**AUTOMATED TRACTOR AND ADVANCED DESIGN IN ATTACHMENTS**

**ABSTRACT**

A soil nitrogen phosphorous sensor (NPK sensor) is developed and installed at the back portion of the automated tractor to measure and to detect the presence of Nitrogen (N), Phosphorus (P) and Potassium (K) of soil. Such sensor network technology is needed to decide how much extra contents of these nutrients are to be added to the soil to increase soil fertility. This can improve the quality of soil and reduces the undesired use of fertilizers to be added to the soil. The N, P, and K value of the sample are determined by the interaction between incident light and soil surface properties, such that the characteristics of the reflected light vary due to soil physical and chemical properties. The stainless-steel probe used in the soil NPK sensor which can be buried in the soil for a long time and is resistant to long-term electrolysis, salt, and alkali corrosion. The shell is vacuumed pot and completely waterproof. It can apply for the detection of alkaline soil, acid soil, substrate soil, seedling bed soil & coconut bran soil. The system utilizes a cloud computing service for data acquisition therefore the output from the sensor is converted into a digital display reading. On various samples of soils, the soil NPK sensor can evaluate the amounts of NPK soil content as High, Normal and low.

A weeder is installed with a mechanical hand and connects the main frame of the automated tractor. The blades in the weeder gets will be placed on the soil while the automated tractor moves through which it helps in uprooting the perennial weeds present on the surface of the soil. Removing the weeds help the crops to absorb more nutrient and water from the soil, which increases the nutrient enrichment and yield of the crop produced.

The automated tractor is powered by solar energy where a solar panel is placed at the top of the automated tractor which a renewable source of energy and the primary source of electricity is collected in solar cells and passed to voltage regulator which stabilizes the voltage and passes the current to inverter where it converts AC to DC current. This DC current powers the motor and sensor of the automated tractor.

**INTRODUCTION**

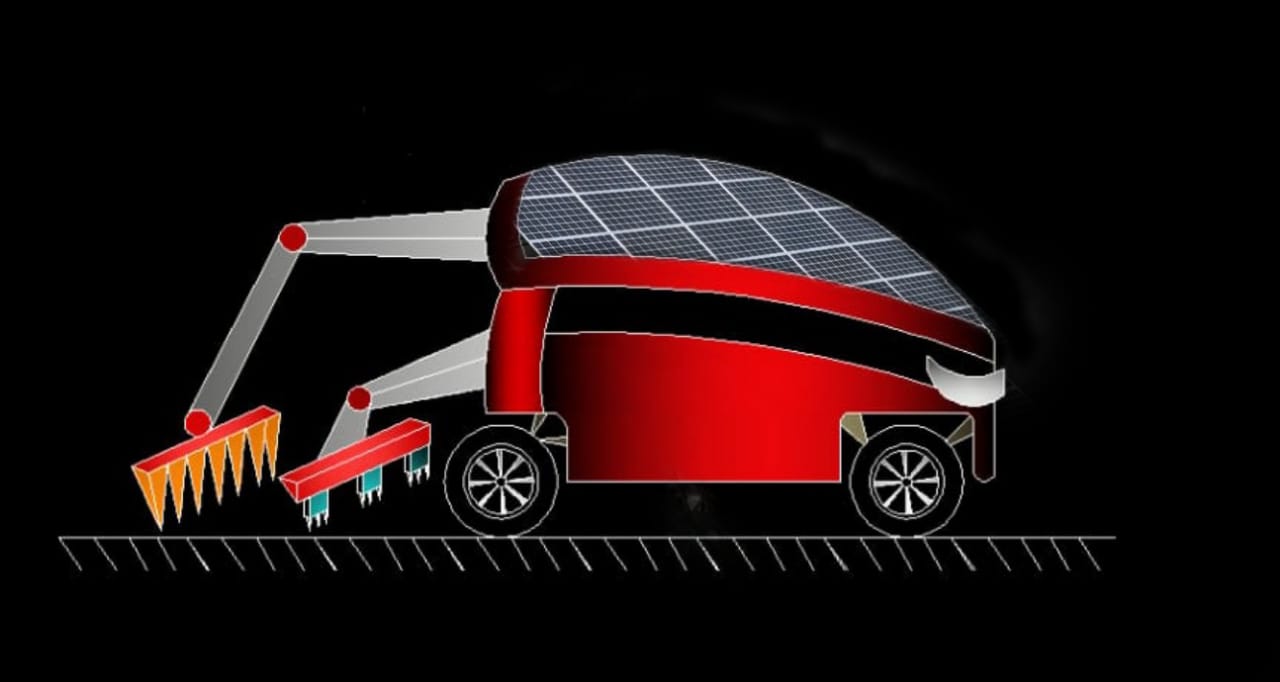
In the world of advanced technology various types of new inventions have been invented to facilitate the daily activities of man. As well as in agricultural technology, a variety of tools that have been created to help farmers make their agricultural activities more effective and easier with more yield and profit, and India is mainly an agricultural country where agriculture is the most important occupation for most of the Indian families. Over 60% of India’s land area is arable making it the second largest country in terms of total arable land. Most of the farming in India is monsoon dependent. Green revolution began in India with an objective to give greater emphasis on Agriculture. Significant increase in the production of food crops, the productivity of land increased tremendously giving huge economic boost to the nation. But still the productivity rate of agricultural practices in India is low in contrast with the available agricultural land.

To get a good crop with higher yield, one of the important things that should be there is land that has adequate fertilizer. Adequate fertilizer can help plants produce good yields and quantities, to meet the needs of food and food production of the drastically population. To improve the quality and quantity of crops, every country must contain sufficient nutrients, which consists of Nitrogen (N), Phosphorus (P) and Potassium (K). These three elements nutrients promote the growth of the plant in different ways [1]; Nitrogen promotes the growth of leaves and vegetation, Phosphorus promotes root and growth and Potassium promotes flowering, fruiting and keeps regulation of nutrient and water in plant cell. Excess usage or lower usage of the fertilizers can affect the crop growth and yield.

Weeds also play a major role in affecting the crop growth and crop yield, these weeds absorb the nutrients and water present in the soil and has the ability to spread their growth rapidly which affects the agricultural process. Thus weeding is an important and essential process in agricultural practices. Weeding requires labours which again affects the profit of farmers due to labour cost. The use of automated weeder can be used in agricultural practices which helps in more accurate weeding and increase the profit of the farmers

Agricultural practices also needs source of energy and man power. Using non-renewable source of energy like petrol, diesel and kerosene for tractors and other agricultural automated tractors will increase the cost of agricultural practices which may have impact on the farmers profit over these practices. In order to overcome these problems and increase the profit of the farmer and decrease the labour costby using AUTOMATED TRACTOR AND ADVANCE DESIGN IN ATTACHMENTS can be used in agricultural practices. Where solar power is a renewable source of energy and also it is eco-friendly. With the advancements in technology, we can implement these ideas in order to improve the nutrient value and yield of the agricultural practices.

**MECHANICAL DESIGN**

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AUTOMATED TRACTOR AND ADVANCED DESIGN IN ATTACHEMENT

**1. STREAMLINED STRUCTURE**

This automated tractor has a streamlined structure. An advantage of this streamlined body is that it decreases the amount of friction drag. Drag is a form of force that slows down the object. The automated tractor with this streamlined structure brings down the friction of movement to minimal value thus reducing overall drag. This is one of the major advantages of this automated tractor.

For example, fishes have a streamlined body that helps them to save energy. The same concept is applied here; this structure helps to save energy as well as to move faster.

**2. ELECTRIC VEHICLE**

Since this automated tractor is an electric vehicle, it has more advantages over a conventional automated tractor.

**POWERTRAIN EFFICIENCY**

This automated electric automated tractor is getting powered by electric motors. Relying on the velocity, torque it has a complete efficiency between 75 to 95 percentages. which means that it consumes muchless amount of strengthfrom the high voltage source when compared to an internal combustion engine

**MACHINE ACCELERATION**

For the traction characteristic, the ideal motor is a permanent magnet synchronous electric motor (PMSM). Furthermore, at zero velocity, this electric motor can generate the maximum available torque, aiding the automated tractor's excellent launch characteristics.

**CO2 AND EXHAUST EMULSION**

Since this is an electric automated tractor there is no internal combustion. So the electric automated tractor will have zero exhaust gas emission. Because solar energy is used to generate electricity in this automated tractor, the overall CO2 footprint of an electric automated tractor is lower than that of automated tractor powered by an internal combustion engine.

**TOTAL COST OF OWNERSHIP**

Because this is an electric automated tractor, there are fewer moving parts and components to maintain, making it easier and less expensive. Furthermore, in most nations, the cost of electric energy is cheaper than the cost of petrol. This automated tractor's main braking system has a lower utilisation factor, resulting in a longer service life. life.

**TORQUE VECTORING**

During cornering, we can easily able to stabilize by adjusting torque in automated tractors. An electric motor has faster torque response when compared to the internal combustion engine. This also provides negative torque, which proves that this is essential to achieve the stability of the automated tractor.

**RELIABILITY**

In comparison to an internal combustion engine, an electric automated tractor provides the following advantages: Because of the high torque and high-speed characteristics of the electric motor, a single-stage mechanical gearbox is sufficient; a multi-stage gearbox is not required.

**3. SOLAR POWERED**

Solar panels are devices which convert heat energy to electrical energy by absorbing sun rays. It is a collection of photovoltaic cells or solar cells. It generates electricity through an effect known as the photovoltaic effect (PV). The solar panel in this automated tractor is flexible so the space occupied by solar panel is less and it looks compact. Solar panels are made up of crystalline silicon solar cells.Solar panels are eco-friendly because it does not lead to any form of pollution.They also reduce the dependence on non-renewable resources (fossil fuels) which are limited.

**WORKING OF SOLAR PANEL**

The solar panel consists of several solar cells. Silicon layers, phosphorous (which functions as a negative charge), and boron make up each one (which serves as a positive charge).

* Solar panels gather sunlight (renewable energy) and turn sunlight into electricity, which is then utilized to power electrical appliances.
* It absorbs light quantum (photons), which causes an electric current to flow.
* When photons impact the surface of a solar panel, the energy released causes electrons to be drawn out of their atomic orbits and ejected into the electric field created by the solar cells, which then draws these free electrons into a directed current. This mechanism is known as the Photovoltaic Effect.
* From the solar array to the battery bank, the charge controller transfers direct current (DC) electricity.
* The electricity is then extracted from the battery system and transferred to the inverter, which converts DC (direct current) to AC (alternating current) so that non-DC equipment may utilize it.
* With the use of inverter, solar cells, battery bank.Solar panel arrays can handle even the most demanding power loads. The alternating current can be used to power loads which supply the power to run the automated tractor.

**Advantages of Solar Panel**

Solar panels are the most efficient way to generate electricity for many purposes. It is both environment - friendly and a renewable energy source. Due to the increase in global warming and greenhouse gasses it is more important to know that whatever we do should not affect the ecological balance and nature. Solar panels require little maintenance because it has no moving parts. It will last for decades when it is maintained properly as solar panels are ruggedly built. The major benefits of using this automated tractor are that we have used flexible solar panel which is more futuristic and more advantageous.

**4. WEEDER**

Weeds are undesired plants that grow in the same area as the main crops. They are hardy and interfere in harvesting. They compete with main crops for water, nutrients, space, and light, thereby affect the main plant growth. Their quick seed germination, easily adapting characteristic make them a good competitor for main crops. The growth of the weeds needs to be controlled to enhance the growth of the main crops.

The damages caused by them are:

1. **Reduction in crop productivity**: Weeds compete with crops for resources such as water, nutrients, and light. Because they are strong and sturdy in growth, they grow much faster than crops and absorb a huge quantity of water and nutrients, leading to significant production losses.
2. **The value of the output is reduced:** When the crop is harvested from a weedy field the seeds of weeds get mixed with the main crop which decreases the quality of the produce.
3. **Weeds depreciate the value of land:** Agricultural lands that are extensively infected with weeds are always sold for a lower price since they are difficult to cultivate without a significant investment in personnel and automated tractor.
4. **Weeds shelter insects, pests, and diseases:** Weeds serve as alternate habitats for a variety of insects, pests, and diseases.

Disadvantages of weeds:

The disadvantages caused by weeds are:   
1.    Suppress the growth of the crop in the agricultural field.  
2.    Reduces the fertility of the land.  
3.   Weeds convert the land unavailable for agricultural Practices.

Weeding is the process which involves removal of weeds from the field. Crop protection and crop production management are made easier with this strategy. It must be eliminated since it causes interference and lowers yield. Land preparation, water management, hand weeding, hand hoeing, crop rotation, and pesticides etc are the methods for controlling weeds. Land preparation aids in the eradication of weeds prior to the sowing of major crop seeds. Farmers manually weed their fields, which is a laborious and time-consuming task.

Rice farming is very hard. Planting in rows also makes weeding much easier. The most of the options for weeding cost more than the salary of farmer.

**WORKING OF WEEDER**

In rice farming, most of the weeds are at the surface of the soil. We are concentrating more on pre-weeding.

* The blades of the weeder is inserted into the soil, while the automated tractor moves through which it helps in uprooting the perennial weeds present on the surface of the soil.
* Its head is larger. These are L-shaped and are commonly used to clear weeds from stone crevices and the soil's surface.

It is expected that this tool will reduce the time spent in weeding. Instead of spending 7 days weeding the field by hand it will two days using this modernized automated tractor.

**CLOUD COMPUTING**

Cloud computing is the distribution of computing services via the Internet (the cloud), including servers, storage, databases, networking, software, analytics, and intelligence, in order to provide faster innovation, more flexible resources, and economies of scale. You usually only pay for the cloud services you use, which helps you cut costs, run your infrastructure more efficiently, and scale as your business grows.

**Top Advantages of cloud computing**

Cloud computing represents a huge change from how companies have traditionally viewed IT resources. The following are seven of the most common reasons why businesses are turning to cloud computing services:

**Cost**

Cloud computing reduces the upfront costs of purchasing hardware and software, as well as the costs of building up and running on-site datacentre’s—server racks, round-the-clock power and cooling, and IT experts to manage the infrastructure.

It quickly adds up.

**Global scale**

The capacity to scale elastically is one of the advantages of cloud computing services.

That implies delivering the proper amount of IT resources—for example, more or less computing resources, storage, and bandwidth—at the right time and from the right geographic place, in cloud language.

**Performance**

The most popular cloud computing services are hosted on a global network of secure datacentre’s that are updated on a regular basis with the current generation of fast and efficient computing hardware. This offers several benefits over a single corporate datacentre, including reduced network latency for applications and greater economies of scale.

**Reliability**

Cloud computing makes data backup, disaster recovery and business continuity easier and less expensive because data can be mirrored at multiple redundant sites on the cloud provider’s network.

**Productivity**

On-site datacentres often necessitate a great deal of "racking and stacking"—hardware configuration, software patching, and other time-consuming IT administration tasks. Many of these duties are no longer required with cloud computing, allowing IT personnel to focus on more critical business objectives.

**Speed**

Most cloud computing services are self-service and on-demand, which means that even massive amounts of computing resources may be provisioned in minutes, usually with only a few mouse clicks, offering businesses a lot of flexibility and relieving capacity planning strain.

**Security**

Many cloud providers provide a comprehensive set of policies, technologies, and controls to help you improve your overall security posture and safeguard your data, apps, and infrastructure from threats.

**Uses of cloud computing**

· Create cloud-native applications

· Quickly build, launch and scale applications—web, mobile and API

· Take advantage of cloud-native technologies and methods, such as containers, Kubernetes, micro services architecture, API-driven communication and DevOps.

· Test and build applications

· Store, back up and recover data

Protect your data more cost-effectively—and on a large scale—by shifting it to an offsite cloud storage solution that can be accessed from any place and device.

· Analyse data

In the cloud, unify your data across teams, divisions, and geographies. Then leverage cloud technologies like machine learning and artificial intelligence to unearth insights that can help you make better decisions.

Stream audio and video

· With high-definition video and audio that is distributed globally, you can connect with your audience anywhere, at any time, on any device.

· Embed intelligence

Use intelligent models to help customers engage and gain important insights from data collection. Also known as software as a service

(SaaS), on-demand software lets you offer the latest software versions MNNMQTTand updates around to customers—anytime they need, anywhere MVthey are

The MQTT protocol was utilised for cloud computing. So, here are some specifics available on this protocol, its implications, and how it tends to work.

In the late 1990s, IBM came up with the concept for MQTT and developed it. First ever aim was to attach oil pipeline sensors to satellites. It's a messaging system that allows parties to communicate synchronously, as the name implies. Asynchronous messaging mechanisms segregate the sender and receiver in space and time, allowing them to be scalable in unpredictable network environments. Asynchronous messaging differentiates the transmitter and recipient in place and time, allowing them to adapt in unpredictably fluctuating network configuration.

• Due to the extreme protocol's low weight, and can be used on both constricted device hardware and networks with high latency and limited capacity.

• Its approach empowers it to accommodate a vast array of IoT device and service key technologies.

A message broker and a number of clients are different kinds of network entities specified by the MQTT protocol. The broker is a server that receives all client messages and delivers them to the appropriate destination clients. A client is anything that can transmit information with the broker. A client might be an IoT sensor in the field or an IoT software development application in a cloud infrastructure.

1. The client needs to connect with the broker. It can sign up to any of the broker's messaging "themes." For sensitive messages, this connection might be a regular TCP/IP connection or an encoded TLS connection.

2. The client conveys the data and the theme to the broker, who then publishes the messages under that theme.

3. The message is then sent by the broker to all clients who have subscribed to that subject.

Since MQTT messages are structured by themes, the application developer can declare that specific clients can only interact with specific messages.

MQTT, on the other hand, is a little protocol. It contains a simple header that indicates the message type, a topic that is text-based, and then an arbitrary binary payload. As long as the key customers can understand the payload, the application can employ any data type for the payload, such as JSON, XML, encrypted binary, or Base64.

The mosquito module, which is part of the Eclipse project. This includes MQTT SDKs and libraries in many programming languages, is the easiest tool to get started with MQTT development. It includes a local MQTT broker and command-line tools for interacting with the broker via messages.

The power of MQTT is its simplicity. There are no restrictions on the kind of subjects or message payloads you can employ. This opens up some intriguing possibilities.

Consider the following questions:

How can I send one-to-one messages using MQTT? Both parties might decide on a topic that is specific to them. To assure its uniqueness, the subject name might, for example, include the IDs of both clients.

How does a client announce its presence? For “presence” subjects, the system may have a standard naming convention. The presence information for a client, for example, may be stored in the “presence/client-id” topic. When the client joins, it sets the message to true, and when it disconnects, it sets it to false.

A last will message can also be set to false by the client, such that it is sent when the connection is lost. The message can be saved by the broker so that new clients can read it and learn about the status of their presence.

How can I keep my conversations safe? To secure data in transit, the client-to-broker connection can be an encrypted TLS connection. Furthermore, because the MQTT protocol does not place any restrictions on the payload data format, the system may use a mutually agreed-upon encryption technique and key update mechanism. After then, the payload's whole content may be encrypted binary data from the original JSON or XML messages.

**SOIL COMPOSITION FOR RICE CROP**

Organic materials, minerals, gases, liquids, and creatures all contribute to the survival of life in the soil. The following are the functions of the pedosphere (earth's surface):

• As a growing substrate for plants

• For water storage, supply, and purification

• As an alternative to the Earth's atmosphere

• As a place for organisms to live

For the production of rice crops, the soil composition should be:

Since rice is a tropical plant, it necessitates a lot of water in order to thrive. As a result, the soil used should be able to hold a lot of water. Some of the soil textures used for rice farming includes silt clay, silt clay loam, and clay. Although the pH of the soil should be 6-7, rice can thrive in a pH range of 4-8. Rice growing is best done on flatland because it allows for even water distribution. Because it keeps water for a long time, clay soil is commonly employed for rice production.

How much nutrients do the crop require?

• 15-20 kg nitrogen (N)

• Phosphorous (P): 2 to 3 kg

• Potassium (K): 15-20 kg (Can be lowered to 3-5 kilogram/ha per tonne of grain yield if all straw remains in the field and is evenly distributed.)

**DEFICIENCY OF N, P, K**:

Rice with NPK deficiencies usually exhibits numerous symptoms like:

**Under N deficiency:** At the tip, the leaves turn pale green and chlorotic. Deficient leaves are narrow, short, erect, and lemon-yellowish, with the exception of immature leaves, which are greener.

**Under P deficiency:** Leaves are narrow, short, very erect if the variety tends to produce anthocyanin.

**Under K deficiency:** On the tips of older leaves, dark-green plants with yellowish-brown leaf edges or dark-brown necrotic patches occur. Leaf tips turn yellowish-brown when there is a severe K deficit, and older leaves turn brown. As a result, nutrient shortage can be detected based on the colour and form of the leaf and sheath.

**EXCESS OF NPK CAUSES:**

• Microorganisms break down fertilisers and decomposing plants, resulting in nitrates. They can be washed into groundwater by irrigation or rain.

• Typically, growth is slowed. Potassium levels that are too high can inhibit growth.

• Older leaves are generally yellowing (bottom of a plant). Certain indicators include the rest of the plant being light green.

**SENSOR**

The usage of commercial N, P, and K fertilizers has resulted in a significant rise in agricultural crop production. In order to meet the ever-increasing demands of food production over time, it is vital to consider the fertilizers that are required. These fertilizers must be applied in the correct quantities. If these fertilizers are applied in insufficient amounts, they may result in weedy crops. These crops may be unappealing in terms of color, length, and flavor. The amount of NPK required depends on the type of crop and the stage of plant growth. The amount of fertilizer to be used is determined by the current amount of NPK components in the soil. Growing worries about environmental degradation as a result of increased fertilizer use has necessitated a greater requirement to monitor and check soil nutrients essential for agricultural growth. Researchers in the agro industry are looking for strategies to boost crop productivity while using less fertilizer. Many researchers have attempted to build sensors to identify the elements of nutrients in farmed fields since the components differ on a small scale. This sensor network technology will help the farmers to identify the soil necessities which will help them take better choices and preventive caution measures at the correct time. This will lead to increased improvement in the crop productivity. This, in turn, is time, labor, and money intensive and will make effective use of resources. An integrated crop management system has been created to explore the behavior of NPK. Precision agriculture is a farm management method based on sensing position and information technology that can help improve soil quality.

**NPK SENSOR**

The soil nitrogen, phosphorus, and potassium sensor (also known as the soil NPK sensor) is suitable for sensing the content of nitrogen, phosphorus, and potassium in the soil as well as evaluating the soil's fertility by identifying the above cited composition, making a well-planned examination of the soil's fertility much easier. The soil npk sensor's stainless-steel probe may be submerged for a long period and is resistant to long-term electrolysis, salt, and alkali damage. The covering is vacuum-potted and totally water-resistant. It can also be used to detect alkaline, acid, substrate, bed soil, and coconut bran soil, among other things.

**Features of soil nitrogen, phosphorus, and potassium sensor**

1. Convenient, minimal operation steps, measurement at a faster pace, without reagents, abundant detection times.

2. High measurement precision, quick response time, and excellent versatility.

3. The electrode is comprised of a specially treated alloy material that can withstand harsh external impact and resists damage.

4. Tightly enclosed, acid and alkali corrosion resistant, and capable of being stored beneath the earth for longer-term testing process.

5. The probe's plug-in architecture ensures that measurements are accurate and that its performance is consistent.

**Datasheet for NPK sensor**

|  |  |  |
| --- | --- | --- |
| Energy supply | 5-30VDC | |
| Power usage at maximum | ≤0.15W | |
| Operating temperature | -40~80℃ | |
| NPK characteristics  NPK characteristics | Range | 0-199 mg/kg(mg/L) |
| Resolution | 1 mg/kg |
| Precision | ±2%FS |
| Response time | ≤1S | |
| Grade of protection | IP68 | |
| Material used for sealing | Epoxy resin that is black and flame-resistant. | |
| The standard cable length | 2 m, the length of the cable can be changed. | |
| Dimensions | 45\*15\*123mm | |
| Output signal | RS485/4-20ma/0-5v/0-10v | |

**How to useNPK sensors in the soil:**

**1.Quick Test Method**

To guarantee that the steel needle does not come into contact with rocks or sharp things, choose a site away from them. The surface dirt must be thrown away according to the appropriate measurement depth, while the soil underneath must be kept as tight as possible. The sensor must be held lengthwise and put into the soil. The needle should not be disturbed. It is suggested that you measure several times within a smaller range of measuring points to get an approximate true value.

**2. Buried measurement method**

Make a pit with a radius> 10cm longitudinally. Fill the pit firmly by inserting the sensor needle lengthwise into the pit wall at a predetermined depth. Following a time of stability, measurement and recording can be done for several days, weeks, or even longer.

**Precautions**

1. During the measurement, all steel needles should be inserted into the soil.

2. To avoid overheating of the sensor, strong and direct sunlight should be avoided. Lightning protection on the field must be considered.

3. The steel needle should not be bent intensely. Do not severely pull the sensor's lead wire, and do not impact the sensor aggressively.

4. IP68, is the sensor's protection grade.

5. The whole sensor can be drenched in water.

**ADVANTAGES**

* **DATA HIGHLY ACCURATE**

The data collected by the sensor is stored and conveyed through the advanced IoT systems which connects with IBM cloud computing services and notifies the user within minutes about the accurate values the Nitrogen (N), Phosphorous (P) and Potassium (K) contents present in the soil.

* **BALANCE NUTRIENT CONTENT**

With the information about the accurate values of the nutrient content in soil, it will be easier for the farmers to maintain the balanced nutrient content in the soil by increasing or decreasing the fertilizer usage which helps the crop to get good nutrients from the soil and can be produced in higher yield.

* **LESS MANUAL WORK**

The advanced electrical automated tractor is capable of doing multi tasks and can be operated by a single person, thus it helps in reducing the works done by laborers for weeding and researchers foe testing the soil in lab.

* **MORE PROFIT**

By reducing the labor cost and lab testing cost the farmer’s job is done easily and cost efficiently, while the nutrient content of the soil is balanced it will help in increasing the yield produced which gains more profit for the farmer.

* **HARVEST SOON**

High nutrient content and proper weeding of the soil can help the crops grow efficiently by reducing the damage of the crops, with proper management of the agricultural practices using technology helps the farmers to harvest at correct time without any delay in the harvesting process.

* **LESS TIME CONSUMPTION**

The AUTOMATED TRACTOR AND ADVANCE DESIGN IN ATTACHMENTS reduces the labor work, lab testing process and gives accurate details about the soil nutrient content through which the soil nutrient content is balanced and no lag is said to be occur in harvesting process which is conventional and highly time efficient method for the farmers to implement in agricultural practices.

**CONCLUSION**

As a conclusion, the AUTOMATED TRACTOR AND ADVANCE DESIGN IN ATTACHMENTS with an NPK sensor, automated weeder which is powered by a solar panel is considered to be an alternative method of determination of the deficiency N, P or K in the soil, hand weeding and other petroleum weeders which are used in agricultural practices. This project can reduce the problems in determining the amount of nutrients in soil with a cheaper cost in contrast to other technologies and this project is also highly time efficient. The weeder and the senor are powered by solar energy which is a renewable source and both weeder and sensor work simultaneously which can reduce the labour cost and helps in time management. It can also reduce the undesired use of fertilizers to be added to the soil which can affect the growth of plants and reduce plant quality and quantity. This can be determined by the values of each nutrient present in the soil separately and decide the level of nutrients into three voltage levels: Low, Medium and High in the display it through digital readings. This project will play an effective role in agricultural practices and with further advancement in technologies this can be achieved with more successful rate in order to increase the productivity of agricultural practice in our country and world.