



ЕВРОПЕЙСКИ СЪЮЗ
ЕВРОПЕЙСКИ ФОНД ЗА
РЕГИОНАЛНО РАЗВИТИЕ



- » Проект BG05M2OP001-1.001-0003:
„Център за върхови постижения по
Информатика и информационни и
комуникационни технологии“
- » Станимир Стоянов

Разработване на диагностични
услуги в системи за интелигентно
селско стопанство ➤



Virtual
physical space

Цел на проект № 10.11 (Задача „Интегрирана интелигентна среда“)

Интегрираната интелигентна среда:

- ✓ Разработвана като **кибер-физическо социално пространство**;
- ✓ Осигуряваща **интеграция** на виртуалния и физическия светове;
- ✓ Улесняваща **взаимодействието** между различни софтуерни компоненти – интелигентни агенти, услуги, микро-услуги;
- ✓ Конструирана като **IoT** екосистема;
- ✓ Адаптируема за **различни приложни области** – **интелигентно земеделие**, дигитализация на българското културно-историческо наследство, интелигентни градове, интелигентна околна среда, интелигентна медицина.



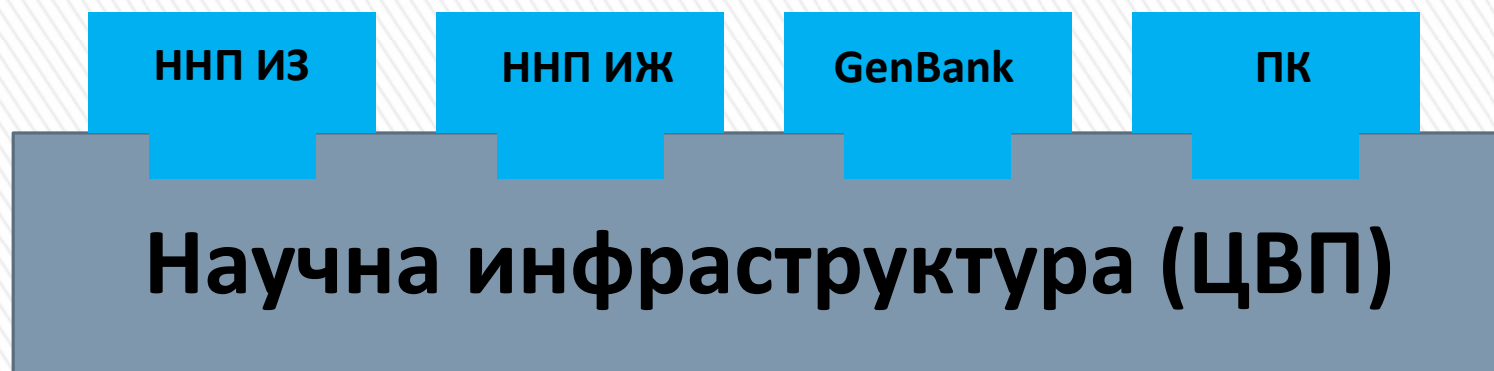
Наш подход

- » Изграждане на хардуерна и комуникационна инфраструктура на центъра
 - > Три нива – локално, регионално и централно
 - > В момента се изграждат локалното и регионалното
- » Разработване на технологичната, софтуерната и информационната инфраструктура
- » Интелигентни услуги - напр., за интелигентно земеделие - в момента диагностични услуги
 - > Идентификация и локализация на аномалии при вегетацията на земеделски култури
 - > Ранно откриване на заболявания при земеделски култури
 - > Диагностика на отравяния при селскостопанските животни

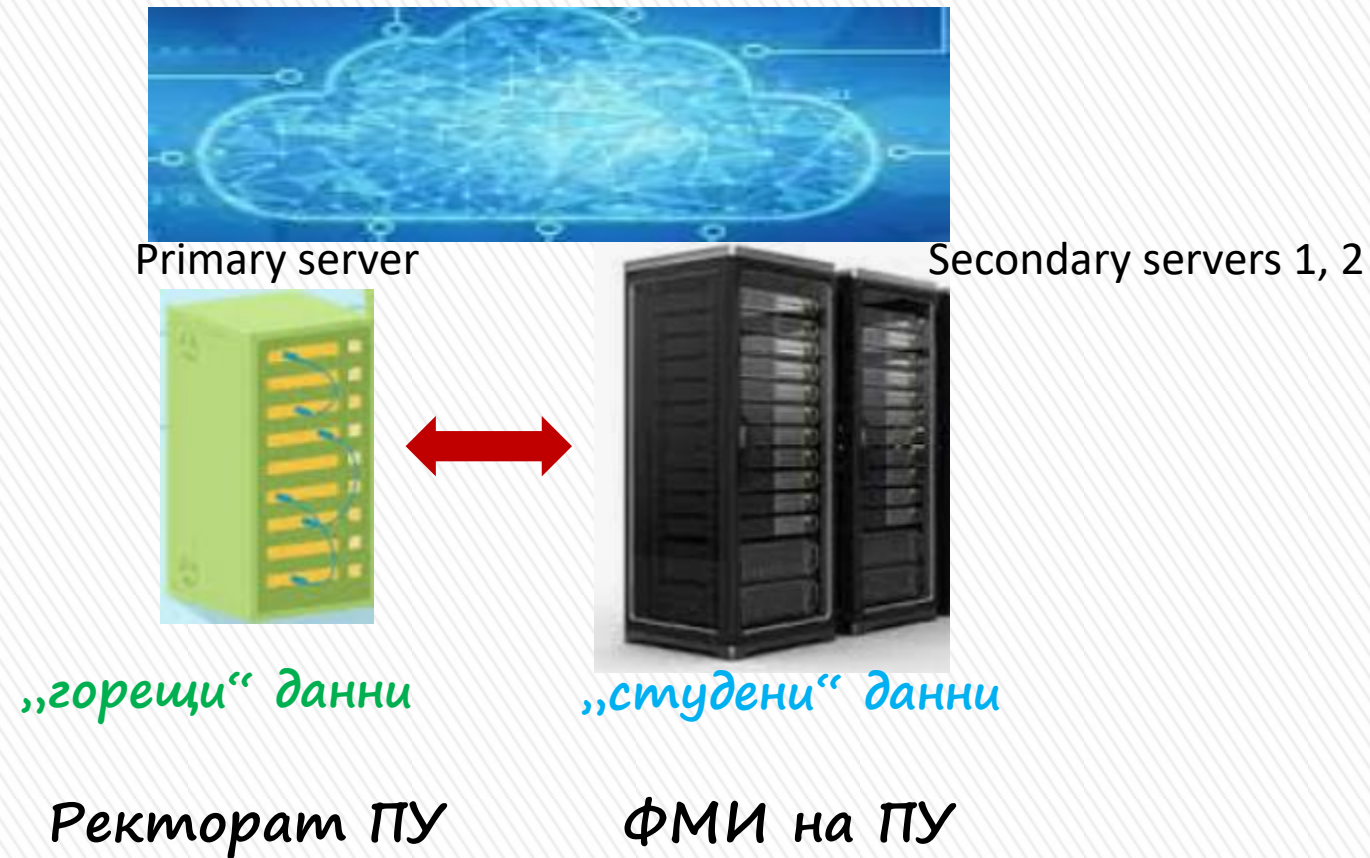


Регионален център за данни

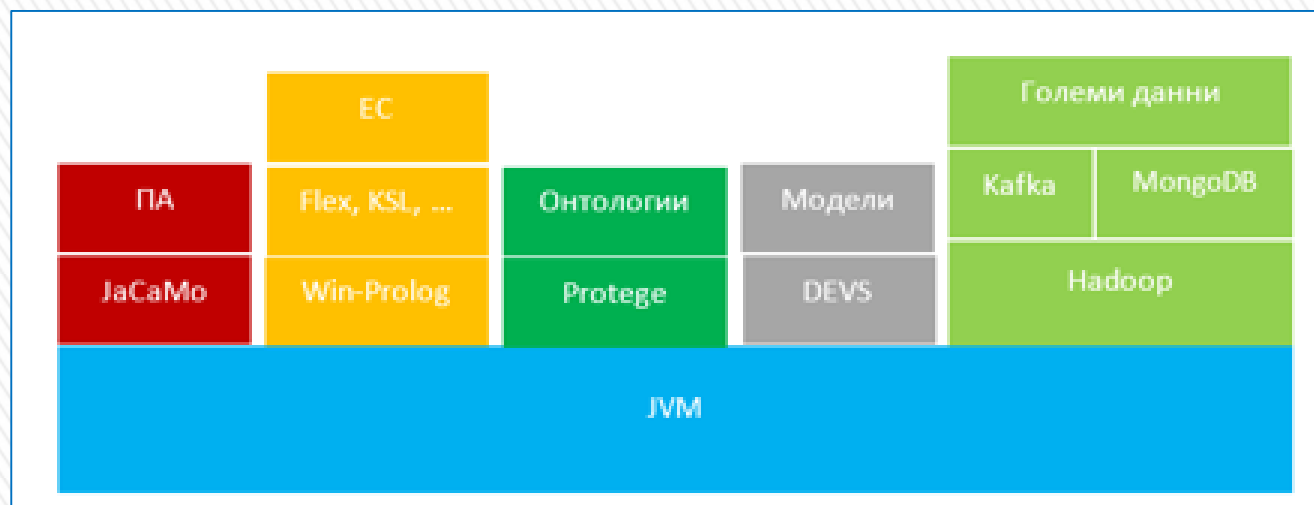
Проекти



Сървърната конфигурация - напълно завършена



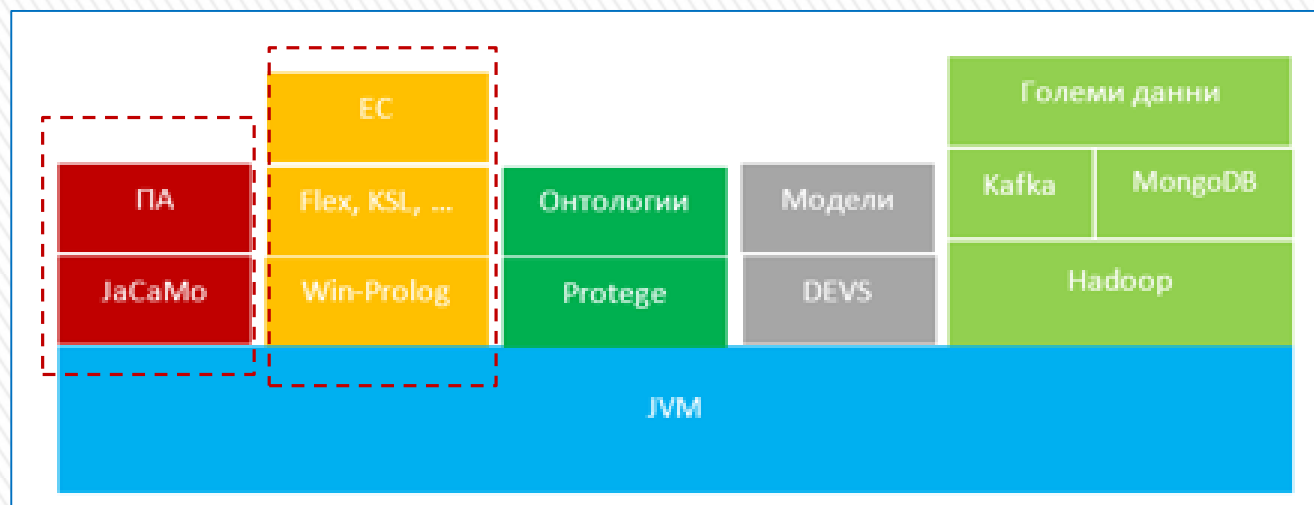
Интегрирана технология



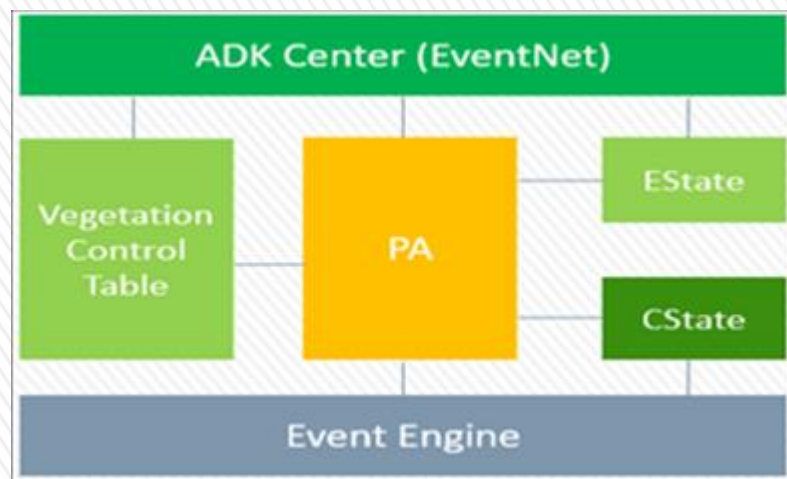
Диагностични услуги за интелигентно земеделие

- » Едни от най-съществените задачи, които трябва да решава интелигентното земеделие могат да бъдат причислени към диагностиката
- » Три диагностични задачи:
 - > Своевременно идентифициране и локализиране на аномалии във вегетацията на земеделски култури – като персонален асистент
 - > Ранно откриване на възможни заболявания при земеделските култури – като експертна система
 - > Диагностика на възможни отравяния при селскостопанските животни - като експертна система

Технологии за диагностичните услуги



Персонален асистент



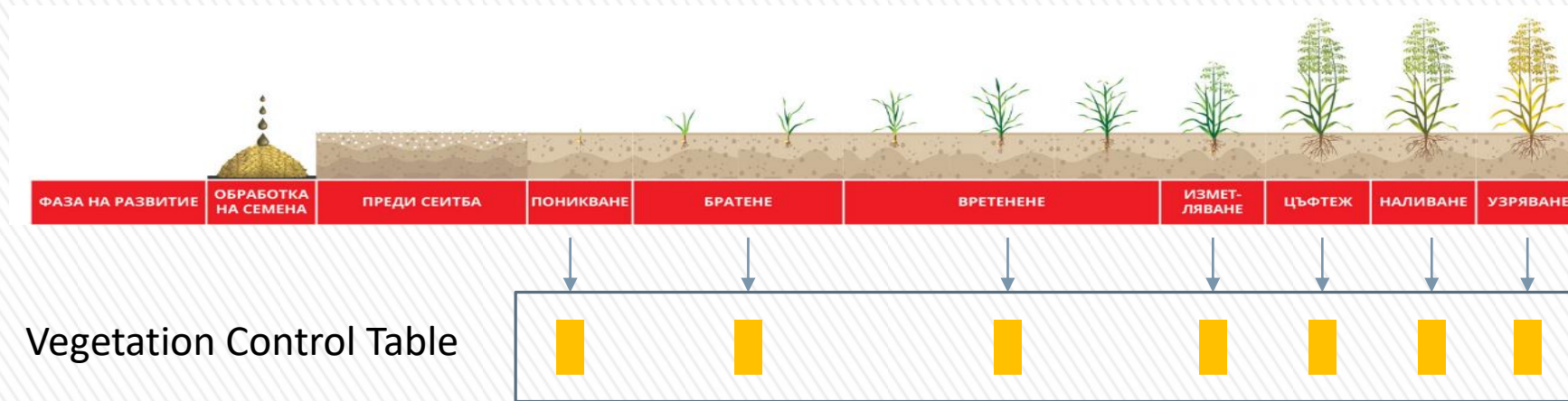
Основна функция: идентификация и локализация на аномалии във вегетацията на земеделските култури

Разработен като интелигентен BDI-агент с технологията JaCaMo

Многокомпонентна околна среда, включваща:

- ✓ Vegetation Control Table
- ✓ EState
- ✓ CState
- ✓ ADK Center
- ✓ Event Engine

Жизнен цикъл на персоналния асистент



Планови събития

JaCaMo код

```
/* Initial goals */

+!monitoring_planned_events
  <- !!track_heat_units; !track_wheat_phases.

/* Plans */

+!track_heat_units
  <- .time(H,M,S) ; H=0 ; ?temperature(X0) ; X0=Max ; X0=Min ; .wait(3600000) ; ?temperature(X1) ;
  if (X1>X0) { X1=Max; } elif (X1<X0) { X1=Min; } else { true; } .wait(3600000) ; ?temperature(X2) ;
  if (X2>Max) { X2=Max; } elif (X2<Min) { X2=Min; } else { true; } .wait(3600000) ; ?temperature(X3) ;
  if (X3>Max) { X3=Max; } elif (X3<Min) { X3=Min; } else { true; } .wait(3600000) ; ?temperature(X4) ;
  if (X4>Max) { X4=Max; } elif (X4<Min) { X4=Min; } else { true; } .wait(3600000) ; ?temperature(X5) ;
  if (X5>Max) { X5=Max; } elif (X5<Min) { X5=Min; } else { true; } .wait(3600000) ; ?temperature(X6) ;
  if (X6>Max) { X6=Max; } elif (X6<Min) { X6=Min; } else { true; } .wait(3600000) ; ?temperature(X7) ;
  if (X7>Max) { X7=Max; } elif (X7<Min) { X7=Min; } else { true; } .wait(3600000) ; ?temperature(X8) ;
  if (X8>Max) { X8=Max; } elif (X8<Min) { X8=Min; } else { true; } .wait(3600000) ; ?temperature(X9) ;
  if (X9>Max) { X9=Max; } elif (X9<Min) { X9=Min; } else { true; } .wait(3600000) ; ?temperature(X10) ;
  if (X10>Max) { X10=Max; } elif (X10<Min) { X10=Min; } else { true; } .wait(3600000) ; ?temperature(X11) ;
  if (X11>Max) { X11=Max; } elif (X11<Min) { X11=Min; } else { true; } .wait(3600000) ; ?temperature(X12) ;
  if (X12>Max) { X12=Max; } elif (X12<Min) { X12=Min; } else { true; } .wait(3600000) ; ?temperature(X13) ;
  if (X13>Max) { X13=Max; } elif (X13<Min) { X13=Min; } else { true; } .wait(3600000) ; ?temperature(X14) ;
  if (X14>Max) { X14=Max; } elif (X14<Min) { X14=Min; } else { true; } .wait(3600000) ; ?temperature(X15) ;
  if (X15>Max) { X15=Max; } elif (X15<Min) { X15=Min; } else { true; } .wait(3600000) ; ?temperature(X16) ;
  if (X16>Max) { X16=Max; } elif (X16<Min) { X16=Min; } else { true; } .wait(3600000) ; ?temperature(X17) ;
  if (X17>Max) { X17=Max; } elif (X17<Min) { X17=Min; } else { true; } .wait(3600000) ; ?temperature(X18) ;
  if (X18>Max) { X18=Max; } elif (X18<Min) { X18=Min; } else { true; } .wait(3600000) ; ?temperature(X19) ;
  if (X19>Max) { X19=Max; } elif (X19<Min) { X19=Min; } else { true; } .wait(3600000) ; ?temperature(X20) ;
  if (X20>Max) { X20=Max; } elif (X20<Min) { X20=Min; } else { true; } .wait(3600000) ; ?temperature(X21) ;
  if (X21>Max) { X21=Max; } elif (X21<Min) { X21=Min; } else { true; } .wait(3600000) ; ?temperature(X22) ;
  if (X22>Max) { X22=Max; } elif (X22<Min) { X22=Min; } else { true; } .wait(3600000) ; ?temperature(X23) ;
  if (X23>Max) { X23=Max; } elif (X23<Min) { X23=Min; } else { true; }
  if (Min<0) { Min=0; } else { true; }
  ?heat_units(H) ;
  if (Max>21 & H<200) { Max=21; } else { true; }
  if (Max>35 & H>=200) { Max=35; } else { true; }
  (Max+Min)/2=Y ; +heat_units(Y) ; !track_heat_units.

-!track_heat_units
  <- .wait(3600000) ; !track_heat_units.
```

```
+!track_wheat_phases
  <- ?heat_units(H) ;
  if (H>=0 & H<100) { println("It is assumed that the 'Germination' phase has been reached!"); }
  elif (H>=100 & H<300) { println("It is assumed that the 'Seedling' phase has been reached!"); }
  elif (H>=300 & H<800) { println("It is assumed that the 'Tillering' phase has been reached!"); }
  elif (H>=800 & H<1100) { println("It is assumed that the 'Jointing' phase has been reached!"); }
  elif (H>=1100 & H<1250) { println("It is assumed that the 'Booting' phase has been reached!"); }
  elif (H>=1250 & H<1350) { println("It is assumed that the 'Heading' phase has been reached!"); }
  elif (H>=1350 & H<1600) { println("It is assumed that the 'Flowering' phase has been reached!"); }
  elif (H>=1600 & H<1850) { println("It is assumed that the 'Milk' phase has been reached!"); }
  elif (H>=1850 & H<1950) { println("It is assumed that the 'Dough' phase has been reached!"); }
  elif (H>=1950) { println("It is assumed that the 'Ripening' phase has been reached!"); }
  .drop_intention(track_wheat_phases);
  .wait(86400000); !track_wheat_phases.

+temperature(T) : .date(Y,M,D) & M=9 | M=10 & heat_units(H) & H>=0 & H<100 & T<5
  <- println("Attention, critical temperature in the 'Germination' phase!").

+temperature(T) : .date(Y,M,D) & M=10 | M=11 | M=12 | M=1 | M=2 | M=3 & heat_units(H) & H>=300 & H<800 & T<(-10)
  <- println("Attention, critical temperature in the 'Tillering' phase!").

+temperature(T) : .date(Y,M,D) & M=3 | M=4 | M=5 & heat_units(H) & H>=800 & H<1100 & T<(-3)
  <- println("Attention, critical temperature in the 'Jointing' phase!").

+temperature(T) : .date(Y,M,D) & M=5 & heat_units(H) & H>=1100 & H<1250 & T<(-1)
  <- println("Attention, critical temperature in the 'Booting' phase!").

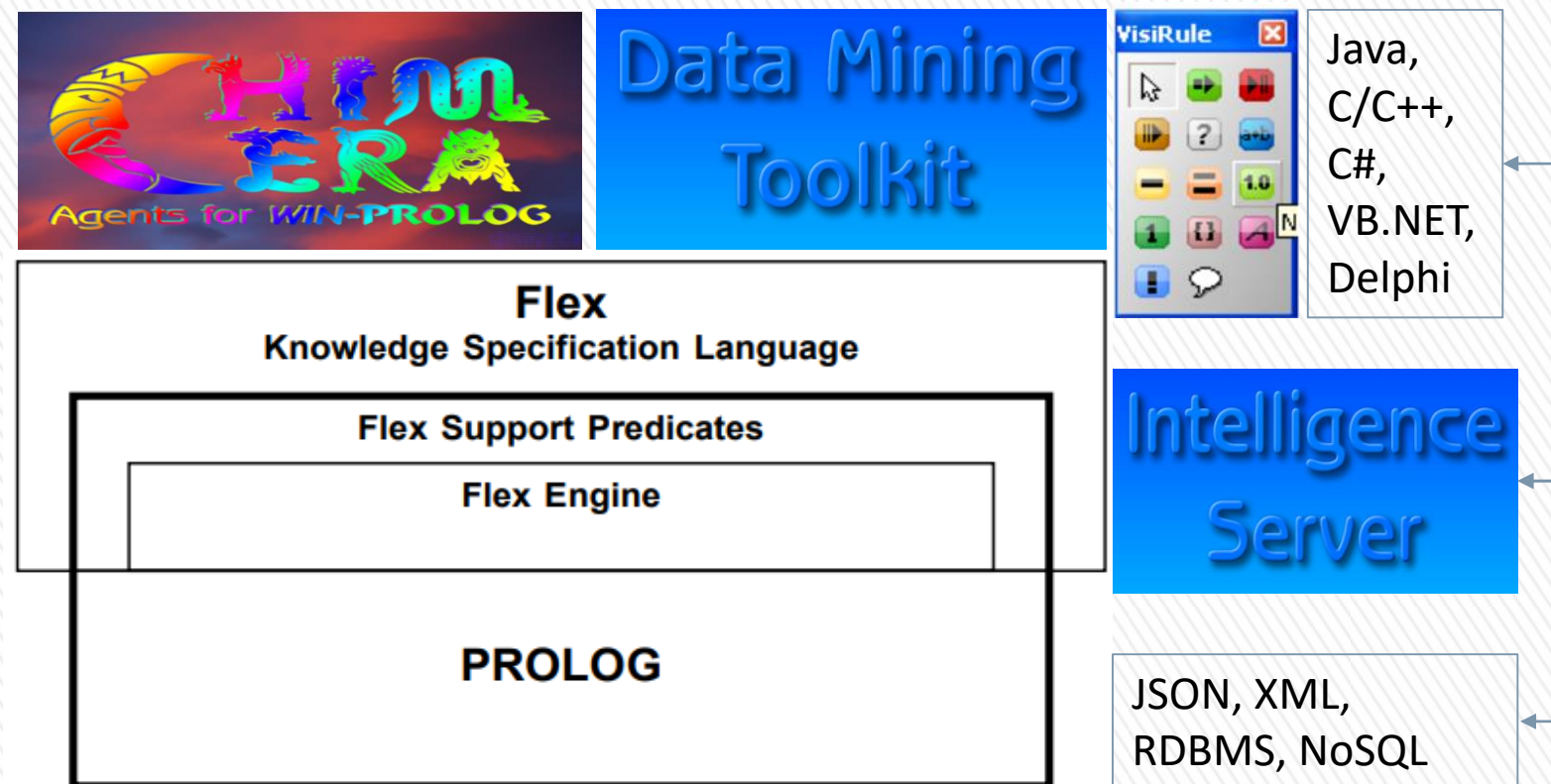
+temperature(T) : .date(Y,M,D) & M=5 | M=6 & heat_units(H) & H>=1250 & H<1350 & T<0
  <- println("Attention, critical temperature in the 'Heading' phase!").

+temperature(T) : .date(Y,M,D) & M=6 | M=7 & heat_units(H) & H>=1350 & H<1600 & T<0
  <- println("Attention, critical temperature in the 'Flowering' phase!").

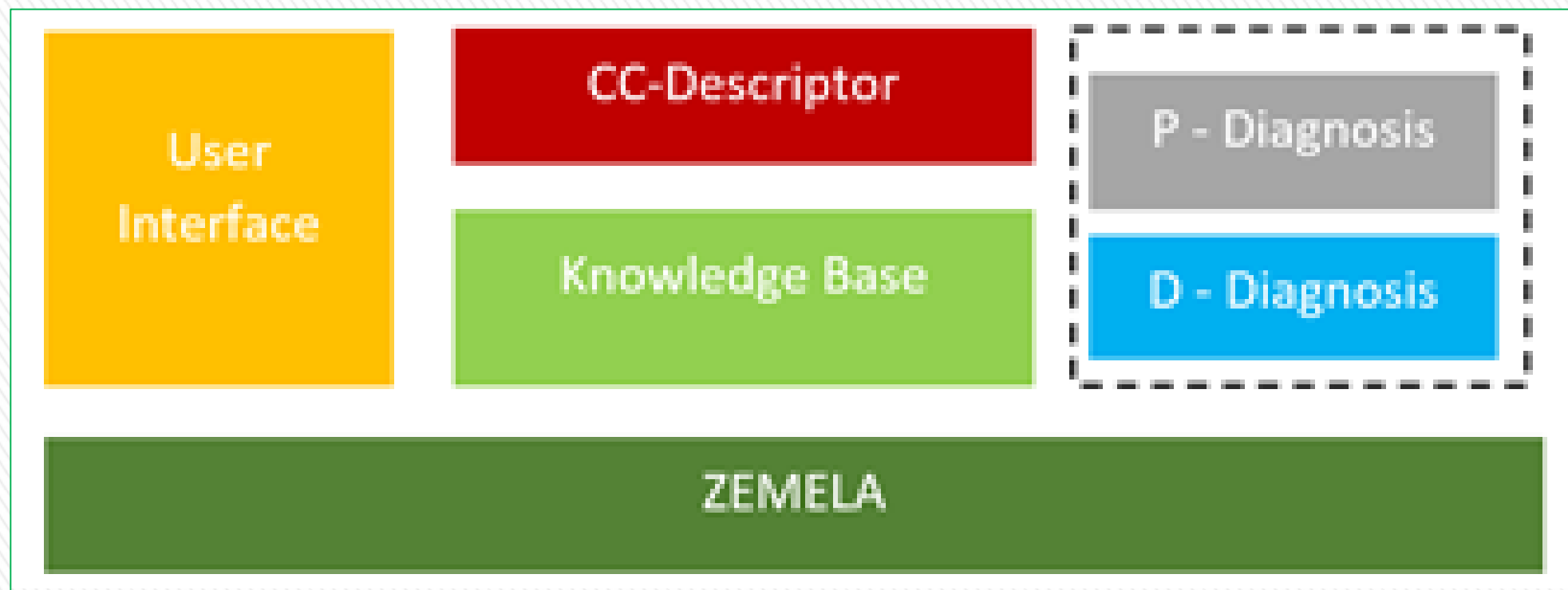
+temperature(T) : .date(Y,M,D) & M=6 | M=7 & heat_units(H) & H>=1600 & H<1850 & T<(-1)
  <- println("Attention, critical temperature in the 'Milk development' phase!").

+temperature(T) : .date(Y,M,D) & M=6 | M=7 & heat_units(H) & H>=1850 & H<1950 & T<(-1)
  <- println("Attention, critical temperature in the 'Dough development' phase!").
```

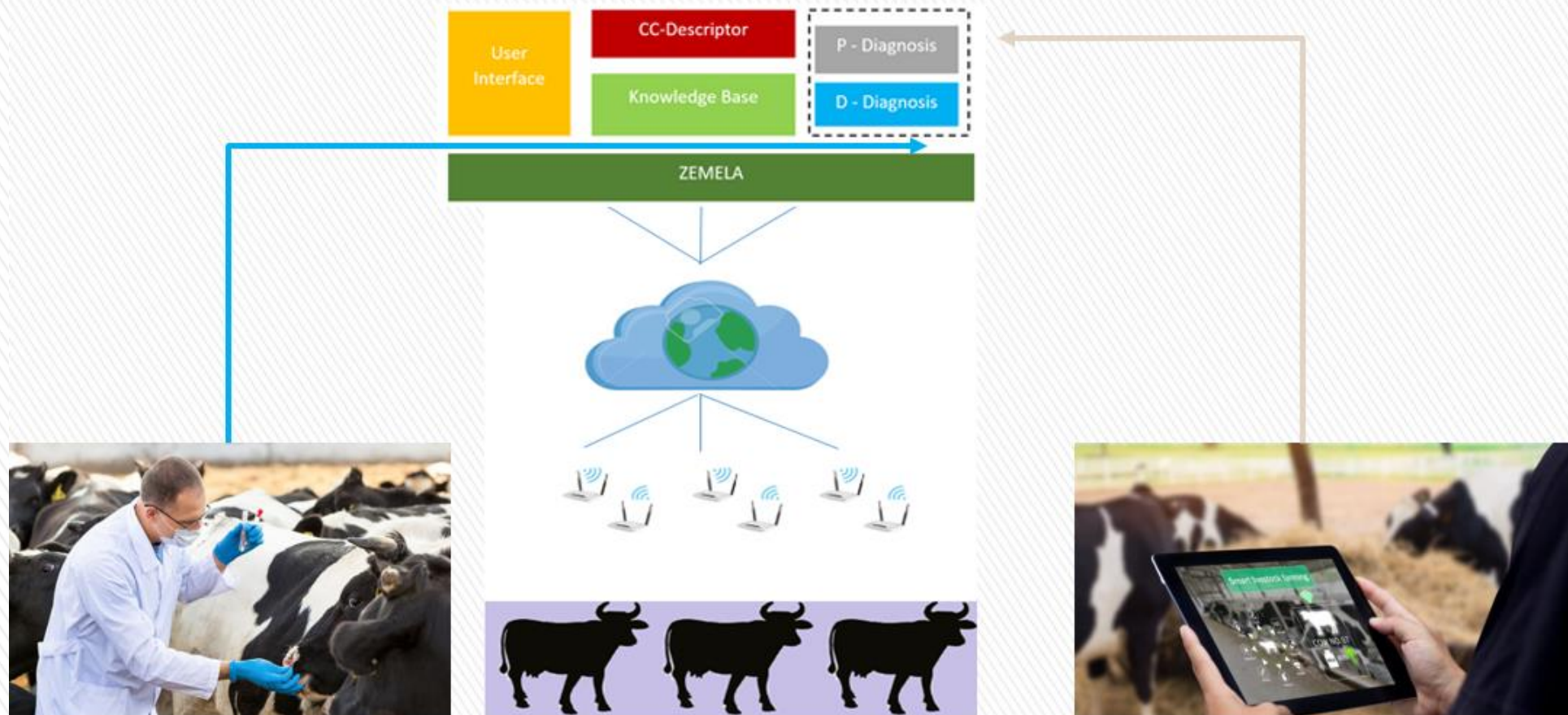

KSL интегрирана технология за двете диагностични услуги



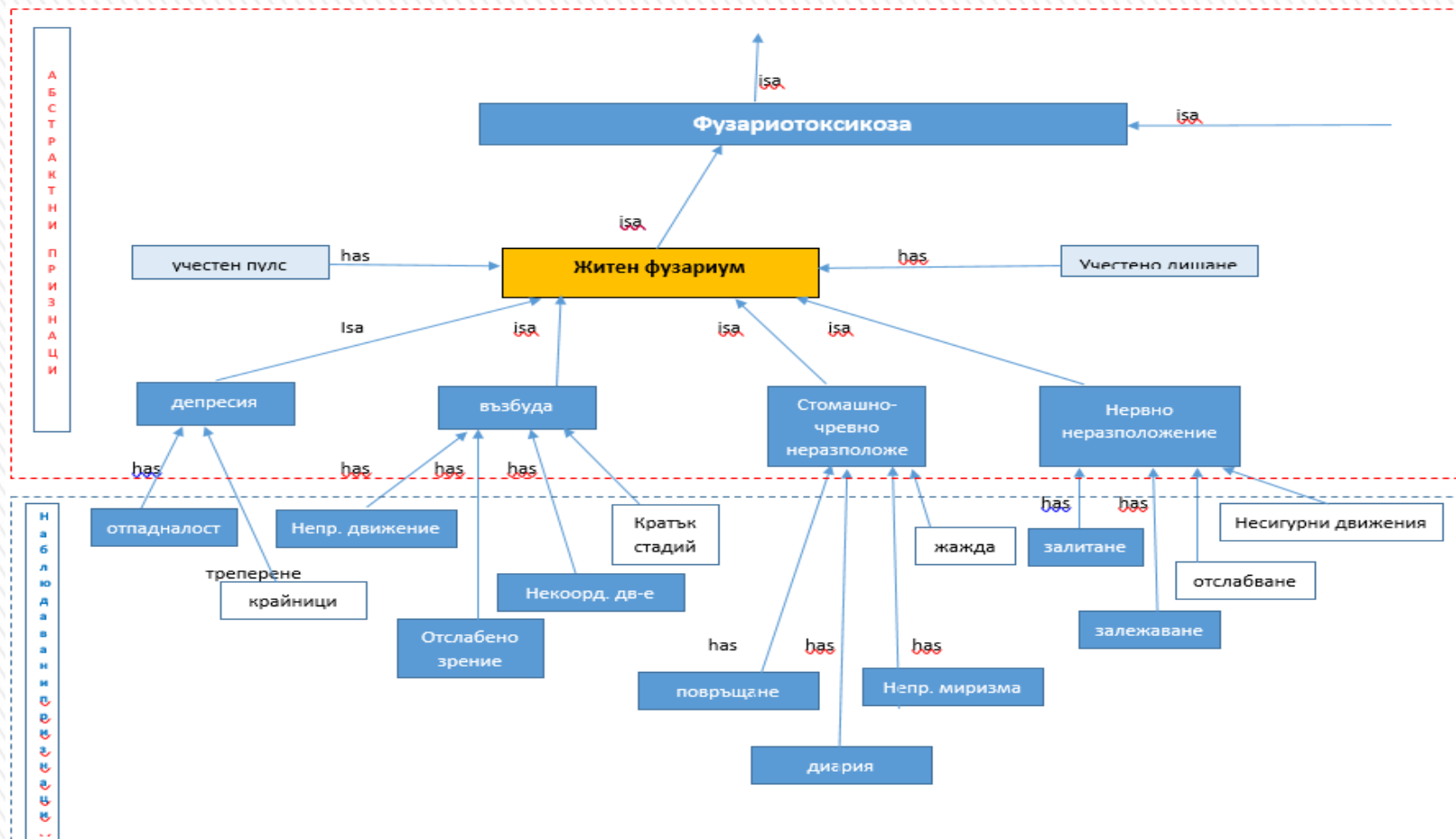
Референтна архитектура на диагностична експертна система



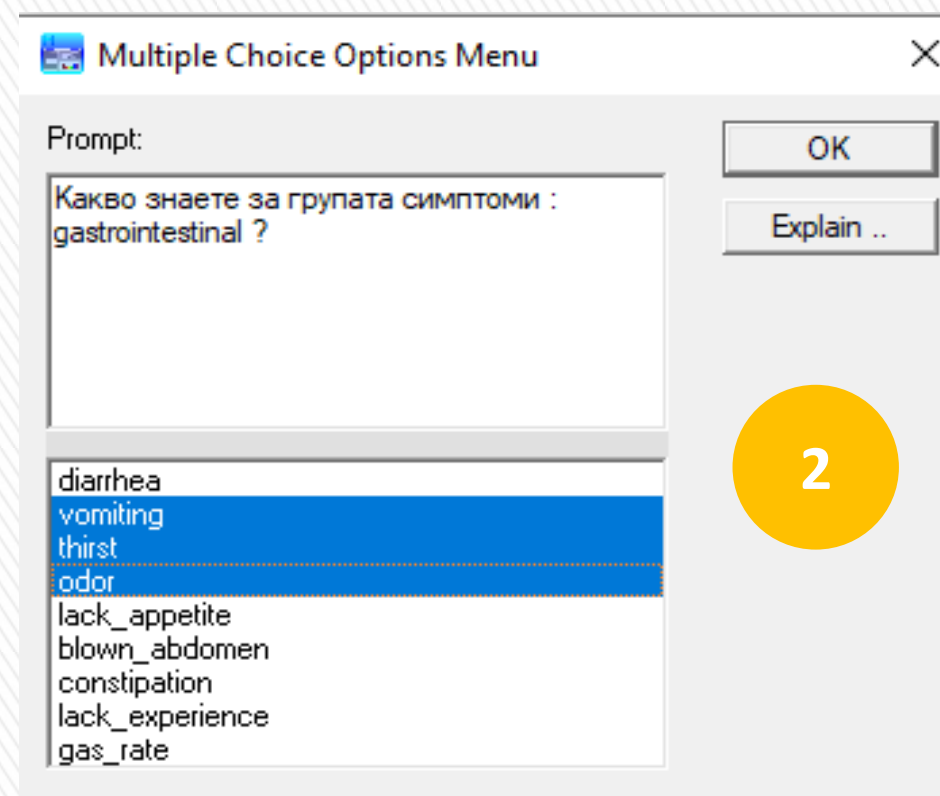
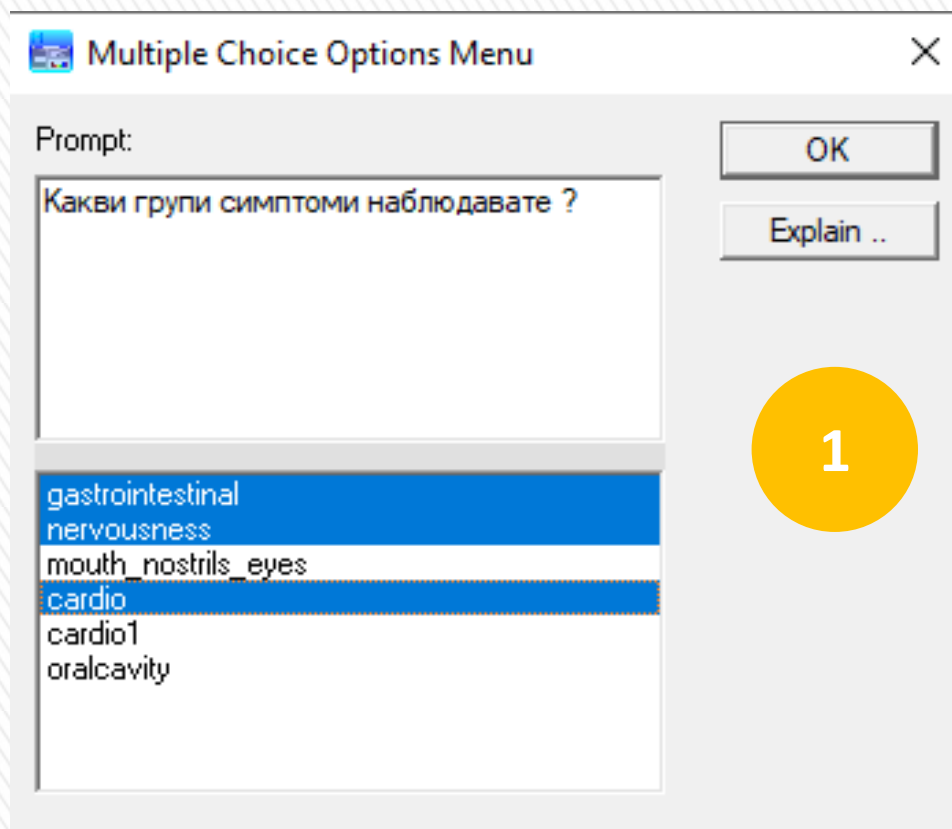
Обща схема на използване на ЕС за диагностика на отравяния при крави



Сегмент от базата знания на експертната система



| ?- run(pd) . ← Демо сесия на експертната система



Multiple Choice Options Menu [X]

Prompt:

Какво знаете за групата симптоми :
nervousness ?

OK

Explain ..

staggering
lying_down
unsteady_movements
paralysis_limbs
trouble

3

Single Choice Options Menu [X]

Prompt:

Какво знаете за групата симптоми : cardio
?

OK

Explain ..

rapid_pulse
rapid_breathing

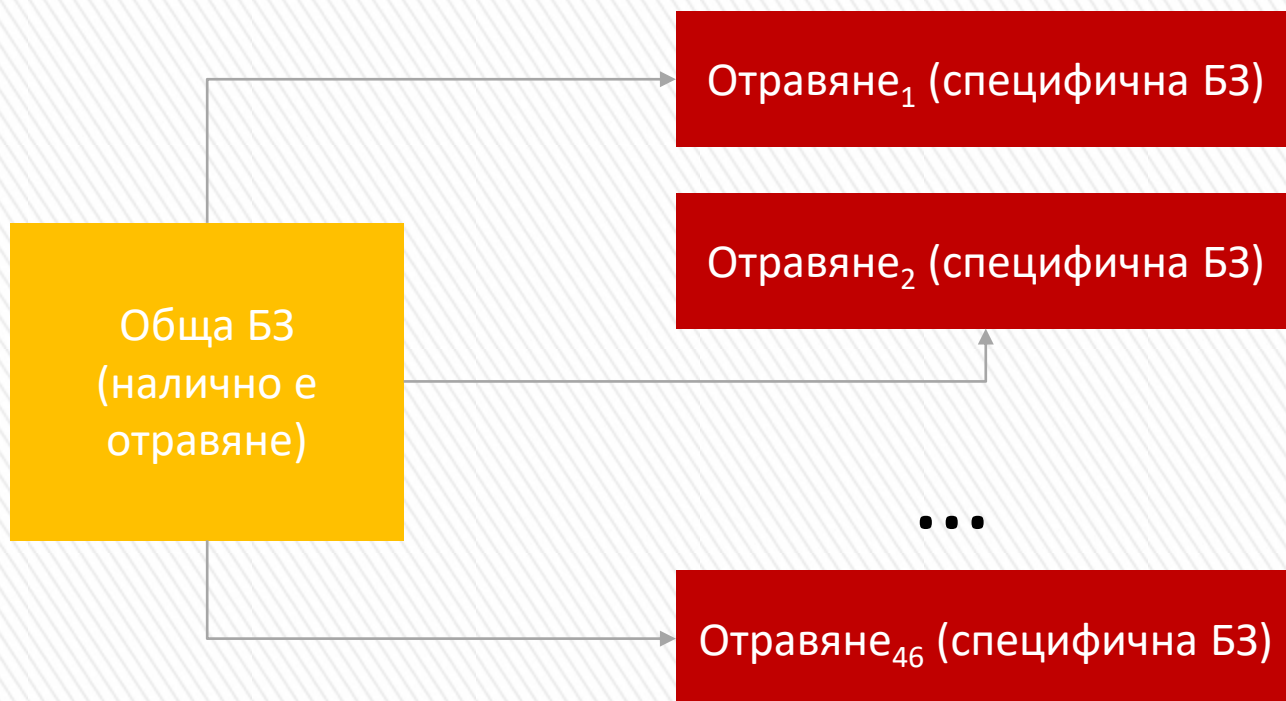
4

```
| ?- run(pd) .  
FUSARIUM GRAMINEARUM  
yes
```

```
| ?- run(pd) .  
UNTINAGINALES  
yes
```


Разширяване на БЗ и усъвършенстване на архитектурата

И за различни животни



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Go

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Special Issue "Virtual-Physical Architectures and Applications"

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A special issue of *Information* (ISSN 2079-2489). This special issue belongs to the section "Information Applications".

Deadline for manuscript submissions: **1 November 2022**

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Special Issue Editor

Prof. Dr. Stanimir Stoyanov

E-Mail Website ScIProfiles

Guest Editor

1. Institute of Information and Communication Technologies, Bulgarian Academy of Science, 1113 Sofia, Bulgaria

2. Department of Computer Systems, Plovdiv University "Paisii Hilendarski", 4000 Plovdiv, Bulgaria

Interests: AI, intelligent agents, virtual-physical spaces, semantic modeling, smart agriculture

Special Issues, Collections and Topics in MDPI Journals



Special Issue Information

Dear Colleagues,

Providing information systems with the ability to understand, perceive, and take into account the surrounding physical world opens up new broader perspectives for their widespread and effective use. AI, enhanced with technologies such as IoT, Block chain, Cyber security, and Big Data, is a suitable paradigm for developing infrastructures and systems that integrate virtual and the physical worlds.

The main challenge for the implementation of virtual-physical systems is the virtualization of physical things. The components of such systems are usually autonomous, proactive, reactive, and social, and they are deployed at the edge, fog, and cloud levels, providing opportunities for global decision-making in the virtual world based on information received from the physical world. At the same time, "lowering" the intelligence of systems down to the physical world provides an opportunity to make local decisions without the need for additional traffic in the communication network.

For many applications, taking into account the state of the physical world around us is important. This is especially true for domains such as agriculture and the environment. In recent years, enhanced AI has increasingly been used to monitor crop vegetation, forecast yields, detect diseases, record soil content, effectively load the environment with pesticides, and use water resources efficiently. Crop monitoring data automatically collected by sensors or satellites can be processed continuously by AI applications, and, in the event of anomaly detection, recommend immediate action to address these issues.

Therefore, the purpose of this Special Issue is to present the latest developments in virtual-physical architectures and its applications mainly for (but not limited to) smart agriculture. Investigators in the field are invited to contribute with their original, unpublished works. Both research and review papers are welcome.

Prof. Dr. Stanimir Stoyanov

Guest Editor

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Special Issue Editors

Dr. Stanimir Stoyanov

E-Mail Website

Guest Editor

1. Intelligent Systems Department, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria

2. Computer Systems Department, Plovdiv University "Paisii Hilendarski", 4000 Plovdiv, Bulgaria

Interests: AI, multi-agent systems, intelligent agents, virtual-physical spaces, semantic modeling, smart agriculture

Special Issues, Collections and Topics in MDPI Journals

Dr. Lyubka Doukova

E-Mail Website

Guest Editor

Intelligent Systems Department, Institute of Information and Communication Technologies, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria

Interests: AI, multi-agent systems, intelligent systems, radar technologies, process control, smart agriculture

Special Issue Information

Dear Colleagues,

Systems exposing intelligent behavior are becoming increasingly relevant and present in our daily lives. Building such systems is a huge challenge. However, the integration of various concepts, technologies, and solutions can contribute to the solution. Intelligent agents are autonomous components that can recognize and influence the environment in which they operate. Furthermore, intelligent agents can initiate certain actions to achieve a specific goal. Usually, societies of agents work together as multi-agent systems, in such cases, issues such as cooperation, negotiation, and joint implementation of plans are at the forefront of attention. Agent-oriented approaches are suitable for developing systems that take dynamic changes in the environment into account. However, they are not appropriate components for implementing functionality (business logic) in applications.

Services are components that implement functionality. One such type of special service is semantic web services. In client-server architectures, semantic web services (such as conventional web services) fulfill the role of the server-end of machine-machine interaction through the world-wide web. At the same time, semantic web services are components of the semantic web, because they utilize markup, which makes data machine-readable.

The development of a third prospective aspect, which deals with the intelligent structuring of data as semantic models (ontologies) to obtain powerful tools for developing truly intelligent systems, is an ongoing project.

Therefore, this Special Issue will present the latest developments in architectures and platforms integrating intelligent agents,

Онлайн конференция, 01.12.2022

19



Благодаря за вниманието!