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# Internet of Things Enabled -Automated Farming as a Service

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**Abstract:**

The majority of the work that needs to be done in the agricultural sector is described in this paper. This work is performed by an android-based automated device that works according to the command of the farmer (in a language that is specific to his native tongue) using an android application that is installed on the farmer's phone. We offer adequate connectivity between the farmer, the data center, and the automated equipment that are present in the agricultural field so that we may construct an Android automated system. In relation to communication carried out using GCM or JSON, we are going to get the Android automated device to function and then send the acknowledgement message back. In addition, we provide an automatic mode known as auto mode, which enables the automated devices and the data center to connect with one another and share data. The artificial intelligence is supported by the data center. It performs an analysis on the data that was received and then sends back instructions based on the results of the analysis. Additionally, it logs information about each and every process for storage and use at a later time. The farmer-friendly nature of the program that we are developing also includes the capability of asking inquiries or submitting queries. Because of this, we are going to merge the many applications of agriculture into a single system, which is something that has not been possible with earlier technologies and research.

## 1. Introduction:

Agriculture in India has a long and illustrious history that extends back to the time of the Indus Valley Civilization and even farther back in some regions of southern India. The agricultural production of India now places it in second place globally. In 2013, agriculture and its ancillary industries, such as forestry and fisheries, accounted for 13.7% of the gross domestic product (GDP), which is roughly equivalent to 50% of the workforce. The percentage of India's gross domestic product (GDP) contributed by agriculture is falling at a rate that is directly proportional to the overall expansion of the country's economy. Despite this, agriculture is the demographically most pervasive economic sector in India, and it plays a vital part in the country's overall socio-economic fabric.

The elimination of the need for human labor is one of the primary benefits of automation. The rate of growth in industrial automation has been exceptionally significant during the last two decades. However, the notion of automation is not nearly as established in the agricultural sector. The first and foremost reason why automation in agriculture is very essential is because by the year 2042, it is anticipated that the global population will have increased to 9 billion people. The provision of the requisite quantity of food that is of high quality, safe, healthful, and nutritious will be a very difficult issue. Second, traditional methods of agriculture have several downsides, such as the wasting of seed


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and the incorrect spraying of pesticides on crops, which leads to a decline in the quality of the soil and causes food to be toxic to the human body [1].

Automation is the solution to India's quest to become an industrial powerhouse on par with the best in the world. The agricultural sector in India is only starting to experience the effects of the recent stimulus package for the instrumentation, control, and automation business. The field of automation in India is making rapid progress, but it is one that can never be perfected or admired because it is something that requires continuous innovation and the identification of emerging technological trends as well as the innovations that drive the implementation of automation in other countries.

A fresh perspective on the role of mechanization in agricultural crop care was made possible by the advent of technology for precision agriculture in the 1990s. It brought about a change in the understanding and management of variability by presenting a variety of notions, some of which were not novel but brought about the shift anyway. It wasn't until the advent of yield mapping and VRT (Variable Rate Treatments) that the geographic scale of variability was finally able to be effectively evaluated and managed for the first time since the introduction of mechanization. Extending the work that has been done by others in the area of agriculture, a new idea based on Android has been brought to light that makes farming easier and more productive. This concept extends the work that has been done by others in the field.

Due to the aforementioned circumstances, the implementation of an information-based agriculture, often known as "precision agriculture," is required. When used in the realm of agriculture, combining techniques from precision agriculture with the internet of things produces the greatest possible outcomes [2]. Using this, we will be able to exercise stringent control over all of the resources, which will result in increased productivity at a reduced expense.

Agriculture has been one of man's principal jobs ever since the first civilizations, and even in modern times, there is no way to avoid the need for human labor in the agricultural process. The applications of smart phones have been extensively developed in a range of areas as a result of the explosive proliferation of smart phones and the fast development of information technology. The primary goal of this project is to develop the application of android in the agricultural sector as well.

India, while having one of the world's fastest-growing economies that is mostly focused on agriculture and farming, has not adopted technology at a particularly rapid rate. The government need to take the initiative and spread information about the automated system among the populace in order for them to get familiar with it and to be able to participate in its operation.

## 2. Related work:

WSNs were used to create the earlier automation systems that were being built. There have been several suggestions made to design protocols that take into account the energy efficiency of sensors in the tasks that they do for routing. Nodes in hierarchical networks are often arranged in clusters, and one of the nodes in each cluster serves as the hierarchy's head node. The person in charge of a cluster is accountable for organizing activities that take place inside that cluster as well as sharing information with other clusters. By reaching a high delivery ratio in a scalable way, clustering has the ability to cut down on the amount of energy that is used while also extending the lifespan of the network [3]. Because it has to include all of the fields that are being farmed, the network that is used in agriculture may be rather extensive.


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Those wsn are now considered to be obsolete technology since all devices are now linked to the internet of things and android is the dominant mobile operating system worldwide. Therefore, combining Internet of Things with Android technology in the sector of agriculture is likely to result in massive changes in agriculture, as well as an increase in productivity at a lower cost.

The Android Automated device interacts with the internet and data that is either GCM or JSON, which are both lightweight formats. Andy Rubin established Android as an open-source platform in October of 2003. Google and other key hardware and software developers (including Intel, HTC, ARM, Motorola, and Samsung) that are members of the Open Handset Alliance have supported Android from its inception. In the month of October 2008[4,] The software package that comes preinstalled on the device allows for interaction with Google's proprietary apps like Maps, Calendar, and Gmail, and it also includes a web browser that supports the entire HTML standard. Android allows users to run native programs as well as third-party applications that may be downloaded through Google Play. Android Market was first released in October 2008 and was renamed Google Play. Android has evolved to become the most popular mobile operating system. Following this, we will go on to provide an overview of the Android Platform as well as an Android application's individual components. As can be seen in Figure 2, the Android platform is made up of four distinct layers: the applications sit atop the stack, followed by an Application Framework layer that offers various services to applications (such as the ability to control activities or provide data access), a Library/VM layer, and finally the Linux kernel sits at the very bottom.

The code that is used to create JavaScript objects and the JSON format are structurally equivalent in every way. Because of this closeness, a JavaScript application may utilize ordinary JavaScript methods to transform JSON data into native JavaScript objects [5, rather to employing a parser, which is what is required to convert XML data into native JavaScript objects].

A great number of novel ideas are now being created in order to foster the growth of agricultural automation and realize its full potential. In some ways, this situation calls for a paradigm change, in which we move away from the ways in which we have completed these activities in the past and toward the ways in which we might do these jobs utilizing SSM (small smart machines) [6]. The present tendency in the development of equipment is known as incremental development, which means that each new machine is somewhat better than the one that came before it. This is a successful strategy, but it is one that completely disregards other revolutionary options and chances.

## 3. Idea

The primary objective of the A2S is to make life easier for farmers by creating an android-based automatic farming system that is capable of controlling a large number of electrical appliances in an irrigation or field by means of an android platform and a mobile handset, with data transmission being accomplished wirelessly through the use of an Internet service provider [7]. We are aware that energy is supplied to farmers at strange hours. Because of this, we utilize an Automated Android Device to allow the farmer to turn on the motor with a click and turn it off with a touch even when we are not physically present there. When set to automatic mode, the AAD communicates with the data center to relay the results of its statistical calculations on the temperature, humidity, water level, and water content of the soil. In the event that it is necessary, we are able to interact with the automated agricultural machines via Bluetooth in order to get them to function [8]. The farmer keeps a data center running, which is where all of the farmer's activities are kept. The AI is stored at the data center, and it is responsible for analyzing the


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statistical data that is obtained from the device. Based on its findings, the next actions are determined. In the event that the farmer is away from the station, he or she may use the video buffering option to check in on how things are progressing while they are absent. In addition to this, farmers have an option in the Android app where they may submit their questions and subsequently obtain the answers to those questions.

## 4. Working Prototype

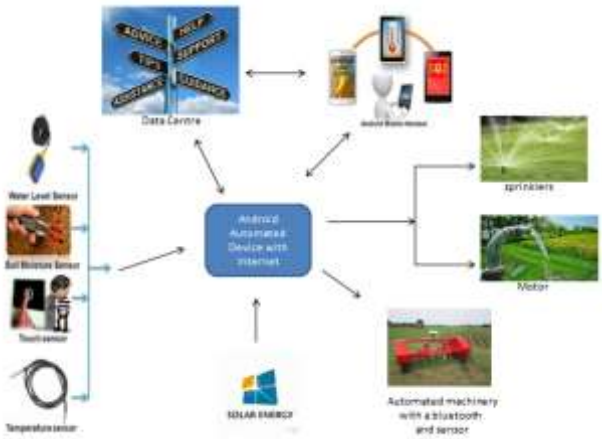

**FIG 1: Architecture of $A^2S$**

### 4,1Devices used in $A^2S$

| SL.NO | Device | Usage |
|---|---|---|
| 1 | **Automated Android Device** | It is the main part of the $A^2S$ and it communicates with all the other parts of the system and transfers the data |
| 2 | **Application** | Rests on the android phone and is used to control the operation of the device |
| 3 | **Solar Panel** | It is used to supply the power to AAD (Automated Android Device). |
| 4 | **Data Centre** | Data center rests the AI which is used to analyze the data and send the commands back. It also stores the every single user operations. |
| 5 | **Sensors** | These are used to sense the humidity, water level, water content and temperature in the soil and the sends the data to AAD. |

- **Automated Artificial Device** is the main part of the system and works on Android Operating System. It collects the data from the sensors at given periods of time and sends that to the farmer. It receives the commands from the user in the form of GCM or jsonwhich are light in weight and use less data for transferring the data. On Command it communicates with motors,


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automated machines and does operations as per the command [9]. It communicates with automated machines using Bluetooth. AAD in auto mode sends the calculated statistical details of temperature, humidity, water level and water content in the soil to the data center. In normal mode the data is sent to the android app which is being used by the farmer. When the ISP is not available then it uses GSM for exchange of data.

- **Application** is developed for the android phones. It consists of two modes. One is normal mode where the AAD send the authenticate access notification to the phone where u can authenticate for the operation to take place or not. Where as in the auto mode the data is sent to the data center and the data is analyzed and the data is sent back to do an operation. It also has the option of posting questions about the farming issues and gets the reply from the data center in few hours describing the solution for the query. With a tap on the application we can switch the motor on and off from remote place. It receives the statistics about temperature, humidity, water content and water level in the field.
- **Solar Panel** is installed near the AAD and this is used to supply the electricity to the AAD [10]. This solves the problem of having the electricity supply issues with to the AAD.
- **Data Center** rests the AI where data received from the AAD is analyzed and reply is sent back to AAD to do the required operation. It replies to the queries asked by the farmers. It aslo stores the every operation of the farmer.
- **Sensors** are deployed in the field at certain positions and the data is sent to AAD at certain intervals of time.

## 4. Implementation

Working of the above system is explained in the form challenge faced and the solution provided by this system

**Challenge-1:** Need of monitoring the crop for statistics like humidity, water content in soil, temperature etc.

**Solution:** It solves the above challenge as sensors are deployed in the field and the statistics are collected in AAD and the normalized results are sent to both user and the Data Center. Farmer can regulate the time interval before receiving another notification about the statistics i.e. we can set the time interval for receiving the data about this [11]. The data sent to the Data Center is stored for analyzing. When the AAD is in auto mode the data is sent to both but the next action to do is taken care by the AI which is present in the Data Center



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**FIG 2: Field or land monitoring**

**Scenario 1:**

Let us assume there a crop is in the initial stages and there a requirement that some environmental conditions to be maintained for the growth of crop. With the title we can get data about conditions like humidity, water level and content of water in the soil. And if we think that there is need of water then motor can be switched on immediately.

**Challenge-2:** Controlling the motor/sprinkler remotely

**Solution:** If farmer is far away from the field and the above is needed to be controlled then with a click of a button in the application it is turned on and off using GCM or JSON [12]. In auto mode the average time between two turning on off motors is calculated by the AI and the motor is switched on or off accordingly.


FIG 3: Motor Control

**Scenario 2:**

Let us assume that the electricity is being supplied at late hours and the farmer has to go all the way to the field and switch the motor on and have to be present to turn off the motor at those late hours. So this product gives the solution as they can switch the motor on or off very easily using the Application being present at home.

**Challenge-3:** Controlling the level of water in the field.

**Solution:** Let us assume there is a heavy rain with which the field is completely filled with water. So if these persist then there may be a chance of losing the crop. So as a solution a small gate as dam is prepared near the field and whenever there is large amount of water they can be taken off the field automatically. The water being drained out can be used for storing purpose for future use.


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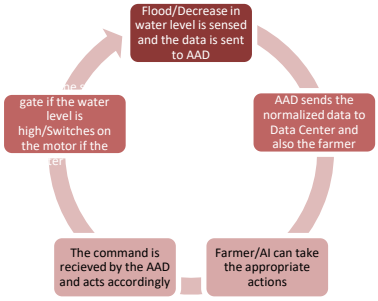


**FIG 4: Water Management`**

**Scenario 3:**

Let us assume the crop is at the final stage and is ready to harvest. Assume it rained very heavily that the complete field is filled with water which destroys the crop. The AAD sends the alert to the farmer and also the data center. If the farmer opts to open the gate then the AAD opens the gate until the water is drained off.

**Challenge-4:** Control of Farming Machinery

**Solution:**Let us think that in future we will be using automated machines like automated tractors in our Indian Fields which are used to plough the field. So we can access them by turning it on or off using Bluetooth or any other communication devices. AAD receives the command and communicates with the device to turn it on or off.

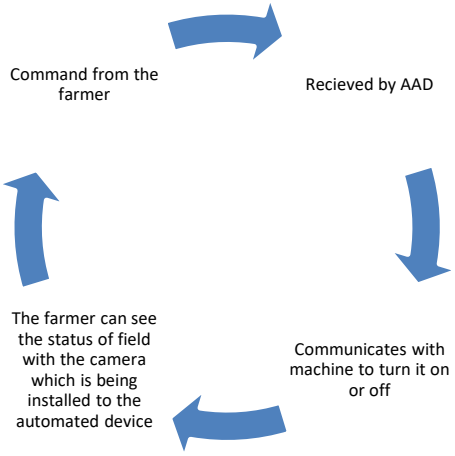


**FIG 5: Online Monitoring**

**Challenege-5**: If there is query about farm and agriculture.

**Solution:** So as to clear the queries and doubts of the farmer. We add a forum to it where farmers can ask their questions and get the answers. To our assumption if they are illiterate they can capture the diseased leaf and they can send that to Data Center. Data Center analyzes it and gives the remedial solution to farmer.


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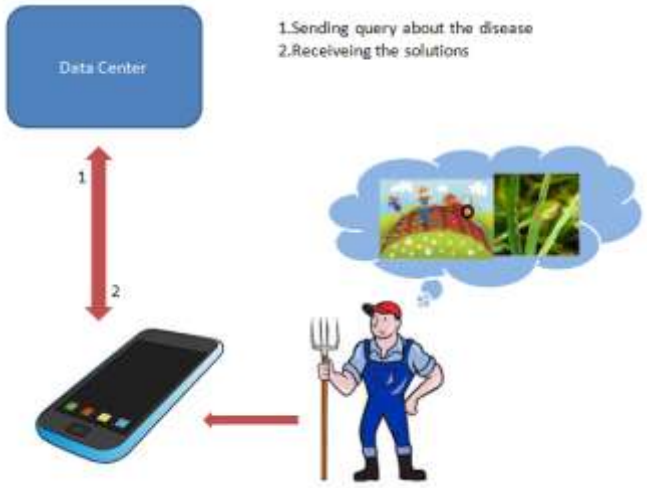


**FIG 6: Mobile Query**

**Scenario:** Assume the crop is infected with a disease. The farmer don't know the solution for it. He can just capture the photo graph of the diseased plant and can send that to the Data Center. They provide farmers with the solution.

**Challenge-6:** Notifying the farmer about spraying the pesticides.

**Solution:** This system also solves the problem of forgetting about spraying the insecticides and pesticides. If farmer give the date of the first sprayer and later how many days the next course is to be implemented then it alerts the farmer before 3 to 4 days so that he can make ready of what he actually need like pesticides etc.

**Challenge-7:** The tension to the farmer about what is happening in the field if he/she is out of station.

**Solution:** The solution that is being given here is using the video buffering facility provided. Though the each part of the field is not covered if AAD is placed such that all there will be a overall view it would be helpful for the farmer. It is still in the idea development phase. If it is developed better then it would be very much useful to the farmer.

**Drawbacks and their solutions:**

| SL.NO | Drawback | Solution |
|---|---|---|
| 1 | 24*7 supply of electricity to the Automated Device | Solved the problem of electricity by using Solar Plant in the system. And as the solar Plant is subsidized by govt. of AP the projects gets cost efficient. |
| 2 | 24*7 ISP | As a new project on Internet provision is being implemented in AP makes the project cost efficient. |
| 3 | Theft | 1. Touch sensors are placed which raises an alarm and sends notification to android application when |


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| | | |
|---|---|---|
| | | it is touched.<br><br>2. When the ISP is disconnected or the connecting cable is damaged it sends a message to the farmer. |
| 4 | ISP Connectivity Issues | If ISP is not available then it uses GSM module to communicate with the farmers in the form of messages. |
| 5 | Illiteracy | Though the farmer is uneducated they can work with android applications as they are developed on their native languages. |

## 5. Future Enhancement:

In future it may be possible to control all the machinery present in the agriculture land with just one application by using this System. As IoT is building a lot of craze there may be extensions possible and android has been used that this can used for future projects also.

## 6. Conclusion:

Irrigation has been the backbone of human civilization since man has started agriculture. As the generation evolved, man developed many methods of automation in the agriculture. In the present scenario decreasing the man power is of high importance. Present work is attempts to save the natural resources available for human kind and also make easy way of farming. By continuously monitoring the farm we can easily get maximum yield of crop.

By knowing the status of moisture, temperature and water level sensors through ISP and GSM with the use of moisture and temperature sensors, water flow can be controlled by just clicking a button or sending a message from our mobile. In large scale applications, high sensitivity sensors can be implemented for large areas of agricultural lands

Conservation of water and labor: Since the systems are automatic, they do not require continuous monitoring by labor.

System and operational flexibility: We can make AAD work in both manual and auto mode where the land is being managed by farmers commands or AI. The design is robust and highly versatile.

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