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# AgroVaid: A User-friendly Agriculture System for Enhanced Farmer Interaction

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***Abstract*—**In an agricultural country like India farmers need to be empowered with technology to improve their productivity and reduce their losses. However this is a challenge since majority of the people in rural areas are not well-educated. Thus there is need to develop an agricultural system that is simple yet useful. Our proposed system AgroVaid is one such system. It will be used to provide information about various crops, pests and crop diseases. The user (farmer) either needs to type the crop/pest name or speak the same in the microphone to get the desired information. The system is also capable of identifying a real pest with the help of a 3D scanner. All the processing of the system will be done by ARM controller. The output will be displayed on the LCD screen. However the result will also be available in the audio format through speakers. AgroVaid will also be available as an online portal as well as a mobile application.

***Keywords*—** ARM controller; 3D scanner; GSM; agrovaid; pest identification

## I. INTRODUCTION

Agriculture is the lifeline of a civilization. Most of the countries in the world are directly or indirectly dependent on agriculture. Agriculture not only makes a country self sufficient but also boosts its economic growth. Conventional farming methods have become outdated. Much like other fields and areas, technology has got a significant role to play in agriculture. From accurate weather forecasts to automating the farm equipments, technology has bestowed us with everything. Moreover there are so many websites and online portals that are contrived exclusively to assist the farmers and elucidate all their queries.

The advances in science and technology have almost touched all aspects of agriculture. Today we have hi-tech tractors that have autopilot and Global Positioning System (GPS). Smartphones have changed the world and the field of agriculture is no exception to it. Smart irrigation technology is all about prudent use of water by using sensors in the soil that measure soil moisture content. Crop sensors, collars with GPS, RFID and biometrics for livestock and agricultural robots are all possible because of technology.

Increasing the crop yield without degrading its quality is the main aspect of agriculture. Crop yield is usually affected by improper irrigation facilities, infections caused by insects and pests, natural phenomenon like floods, drought etc. Although natural phenomenon are unavoidable but factors like irrigation, pests and diseases can be controlled by men to a large extent. Insects and pests not only threaten crop quality but also decrease crop yield. Crop damage due to these harmful organisms can be hefty and may be prevented, or reduced, by taking suitable measures. [1] and [2] give a very detailed overview of potential and actual crop losses due to pests. Thus there is a need to come up with a system that will help farmers in protecting their crops from various pests and diseases caused by them.

Countries like America, China and Japan have modernized their agricultural methods and tools and also have a number of projects to boost their agricultural productivity. Besides countries, the World Bank also undertakes programs and projects relating to agriculture. The World Bank's work in agriculture is focused on five areas: raising productivity; helping farmers reach markets; reducing risk, vulnerability and inequality; improving incomes off the farm; and making agriculture more environmentally sustainable.

India is an agricultural country, since more than 60 per cent of the total land area is under agriculture. Thus agriculture has a critical impact on Indian economy. Government of India and various other organizations have developed and proposed ideas and projects for the betterment of agriculture in the country. One such initiative is Krishi Vigyan Kendra (KVK) by the Indian council of Agricultural Research (ICAR) [3]. KVKs have been set up in all the districts of the country with a view to conduct on-farm testing, providing training to farmers to update their knowledge and skills and work as knowledge centres of agricultural technology [4]. Another such scheme is Soil Health Card Scheme [5], which was launched by Government of India in february 2015. This scheme is aimed at helping the farmers to increase their crop productivity. Forecasting Agricultural output using Space, Agrometeorology and Land based observations (FASAL) is a again a project of Government of India to forecast production of agricultural crops. Besides these initiatives, websites such as [6-8] are dedicated to help farmers regarding their crops, livestock and farm equipments.

Besides all these advances, there are still a number of limitations. For example, agricultural robots have not yet come to practical use. Models have been designed and proposed but none of them have shown perfectly accurate results. Moreover the farmers have to be technically sound to



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use most of the above mentioned technologies. Thus it is required to come up with something simple to use but still of great value to the farmers. The proposed system AgroVaid is one such attempt in this direction. It is developed with an aim to protect the crops from various pests and diseases caused by them. The target users of the system will be farmers. AgroVaid is an agricultural system that will also be available as an online portal and mobile application. It will provide its users with information about various crops, pests and crop diseases.

## II. Existing Agricultural Systems

In the second decade of the twenty first century, technology has found its use in every field. Scientific advancements in the field of agriculture have enabled farmers to maintain a balance between the growing population and the crop production. Thus there is a need to move from input intensive to technology intensive agriculture. One of the most important challenges faced by farmers is to increase the crop production with minimum operating costs. Canakci, Unal and Topakci [9] have developed a software to determine optimum size of mechanization vehicles used in farms. The program was developed to help in the selection of a tractor and farm machinery to reduce machinery as well as production cost in the farms.

Hamrita and Hoffacker [10] have used Radio Frequency Identification (RFID) technology for wireless real-time monitoring of soil properties. They developed a prototype system for wireless measurement of temperature of the soil. The sensor prototype is developed in such a way that it allows for additional soil transducers to be integrated into it without changes to the sensor design. The sensor could be used where soil properties such as temperature might be monitored in a wireless manner.

Technology in agriculture can be used either as a direct tool to improve productivity or as an indirect tool to empower farmers to take quality decisions regarding their crops. K. Ramamritham, A. Bahuman, S. Duttagupta, C. Bahuman and S. Balasundaram [11] have proposed three tools having database at their backend- (i) First tool is aAqua. aAqua stands for "Almost All QUestions Answered". It is an online agricultural portal that is meant to solve the problems of the farmers in their own language. (ii) Second tool, Bhav Puchiye is a web-based application for knowing the price of agricultural products at the nearest wholesale market. (iii) Third tool is a Crops Library consisting of collection of crop diseases and crop recommendations.

Shitala Prasad, Sateesh K. Peddoju and Debashis Ghosh [12] have developed a mobile application called AgroMobile for farmers to assist them for better cultivation and marketing. This application is based on Mobile Cloud Computing (MCC). It is a multi-lingual software that can provide farmers with information about various crops, crop diseases and their causes, audio and video lectures and quick replies to their questions.

In order to use most of the above discussed agricultural systems the farmers have to be well- versed with technology. But in a developing country like India, people in rural areas are not technically aware. So there is a need to introduce an agricultural system that is simple yet useful. AgroVaid deals with all these issues.

## III. Proposed Model

The proposed model consists of an ARM controller, 3D model generator, GSM, microphone, speaker and keyboard. All the processing of the system will be done by ARM controller and different modules interact with ARM through interfacing circuits. Hardware requirements of this system are shown in fig. 1. Various components of the block diagram of the proposed model are discussed below.

ARM is an acronym for Advanced RISC Machine. ARM processor is a family of computer processors based on Reduced Instruction Set Computer (RISC) architecture [13]. The RISC architecture concentrates on reducing the complexity of instructions performed by the hardware because it is easier to provide greater flexibility and intelligence in software rather than in hardware [14]. ARM is one of the most widely used processors in the world. ARM processors are a key component of many embedded systems because of their remarkable power rating, reduced complexity and smaller size [15].

3D models help us in visualizing the objects with great detail and precision. 3D models are more interactive and informative than 2D images [16], [17]. In the proposed system the user will be able to see 3D models of various pests and insects along with their related information. This system also facilitates the generation of 3D model of a real pest with the help of a 3-d scanner [18], [19]. A 3D scanner collects data about shape and appearance of a real-world object and generates dense point cloud of the data. We can generate the shape of the object with the help of this point cloud. The display device will be a LCD screen. Information about crop or pest mentioned by the user in the query will be displayed on it. It acts as an interface between the system and the user.

Microphone is a device that converts sound into an electrical signal. In the proposed system microphone can be used by the user to give input to the system. This means that the system is capable of audio search. Besides audio search, the interactivity of the system is further increased by the use of speakers. The results of the entered query will also be available to the user in audio format through speakers. Interfacing circuit will be used for connecting one device with another so that we can change the output and input configurations to make them work correctly. Amplifier is an electronic device that can increase the power of a signal . It will be used to amplify the signal for speakers to enable audio results.

GSM is an open, digital cellular technology used for transmitting mobile voice and data services. GSM will be used for providing remote access to the system. A simple keyboard with limited number of keys will be sufficient for the system. It will mainly be used for handling information on the display device. The functionality of the keyboard can also be



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increased by adding more number of keys for text based search.

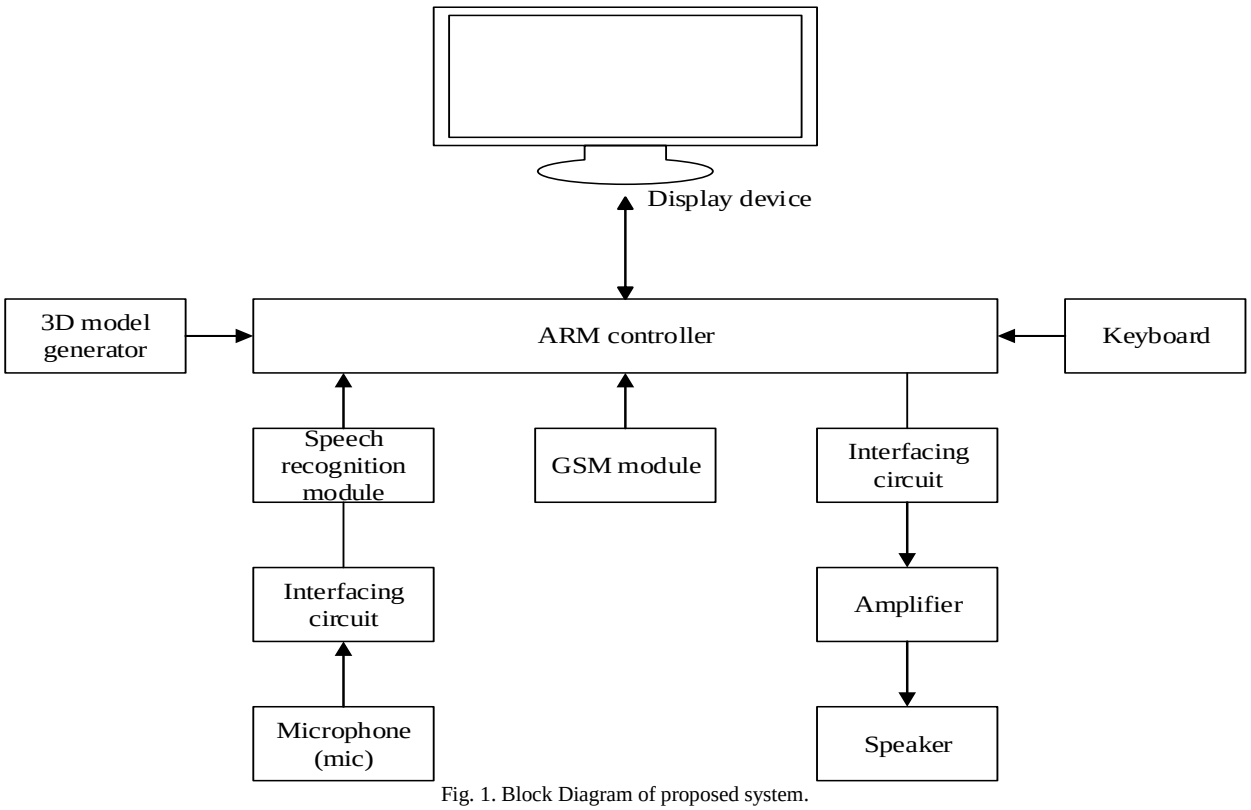


Fig. 1. Block Diagram of proposed system.

## IV. IMPLEMENTATION

The proposed system will assist the farmers in the simplest way possible. All the processing of the system will be done by ARM controller. The user will give input either through microphone or keyboard. Keyboard is connected directly to the ARM controller while microphone is connected to the controller via an interfacing circuit as shown in figure 1.

The output will be displayed on the LCD screen. However the user can also hear the results with the help of speaker. The system also supports identification of a real pest. A 3D model of a real pest will be produced with the help of a 3D scanner. Then this model will be searched throughout the database for identifying the pest. Global System for Mobile Communication (GSM) will be used for data transfer to and from the system for generating the output.

Figure 2 shows the workflow of the proposed system. Once the system is started and initialized, it will require input. Input can be in text format (from keyboard), image format (from scanner) or audio format (from microphone). Highest priority will be given to image based input. If the input is in the text format then the system will generate the corresponding SQL query containing the keywords mentioned in the input. The result of the SQL query will be displayed on the screen. In case of input from the scanner, firstly the real pest or insect will be scanned to generate its 3D image. This will be followed by feature matching of the generated image with the rest of the images in the database. If there is a successful match the relevant information is displayed on the screen otherwise the image is added to the database and the database need to be updated. Input in the audio format will be handled by the speech recognition module. Such an input will either be to scan a real pest or to provide information about a crop, pest or disease. For the first case, scanning will take place as described above and in second case the requested information will be displayed on the display screen.

## V. SIGNIFICANCE

AgroVaid serves its target users(i.e., farmers) in the most rudimentary way. Being integrated with some specialized hardware makes AgroVaid different from existing agricultural portals. Moreover it does not have a complex interface. The user just needs to enter the crop or pest name in order to get related information. One of the most eloquent features of the system is that it can also identify a real pest with the help of a 3D scanner. The user can thus get to know about a pest that is new to him. The availability of the AgroVaid online portal and mobile application further increases the utility of the system.

AgroVaid has got varied number of applications for the farmers. There may be a case where the crop may be infected by a pest or insect that is new to the farmer. The proposed system in this case can identify the real pest with the help of 3D scanner and generate the information about the pest and the disease. There is no need that the proposed system should be personally owned by each farmer in the village. One single hardware model of AgroVaid can be used by a number of people. The system also provides information about preventing crops from various diseases. Thus it can play a



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vital role in preventing crops from damage.

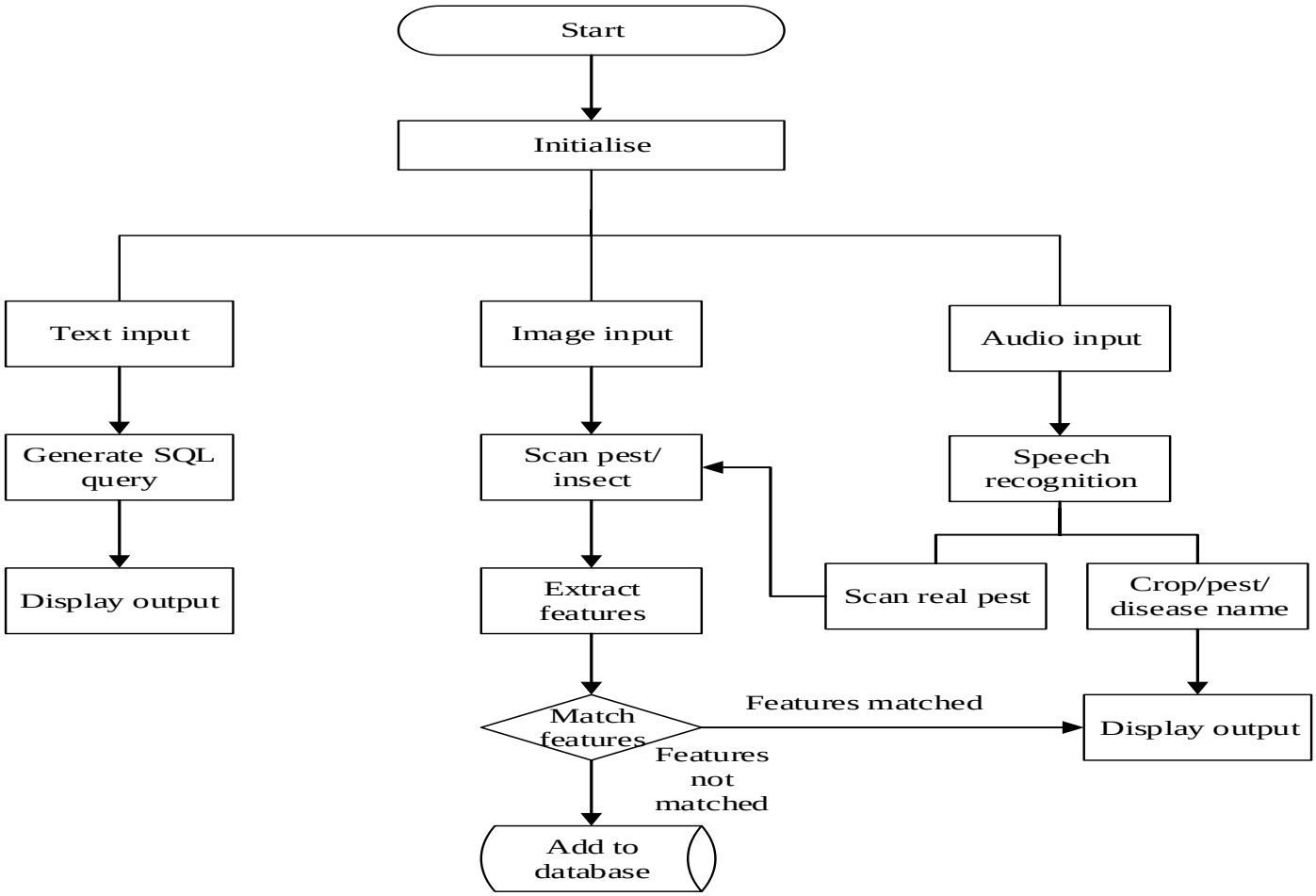


Fig. 2. Workflow of proposed system.

## VI. Conclusion

Agriculture in 21st century depends largely on engineering and technology. Majority of the advancements in this field require technical knowledge for their effective use. But in a developing country like India most of the farmers are either not aware of the latest technology or they are unable to use it. Thus there is a need to introduce an elementary, easy to use system will be of great value to the farmers. AgroVaid is a simple and interactive agricultural system. The proposed system can generate useful information by simply speaking the crop name or pest name, or by typing the same or even by identifying a real pest with the help of a 3-D scanner. It provides information about various crops, pests and diseases caused by them, and precautions to be taken to prevent the crop from various diseases. It will prove to be of great help in increasing the crop yield.

## Acknowledgment

This research work consists of generating an enhanced farmer-friendly interactive system using surface interpolation of 3D object models. This research work shall be integrated with the required hardware by B.E. students (MBSCET, Jammu) as per the idea originally proposed by Dr. Parveen Lehana.

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