

Leveraging ICT for Mushroom

Research and Farming

Dr. Sudeep Marwaha,
Sr. Scientist,

sudeep@iasri.res.in

Division of Computer Applications,
Indian Agricultural Statistics Research Institute

Introduction

- **Information communication technology (ICT) is a contemporary term that describes the combination of computer technology (hardware and software) with telecommunications technology (data, image, and voice networks).**
- **It empowers both people and machines with information, which is transformed into knowledge and intelligence.**
- **Appropriate use of the knowledge by both people and machines contributes to sustainable development.**
- **Informed and empowered people know their role as citizens in an environmentally sustainable society.**
- **Empowered machines have the knowledge to minimize energy and material use, wastes, and**

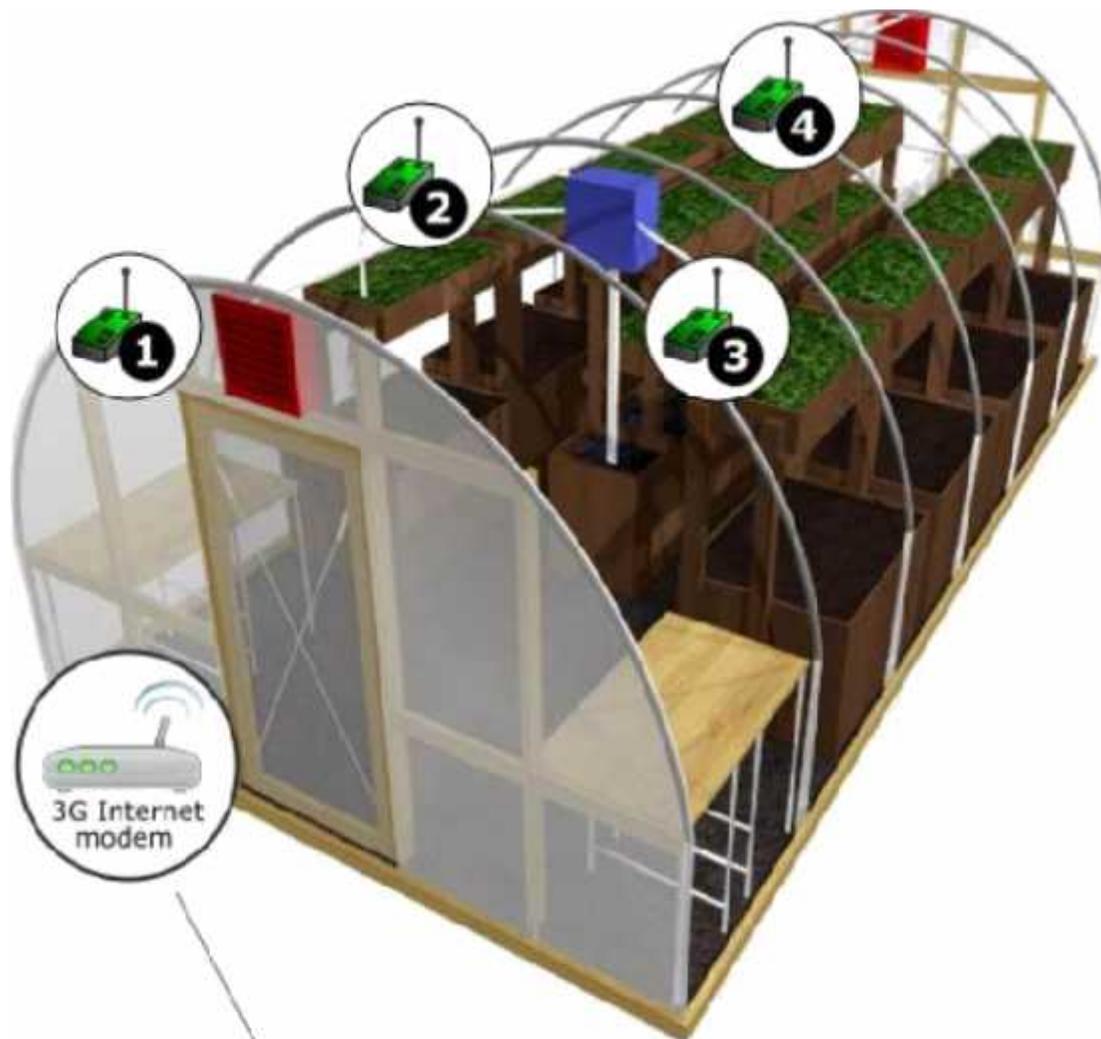
pollutants.

Introduction

- **Internet facilitates people from across the globe to cooperate and perform various activities of human life and agriculture is not an exception.**
- **Mushroom being a commercial crop with elite appeal, rich source of nutrients along with its relatively high immunity to climate change, and draught puts it in better place for harnessing potential of ICT revolution than other field crops.**
- **Mushroom researchers and farmers can take leverage of processing, storage, transmission, and sharing of knowledge generated by Directorate of Mushroom Research or other R&D centers existing across the globe without any spatial or temporal constraints.**
- **ICT tools can, not only support mushroom extension or advisory services but can play the role of game changer.**

Demand Driven Research/ Knowledge Flow

- In the current scenario, most of the research/knowledge flow is from top to bottom (scientists to farmers)
- Use of ICT tools it can be changed to demand driven research/knowledge flow for solving problems originating from farmer's field, seeking solutions in real time.
- ICT can also help in organizing farmers and producer groups and facilitate adoption of technologies that promotes sustainable natural resource management practices
- Scenario:
Mushroom climate controlled units can be fitted with interconnected sensors that are connected to Internet and real time information about various parameters can be sent to plantation manager's desk.



Zigbee sensors:

- 1: Power switch sensor to turn On/Off ventilation
- 2: Temperature sensor
- 3: Humidity sensor
- 4: Gas sensor to measure carbon dioxide levels



ICT Assisted Plantation Units (Internet of Things)

- The datacentre interacts with client devices to manage the mushroom farm
- Send real time temperature, humidity, gas level data in the mushroom plantation facility
- Provides data visualization services. Render charts and tables for a better user experience to desktop and mobile devices
- Real time device control. Turn on/off the ventilation from your PC and mobile devices
- Send an alarm (SMS) when the measured levels reach a critical value.
- The system automatically turns On/Off the ventilation when the carbon dioxide level is at a certain level.
- Motion sensors to identify pests and keep them out
- Cameras to send high quality photos
- Programmable actions.....

Virtual Trainings and e-Learning

- **ICT based virtual trainings can enhance the mushroom production and processing skills of more number of farmers in few courses as compared to the number of farmers trained till now by the Directorate.**
- **Many open source e-learning platforms are available such as Moodle, Blackboard etc.**
- **Contents need to be designed carefully and it can be divided into multiple learning objects. These learning objects are small atomic modules of 15-20 minutes duration.**
- **Some of the learning objects can be:**
 - **Pure culture preparation**
 - **Substrate preparation**
 - **Mother spawn preparation**
 - **Commercial spawn preparation**
- **These can be supported with videos, animations, learning games etc.**

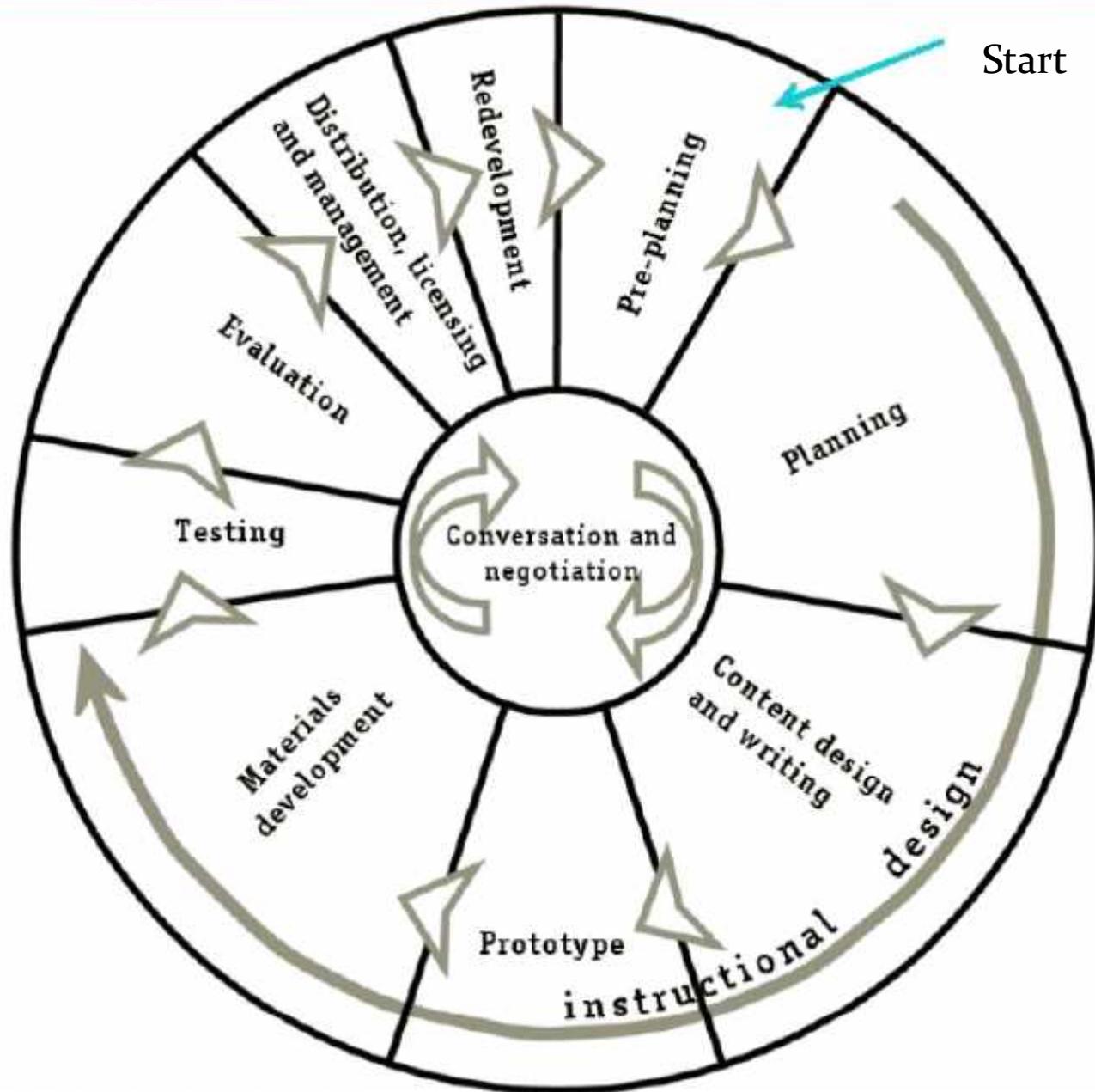
Features of E-learning

- **Universal – apply to all**
- **Convenience**
Through the internet, anyone can log onto an e-learning at any time from anywhere.
key advantage: FLEXIBILITY
- **Independence**
Group learning: Traditional
Independent learning: E-Learning
- **Adaptation**
Can provide adaptive teaching templates, contents to fit each learner's background and needs, whereas in traditional it is for majority.
- **Interaction**
Disadvantage of e- learning: lack of face-to-face interaction with a teacher.



Content Development Cycle

- Deals with the various aspects of the development of e-learning resources in terms of a Content Development Cycle.
- The cyclical representation is used to emphasize that developing learning resources is an
 - Iterative process that builds on existing resources
 - Content needs to be evaluated
 - Results fed back to future activities.



Content Development Cycle

Learning Management Systems (LMS)

- Learning Management Systems (LMS) automate the administration of training through eLearning products.
- The LMS registers users, tracks courses in a catalog, records data from learners; and provides reports to the management.
- An LMS is typically designed to handle courses by multiple publishers and providers.
- It usually doesn't include its own authoring capabilities; instead, it focuses on managing courses created by a variety of other sources.
- LMS is one of the key strategic eLearning infrastructures which need to be integrated with corporate Human Resource Systems.

Moodle

Learning Management Systems

- Moodle is a software package designed to help educators create quality online courses and manage learner outcomes.
- Students need only a browser (e.g., IE, Firefox, Safari) to participate in a Moodle course.
- Moodle is open source software, which means you are free to download it, use it, modify it and even distribute it .
- Moodle runs without modification on Unix, Linux, Windows, Mac os x, Netware and any other system that supports PHP, including most web host providers.
- Data is stored in a single database: Mysql and Postgresql are best supported, but it can also be used with oracle, access, Interbase, ODBC and others.



e-Learning Portal on Agricultural Education

(e-KrishiShiksha)



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5	B.Sc.(Home Science)	B.Sc.(Home Science)
6	B.Tech.(Agricultural Engineering)	B.Tech.(Agricultural Engineering)
7	B. Sc. (Horticulture)	B. Sc. (Horticulture)

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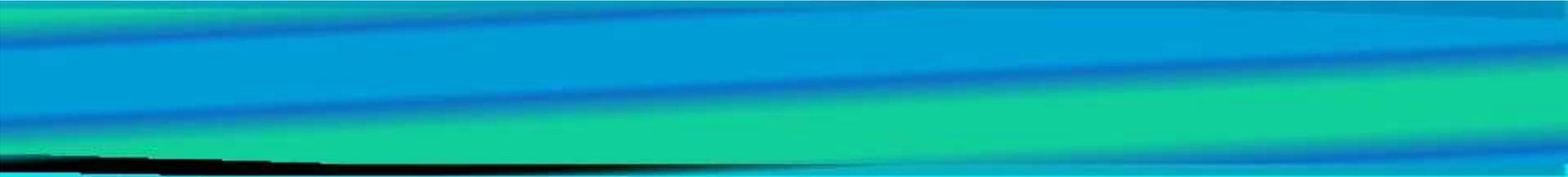
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S.No.	User Name	User Status	Email	State
1	Aravinda Kumar M.K.	Faculty	aravinda.economics@gmail.com	Karnataka
2	Atheekurrehman	Faculty	atheek.agri@gmail.com	Karnataka
3	Dr. Bhayani	Faculty	deerabagowda@gmail.com	Karnataka
4	Dr.S.Sridhara	Faculty	sridharas1968@gmail.com	Karnataka
5	Dr.Suneetha	Faculty	suneethavsn@gmail.com	Karnataka
6	H.V.Ganesh	Faculty	hv_ganesh@rediffmail.com	Karnataka
7	Pankaja B.D	Faculty	pankajagirish03@gmail.com	Karnataka
8	Poornima	Faculty	poornimamail@gmail.com	Karnataka
9	Radha B.N.	Faculty	radhabn29@gmail.com	Karnataka
10	Shivakrishna S.D	Faculty	shivakrishna2002@yahoo.com	Karnataka
11	Shoba S	Faculty	sho_123@rediffmail.com	Karnataka
12	Anjum Ahmed N.A	Other	anjum.na@gmail.com	Karnataka
13	Ashok Biradar	Other	agronashok@gmail.com	Karnataka
14	B.Chandra Obuja Reddy	Other	career.chandra@gmail.com	Karnataka
15	Gireesh S.R.	Other	girisr813@gmail.com	Karnataka
16	Laxmidhar	Other	felu@gmial.com	Karnataka
17	Pradeep	Other	pradi_mr@yahoo.com	Karnataka
18	Raghavendra	Other	raghukdurga@gmail.com	Karnataka
19	Raj	Other	RP.CK@SIFY.COM	Karnataka
20	Ranganath Krishnan	Other	ranganath.krishnan@gmail.com	Karnataka
21	S.P.S. Stephen	Other	srsstephen@yahoo.com	Karnataka
22	Vinay H.R.Lamba	Other	vinaylamba@gmail.com	Karnataka



E-Commerce

- **Farmers can not only get the market prices but can also connect to consumers directly through ecommerce applications.**
- **Some of the open source e-commerce platforms are Oscommerce, Magento etc.**
- **On the other hand, government and traders can accurately estimate the inflow of produce in the market on daily basis.**



DMR Home Page

Expert System on Mushroom



ICAR



Mushroom



ICAR



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Brief of Expert System for Mushroom

Expert System for Mushroom Crop has been developed using AgriDaksh. This system is a farmer oriented and user friendly software which provides spectrum of information with images of mushroom crop such as cultivation technology of different mushrooms, diseases and pest management, spawn production technology, compost preparation by short & long method, Post harvest handling & harvesting, Crop management, Nutrition & medicinal value, Transfer of technology, Fungal, viral, bacterial diseases & abiotic disorders etc. Cultivation Technology module gives detail information about compost preparation, spawning, spawns running, casing, fruiting. Post harvest management module gives detail information about Packing and Storage and Short Term Storage. Pest & Diseases module gives detail information about Insect,Pest like Nematodes, mites and springtails and several diseases like Dry Bubble (brown spot), Wet Bubble (White Mould), Cobweb, Green Mould, False truffle (Truffle disease) etc, and timely control measures against pests & diseases.



Domain Experts Sign in to **AGRIDaksh Account**

Username:

Password:

Language: ENGLISH

New user? [Sign up](#)

[Forgot password?](#)

Announcement

AgriDaksh Features

- ▶ **One system for all crops with ability to create knowledge models for new crops**
- ▶ **Location specific variety information with the ability to add multiple pictures for each variety**
- ▶ **Comprehensive plant protection sub module with**
 - ▶ **Diseases**
 - ▶ **Insects**
 - ▶ **Weeds**
 - ▶ **Nematodes**
 - ▶ **Physiological disorders**

AgriDaksh Features

- ▶ Ability for domain experts to define problems and create decision trees to solve the problems
- ▶ Ontology based diseases and insects identification and variety selection
- ▶ Ability to add static web pages
- ▶ Powerful administrative module
- ▶ Full featured online help
- ▶ Semantic Web compliant
- ▶ Built on robust, platform independent Java technology using n-tier web architecture

Problem Identification

http://agritech.iiasri.res.in/mushroom/

Expert System for Mushroom | Expert System for Mushroom | Web Mail

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Mushroom

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Problem Identification : Disease Diagnosis

Question - Answer History

Expert Question	Your Response
select the crop	Mushroom

Expert Question: Select the Stage of the Crop

Casing 

Cropping 

Phase 1 Composting 

Phase 2 Composting 

Pinning 

Spawning 

Partner Institute

- IASRI
- DMR (Solari)

Mushroom Technology

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Problem Identification



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- DMR (Solon)
- Most common technology
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Question - Answer History

Expert Question	Your Response
select the crop	Mushroom
Select the Stage of the Crop	Phase 2 Composting

Expert Question: select the part affected.

compost



casing soil



Cap



Sidebags of mushroom growing



Problem Identification



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Expert Responses...

Problem Identification : Disease Diagnosis

Question - Answer History

Expert Question	Your Response
select the crop.	Mushroom
Select the Stage of the Crop.	Phase 2 Composting
select the part affected.	compost

Expert Question: select the initial symptom.

- Whitish mycelial growth on the exposed surface surface of compost and casing soil in trays as well as on sides in bags due to moisture condensation



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Problem Identification



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Feedback / Ask Question?

Expert Response...

Problem Identification : Disease Diagnosis

Question - Answer History

Expert Question	Your Response
select the crop	Mushroom
Select the Stage of the Crop	Phase 2 Composting
select the part affected.	compost
select the initial symptom.	Whitish mycelial growth on the exposed surface surface of compost and casing soil in trays as well as on sides in bags due to moisture condensation

Expert Question: select the final symptom.

• Large dense patches gradually changing color through shades of tan and light brown to cinnamon powder ultimately becoming rust col



Proceed further

Problem Identification



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Question - Answer History

Expert Question	Your Response
select the crop	Mushroom
Select the Stage of the Crop	Phase 2 Composting
select the part affected	compost
select the initial symptom.	Whitish mycelial growth on the exposed surface surface of compost and casing soil in trays as well as on sides in bags due to moisture condensation
select the final symptom.	Large dense patches gradually changing color through shades of tan and light brown to cinnamon powder ultimately becoming rust col

Expert Solution! Your crop may be affected by the following Disease/Diseases:

Brown Plaster Mould



Management Practices

1. Composting should be carried out carefully using sufficient gypsum and not too much water.
2. Peak heating or pasteurization should be for sufficient duration and at proper temperature. The compost should not be too wet before or after peak heating or pasteurization.
3. Localized treatment of Infected patches with 2 percent formalin.

Ask Questions to Experts

The screenshot shows a web browser window displaying an expert system interface for mushrooms. The browser address bar shows the URL <http://agridaish.iasri.res.in/mushroom.jsp>. The page features a navigation menu on the left with categories like 'Partner Institute', 'Mushroom Technology', and 'Queries & Solutions'. The main content area is titled 'Farmer's Question/Feedback & Expert Response' and contains a table with the following data:

SN	Date	Name	Email	Phone	State	District	Problem Area	Farmer's Question/Feedback	Reply Status
1	2013-10-08	Dharmesh gupta	dkgubf@rediffmail.com	9415030489	Himachal Pradesh	Solan	Physiological Disorder	Button Mushroom crop has started in our mushroom unit but I could see that stipe of most of the mushrooms is very thick. What can be the reason?	

A pop-up window titled 'Expert's Answer' is overlaid on the table, showing the following details:

- Question:** Button Mushroom crop has started in our mushroom unit but I could see that stipe of most of the mushrooms is very thick. What can be the reason?
- Answered By:** yogesh
- Answered Date:** 2013-12-27 00:00:00.0000000
- Expert Answers:** 1. Please check the Carbon Dioxide content. It could be above the desired concentration.



Mushroom



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Mushroom Technology

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About Mushrooms

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[Cyphelloids mushrooms](#)

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a. [Earth star](#)

b. [Puff balls](#)

c. [bird's nest fungi](#)

[Clavarioid mushrooms](#)

[Polypore mushrooms](#)

[Stinkhorn mushroom](#)

[Morels](#)

[Jelly mushroom](#)

Recommender Systems

- ▶ With the development of the WWW(World wide web), internet is growing with a tremendous speed regarding both content and users
- ▶ The tremendous growth of both information and it's usage has lead to information overload problem
- ▶ This problem has led researchers to think of how to provide more proactive and personalized information services to the users
- ▶ This is where the concept of Recommender systems came in picture as one of the potential solutions
- ▶ It helps to achieve the goal of providing personalized information services to users

Wednesday, December 3, 2014

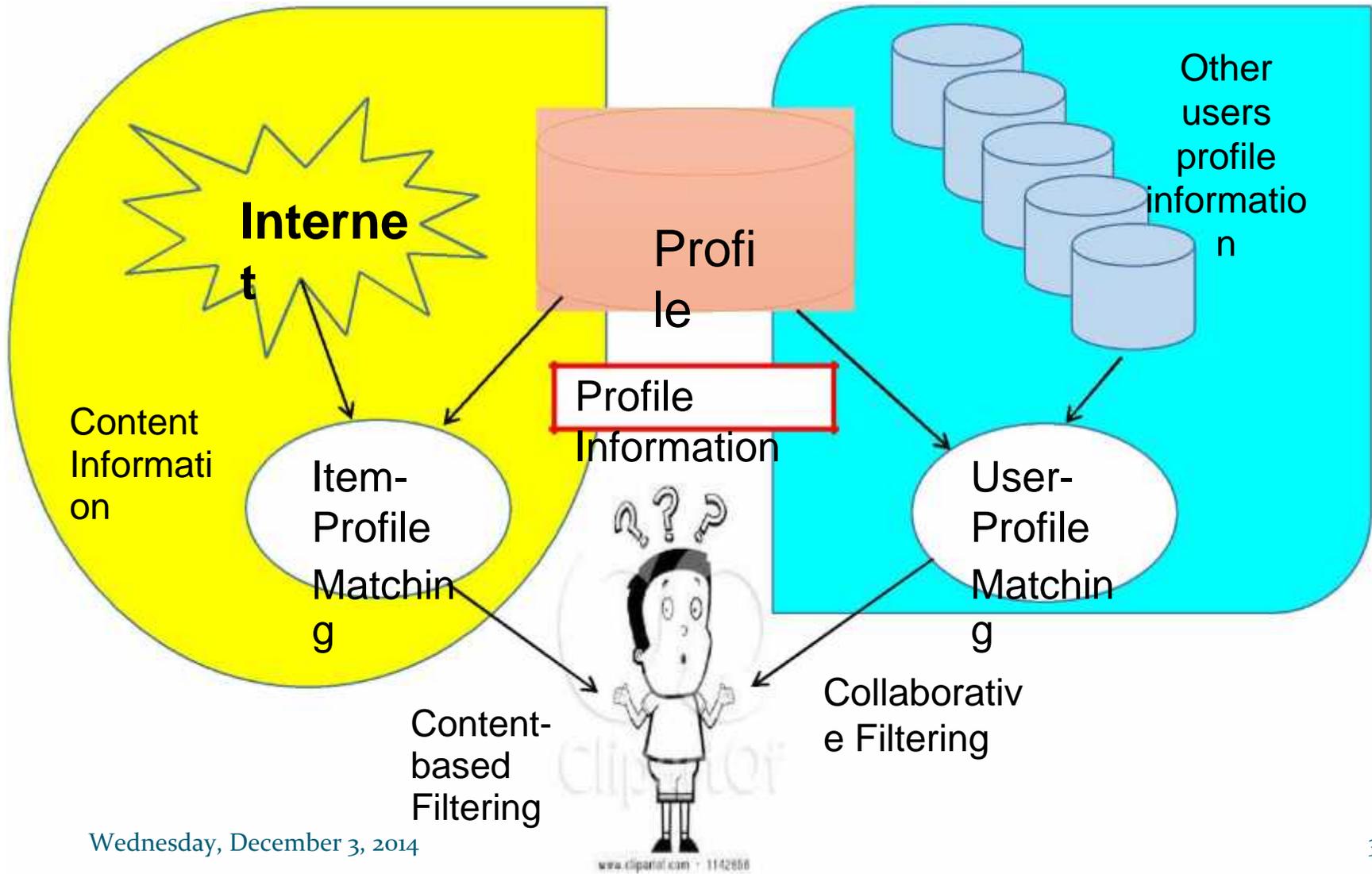
Recommender Systems

- ▶ It uses the opinions of a community of users to help individuals in the community more effectively identify content of interest from a potentially overwhelming set of choices
- ▶ As a typical definition,
 - Recommender System is a sub class of information filtering system that seek to predict the rating or preference that user would give to an item they had not yet considered, using a model built from the characteristics of an item or the user's social environment.**
- ▶ Information filtering systems focus on retrieval of information based on user's profile

Recommender Systems

- ▶ **Recommender systems are now used in a variety of applications. Starting from music stores to e-commerce sites, online communities, web stores etc.**
- ▶ **It uses mainly two algorithmic techniques:**
 - **Content – Based Filtering**
 - **Collaborative Filtering**

Content-based and Collaborative Filtering



Knowledge Management

Ontology

- **Ontology is “An explicit and formal specification of a shared conceptualization”.**
- **It is explicit because it defines the concepts, properties, relationships, functions and constraints that compose it.**
- **It is formal because it is machine readable and interpreted.**
- **It is a conceptualization because it is an abstract model and a simplified view of the existing things it represents.**

Knowledge Management

Ontology

- **Ontologies are XML based knowledge representation technique and have inherent capability for machine and software agents interoperability.**
- **Ontologies are evolved from the Frame, Object Oriented Programming and Database paradigms.**
- **Ontologies define domain concepts and the relationships between them, and thus provide a domain language that is meaningful to both humans and machines.**
- **SPARQL is a powerful query language for querying ontology and has inference capability.**

Knowledge Management

Crop Ontology

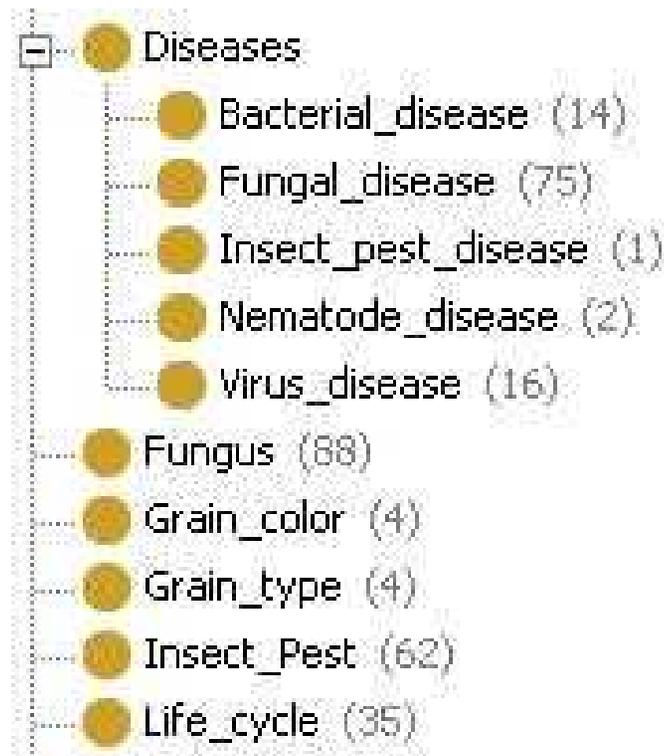
- **Crop Ontology is the Knowledgebase of the presented Expert System.**
- **It contains various classes, properties, restrictions and individuals related to**
 - **Crop Names**
 - **Varieties**
 - **Diseases**
 - **Insects/Pests**

Knowledge Management

CROP Ontology

Class and sub - class

■ Class is simply a name and collection of properties that describe a set of individuals and individuals are the members of those sets.



Knowledge Management

Crop Ontology

Individuals

- An individual is introduced by declaring it to be a member of a class. Individuals have properties of their class.

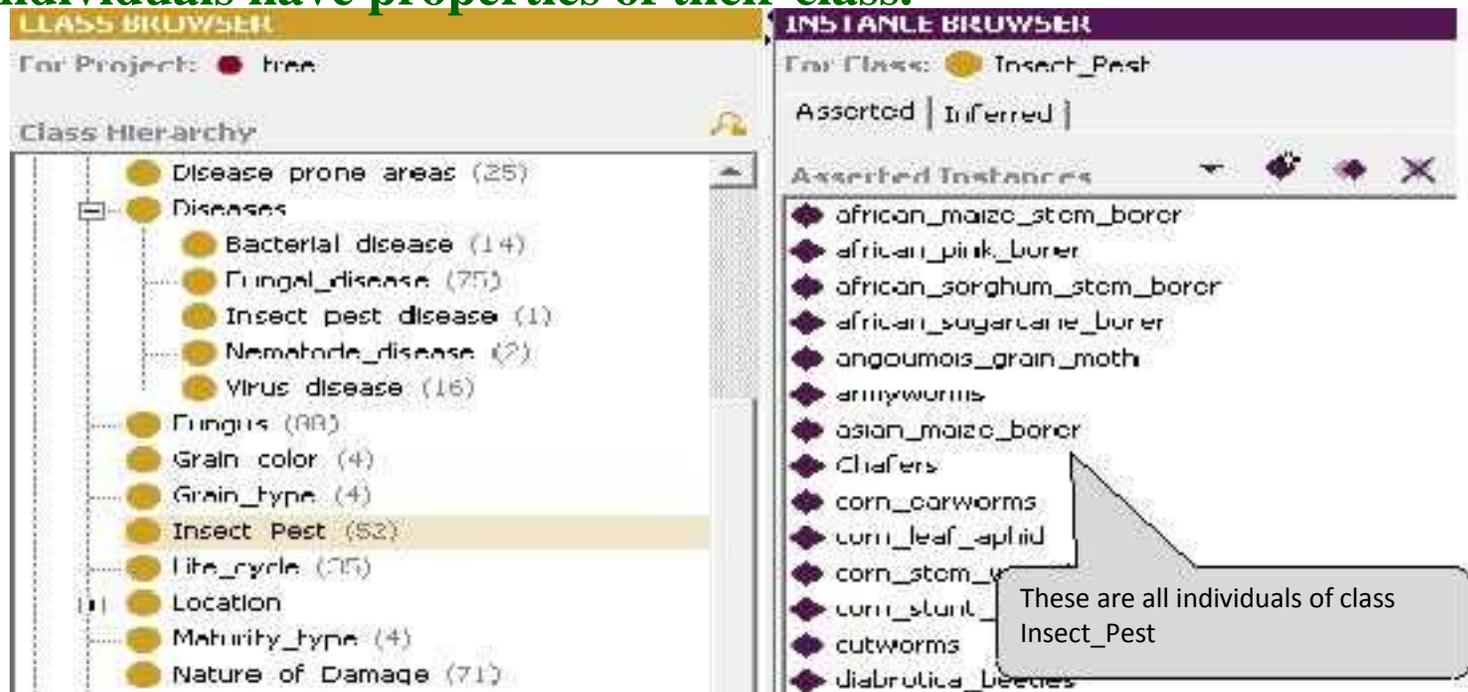
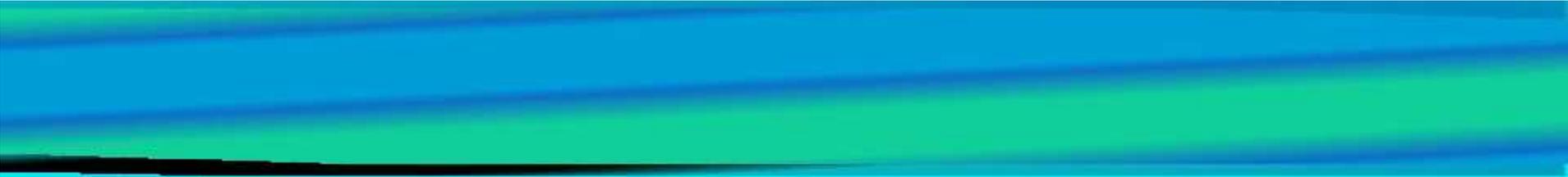


Fig 2. Individuals of class Insect_Pest in Crop Ontology

Crop Ontology

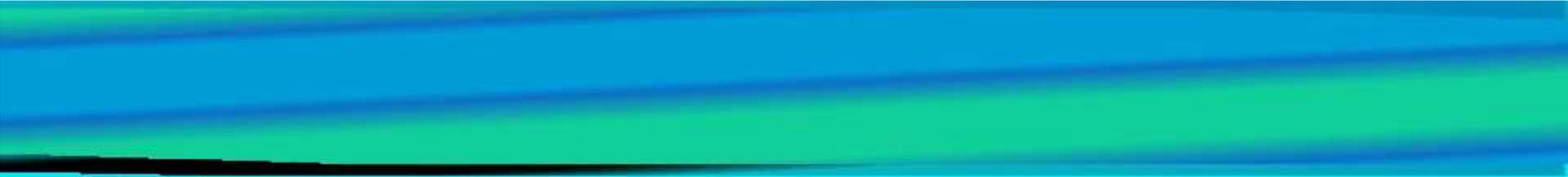
Properties

- **Properties**, assert general facts about the members of classes and specific facts about individuals.
- **Datatype properties**: relations between instances of classes and RDF literals and XML Schema datatypes (like `xsd:integer`, `xsd:string` etc.).
- **Object properties**: relations between instances of two classes.
- To restrict the relationship between classes or between classes and RDF literals the domain and range can be specified for the property.



Conclusion

With the upcoming intelligent systems like web enabled expert systems (AGRIDaksh), recommender systems, internet of things powered by the IPv6 protocols, sensor based networks, the present role of ICT in mushroom farming and research is like a tip of iceberg and can only grow with a more faster speed.



Thanks