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Stochastic logicallinguistic approachMulti-level automated object's dialogue control (MADC)

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∇ ABSTRACT ∇

Object's supportingmulti-leveladaptive dynamic dialogue scenario depends on eliminatinguselessobject's transmission between and through differentlevel's stepsand building an object's module which reflects all it's parameters(evaluation criteria , failed or successful tries intensity for solving problems, visit number of each dialog level , step expired time at different levels etc.)taking in consideration all passed steps and issues an order to transfer the dialogue from one step to another depending on evaluated object's activity at current step and at all passed steps at different levels,so minimize lost time required to execute useless operations and unsuitable dialogue scenario demonstration, and minimizethe dialogue time and so increasing dialogue efficiency .For registering and recognizing object's activities and parameters it's good touselinguisticapproachusing non-context-free formal grammar (type .1-regarding toChomsky's classification), so having viewed number of grammar's productionscan begenerate asuitableenough number of symbolic string for registering and recognizingobject's activities then selecting the suitable next dialogue scenario and effective controlofcomplex object's motion and permits to construct multi-leveladaptive dynamic dialogue system.Adaptive dialogue depends on modeling object'sdialogueand building twoobject's modules: step object's module (object's activities in range one step) andcurrent object's module (object's activities history at all dialogue levels -passed path).

Keywords: Grammar,formal,free,dialogue,scenario,object, production, module, level, step.

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المبدأ اللغوي المنطقي للتحكم بالمحادثة المؤتمتة متعددة المستويات مع الكائن

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∇ ملخّص ∇

إن تقديم السيناريو المناسب للمحادثة الديناميكية متعددة المستويات مع الكائن، يعتمد على استبعاد عمليات النقل العشوائي للمحادثة بين خطوات مستويات المحادثة وضمنها ، وبناء نموذج للكائن الذي يعكس جميع بارامتراته (زمن عبور خطوة واحدة ,عدد المحاولات الناجحة وفي حدود الخطوة الواحدة, عدد مرات زيارة مستوي المحادثة ,آلية تقييم نشاط الكائن... الخ.)

إن اتخاذ قرار بنقل المحادثة من خطوة إلى أخرى بين خطوات مستويات المحادثة وضمنها، يعتمد على تقييم نشاط الكائن ، وفي حدود الخطوة الواحدة آخذين بالحُسبان الطريق المتبعة، وبذلك يتم اختزال زمن المحادثة الضائع لتكرار تنفيذ العمليات الناجحة المنفذة نفسها، لحل مسألة ما أو استعراض البيانات ،غير المناسب وبالتالي اختصار زمن المحادثة الكلي.

من الأنسب استخدام المبدأ اللغوي المنطقي (النحو الشكلي الشرطي) لتدوين نشاط وبارامترات الكائن .إن استخدام النحو الشكلي اللا حر (type−1 وذلك بحسب تصنيف Chomsky) ، إذ يمكن استخدام عدد كبير من قواعد الاشتقاق ، يسمح بتدوين حالة الكائن نفسه بشكل مختلف وفي مستويات مختلفة مما يسمح، بدوره، بالتحكم بكائنات معقدة الحركة، ومتعددة الحالات وتقديم سيناريو المحادثة المناسب التالي، والارتقاء لتصميم أنظمة محادثة مؤتمتة ديناميكية متعددة المستويات ومتطورة جدا".إن نظام نمذجة المحادثة مع الكائن يسمح بدراسة مواصفاته بدقة، وإجراء محادثة ديناميكية، متعددة المستويات حيث يُميِّز نوعين: نموذج الكائن الحالي(يعكس سلوك الكائن من الخطوة الأولى ولغاية الخطوة الحالية ولجميع مستويات المحادثة) ونموذج الكائن الخطوي(يعكس سلوك الكائن ضمن حدود خطوة ما).

الكلمات المفتاحية: النحو, الشكلي, الحر,المحادثة, سيناريو, كائن, اشتقاق, نموذج,مستوي, الخطوة.

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Introduction:

Multi-level automated object's dialogue control must provide adaptive dialogue scenario at suitable level depending on it's activity[6,10,11], so demonstrated required data base to solve problems must be divided into different complexity dialogue levels each one has specific parameters looks like: complexity and spent time given for solving problems in range of one step(group of given problems to solve) each level has it'sown specific steps,data and problems demonstration methods, content somestack(last passedlevel),evaluation criterion etc.

MADC author can modify these parameters so system can provide each object with the suitable dialogue scenario at relevant level taking in consideration all passed steps and issues an order to transfer the dialogue from one step to another depending on evaluated object activity and eliminates useless transfers between and through steps dialogue levels, so minimize dialogue time and increase dialogue efficiency.

Importance and aim of this work:

For supporting an object adaptive dialogue it is important to build symbolic object's modules which reflects object's activities at different dialogue level's steps using suitable formal grammar (Non -context- free type)for registering and recognizing object's modules then generation the next suitable adaptive dialogue scenario.

Search methods and materials:

Support adaptive dialogue mainly depends on the evaluationof current object'sactivity at certain step current level and passed path type (activity history at all levels).

To solve this problem it's very effective using stochastic linguistic approach andalso to build object module which reflects all itsparameters at given dialogue level (we can include different object's parameters and numbers at any step of dialogue level).

We will use oriented weighted graph to represent the possible object's activities conditions (states-vertex) and possible transmission between different steps [7] (fig.1).Where:

Arrow → points to next possible dialogue level step ,each edge has it'sown symbol followed by step numberand it represents object's activity in range of one step at given dialogue level(for example:E2 –represent excellent object's dialogue evaluation level at 2^{-nd}step of 1^{-st} dialogue level).

Each vertex hasa level number:0-for initial level, 1-for first level, etc.Start/End vertex points to start/finish operation. The most important object's parameters are:$Q_{j,k}$denotes successful intensity tries , $j = \overline{1,n}$for solving $\mu_{j,k}$ problems at different dialogue level through expired time $t_{j,k}$, step number k, object's last content stack denoted by $L_{c.}$

Each edge represent an object's state and has it's special letter ,which represents object activities conditionsevaluation inside one step followedby step numbers at given dialogue leveltaking in consideration all necessary parameters .

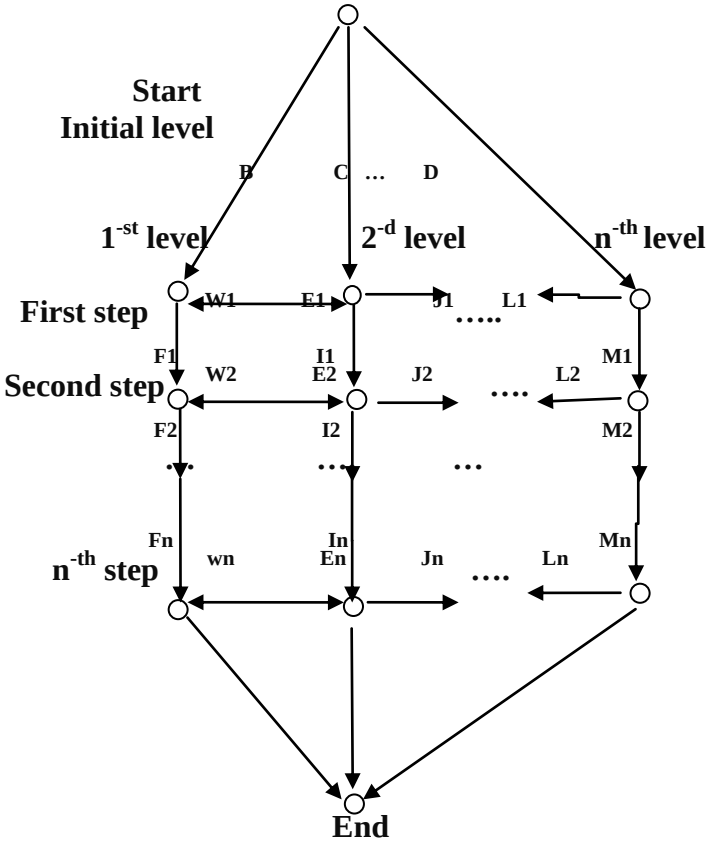

Fig.1: conditionaloriented automated dialogue graph

For supporting an adaptive dialogue scenario it's necessary to build object's module M_c (group of characters)which reflects all object's parameters depending on it's activity through solving $\mu_{j,k}$ problems,$j = \overline{1,n}$level sequence number),k-step number into $t_{j,k}$timeand object's activities evaluation as object's intensity tries to solve a given problems in range of one step .

Each character represent object's activity in range of one step at given dialogue level taking in consideration the passed path(object's history) , builtobject's module M_c will be using for registering and recognizing object's activities and selecting next dialogue scenario [1].

For construction object's adaptive dialogue it's necessary to build two object's module: step object's module $M_s$and currentobject's module $M_c$where:

M_s -reflects object's activity level inside one step at given dialogue level, (different object's parameters can be contained) mainly depending on the object's intensity of successful tries number for solving $\mu_{j,k}$problems at K step given dialogue level. Each object's activity state at dialogue level can be registered by using grammar's productions(Non -Context- Cree Grammar) at corresponding below mentioned suitable formal grammar dialogue level G_j ,$j=\overline{1,n}$.

M_c - reflects object's activity level at all passed steps different dialogue levels starting at initial dialogue level and ending at any dialogue level including step modules, so the general object's module ,which reflects object's activities at all steps including current step, will take the next form: $M_c = M_c \&\& M_s$ (&&-concatenation operator).

Constructed general object's module M_c will be used later to define and recognizing the object's activity level taking in consideration all passed steps at different

dialogue[9,10] levels, then support the object 's next suitable scenario dialogue(so we eliminated useless random object's dialogue transfer between and through different dialogue levels),which decrease spent time at given step levels and so increasing the dialogue efficiency.

For supporting an adaptive scenario dialogue its necessary to build an object's module M_c which corresponds to all object's parameters and all passed situations depending mainly on the object's intensity of successful tries number for solving $N_{j,k}$problems ,$j=\overline{1,..n}$ in range k-step, through spent time $t_{j,k}$.

Issuing a suitable (in time and place) order to transfer dialogue along and betweendialogue levels depends so far on the object's module M_c contents avoiding useless dialogue transfer between and through different level's steps so we eliminate useless dialogue transfers and minimize spent time and increase the result of the dialogue efficiency, so issuing an order to transfer dialogue from a situation to another depends on actual object's activities.

For registering and recognizingobject's activities and parameters it's good to use stochastic linguistic approach using Non-Context-Free formal grammar[2,3,5]which has the following production type $\xi_1\alpha\ \xi_2 \longrightarrow \xi_1\beta\xi_2$,that means substitute α by β symbol in the contextξ_1, ξ_2 inconditions:$\xi_1\alpha\xi_2| \leq |\xi_1\beta\xi_2|$where:

$\beta \in V^*$(non empty group of terminal and nonterminal(secondary) symbols).

$\beta \neq \varepsilon$(empty symbolic series).

Each dialogue level has specific formal grammar which permits generate rich symbolic series that is enough for registering and recognizingobject's activities and parameters at each dialogue level as follows:

a)Non-Context-Free formal grammar 1'st dialogue level G_1:

$G_1=\{V_{T1},V_{N1}, S_0,R_1\}$ Where:

V_{T1}={B,C,D,E,F, I,J,K,L,M,W,0,1,…9}-group of terminal symbols ,

$V_{N1}= \{S_0, S_1, S_2, S_3, S_n,\xi_1,\xi_2, T_1, T_2 , T_n, T_3, N, \varepsilon\}$ −non-terminal group symbols,

$V_1= V_{T1}UV_{N1}$ –dictionary of G_1,S_0-start symbol, R_1- group of G_1grammar's productions, ε − empty string symbols.

R_1:

1:$\xi_1 S_0\, \xi_2 \longrightarrow \xi_1 S_1 \xi_2$

2: $\xi_1 S_1 \xi_2 \longrightarrow \xi_1 S \xi_2$

3:$\xi_1 S \xi_2 \longrightarrow \xi_1 S_1 \xi_2$

4: $\xi_1 S_1 \xi_2 \longrightarrow \xi_1 S_2 \xi_2$

5: $\xi_1 S_1 \xi_2 \longrightarrow \xi_1 S_3 \xi_2$

6: $\xi_1 S_1 \xi_2 \longrightarrow \xi_1\ S_1 S \xi_2$

7: $\xi_1 S_1 \xi_2 \longrightarrow \xi_1 S_1 S_2 \xi_2$

8: $\xi_1 S_2 \xi_2 \longrightarrow \xi_1 S_2 S_3 \xi_2$

9: $\xi_1 S_2 \xi_2 \longrightarrow \xi_1 S_2 S_1 \xi_2$

10: $\xi_1 S_2 \xi_2 \longrightarrow \xi_1 S_2 S \xi_2$

11:$\xi_1 S_3 \xi_2 \longrightarrow \xi_1 S_3 S_2 \xi_2$

12:$\xi_1 S_3 \xi_2 \longrightarrow \xi_1 S_3 S \xi_2$

13:$S_1 S \xi_2 \longrightarrow S_1 T_1 \xi_2$

14:$S_1 S_2 \xi_2 \longrightarrow S_1 T_2 \xi_2$

15:$S_3 S_2 \xi_2 \longrightarrow S_3 T_2 \xi_2$

16:$S_2 S_3 \xi_2 \longrightarrow S_2 T_3 \xi_2$

17: $S_1T_1\xi_2 \longrightarrow S_1TN\xi_2$
18: $S_1T_2\xi_2 \longrightarrow S_1T_1\xi_2$
19:$S_3T_2\xi_2 \longrightarrow S_3T_1\xi_2$
20:$S_2T_3S_3 \longrightarrow S_2T_1S_3$
21:$\xi_1S_0\xi_2 \longrightarrow \xi_1B\xi_2$
22:$S_1TN\xi_2 \longrightarrow S_1EN\xi_2$
23:$S_1TN\xi_2 \longrightarrow S_1FN\xi_2$
24:$S_1TN\xi_2 \longrightarrow S_1WN\xi_2$
25:$S_1TN\xi_2 \longrightarrow S_1IN\xi_2$
26:$S_1TN\xi_2 \longrightarrow S_1JN\xi_2$
27:$S_1TN\xi_2 \longrightarrow S_1LN\xi_2$
28:$S_1TN\xi_2 \longrightarrow S_1MN\xi_2$
29: $T\ N\xi_2 \longrightarrow T1\xi_2$
30: $T\ N\xi_2 \longrightarrow T\ 2\ \xi_2$
……
37: $T\ N\xi_2 \longrightarrow T9\xi_2$
38: $T\ N\xi_2 \longrightarrow T\varepsilon\xi_2$
39:$S_1TN\xi_2 \longrightarrow S_1\varepsilon N\xi_2$
40:$S_2S_3\xi_2 \longrightarrow S_2\varepsilon\xi_2$
41:$S_1S_2\xi_2 \longrightarrow S_1\varepsilon\xi_2$

b)Non-Context-Free formal grammar 2-nd dialogue levelG_2.

$G_2=\{V_{T2},V_{N2}, S_0,R_2\}$

Where:

$V_{T2}= V_{T1}$-group of terminal elements, $V_{N2}= V_{N1}$- group of non-terminal symbols,

S_0-start symbol,$V_2= V_{T2}U\ V_{N2}$ –dictionary of G_2, R_2- group of G_2grammar's productions.

R_2:

1:$\xi_1S_0\ \xi_2 \longrightarrow \xi_1S_2\xi_2$
2: $\xi_1S_2\xi_2 \longrightarrow \xi_1S_3\xi_2$
3:$\xi_1S_2\xi_2 \longrightarrow \xi_1S_1\xi_2$
4: $\xi_1S_2\xi_2 \longrightarrow \xi_1S_2S\xi_2$
5: $\xi_1S_2\xi_2 \longrightarrow \xi_1S_2S_3\xi_2$
6: $\xi_1S_2\xi_2 \longrightarrow \xi_1\ S_1S_2\xi_2$
7: $\xi_1S_2\xi_2 \longrightarrow \xi_1\ S_2S_1\xi_2$
8: $\xi_1S_2\xi_2 \longrightarrow \xi_1S_2S_3\xi_2$
9: $\xi_1S_2\xi_2 \longrightarrow \xi_1S_2S_1\xi_2$
10: $\xi_1S_2\xi_2 \longrightarrow \xi_1S_2S\xi_2$
11:$\xi_1S_3\xi_2 \longrightarrow \xi_1S_3S_2\xi_2$
12:$\xi_1S_3\xi_2 \longrightarrow \xi_1S_3S\xi_2$
13:$S_1S\xi_2 \longrightarrow S_1T_1\xi_2$
14:$S_1S_2\xi_2 \longrightarrow S_1T_2\xi_2$
15:$S_3S_2\xi_2 \longrightarrow S_3T_2\xi_2$
16:$S_2S_3\xi_2 \longrightarrow S_2T_3\xi_2$
17: $S_2T_1S_1 \longrightarrow S_2TNS_1$

18: $S_1T_2\xi_2 \longrightarrow S_1T_1\xi_2$
19:$S_3T_2\xi_2 \longrightarrow S_3T_1\xi_2$
20:$S_2T_3S_3 \longrightarrow S_2T_1S_3$
21:$\xi_1S_0\xi_2 \longrightarrow \xi_1C\xi_2$
22:$S_1TN\xi_2 \longrightarrow S_1EN\xi_2$
23:$S_1TN\xi_2 \longrightarrow S_1FN\xi_2$
24:$S_1TN\xi_2 \longrightarrow S_1WN\xi_2$
25:$S_1TN\xi_2 \longrightarrow S_1IN\xi_2$
26:$S_1TN\xi_2 \longrightarrow S_1JN\xi_2$
27:$S_1TN\xi_2 \longrightarrow S_1LN\xi_2$
28:$S_1TN\xi_2 \longrightarrow S_1MN\xi_2$
29: $T\ N\xi_2 \longrightarrow T\ 1\xi_2$
30: $T\ N\xi_2 \longrightarrow T\ 2\ \xi_2$
……
37: $T\ N\xi_2 \longrightarrow T9\xi_2$
38: $T\ N\xi_2 \longrightarrow T\varepsilon\xi_2$
39:$S_1TN\xi_2 \longrightarrow S_1\varepsilon N\xi_2$
40: $S_2S_3\xi_2 \longrightarrow S_2\varepsilon\xi_2$
41:$S_1S_2\xi_2 \longrightarrow S_1\varepsilon\xi_2$

c)Non-Context-Free formal grammar n-th dialogue level G_n:

$G_n=\{V_{Tj},V_{Nj}, S_0,R_j\}$ - formal grammar n-th dialogue level

Where:

$V_{Tj}= V_{T1}$-group of terminal elements, $V_{Nj}= V_{N1}$- group of non-terminal symbols, S_0-start symbol,$V_n= V_{Tj}UV_{Nj}$–dictionary of G_n, R_j- group of $G_n$grammar's productions.

R_j:

1:$\xi_1S_0\ \xi_2 \longrightarrow \xi_1S_n\xi_2$
2: $\xi_1S_n\xi_2 \longrightarrow \xi_1S\xi_2$
3:$\xi_1S\ \xi_2 \longrightarrow \xi_1S_n\xi_2$
4: $\xi_1S_n\xi_2 \longrightarrow \xi_1S_{n-1}S\xi_2$
5: $\xi_1S_n\xi_2 \longrightarrow \xi_1S_{n-1}S_{n-2}\xi_2$
6: $\xi_1S_n\xi_2 \longrightarrow \xi_1\ S_nS\xi_2$
7: $\xi_1S_n\xi_2 \longrightarrow \xi_1S_{n-2}S_{n-1}\xi_2$
8: $\xi_1S_{n-1}\xi_2 \longrightarrow \xi_1S_{n-1}S_n\xi_2$
9: $\xi_1S_{n-1}\xi_2 \longrightarrow \xi_1S_{n-1}S_{n-2}\xi_2$
10: $\xi_1S_{n-1}\xi_2 \longrightarrow \xi_1S_{n-1}S\xi_2$
11:$\xi_1S_n\xi_2 \longrightarrow \xi_1S_nS_{n-1}\xi_2$
12:$\xi_1S_n\xi_2 \longrightarrow \xi_1S_nS\xi_2$
13:$S_{n-2}S\xi_2 \longrightarrow S_{n-2}T_{n-2}\xi_2$
14:$S_{n-1}S_{n-2}\xi_2 \longrightarrow S_{n-1}T_{n-2}\xi_2$
15:$S_{n-1}S_{n-2}\xi_2 \longrightarrow S_{n-1}T_{n-2}\xi_2$
16:$S_{n-1}S_n\xi_2 \longrightarrow S_{n-1}T_n\xi_2$
17: $S_nT_nS_{n-1} \longrightarrow S_{n+1}TNS_{n-1}$
18: $S_nT_{n+1}\xi_2 \longrightarrow S_nT_n\xi_2$

19:$S_n T_{n-1} \xi_2 \longrightarrow S_n T_{n-2} \xi_2$
20:$S_{n-1} T_n S_{n+1} \longrightarrow S_{n-1} T_{n-2} S_{n+1}$
21:$\xi_1 S_0 \xi_2 \longrightarrow \xi_1 D \xi_2$
22:$S_{n-1} TN \xi_2 \longrightarrow S_1 EN \xi_2$
23:$S_{n-1} TN \xi_2 \longrightarrow S_1 FN \xi_2$
24:$S_{n-1} TN \xi_2 \longrightarrow S_1 WN \xi_2$
25:$S_{n-1} TN \xi_2 \longrightarrow S_1 IN \xi_2$
26:$S_{n-1} TN \xi_2 \longrightarrow S_1 JN \xi_2$
27:$S_{n-1} TN \xi_2 \longrightarrow S_1 LN \xi_2$
28:$S_{n-1} TN \xi_2 \longrightarrow S_1 MN \xi_2$
29: $T\ N \xi_2 \longrightarrow T\ 1 \xi_2$
30: $T\ N \xi_2 \longrightarrow T\ 2\ \xi_2$
……
37: $T\ N \xi_2 \longrightarrow T\ 9 \xi_2$
38: $T\ N \xi_2 \longrightarrow T \varepsilon \xi_2$
39:$S_{n-1} TN \xi_2 \longrightarrow S_1 \varepsilon N \xi_2$
40:$S_{n-1} S_n \xi_2 \longrightarrow S_{n-1} \varepsilon \xi_2$
41:$S_{n-2} S_{n-1} \xi_2 \longrightarrow S_{n-2} \varepsilon \xi_2$

Modeling of object's adaptive dialogue control and selection of productions rules:

Object's oriented dialogue starts by dataportions demonstration about an idea then asking him to solve some problems through which we can evaluate real Object's state and determine next proposed scenario.

Mainly we will use Non-Context-Free Formal Grammar for registration and recognizing object's current level, so each level has its special with their corresponding generation languages $L(G_j)$, $j=\overline{1,n}$- level number .Generated languages yield this condition:

$L(G_1) \cap L(G_2) \cap \ldots L(G_n)=\emptyset$

For example at initial level object's activities evaluated and represented as symbols using for that function Eval( ) ϵ { B,C,D } represent bad, good ,excellent object activities level evaluation at initial level function respectively.Next dialogue level can be any level: 1^{-st},2^{-nd}….,n^{-th} dialogue levelsrespectively and so step module $M_s \epsilon \{ B, C, D \}$, and current object's modules takes the following form:

$M_c=M_c \&\& M_s$ ($M_c=\varepsilon$, at starting point stack is empty).

Oriented dialogue starts with data demonstration then asking object to solve given group of problems about demonstrated data, object's activities define the next scenario level and for registering and recognizing these activities and parameters it's good to use stochastic linguistic approach where object's activities at dialogue level are evaluated at each step using different symbols .

Each production rule (formal grammars G_j,$j=\overline{1,n}$has it's specific group of conditionsone, two or more). At the end of each step starts searching for yield conditions, if the conditions was yield, then the corresponding production rule will be use and generates in result an symbolic character followed by the step number, then consisting the object's step module "M_s" which will be use for organizing object's current module "M_c", otherwisesearching will be continue to the end of production ruleslist (one of them must be satisfied).

Each element of group conditions reflects a certain object's parameters looks like the following:

$Q_{j,K}$-successful tries number to solve "n" questions at step"k" ,dialogue level "j", $j=\overline{1,n}$.

$t_{j,k}$ –spent time to solve "n" problems in range one step at dialogue level "j" .

$L_{j,k}$ - stack's content reflects object'sactivity at last level's step.

Type and number of object's optional parameters can be defined when designing automated tutorial dialogue. These parameters will be use for organizing different relational and logical conditional expressions ,which permits good checking object's parameters and issue an order to use related suitable production rule for registering or recognizing object'sactivity at dialogue level's current step, then use it for organizing object's step module M_s and object's general module M_g .Suppose production rule after some substationhas the following form:

$\xi_1 S \ \xi_2 \longrightarrow \xi_1 I_1 S_2 \xi_2$, $Q_{j,K}= \mu_{j,k}$ and $t_{j,k}=£_{j,k}$and $L_{j,k}$="string".

Where:$\mu_{j,k}$and $£_{j,k}$ –integer positive constants,$L_{j,k}$–stack's content.

Recording or recognizing object's level starts by checking if the supported conditional expression $Q_{j,K}= \mu_{j,k}$and $t_{j,k}=£_{j,k}$and $L_{j,k}$ ="string"was yield ,then can be use the related production rule and generates symbolic string "I_1" ,so dialogue will be continue at 2^{-nd} level, second step otherwise searching process will continue to find yield conditional expression in the grammar productions list ,which must be recover all possible variants .

Tutorial dialog starts at initial level Wheredefined the initial level (j=0) canbe recognize the following conditions:

1) Eval( ) =" B" if yield conditions $Q_{0,K}< \mu_{0,j},t_{0,k}>£_{0,j}$,than object'sstep modules at initial level takes the form M_s="B" , and current object's modules takes the next form:

$M_c=M_c\&\&M_s$= "B" ,($M_c=\epsilon$, at starting point stack is empty).

where:

$\mu_{1,j}$, $£_{1,j}$ -constants.

Possiblegrammar's productionspossible for registration object's level are:

R_1,R_6,R_{13} , R_{21},R_{38},R_{39}- special formal grammar dialogue 1'st level formal grammar G_1.

2) Eval( ) =" C " if yield conditions $Q_{0,K}= \mu_{0,j}$, $t_{0,k}=£_{0,j}$, than object's step modules at initial level takes the form M_s="C" ,and current object's modules takes the nextform:

$M_c=M_c\&\&M_s$= "C" ($M_c=\epsilon$, at starting point stack is empty).

Next proposed scenario must be selected from 2^{-nd} level so object's module M_c="C".

Possiblegrammar's productions registering and recognizingobject's level are:

R_1,R_4,R_{10},R_{13}, $R_{17},R_{21},R_{38},R_{39}$, of special formal grammar dialogue $2-^{nd}$ level formal grammar G_2.

3) Eval( ) =" D " if yield conditions $Q_{0,K}> \mu_{0,j}$ and $t_{0,k}<£_{0,j}$than object's step modules at initial level takes the form M_s="D" , and the current object's modules takes the next form: $M_c=M_c\&\&M_s$= "D" ,($M_c=\epsilon$, at starting point stack is empty).

and next proposed scenario must be selected from n^{-th} level so object's module M_c="D".Possible grammar's productions for registering and recognizing object's level are: R_1,R_4,R_{10},R_{13}, R_{17},R_{21} ,R_{39},R_{41}- formal grammar dialogue $n-^{th}$ level formal grammar G_n depending on Object's activities evaluation(this is executed by the function Eval( ) dialogue can continue at any dialogue level and can meet the following condition:

1 - Eval( ) ϵ { E,J,M } represents excellent object's activities evaluation function value Eval( ) as letter followed by step number at $1^{-st},2^{-nd}...,n^{-th}$dialogue levelsrespectively

where next dialogue level must be higher(more complexity) than current one(if current level was n- ththe dialogue will continue on the same level)in the following conditions:

-evaluation function value at step k=1 is Eval( ) ="E" if yield conditions $Q_{1,K}>= \mu_{1,j}$ and$t_{1,k}<=£_{1,j}$,than object's step module M_s ="E" , and at step k=1, where :

$M_s= M_s$ && k= "E1", while current object's module reserved value is M_c="B", and current object's module will be as: $M_c= M_c$ && M_s = "BE1".Where:

$\mu_{1,j}$, $£_{1,j}$-constants , $t_{1,k-}$ expired time in range one step k=1 at 1^{-st}level andproposed next scenario must selected from 2^{-nd}level.

Possible grammar's productions forregistering and recognizing object's level are:

$R_1,R_3,R_6, R_{14}, R_{22},R_{30}, R_{39},R_{41}$,special formal grammar dialogue 2-nd level formal grammar $G_{2.}$

-Eval( ) = " J " at step k=1, if yield conditions: $Q_{2,K}>= \mu_{2,j}$ and $t_{2,k}<=£_{2,j}$,than object's step module M_s ="J" , and at step k=1, $M_s= M_s$ && k= "J1" , while current object's module reserved value is M_c="C" , current object's module will be as :

$M_c= M_c$ && M_s = "CJ1" where:

$\mu_{2,j}$, $£_{2,j}$ -constants , $t_{2,k-}$ expired time in range one step k=1 at 2^{-nd}level and proposed next scenario must selected from n-th level.Possible grammar's productions for registering and recognizing object's level are:

R_6,R_{14}, R_{16}, special formal grammar dialogue n-th level formal grammar G_n.

-Eval( ) = " M " if yield conditions: $Q_{3,K}>= \mu_{3,j}$ and $t_{3,k}<=£_{3,j}$, than object's step module M_s ="M" , and at step k=1, $M_s= M_s$ && k= "M1" , while current object's module reserved value is M_c="D" , and current object's module will be as :

$M_c= M_c$ && M_s = "DW1" where:

$\mu_{3,j}$, $£_{3,j}$ -constants , $t_{3,k}$- expired time in range one step k=1 at n^{-th}level and proposed next scenario must selected from n^{-th}level.Possible grammar's productions forregistering and recognizing object'slevel are:

$R_1,R_3,R_8, R_{17}, R_{28},R_{31}, R_{40},R_{41}$-special formal grammar dialogue n-th level formal grammar G_n .

- Eval( ) ϵ {F,W,L } represent bad object's activities evaluation as letterfollowed by step number at 1^{-st},2^{-nd},3^{-d} dialogue levelsrespectively inthe following conditions where next dialogue level must be lower(easier)than current one(at 1^{-st},2^{-nd} ,…n^{-th}dialogue levels will continue onthe same level):

-Eval( ) = " F " if yield conditions: $Q_{1,K}>= \mu_{1,j}$ and $t_{1,k}<=£_{1,j}$, than object's step module M_s ="F" , and at step k=1, $M_s= M_s$ && k= "F1" , while current object's module reserved value is M_c="B" , and current object's module will be as :

$M_c= M_c$ && M_s = "BF1" where:

$\mu_{1,j}$, $£_{1,j}$ -constants , $t_{1,k-}$ expired time in range ofone step k=1 at 1^{-st}level and proposed next scenario must selected from 1^{-ST} level.Possible grammar's productions for registration object's level are:

$R_1,R_3,R_6, R_{13}, R_{17},R_{23},R_{37}$ formal grammar dialogue 1'st level formal grammar $G_{1.}$

-Eval( ) = "W " if yield conditions: $Q_{2,K}>= \mu_{2,j}$ and $t_{2,k}<=£_{2,j}$,than object's step module M_s ="W" , and at step k=1, $M_s= M_s$ && k= "W1" , while current object's module reserved value is M_c="C" , and current object's module will be as :

$M_{c=} M_c$ && M_s = "CW1" where:

$\mu_{2,j}$, $£_{2,j}$ -constants , $t_{2,k-}$ expired time in range one step k=1 at 2^{-nd} level andproposed next scenario must selected from 1^{-ST} level.Possiblegrammar's productionsfor registering and recognizing object's level are:

R_1,R_3,R_9, R_{10},R_{13},R_{17} ,R_{20},R_{24},R_{29} ,R_{40} of special formal grammar dialogue 1'st level formal grammar G_1.

-Eval( ) =" L " if yield conditions: $Q_{3,K}>= \mu_{3,j}$ and $t_{3,k}<=£_{3,j}$,than object's step module M_s ="L" , and at step k=1, $M_s= M_s$ && k= "L1" , while current object's module reserved value is M_c="D" , and current object's module will be as :

$M_{c=} M_c$ && M_s = "DL1" where:

$\mu_{3,j}$, $£_{3,j}$ -constants , $t_{3,k}$ - expired time in range of one step k=1 at 2^{-nd}level andproposed next scenario must selected from 2^{-nd}level.Possible grammar's productions for registration object's level are:

$R_1,R_3,R_8,R_{17},R_{27},R_{30},R_{41}$ of special formal grammar dialogue 2^{-nd}level formal grammar G_2.

- Eval( ) = "I " if yield conditions: $Q_{2,K}>= \mu_{2,j}$ and $t_{2,k}<=£_{2,j}$,than object's step module M_s ="I" and reserved value is M_c="C" , so reserved value is M_c="C" , and current object's module will be as:$M_c= M_c$ && M_s = "CI1" and proposed next scenario must be selected from n^{-th}level .

Where:

$\mu_{2,j}$, $£_{2,j}$ -constants , $t_{2,k-}$ expired time in range of one step k=1 at 2^{-nd}level .Possible grammar's productionspossible for registration object's level are:

R_1,R_4,R_{10},R_{13}, $R_{17},R_{25},R_{30},R_{40}$ of special formal grammar dialogue n-th level formal grammar G_n.

Similarly this will be repeated at next 2-nd(for k=2),3-d,…n-th stepsand will construct a step and current object's modules, so current object's modules reflect object's activity level at all different level's steps (history of object's activities evaluation). This approach eliminates useless repetition of successfully passed step, so reduces spend time andincrease dialogue efficiency factor.Each Ms Value must be followed by step number

(Here K=2) and at any level.

Example:

Suppose we have the following initial conditions: M_c ="C"(current level is 2^{-nd}), K=1 we can recognizing the following situation:

a) Production rule $\xi_1S_2\xi_2 \longrightarrow \xi_1J_1S_3\xi_2$ has it's unique conditional using expression:

$Q_{2,K}> \mu_{2,1}$&& $t_{2,k}<£_{2,1}$ ($\mu_{2,1}$, $£_{2,1}$ –integer constants), if it was yield, then M_s ="J_1", so $M_c = M_c$&& M_s ,then M_c ="CJ_1" ,and dialogue will be continue at 3^{-d} level, step k="1".

b) Production rule $\xi_1S_2\xi_2 \longrightarrow \xi_1S_1\xi_2$ has it's unique conditional using expression:

$Q_{2,K}< \mu_{2,1}$&&$t_{2,k}>£_{2,1}$

If it was yield, then M_s ="G_1",so $M_c = M_c$&& M_s, thenM_c ="CG_1" and dialogue will be continue at 1^{-st} level, step k="1".

c) Production rule $\xi_1S_2\xi_2 \longrightarrow \xi_1S_2S\xi_2$ has it's unique conditional using expression:

$Q_{2,K}= \mu_{2,1}$&& $t_{2,1}=£_{2,1}$, if it was yield, then M_s="I_1"and$M_c= M_c$&&M_s ,Where:

M_c ="CI_1",so dialogue will be continue at 2^{-nd} level, step k="2"(next step).

By the same way other productions rules will be use for updating organized object's step module "M_s" and object's general module "M_c" according to object's activities at passed steps.

Discussions of proposed approach:

Suppose last object's activities evaluated at step k=1 as M_c="BE_1",so next dialogue scenario must select from 2-nd level , at 1-st step .Continue dialogue on 2-nd level, if object's

activities evaluated as bad ,than next dialogue scenario must select from 1-st level at 2-nd step Eval( ) = " W_1",and M_c="BE_1W_1", next dialogue scenario step must select from1-st level , at 2-nd step (k=2) , as you see there is no repetition of successfully passed step and construct step module as:

M_S= M_S && K,it meansM_S="E2" orM_S="F2".

Below aredemonstrated some possible valuesof current object's modules M_c at three different levels (suppose we have three dialogue levels J=3):

a) Non-Context-Free Formal Grammar symbolic string G_1 are:

B \\visit 1-st level

BF1 \\= (step 1)

BF1F2 \\ (steps: 1, 2)

BF1F2F3 \\= (steps:1,2,and 3)

BF1F2F3E4W5 \\ visit 1-stlevel (steps:1,2,3) then 2-ndlevel (step 4), 1-st level step 5).

BF1F2F3E4W5F6 \\ visit 1-st level (steps: 1,2,3) then 2-nd level (steps: 4,5), 1-st level (step:6).

BF1F2F3E4W5 E6F7\\ visit 1-st level (steps: 1,2,3) then 2-ndlevel (steps: 4,5), 1-st level(step: 6),2-nd (step 6),1-st (step: 7).

BF1E2J2M3I4W4 \\ visit 1-stlevel (step:1) then 2-ndlevel (step 2), 3-dlevel (step 3), 2-ndlevel(step 4), 1-st (step 4).

b) Non-Context-Free Formal Grammar symbolic string G_2 are:

C \\visit 2-ndlevel

CI1\\ visit2-ndlevel == (step 1).

CI1I2\\ visit 2-nd level == (steps: 1,2).

CI1I2I3 \\ visit 2-nd level == (steps:1,2,3).

CI1J2L3I3 \\ visit 2-ndlevel (step: 1) then, 3-dlevel (step 2), 2-nd level (step 3).

CI1I2J3L4\\ visit 2-ndlevel (step: 1,2) then 3-dlevel (step 3), 2-nd level (step 4).

CJ1L2W2E2W3E3 \\ visit 3-dlevel (step: 1), 2-ndlevel (step: 2), then 1-st level (step 2), 2-ndlevel (step: 2), 1-st level (step 3), 2-ndlevel (step 3).

c) Non-Context-Free Formal Grammar symbolic string G_2 are:

D \\visit 3-d level.

DM1\\= = (step 1).

DM1M2\\= = (steps:1,2).

DM1M2L3J3\\ visit 3-d level(steps: 1,2) then 2-ndlevel (step:3).

DM1M2L3J3M3 \\ visit 3-d level (steps: 1,2) then 2-nd level(step:3), 3-d level(step: 3).

DM1M2L3J3M4\\ visit 3-d level(steps: 1,2,3) then 2-nd level(step:3), 3-d level (Step: 3,4).

DM1M2M3L4W4E4J4M4 \\ visit 3-d level(steps: 1,2,3,4) then 2-ndlevel (step: 4), 1-st (step: 4), 2-ndlevel (step: 3), 3-d level (step: 4).

For demonstrating the effect of using proposed approach,suppose we have the following conditions:

Numberofdialogue levels:5.

Maximumnumber of repetition execution at selected vertex:1.

Startvertex of passed path: v_1, end vertex of passed path: v_{11}.

Maximum passed path of vertices is: v_1 - v_2 - v_3 - v_4 - v_5 – v_8 – v_9 - v_{10} – v_{11}.

The value of step will be increase only in condition if the dialogue scenario continue at the same level otherwise step value no change .lets calculate the possible used number

production rules for recording or recognizing object's activity with execution repetition at selected vertex denoted by N_1 and the used number of production rules without execution repetition N2 and find the gain which definite as follows: gain= N_1- N_2

Regarding to the place of repetition process (see fig.2) we can recognizing the tow conditions:

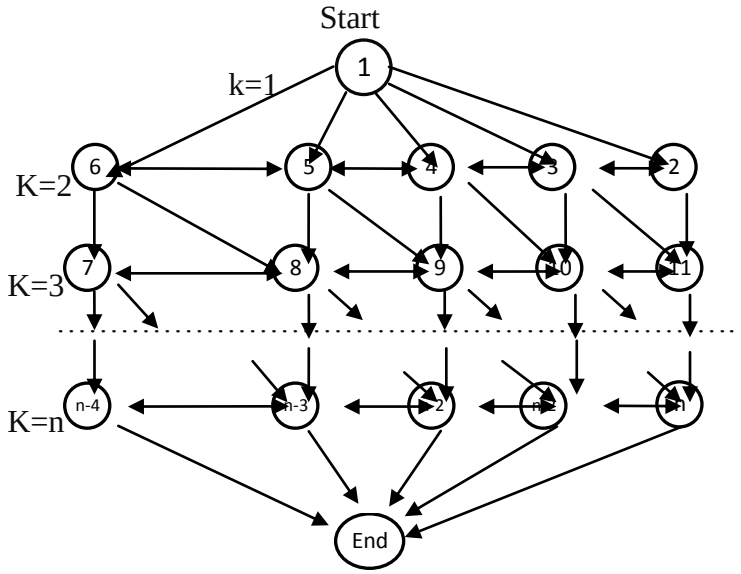

Fig.2.Oriented automated dialogue graph

a) The repetition process occurs only at current selected vertex (v_3, v_4, v_5).The result can arrange in the following table (1)

Table1: The number of N_1, N2 with or without repetition at current vertex.

Items	vertices			
	v_3	v_4	v_5	V_6
N_1(With repetition)	6	8	10	12
N_2(No repetition)	3	5	7	9
Gain= N1- N2	3	3	3	3

Using table (1) was constructed the relationship between all parameters (N1, N2, Gain) illustrated on Fig. (3)

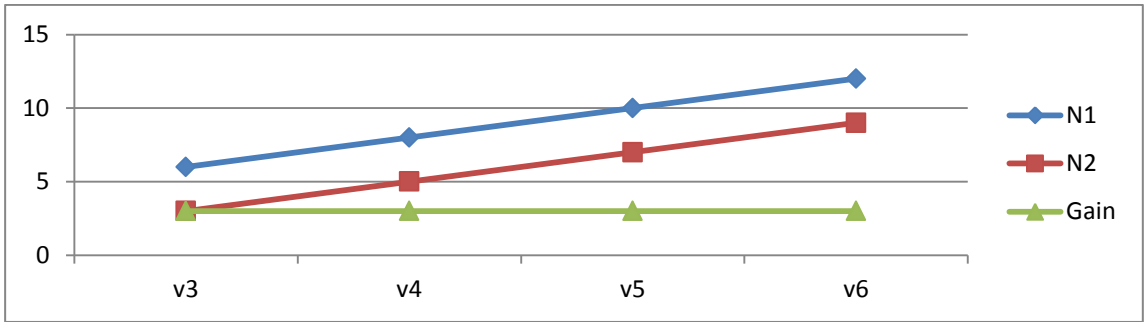

Fig.(3).Repetition occurred at current selected vertex

b) The repetition process occurs at previous and current selected vertex (v_3, v_4, v_5)
The result can arrange in the following table (2):

Table2: The number of production rules N1 and N_2 .

Items	vertices		
	V_4	V_5	V_6
N_1(With repetition)	10	14	18
N_2 (No repetition)	5	7	9
Gain= N1- N2	5	7	9

Using table (2)was constructed the relationship between all parameters (N1,N2,Gain) illustrated on Fig.(4)

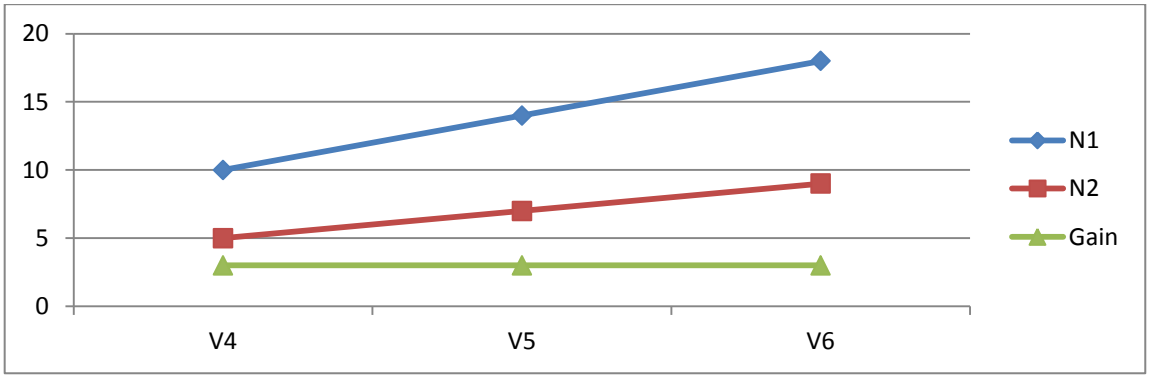

Fig.(4).Repetition occurred at previous and current selected vertex

Results and conclusions:

1-Each formal grammar's productionpermits registering and recognizing object's activitieslevel at different dialogue level's steps and generates a symbolic string followed by the current generated step's numbers.Any production can be used at different steps(positions),so eliminates the necessity to have large formal grammar's production which permits to minimize the necessary spent time for registering and recognizing object's activities.

2- Stochastic linguistic approach permits to use different symbols for the same object's level condition at different for registration and recognizing object's levelLevels, so it's easy to built a very complex multi-level dynamic dialogue automated control system.

3-Issuingorders for transferring object's dialogue between and through dialogue levels using stochastic linguistic approach permits to design high quality and good performance complex multi-level dynamic dialogue automated control system by eliminating useless repetition object's successfully passed dialogue steps and deleting random transferring object's dialogue, so minimizes spent dialogue's time at different steps ,which leads to buildhigh efficiency automated dialogue.

4- Dividing dialogue data into separated data portions for separated steps support dynamic dialogue avoidingdemonstration of complex ideasdialogue between and through steps of dialogue level.

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