Multimedia Based Answering Framework in Mobile Cloud Computing

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Abstract: Multimedia Based Answering Framework (MBAF) is a framework that combines Text Based Answering Technique (TBAT), Image Based Answering Technique (IBAT) and Voice Based Answering Technique (VBAT) to answer semantically for farmers' queries. MBAF can be consumed as cloud service in mobile applications as well as web applications. Combining the answering techniques, help farmers to ask any mode of queries in single application. This framework is proposed as a cloud service, so that it can be utilized as a service in any kind of applications. To handle the requests in a distributed way, MBAF uses load balancers. Datasets used here are ontology, trained model by TensorFlow and Agent service by DialogFlow.

Keywords: Cloud service, Agriculture, Tomato plant diseases, Mobile application, Framework

I. INTRODUCTION

Question Answering (QA) in World Wide Web (WWW) is retrieving precise answer from documents or web pages that are hosted in web. In Information Retrieval (IR), search engines retrieve relevant documents based on keyword search and ranking algorithms. Now, the querying methods have changed a lot. MBAF is designed to answer farmers' queries regarding diseases that affect tomatoes. The queries from the farmers can be text, image, voice or video. Queries in text format are answered in semantic manner with the developed ontology. When TBAT has language issues, IBAT is introduced as solution to the language problem addressed in TBAT. Disease affected plant's image is captured and uploaded to IBAT and farmers retrieving the diseases name and its preventive methods. Some queries that don't have any roles for images need to be answered. VBAT is a solution where query can be asked in voice based and answer is received in voice mode.

The proposed framework is focused on farmers, because agriculture contributes 18.5% of India's Gross Domestic Product (GDP).Farmers make up 24.8% of India's total work force with 118.9 million farmers spread across the length and breadth of the country [1]. Indian government has taken many initiatives to improve the productivity in agriculture and enhance the life of farmers. mKisan, RainbowAgri, MandiTrades are few applications that help farmers to know the market prices up to date[2]. Many mobile applications helps farmers to discuss about their interests and seek guidance from experts through Short Messaging Service (SMS). An automated answering technique that accepts user queries in text/voice/image format is still on demand.

MBAF focus on the query type not answers type. The queries can be in text/image/voice mode. For text and image, the answers are in text format. Voice based queries are answered through voice. Previous works dealt these techniques individually. Proposed work combines the previous works and fits in a framework that can be consumed as cloud service. Cloud service helps developers to avail the proposed work in mobile application. Mobile phones lack in computation and memory. When MBAT is proposed as a cloud service, the heavy computations are offloaded to cloud's powerful server and datasets are offloaded to cloud's storage.

II. RELATED WORKS

Cloud services are the best choice for agriculture based mobile applications and web applications because of its intensive calculations and its need for huge data stores. Shangupta et.al.,[3]proposed Farmer's Plaza, a cloud-enabled mobile and web based framework for farmers. Farmer's Plaza helps farmers to communicate with the customers directly without any middlemen's interference. Mobile phone, cloud hosted middleware and a database in cloud are the three components involved in Farmer's Plaza. There is a question answering module that accepts farmers' queries in text format.

K.Magesh Kumar et.al., [4] proposed a multimedia QA system that focus on the answer type. The users in multimedia QA are prompted to choose the answer type within the given choices. The choices of answer types are text, text and image, text and video and text, image and video. Based on the selection of media, the answer is retrieved. Yanxin Zhy et.al.,[5] proposed a framework about the cloud computing contribution in the agricultural development in China. The framework is for agricultural products supply chain. Agricultural products in the work are seeds, fertilizers, feed sources that are stored in cloud data centers along with the suppliers name and details in cloud data centers. Based on the requirement, farmers supply on demand basis.

AgriCloud is a framework proposed by Abhishek Pandey et.al.,[6] is a cloud computing environment for Indian agriculture. The framework is designed to provide the services as cloud services. It is designed to provide, Food as a Service (FaaS), Consultation as a Service (CaaS), Dairy as a Service (DaaS), Marketing as a Service (MaaS), Training as a Service (TaaS) and a chat service. The farmers can access the service through a laptop or mobile phones. Whenever the terminology Multimedia answering [7] is coined, the authors represent the answer types. Richang Hong et.al., proposed a frame work, that accepts query as keywords, natural language queries, query in text, image and video and retrieves the answer in any of the media type specified in the above statement.

MBAT combines TBAT that is developed as an ontology (.owl file) using protégé. The inspiration for TBAT Online Agriculture Prescription Recommendation System (OAPRS)[8] that answers to farmers' queries. MEdical question ANSwering (MEANS) ontology [9] that is developed for answering human diseases relevant queries is another significant inspiration for TBAT. For IBAT, Machine Learning's (ML) human like accurate recognition feature provides the base. IBAT uses Convolutional Neural Network [10], Deep learning algorithms [11][12] and Google's TensorFlow to recognize and classify the images. VBAT got its inspiration from interactive answering machines that are called as chat bots. Apple's SIRI [13], IBM's Watson [14] , Google's Alexa, Microsoft's Cortona [ ] are few voice based answering techniques that helps in developing VBAT.

From the above mentioned related work, each and every work is partially contributes for MBAT. Cloud servers, mobile applications, cloud storage, cloud functions, cloud service providers and user interface are the technologies that are involved in MBAF.

III. MULTIMEDIA BASED ANSWERING FRAMEWORK

The proposed framework is designed as a cloud service. MBAF is designed to accept the query as text, image and voice. For each answering technique, different technology is used. The conceptual framework for MBAF is given in Figure1. Ontology based "Plant.owl" file is the database for TBAT that answers semantically for queries regarding diseases that affects tomatoes. That owl file is uploaded to cloud storage. For IBAT, trained model is the backend that accepts image query and answers. Trained model and few library files are store in cloud storage. "Tomato Doctor" is an Agent service that is uploaded in cloud storage to provide storage for VBAT.

Figure1. Conceptual Framework of MBAF

Farmers are allowed to send queries from their mobile phones as well as their laptops or desktops. Farmers need internet connection to avail these services. When the query is received by cloud, it triggers its corresponding function that is hosted in the cloud. The function is executed in the powerful servers (Virtual Machines/ Elastic Cloud) that are in cloud. To execute the query, the servers need the databases that are stored in the cloud storage. Connection to the cloud storage is established and the data sources are used to provide data for computation. After the execution is over, based on the user query, answer is retrieved by MBAF and send to farmer's mobile. The step by step procedure is mentioned below.

Input	**: Query in Text/Image/Voice**
Output	**: Answer(s) (in Voice and Text)**

Step1: Upload the datasets to cloud storage forTBAT,IBAT and VBAT

Step 2: Avail a cloud server to perform heavy computational tasks

Step 3: Offload the answering techniques' methodologies to the VM

Step 4: Design User Interface to avail this MBAF

Step 5: Integrate the dataset and methodologies of MBAF and host it as cloud service

Step 6: Use Load Balancers to evenly distribute the requests to MBAF

Step 6: Avail the proposed cloud service in mobile phones

When implementing MBAF, firstly, a Cloud Service Provider (CSP) has to be chosen. Amazon Web Services (AWS) and Microsoft Azure are the dominant CSPs. From the developers' perspective, AWS is the suitable for MBAF. After

choosing the CSP, an account has to be created in AWS. The cloud services that MBAF is going to avail are AWS's S3 as Cloud storage, AWS's Windows 12 Server (Elastic Cloud EC2) for computation environment or AWS's Lambda functions to do the business logic.

Secondly, User Interface (UI) in mobile application has to be designed as the MBAT is going to be used in mobile phones. To use MBAT in mobile phones, farmers need internet connection. The database files such as "Plant.owl" of TBAT, classified and trained model of IBAT, Tomato_Doctor Agent service of VBAT are uploaded in cloud storage S3. For computing environment, EC2 can be used and to do the business logic, a function has to be triggered. Lambda function of AWS is the best choice to upload the developer's business logic code. For TBAT, IBAT and VBAT two Lambda functions will be required. The interaction between the Lambda functions and S3, developers need credentials. Thus, when the farmers send the queries through their mobile phones, the corresponding Lambda function is triggered and the answer is send back to the farmers' phone as voice or text based on their choice.

IV. RESEARCH FINDINGS

MBAF is a framework that is proposed as a cloud service. This framework is an "Innovative Idea", so that, it cannot be compared with any existing framework. The framework is designed to use Amazon's Elastic Load Balancer (ELB). So that, the traffic across EC2 instances are distributed. To use the ELB, the proposed framework MBAF's EC2 instance is registered or duplicated with one or more zones. When ELB is used, it accepts incoming traffic from farmers' and routes the requests to its registered instances of EC2. If any of the registered EC2 zones have problems, ELB automatically routes the requests to the healthy zones. After correcting the affected zone, it becomes healthy and ELB resumes routing traffic to the available zones in a distributed way.

V. CONCLUSION

MBAF is an innovative idea that can help farmers to answer their queries by 24 X 7. Due to the mobile phone's rapid growth and Digital India's innovative steps give farmers a basic idea about technology usage in agriculture. MBAF is designed as a user friendly framework that requires no need of training to use it. The farmers are able to verify the diseases that affects their tomato crop just by taking a picture of it and send it to MBAF. The interactive voice based answering gives a feel such as an agriculture expert is talking and clarifying the doubts of the farmers. The proposed framework will be very beneficial if it is implemented in real time.

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