



MaramaAI: Tool Support for Capturing and Managing Consistency of Multi-lingual Requirements

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What is Multi-lingual Requirements?

- Requirements express in >than 1 languages
- Malaysia is an example → English and Malay languages
- “code-switching” leads to inconsistency and other requirements errors



Motivations: Real Example

Sales Request Inquiry

Upon creation of booking, DMS system will validate if any booking falls under Special Sales Programme and generate unique sales request number for each transaction. Sales request will carry a "New" status. Meanwhile, booking function will introduces a new status "In Process" as to indicate that this sale belongs to Special Sales (MM2H, PAKAR, Embassy, Government), Parliament or Tourism. Any new sales request gives the user an option to either submit or cancel the sales request from this Sales Request Inquiry page.

As part of the requirements in the Special Sales Programme, user must attach the required document prior to the submission of a sales request. Document attached may be deleted according to necessity. At this stage, any cancellation to the sales request requires the user to recreate a new booking. Otherwise, the request will be submitted to HQ for approval. A successful submission will carry a "Submitted" status.

User Intention	System Responsibility
	1.validate booking
	2.generate id
	3.provide status
	4.offer choice
5.attach document	6.ask user
7.create booking	

Pemohonan Pertanyaan Jualan

Semasa pengwujudan tempahan, sistem DMS akan menyemak tempahan sekiranya terdiri daripada Program Jualan Istimewa dan mengeluarkan nombor unik permohonan jualan pada setiap transaksi. Permohonan jualan akan membawa kepada status "Baru". Sementara fungsi tempahan akan diperkenalkan ke status "Dalam Proses" untuk mengenalpasti bahawa jualan tersebut adalah hak milik Jualan Istimewa (MM@H,PAKAR,Kedutaan,Kerajaan), Parlimen atau perlancongan. Sebarang permintaan baru jualan memberi pilihan kepada pengguna samada menghantar atau membatalkan permohonan jualan dari laman permohonan Jualan.

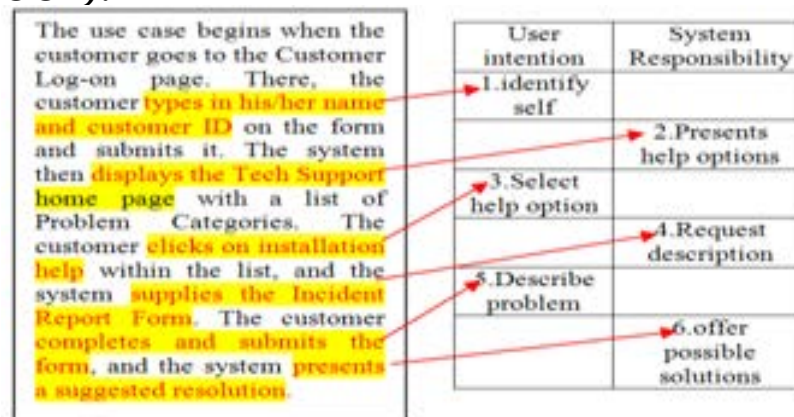
Pengguna perlu mengepulkan dokumen yang dikehendaki semasa pengantran permohonan jualan sebagai salah satu keperluan dalam Program jualan Istimewa. Pada fasa ini, sebarang pembatalan kepada jualan memerlukan pengguna membuat tempahan baru. Sekiranya tidak, permohonan akan dihantar ke HQ untuk penerimaan. Permohonan yang diterima akan membawa status "hantar".

User Intention	System Responsibility
	1.semak tempahan (validate booking)
	2.mengeluarkan id (generate id)
	3.membri status (provide status)
	4.membri pilihan(offer cho
5.kepil dokumen (attach document)	
6.membuat tempahan (make reservation)	
7.(missing)	

Example of detected inconsistencies and errors

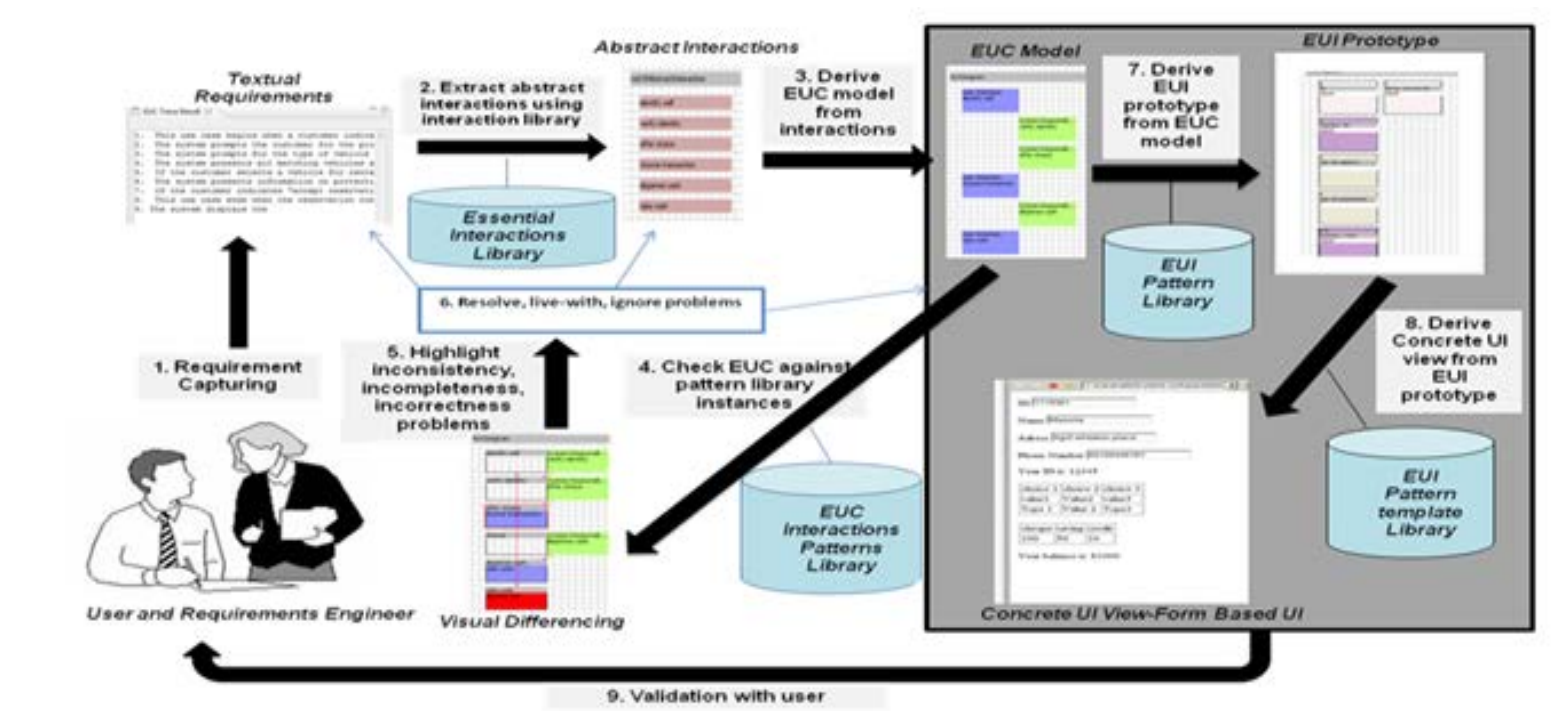
Essential Use Cases (EUCs)

- **Essential Use Cases (EUCs)**-“structured narrative, expressed in a language of the application domain and of users, comprising a simplified, generalized, abstract, technology free and independent description of one task or interaction that is complete, meaningful, and well-defined from the point of view of users in some role or roles in relation to a system and that embodies the purpose or intentions underlying the interaction”(Constantine and Lockwood,2001).



Example of generated EUC model (right) from the textual natural language requirements (left) adapted from (Constantine and Lockwood,2001)

Overall Approach



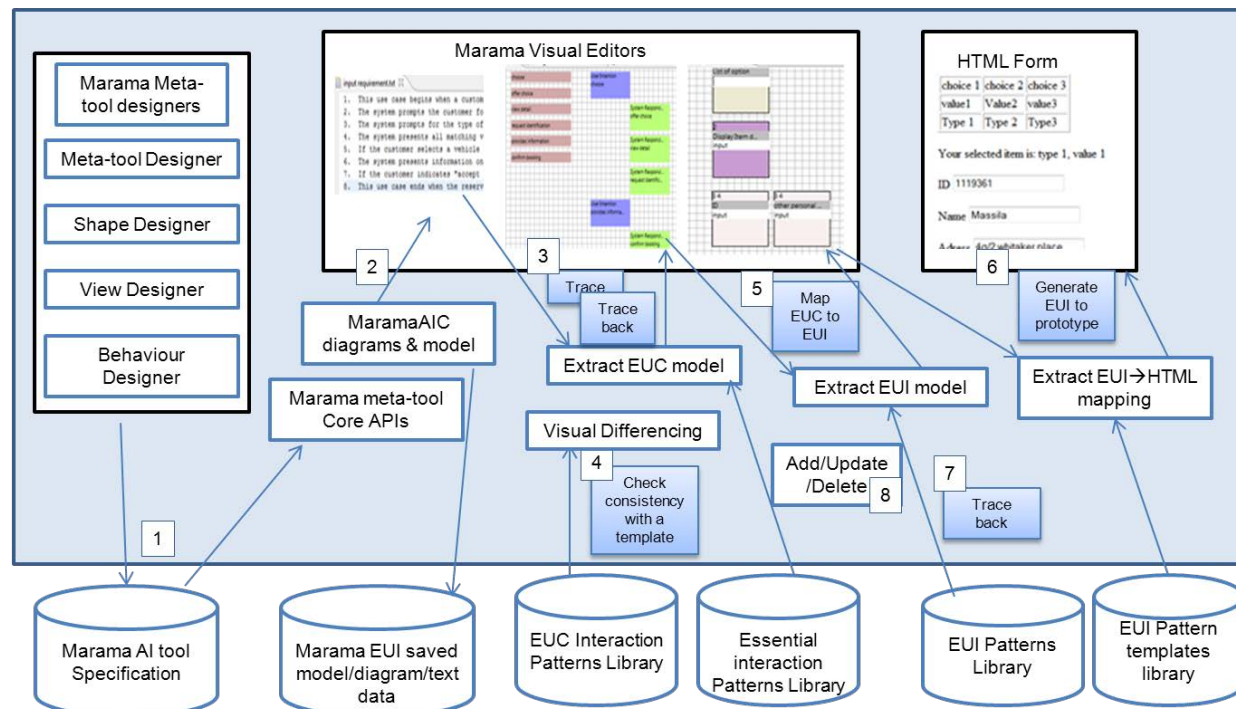
End-to-end EUC and EUI prototyping approach adapted from (Kamalrudin and Grundy, 2011)

Extend EUC (Essential interactions and Abstract interaction) and EUI library patterns to support Malay requirements

Essential Interaction	Abstract interaction	EUI pattern
Memasukkan id (insert id)	Mengesahkan diri (identify self)	ID
Memasukkan pin (insert pin)		

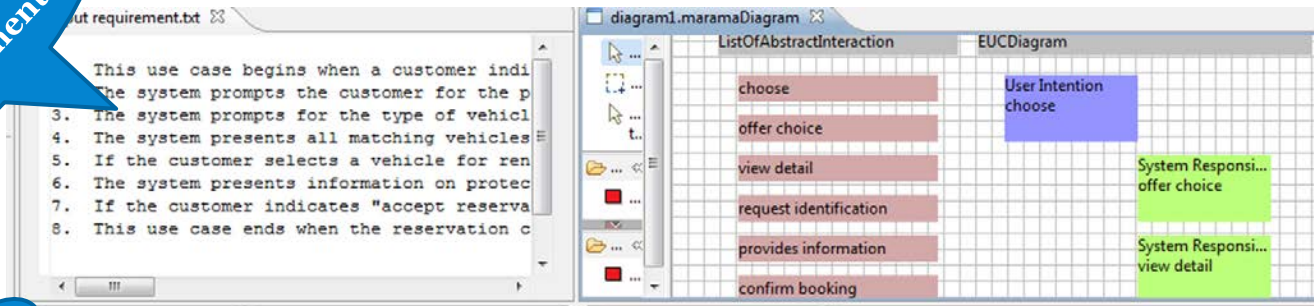
Tool Support

- extended our original MaramaAI tool to support English & Malay languages requirements
- realised on top of Marama platform → Eclipse IDE

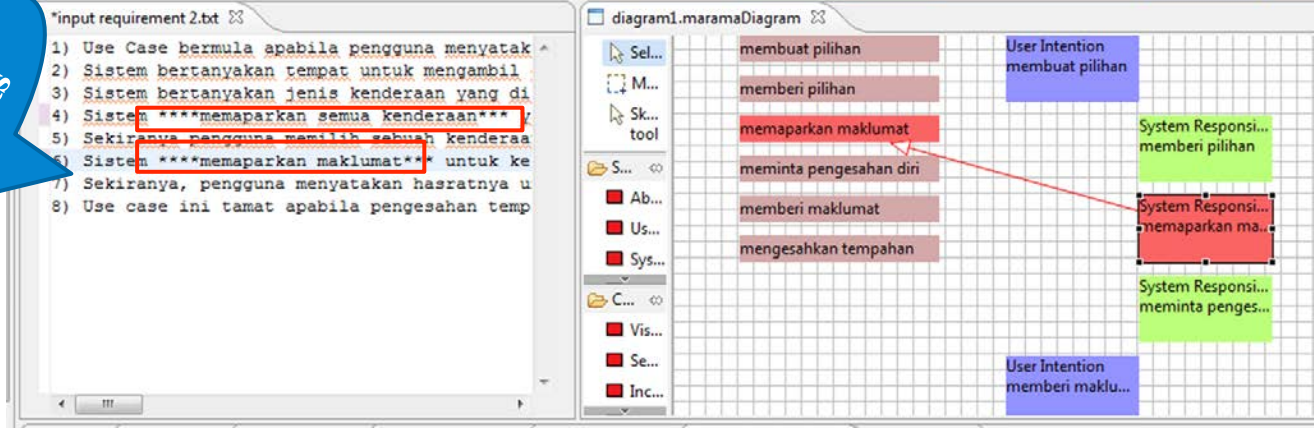


Marama AI: Capture Multi lingual requirements

English requirements



Malay requirements



Marama AI: Consistency Checking

Highlight

Notification error

Problem marker

Warning

EUC Component sequence is inconsistent with the sequence of abstract interaction and textual requirement.

Update Cancel

Description	Resource	Path	Location	Type
Warnings (1 item)				
Inconsistency: The sequence of EUC compon...	diagram1.mar...	A17	membu...	Problem

Marama AI: Consistency Checking with Best-practise Template

The screenshot displays the Marama AI interface. On the left, a text editor shows Malay requirements: "pengguna menyatakan hasrat utk membuat tempahan untuk mengambil dan menghantar tempahan beserta kenderaan yang dikehendaki oleh pengguna. Pengguna memerlukan kenderaan yang sesuai dengan tempat untuk mengangkut sebuah kenderaan untuk tempahan, system pun me... untuk keselamatan (cthnya, perlindungan kebina... kan hasratnya untuk "menerima tempahan", syst... pengesahan tempahan telah ditunjukkan kepada p...".

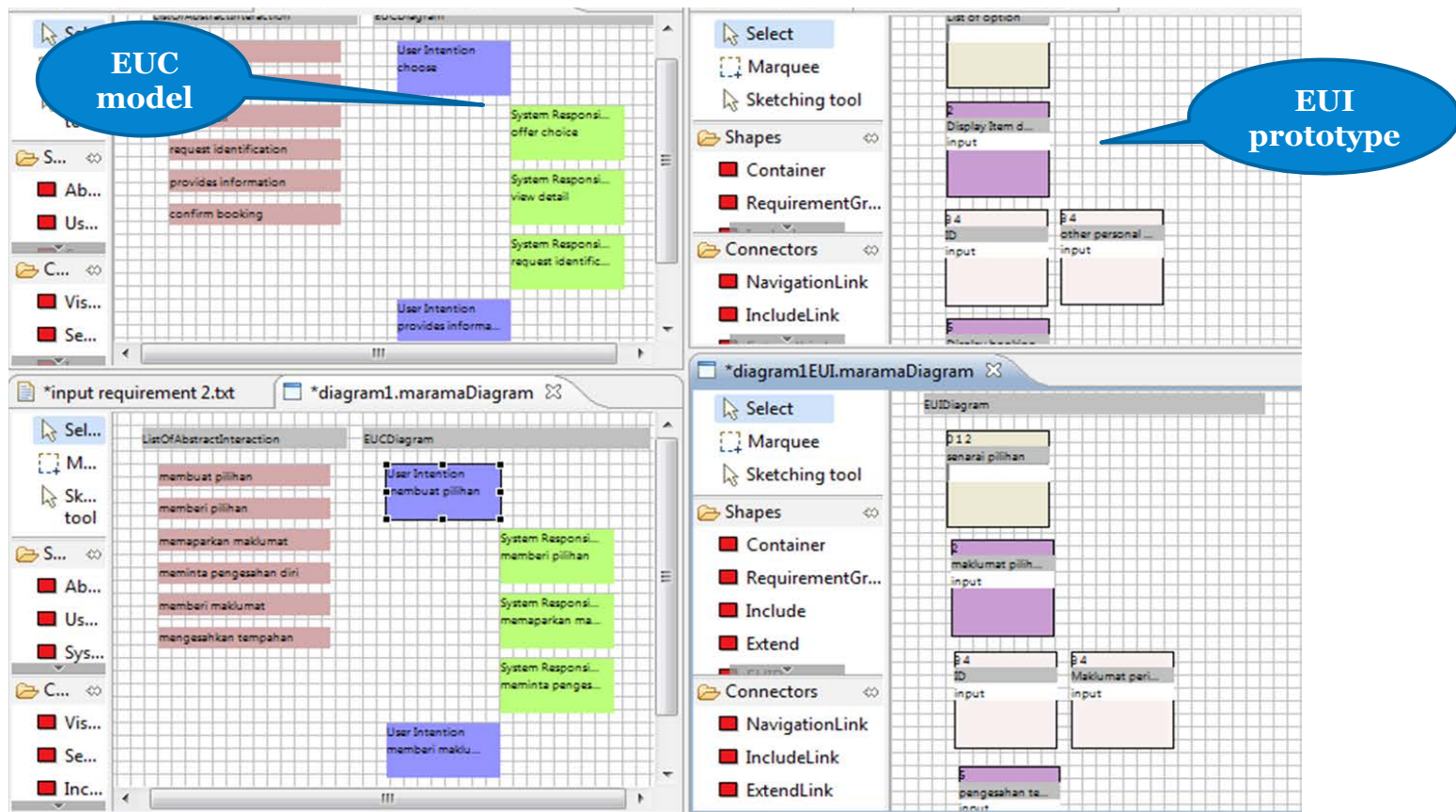
In the center, a diagram titled "ListOfAbstractInteraction" lists three actions: "membuat pilihan", "memberi pilihan", and "memaparkan maklumat".

On the right, an "EUCDiagram" shows a sequence of actions: "choose membuat pilihan" (highlighted in blue), "offer choice memberi pilihan" (green), "view detail memaparkan ma..." (green), "request identific... meminta penges..." (green), "identify self memberi maklu..." (blue), and "confirm booking mengesahkan te..." (green).

A "Template Consistency Checking" dialog box is open in the foreground, displaying an information icon and the message: "Your EUC diagram is Consistent with the template. Click OK to Proceed." with an "OK" button.

A blue speech bubble on the right contains the text: "Malay Requirements vs English best-practise template".

Marama AI: Generate EUC to EUI prototype model

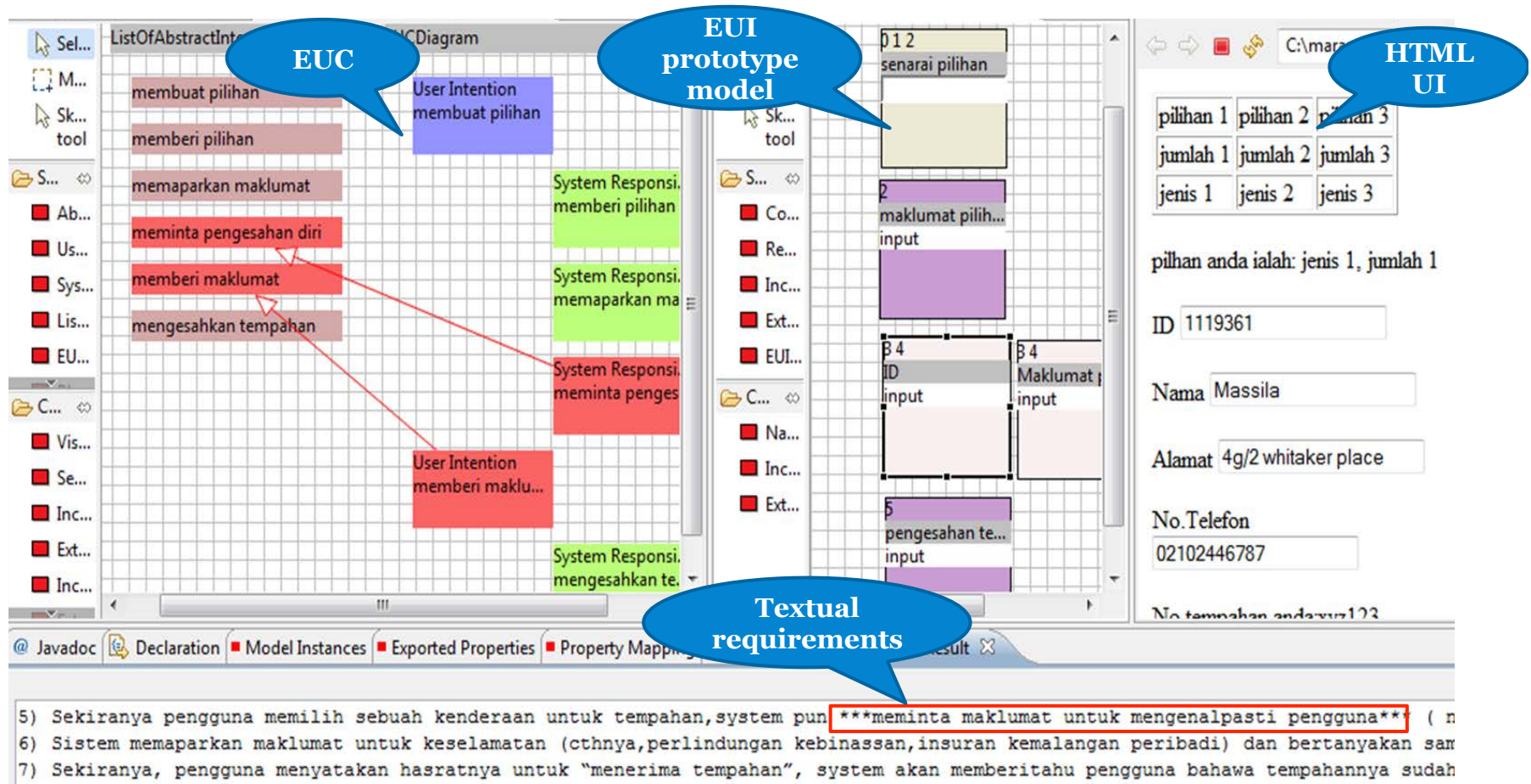


MaramaAI: Translate EUI prototype to HTML form UI

The screenshot displays the MaramaAI interface, which is used for translating EUI prototypes into HTML form UIs. The interface is divided into four main sections:

- Top Left:** A diagram editor titled "EUIDiagram" showing a prototype with three main components: a yellow box labeled "D 1 List of option", a purple box labeled "D 2 Display Item d...", and a pink box labeled "input".
- Top Right:** A browser window showing the generated HTML form UI. It features a table with three columns: "choice 1", "choice 2", and "choice 3". Below the table, it displays "Your selected item is: type 1, value 1". There are input fields for "ID 1119361" and "Name Massila". A blue speech bubble points to this section with the text "HTML form UI".
- Bottom Left:** A diagram editor titled "2.txt" showing a translated prototype with three main components: a yellow box labeled "D 1 2 senarai pilihan", a purple box labeled "D 2 maklumat pilih...", and a pink box labeled "input".
- Bottom Right:** A browser window showing the translated HTML form UI. It features a table with three columns: "pilihan 1", "pilihan 2", and "pilihan 3". Below the table, it displays "pilhan anda ialah: jenis 1, jumlah 1". There are input fields for "ID 1119361" and "Nama Massila".

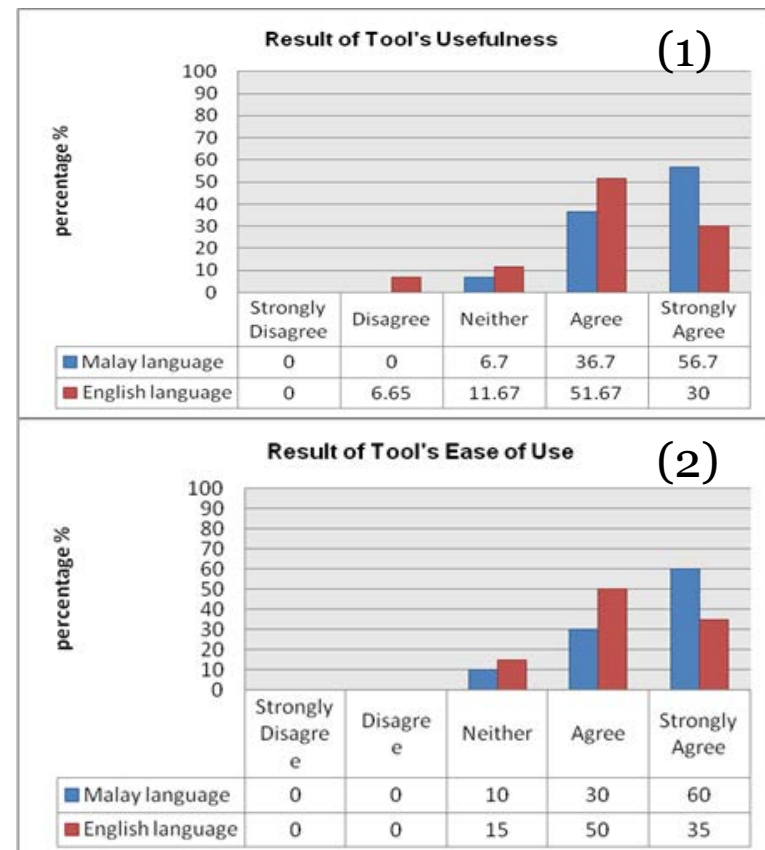
MaramaAI: Overall Traceability



Evaluation & Results

Comparison of Abstract Interactions' Extraction between Manual and Automated tool for both Malay and English language requirements

Answers: Malay language requirements	N o . Correct answers		N o . Wrong answers		Answers: English language requiremen ts	N o . Correct answers		N o . Wrong answers	
	Man ual	Auto	Man ual	Auto		Man ual	Auto	Man ual	Auto
Membuat pilihan	3	1	7	0	choose	6	1	14	0
Memberi pilihan	2	1	8	0	Offer choice	12	1	8	0
M e m a p a r k a n maklumat	1	1	9	0	View detail	8	1	12	0
M e m i n t a pengesahan diri	2	1	8	0	Request identification	5	1	15	0
M e m b e r i maklumat	3	1	7	0	Provides information	6	1	14	0
M e n g e s a h k a n tempahan	4	1	6	0	C o n f i r m booking	11	1	9	0
Correctness ratio	25%	100 %	75%	0%	Correctness ratio	40%	100%	60%	0%



Tool's Usefulness (1) and Ease of Use(2) results for Capturing and Managing consistency for English and Malay language Requirements



Future Works:

- Develop a pattern editor-EUC & EUI pattern
- Conduct a formal evaluation of the effectiveness of our tool in improving the multi-lingual dialogue between the requirements engineer and the stakeholder clients.



Thank you..

References

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