

# Cotton Mitra – An Agricultural Advisory System for Cotton Crop

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**Abstract** - In current agricultural scenario, the main aim of agricultural experts to provide proper up-to-date information to the farmers so that they can efficiently utilize the given information to improve their agricultural practices and thereby increase the production. The huge amount of agricultural data is generated from the different sources which have to be handled efficiently. By the use of ICT we can handle this data generated from different sources and can build knowledge based system to provide experts advices to the farmers. An agricultural advisory system presented in this paper aims to build the gap between cotton farmers of Indian state Maharashtra and experts in agriculture domain. The system maintains knowledge like soil information, weather data, crop disease, pesticides, etc. for cotton crop and it is collected from different sources. The system consists of three core components such as - Web Ontology, Web Services and Android Mobile Application.

**Key Words:** Web Ontology, Web Services, Android Application, RESTful Services, Web Ontology Language, Semantic Web, Advisory System.

## 1. INTRODUCTION

In India, Maharashtra is the largest producer of cotton. Approximately 27% of total cotton is produced in Maharashtra. Our aim is to build a knowledge based advisory system to help cotton farmers in Maharashtra to improve production of cotton even more. The system has user friendly GUI and provides services like weather information, disease prediction, pesticides recommendations, etc. The knowledge base is developed using Web Ontology Language (OWL), web services are developed in REST, and Android Application developed to provide easy to use User Interface (UI) to the farmer.

## 2. MOTIVATION

India is a second largest producer of the cotton worldwide and in India, Maharashtra is a largest producer of the cotton. Production of the cotton plays a significant role in Indian economy as Indian economy is still highly based on agriculture productions. The large amount of data related to agriculture like soil information, weather details, etc are being gathered from different sources like sensors. This information have to be provided to the farmer in efficient way to solve their queries regarding to the crop, weather,

disease, pesticides, etc. We are motivated to develop an expert advisory system to provide such information to the cotton farmers of Maharashtra in order solve their queries and thereby improve the overall cotton production.

## 3. EXISTING SYSTEM

During literature survey we found existing agriculture advisory systems like Kisan Suvidha, eSagu, mKrishi, Kisan Vikas, Krishi Mantra.

### 3.1 Kisan Suvidha

Kisan Suvidha is developed by Department of Agriculture Cooperation and Farmers Welfare Ministry of Agriculture and Farmers Welfare Govt. of India. It is an omnibus mobile application developed to help farmers by providing relevant information to them quickly. It provides weather information, IPM practices, plant protection, etc.

### 3.2 eSagu

eSagu is an IT-based agro advisory system developed by IIIT, Hyderabad and Media Labs Asia. It aims to improve farm productivity by providing appropriate advice to each farmer.

### 3.3 mKrishi

mKrishi is a mobile based advisory system developed by TCS group. It provides the agro advices to the farmer with audio-video facilities on a mobile phone.

### 3.4 Kisan Vikas

Kisan Vikas is Android based ICT solution in Indian agriculture to assist farmers. It is developed by IIT, Mandi. It provides essential agriculture related information like govt. helplines, weather forecasts, news, market prices, etc.

### 3.5 Krishi Mantra

Kisan Mantra is an Android based ICT system developed to assists cotton farmer of Gujarat region of India. It is developed by IET, Ahmedabad and DAIICT, Gandhinagar. It provides web ontology based solution.

#### 4. PROPOSED SYSTEM

Cotton Mitra proposes an agricultural advisory system for Maharashtra state where advices to the farmer are provided through RDF knowledge base (OWL Ontology). SQL database will store static information about the end-user. Yahoo weather API is used to display weekly weather details. The communication between different system components is provided through REST framework. RESTful services along with Ontology and SQL database is stored on Cloud Platform as a Service. The end-user (farmer) will have to install Cotton Mitra Android application to communicate with the system. Disease prevention and pesticide details are provided based on the inputs given by the user.

#### 5. RESEARCH CHALLENGES

##### 5.1 User Interface

User interface is the main research issue. It should be user friendly as most of users (farmers) won't be able to use a system if it is complex.

##### 5.2 Web Ontology Development

System should consists of knowledge base data. Such knowledge base with ability to query the system will enables reasoning capability and inference. The main task is to build web ontology which can answers queries of each user.

##### 5.3 Ontology Reasoning

The system should be capable to generate recommendations. Efficient ontology reasoner is required to solve user queries.

##### 5.4 Deployment of the system

System should be easy to access. So we have to deploy the system on a cloud. The web services and database should be deployed on cloud so that the user can access it from anywhere. The response time should be less.

#### 6. SYSTEM DESIGN

Fig. 1 shows system architecture.

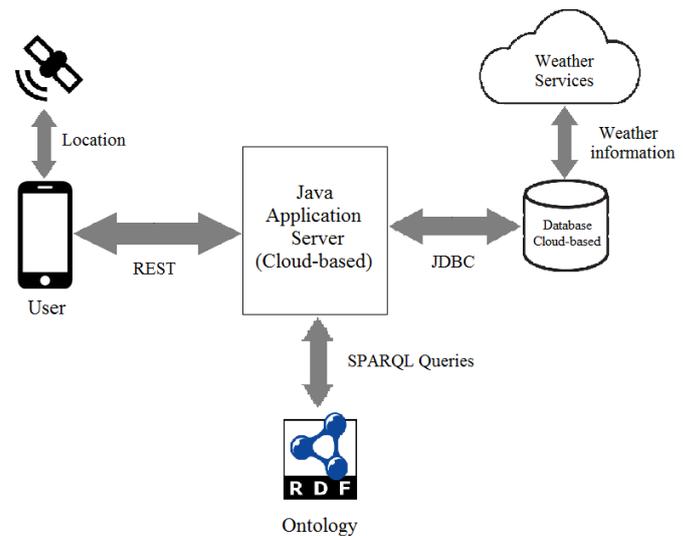


Fig -1: System Architecture

As shown in fig. 1, there are five major components of the system.

##### 6.1 The knowledge base

The knowledge base consists of data for Cotton crop in RDF format. It stores variety of information like crop disease, pests, pesticides, bacteria, etc. SPARQL queries and reasoning is used on this RDF ontology to answer the user queries. RDF ontology is developed using Protégé tool. Apache Jena is used to query the ontology. Pallet reasoner is used to check consistency of the ontology.

##### 6.2 SQL database

SQL database stores all the static information related to the farmer. POSTGRESQL is used to develop this static database.

##### 6.3 RESTful Web Services

These are the light weight web services and responsible for the communication between the end user and cloud server. It connects the RDF ontology, SQL database and user of the system over the internet. REST web services are developed using JAX-RS (Jersey) framework written in Java with the help of Eclipse IDE. The web services provides results in JSON format.

##### 6.4 Geographic data

It contains information about the weekly weather of the user location. Yahoo weather API is used to display the weather information.

## 6.5 Android App

The user friendly Android application is developed to access the rest of the system. User Interface have made user friendly so that anyone can interact with the system easily. Android application is developed using Android studio with Android SDK - 24.

## 7. IMPLEMENTATION DETAILS

### 7.1 Hardware and Software Requirements

JDK 1.7 or higher, Eclipse Neon EE, Apache TomCat web server, Jersey framework, PostgreSQL 9.6, Postman (for testing), Protégé 5.1, Apache Jena, Android SDK - 24, Android Studio, Yahoo weather API.

## 8. SYSTEM SCREENSHOTS

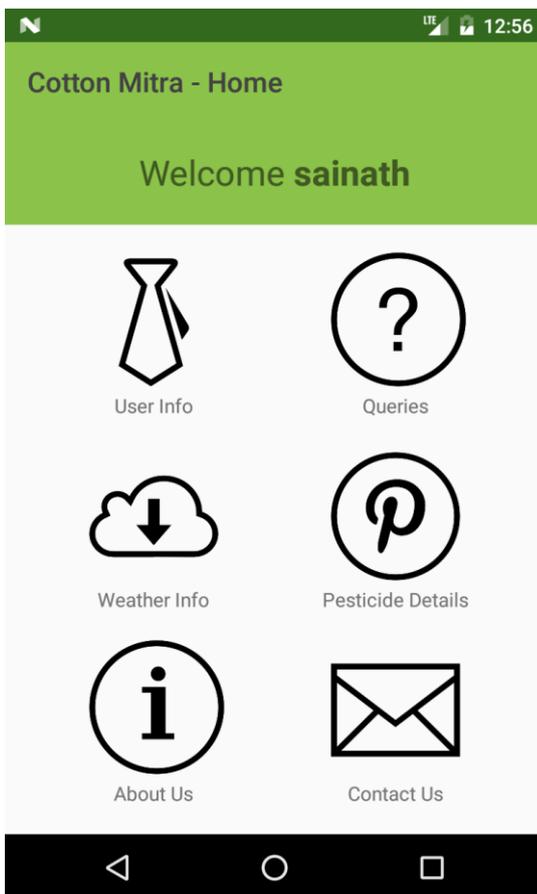


Fig -2: Home Screen User Interface

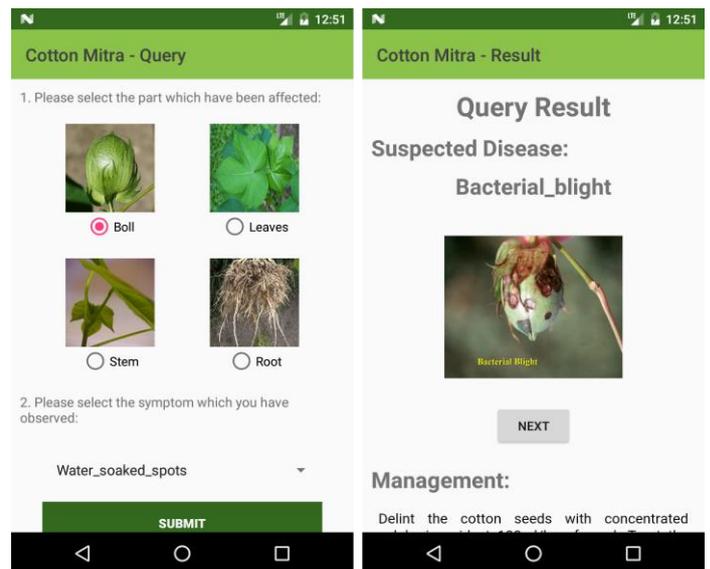


Fig -3: Result for disease prevention based on part of the crop and observed symptom.

## 9. CONCLUSION AND FUTURE WORK

This paper presents an Agricultural advisory system for cotton crop developed for cotton farmers of Indian state Maharashtra. This is an Android based mobile WebApp and uses semantic web technologies like RDF, OWL, and SPARQL. The system efficiently provides experts advices and solves issues like lack of knowledge of the farmer.

We can make this system more efficient and useful by including weather alerts, weather notifications before causing further damage to the crop.

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