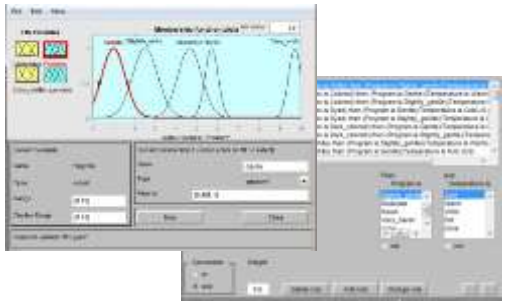
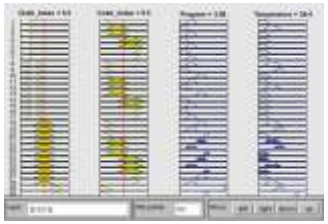
Interview with domain expert



Fuzzy Logic Designer

Build Rules based on input from domain expert



Validate the rules with domain expert

- Fuzzy logic designer allowed domain expert to understand and validate the rules and the responses very quickly.

Tools Used

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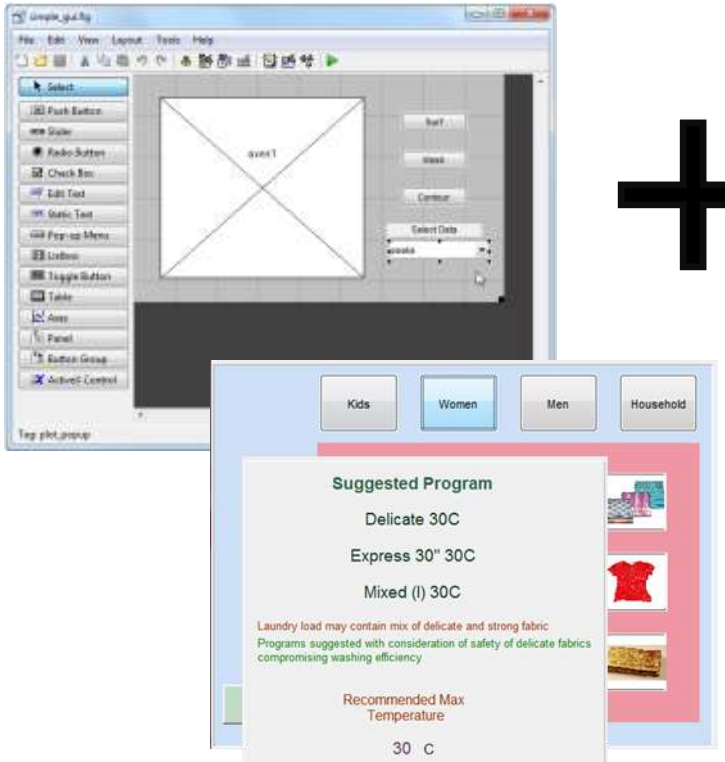
MATLAB GUI



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Fuzzy Logic Designer

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- Desktop prototype for concept validation
- Functional prototype to refine algorithm
- Platform for Algorithm validation
- Template for verifying the app

Summary

- The concept prototype on the MATLAB was used for initial usability testing with potential users.
- This helped in identifying critical UI elements that could affect the performance of decision support system.

- The refined fuzzy inference system developed in MATLAB was used as standard for the mobile app development.

Customer response for the app:

"Nice app allows you to see machine's current running program state and remaining time. Flexible to customize programs according to our washing needs ."

"We can use it for special clothes, which should not get damaged."

"the app feels like it is designed for me."

"I didn't use the application yet before. Now I will use this application. Highlight is machine prescribes the program according to the clothes type and dirt level."

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Thank you.