



## International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

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Vol. 5, Issue 3, March 2017

# Unmanned Agriculture System Model Design Using Programmable logic controller

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**ABSTRACT :** The creation in agribusiness is not adequate in this day and age. So we have to expand the creation to balance the requirements. Be that as it may, because of the advancement in different fields, the human hotspot for working and keeping up the development arrive with legitimate consistency is inadequate. With regards to Indian Agriculture System, the climatic condition is isotropic and there is a need in the utilization of horticulture resources. The water system framework which is controlled physically is not in effective way. There are a few issues, for example, extra water utilization, terrible nature of compost readiness, Additional or lacking manure utilization. Programmed horticultural framework with computerized water system framework having all inclusive spout for showering water, compost, pesticides in view of the need is executed. The field is checked by having soil dampness sensor, mugginess sensor and temperature sensor. The detecting units are set in different areas for perception. The development of the plant is observed utilizing IR sensors.

This module comprises of Programmable Logic Controller(PLC) for its general robotization. Sensors are associated with the controller and the yield is given to the solenoid valve. A pumping engine is executed for water system relying on the necessity the qualities are opened by utilizing an electrical valve named Solenoid valve (a rationale capacity of ON and OFF as yield). When required level of water is flooded the detecting component faculties and prevents the pump keeping from overabundance water system. This PLC computerization is more effective in programmed water trickle Irrigation framework, pesticide and compost splashing with buoy level switch.

**KEYWORDS:** Programmable Logic Controller (PLC), Solenoid valve, Water pump level, humidity sensor, Soil moisture sensor, temperature senso.,

## I. INTRODUCTION

At first ranchers utilized manual water system in cultivating .They used to water the product arrive for certain general interims. However, because of specific reasons the field expends extra water or some of the time absence of water to the plant is acquired. The change in the innovations and cultivating strategies actualized Automation in water system appeared be that as it may, they were not productive for appropriate water system subsequently with usage of present day sensor and valves a decent water system has executed .with regards to cost shrewd it is high .To accomplish a legitimate water system framework with cost effective robotization is achieved utilizing PLC. At first robotization utilized transfers for controlling the water system forms. The hand-off control boards must be frequently supplanted, expended part of energy and it was hard to make sense of the issues related with it. So for, Programmable Logic Controller was acquainted with fathom these issues. Aside from businesses, a noteworthy reason for our India's advancement is relied on the horticulture, It is thought to be a spine of our country. This PLC makes general development in computerization mode. Since by manual in the water system prepare prompts additional time utilization



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and ill-advised work was actualized. Because of sporadic precipitation, there's a water shortage for the harvests to be developed till the end. By this method, programmed pumping framework is utilized for water showering with the required level of water in the well. This will be executed as an automated framework for water system to conquer the time postponement and make utilization of least level of water to be splashed by having a buoy level change to detect the amount of water put away. The climatic conditions are observed by the detecting unit, which utilizes sensors, for example, soil dampness sensor, temperature sensor and stickiness sensor. A programmed water dribble framework, programmed compost showering framework, programmed pesticide splashing framework by the Programmable Logic Controller.

## ***B. Existing System:***

The homestead water system frameworks previously, utilized straightforward clock and changes to control the water system instrument for a foreordain day and age independent of the climate condition or soil dampness content. 70% of the world's freshwater assets are being utilized for water system purposes. This actualizes plenteous or lacking supply of water to the harvests. Dribble water system framework is not computerized. It includes a manual mode to work the framework to dribble the water on the harvests. Utilizing pesticides for products, if there should be an occurrence of manual splashing not just the unhealthy harvests get influenced, additionally the showering individual will influence. This leads them for reason for hopeless maladies.

## ***C. Proposed System:***

To fabricated a completely robotized framework in agribusiness. Water system in view of booking brings about sparing water up to 42% contrasted with existing framework. In light of the sort of the harvest the seeding framework contrasts. The composts and pesticides are showered as booked relying on the accessibility of water all through the development time frame. The test is to build up a moderate and disentangled robotization in water system framework. Moistness esteem is measured by mugginess sensor. Temperature and soil dampness sensors are utilized to decide the temperature of field. Contrasted with existing framework, sprayer is utilized rather than dribble association with the harvests for robotization handle. This spares time for agriculturists to work more towards high return in his execution this present innovation's cost is low when contrasted with the manual work.

## ***D. Technique Concept:***

In this conventional culture, these days there's an absence of development because of human powerlessness, water shortage and further a characteristic disasters, it happened to be an extraordinary disadvantage of our creating country. To defeat these kind of deformities, an innovation going to be prompted for self water system framework. The real thing, which going to execute by means of PLC. Mechanization causes innovation for both water system and preparing and pesticide splashing strategies. This over standards the aggregate powerlessness of human power for this operation. The controller includes taking after approaches to experience the mechanization procedure on horticulture framework are,

- Irrigation
- Fertilizing
- Pesticide showering

## **Irrigation:**

Water system is the technique in which a controlled measure of water is provided to plants at standard interims for farming. It is utilized to aid the developing of rural yields, support of scenes, and revegetation of irritated soils in dry ranges and amid times of insufficient precipitation. Moreover, water system additionally has a couple of different uses

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in harvest creation, which incorporate securing plants against ice, smothering weed development in grain fields and averting soil union. Conversely, agribusiness that depends just on direct precipitation is alluded to as rain-encouraged or dry land cultivating. Water system frameworks are additionally utilized for tidy concealment, transfer of sewage, and in mining. Water system is frequently concentrated together with waste, which is the regular or manufactured expulsion of surface and sub-surface water from a given region. Water system has been a focal component of horticulture for more than 5,000 years and is the result of many societies. Truly, it was the reason for economies and social orders over the globe, from Asia toward the Southwestern United States.

## Types of Irrigation:

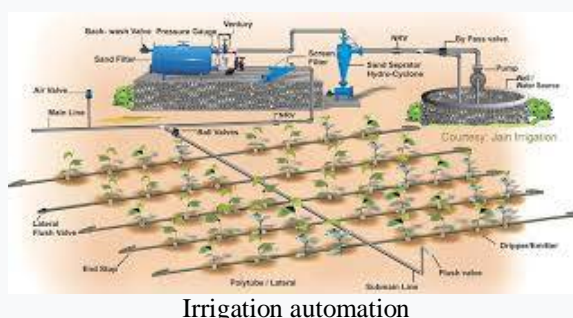
Different sorts of water system strategies contrast in how the water acquired from the source is dispersed inside the field. When all is said in done, the objective is to supply the whole field consistently with water, so that each plant has the measure of water it needs, neither an excessive amount of nor too little.

### Surface irrigation system :

In surface (winkle, surge, or level bowl) water system frameworks, water moves over the surface of agrarian terrains, with a specific end goal to wet it and invade into the dirt. Surface water system can be subdivided into winkle, outskirt strip or bowl water system. It is regularly called surge water system when the water system brings about flooding or close flooding of the developed land. Generally, this has been the most widely recognized strategy for flooding rural land and still utilized as a part of most parts of the world.



Basin flood irrigation of wheat



Where water levels from the water system source allows the levels are controlled by barriers, generally stopped by soil. This is frequently observed in terraced rice fields (rice paddies), where the strategy is utilized to surge or control the level of water in each unmistakable field. Sometimes, the water is pumped, or lifted by human or creature energy to the

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level of the land. The field water productivity of surface water system is normally lower than different types of water system yet has the potential for efficiencies in the scope of 70% - 90% under fitting administration.

## Localized irrigation system

Limited water system is a framework where water is dispersed under low weight through a funneled organize, in a pre-decided example, and connected as a little release to each plant or adjoining it. Dribble water system, shower or miniaturized scale sprinkler water system and bubbler water system have a place with this classification of water system techniques.

## Drip irrigation system:

Dribble (or miniaturized scale) water system, otherwise called stream water system, works as its name recommends. In this framework waterfalls drop by drop exactly at the position of roots. Water is conveyed at or close to the root zone of plants, drop by drop. This strategy can be the most water-productive technique for water system, if oversaw legitimately, since vanishing and spillover are limited. The field water productivity of trickle water system is commonly in the scope of 80 to 90 percent when overseen effectively.



Drip irrigation – a dripper in action

In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivery of fertilizer. The process is known as *fertigation*.

Deep percolation, where water moves below the root zone, can occur if a drip system is operated for too long or if the delivery rate is too high. Drip irrigation methods range from very high-tech and computerized to low-tech and labor-intensive. Lower water pressures are usually needed than for most other types of systems, with the exception of low energy center pivot systems and surface irrigation systems, and the system can be designed for uniformity throughout a field or for precise water delivery to individual plants in a landscape containing a mix of plant species. Although it is difficult to regulate pressure on steep slopes, pressure compensating emitters are available, so the field does not have to be level. High-tech solutions involve precisely calibrated emitters located along lines of tubing that extend from a computerized set of valves.

## Irrigation using sprinkler systems:

In *sprinkler* or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a *solid-set* irrigation system. Higher pressure sprinklers that rotate are called *rotors* and are driven by a ball drive, gear drive, or impact mechanism. Rotors can be designed to rotate in a full or partial circle. Guns are similar to rotors, except that they generally operate at very high pressures of 40 to 130 lbf/in<sup>2</sup> (275 to 900 kPa) and flows of 50 to 1200 US gal/min (3 to 76 L/s), usually with nozzle diameters in the range of 0.5 to 1.9 inches (10 to 50 mm). Guns are used not only for irrigation, but also for industrial applications such as dust suppression and logging.

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Sprinklers can also be mounted on moving platforms connected to the water source by a hose. Automatically moving wheeled systems known as *traveling sprinklers* may irrigate areas such as small farms, sports fields, parks, pastures, and cemeteries sunattended. Most of these utilize a length of polyethylene tubing wound on a steel drum. As the tubing is wound on the drum powered by the irrigation water or a small gas engine, the sprinkler is pulled across the field. When the sprinkler arrives back at the reel the system shuts off. This type of system is known to most people as a "waterreel" traveling irrigation sprinkler and they are used extensively for dust suppression, irrigation, and land application of waste water.



Impact sprinkler head

Other travelers use a flat rubber hose that is dragged along behind while the sprinkler platform is pulled by a cable. These cable-type travelers are definitely old technology and their use is limited in today's modern irrigation projects.

## Fertilizing :

In order to get maximum benefit from manures and fertilizers, they should not only be applied in proper time and in right manner but any other aspects should also be given careful consideration. Different soils react differently with fertilizer application. Similarly, the N, P, K requirements of different crops are different and even for a single crop the nutrient requirements are not the same at different stages of growth.

### Application of fertilizers in solid form:

It includes the methods like:

**I) Broadcasting:** Even and uniform spreading of manure or fertilizers by hand over the entire surface of field while cultivation or after the seed is sown in standing crop, termed as broad casting. Depending upon the time of fertilizer application, there are two types of broadcasting:

**A) Broadcasting at planting and**

**B) Top dressing.**

**A) Broadcasting at planting:** Broadcasting of manure and fertilizers is done at planting or sowing of the crops with the following objectives:





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- 1) To distribute the fertilizer evenly and to incorporate it with part of, or throughout the plough layer.
- 2) To apply larger quantities that can be safely applied at the time of planting/sowing with a seed-cum-fertilizer driller.

## B) Top dressing:

Spreading or broadcasting of fertilizers in the standing crop (after emergence of crop) is known as top-dressing. Generally,  $\text{NO}_3 - \text{N}$  fertilizers are top dressed to the closely spaced crops like wheat, paddy. E.g.: Sodium Nitrate, Amm. Nitrate and urea, so as to supply N in readily available from the growing plants. The term side dressing refers to the fertilizer placed beside the rows of a crop (widely spaced) like maize or cotton. Care must be taken in top dressing that the fertilizer is not applied when the leaves are wet or it may burn or scorch the leaves. The top dressing of P and K is ordinarily done only on pasture lands which occupy the land for several years. In some countries, aero planes are used for fertilizer application in hill terrains where it is difficult to transport fertilizers and where large amount are to be applied because of severe deficiency and under following situations:

1. Where very small quantities of fertilizers are needed over large areas. E.g.: Micro nutrients.
2. When high analysis materials are applied.
3. When fertilizer application may be combined with insect control or some other air operation and
4. As a labour and time saving device.

## II) Placement:

In this, the fertilizers are placed in the soil irrespective of the position of seed, seedling or growing plant before or after sowing of the crops. It includes.

**1. Plough sole placement:** The fertilizer is placed in a continuous band on the bottom of the furrow during the process of ploughing. Each band is covered as the next furrow is turned. By this method, fertilizer is placed in moist soil where it can become more available to growing plants during dry seasons. It results in less fixation of P & K than that which occurs normally when fertilizers are broadcast over the entire soil surface.

## 2. Deep placement or sub-surface placement:

In this method, fertilizers like Amm. Sulphate and Urea, is placed in the reduction zone as in paddy fields, where it remains in ammonia form and is available to the crop during the active vegetative period. It ensures better distribution in the root zone, and prevents any loss by surface runoff. It is followed in different ways, depending upon local cultivation practices such as:

**i) Irrigated tracts:** The fertilizer is applied under the plough furrow in the dry soil before flooding the land and making it ready for transplanting.

**ii) Less water condition:** Fertilizer is broadcasted before puddling which places it deep into the reduction zone.

**iii) Sub – soil placement:** This refers to the placement of fertilizers in the sub-soil with the help of heavy power machinery. It is followed in humid and sub-humid regions where many sub-soils are strongly acid, due to which the level of available plant nutrients is extremely low. P-tic and K-ssic fertilizers are applied by this method in these regions for better root development.

**III) Localized placement:** It refers to the application of fertilizers into the soil close to the seed or plant. It is usually employed when relatively small quantities of fertilizers are to be applied.

## Pesticides spraying:

**Pesticides** are substances that are meant to control pests or weeds. The term pesticide includes all of the following: herbicide, insecticide, insect growth regulator, nematicide,

In general, a pesticide is a chemical or biological agent (such as a virus, bacterium, antimicrobial, or disinfectant) that deters, incapacitates, kills, or otherwise discourages pests. Target pests can include insects, nematodes (roundworms), and microbes that destroy property, cause nuisance, or spread disease, or are disease vectors. Although pesticides have benefits, some also have drawbacks, such as potential toxicity to humans and other species. According to the Stockholm Convention on Persistent Organic Pollutants, 9 of the 12 most dangerous and persistent organic chemicals are organochlorine pesticides.

The above methodologies consists of their commonly approached system for their whole processes. Actually our proposed system determines that about drip irrigation and spraying system. These systems which connected to the plc



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controller for its process, then the automayion takes place. Apart fom this, there are more propesdhardwares are implemented for this proposed system.

The **hardwares** are:

- PLC(Programmable Logic Controller)-ABB 07KR51
- Water Level Sensor
- Pump Motor
- IR Sensor
- Humidity sensor
- Moisture sensor
- Temperature sensor
- Sprayer
- Solenoid valve

## PLC :

**Programmable Logic Controller (PLC)** is a digital computer used for the automation of various electro-mechanical processes in industries. These controllers are specially designed to survive in harsh situations and shielded from heat, cold, dust, and moisture etc. **PLC** consists of a microprocessor which is programmed using the computer language.



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ABB controller

## PLC Controller

The program is written on a computer and is downloaded to the PLC via cable. These loaded programs are stored in non – volatile memory of the PLC. During the transition of relay control panels to PLC, the hard wired relay logic was exchanged for the program fed by the user. A visual programming language known as the Ladder Logic was created to program the PLC.

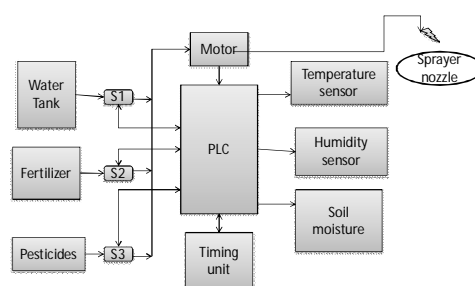
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## BLOCK DIAGRAM



### Water Level Sensor :



A **water level sensor** is also considered to be a **float switch**. A **float switch** is a device used to detect the level of liquid within a tank. The switch may be used in a pump, an indicator, an alarm, or other devices.

Float switches range from small to large and may be as simple as a mercury switch inside a hinged float or as complex as a series of optical or conductance sensors producing discrete outputs as the liquid reaches many different levels within the tank. Perhaps the most common type of float switch is simply a float raising a rod that actuates a microswitch.

### Pump Motor :

A **pump** is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: *direct lift*, *displacement*, and *gravity* pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

An electric **motor** is a device that turns electrical energy into motion, usually rotation. It changes electrical energy into mechanical energy or kinetic energy (kinetic energy means movement). This works using electromagnetism. A loop of wire containing a current is passed through an electromagnet's magnetic field.

### IR Sensor :

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.



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Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation can be found between the visible and microwave regions. The infrared waves typically have wavelengths between 0.75 and 1000 $\mu$ m.

## The Types of Infrared Sensors

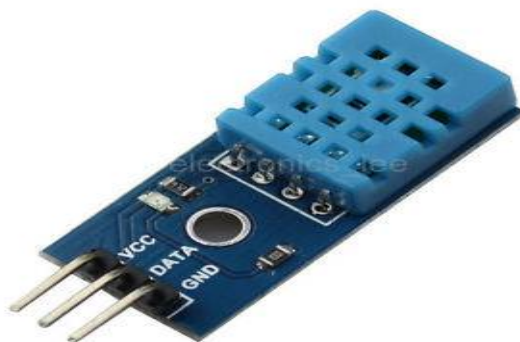
Infrared sensors are broadly classified into two main types:

- **Thermal infrared sensors** - use infrared energy as heat. Their photo sensitivity is independent of the wavelength being detected. Thermal detectors do not require cooling but do have slow response times and low detection capabilities.
- **Quantum infrared sensors** – provide higher detection performance and faster response speed. Their photo sensitivity is dependent on wavelength. Quantum detectors have to be cooled in order to obtain accurate measurements.

All objects which have a temperature greater than absolute zero (0 Kelvin) possess thermal energy and are sources of infrared radiation as a result. Sources of infrared radiation include blackbody radiators, tungsten lamps and silicon carbide. Infrared sensors typically use infrared lasers and LEDs with specific infrared wavelengths as sources.

## Humidity Sensor :

A humidity sensor (or hygrometer) senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature. Relative humidity is the ratio of actual moisture in the air to the highest amount of moisture that can be held at that air temperature. The warmer the air temperature is, the more moisture it can hold. Humidity / dew sensors use capacitive measurement, which relies on electrical capacitance.



## Humidity Sensor

Electrical capacity is the ability of two nearby electrical conductors to create an electrical field between them. The sensor is composed of two metal plates and contains a non-conductive polymer film between them. This film collects moisture from the air, which causes the voltage between the two plates to change. These voltage changes are converted into digital readings showing the level of moisture in the air.

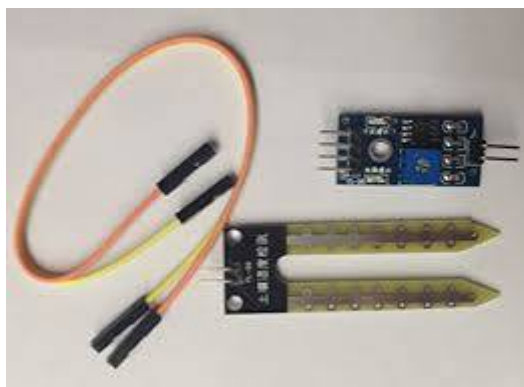
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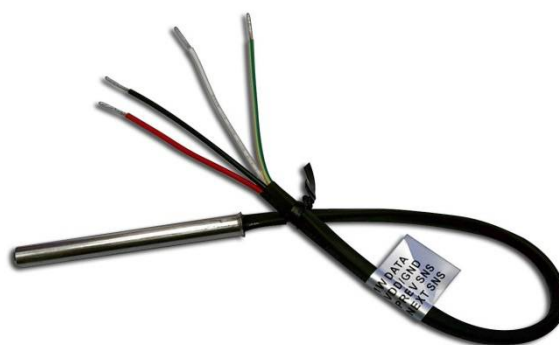
### Soil Moisture Sensor :



**Soil moisture sensors** measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.

Soil moisture sensors typically refer to sensors that estimate volumetric water content. Another class of sensors measure another property of moisture in soils called water potential; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

### Temperature Sensor :



A temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature. An RTD (Resistance Temperature Detector) is a variable resistor that will change its electrical resistance in direct proportion to changes in temperature in a precise, repeatable and nearly linear manner.

### Sprayer :

A **sprayer** is a device used to spray a liquid. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers range in size from man-portable units (typically backpacks with spray guns) to trailed sprayers that are connected to a tractor, to self-propelled units similar to tractors, with boom mounts of 60–151 feet in length.

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### Sprayer Nozzle :



A **spray nozzle** is a precision device that facilitates dispersion of liquid into a spray. Nozzles are used for three purposes: to distribute a liquid over an area, to increase liquid surface area, and create impact force on a solid surface. A wide variety of spray nozzle applications use a number of spray characteristics to describe the spray. Spray nozzles can be categorized based on the energy input used to cause atomization, the breakup of the fluid into drops. Spray nozzles can have one or more outlets; a multiple outlet nozzle is known as a compound nozzle.

### Solenoid valve:



A solenoid valve is an electromechanically worked valve. The valve is controlled by an electric current through a solenoid; on account of two port valve, the stream is turned on or off; for the situation of three port valve, the surge is exchanged between the two outlet ports. Different solenoid valves can be put together on a manfield. Solenoid valves are the most much of the time utilized components in fluidics. Their assignments are to close off, discharge, measurements, disseminate or blend liquids. Solenoids offer quick and safe exchanging, high dependability, long administration life, great medium similarity of the materials used, low control power and conservative plan.

### Types :

Many variations are possible on the basic, one-way, one-solenoid valve described above:

- one- or two-solenoid valves;



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- direct current or alternating current powered.

## V. CONCLUSION:

The center intension of our ventures is to manufactured a completely mechanized framework in horticulture, in view of the kind of the harvest the seeding framework contrasts. The composts and pesticides are showered as planned relying on the accessibility of water all through the development time frame. Nuisances are controlled by survey the pictures of the harvest at the specific interim, if any products gets influenced because of bugs the widespread sprayer spout showers the pesticides in the relating area. Once the harvest is developed completely

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