VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JnanaSangama, Belagavi – 590018

A Project Report
On

"Multiple Parameter Control Automated Robot for Farming"

Submitted in partial fulfillment of the requirements as a part of the curriculum,
Bachelors of Engineering in Mechanical Engineering

Submitted by

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2019-2020

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CERTIFICATE

Certified that the project work entitled "**Multiple Parameter Control Automated Robot for Farming**" is a bonafide work carried out by **Mr. Akash M Tigadi, Mr. Akhilesh R, Mr. S Amith Chandra, Mr. Deepankhar P** bonafide students of **CMR Institute of Technology** in partial fulfillment for of the requirements as a part of the curriculum,

Bachelors of Engineering in Mechanical Engineering, of **Visvesvaraya Technological University, Belagavi** during the year **2019-2020**. It is certified that all correction/suggestion indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the bachelor of engineering degree.

(Mr. Harish P)	**(Dr. Vijayanand Kaup)**	**(Dr. Sanjay Jain)**
Signature of the Guide	**Signature of the HOD**	**Signature of the Principal**

External Viva

Name of the examiners	**Signature with date**

1.
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DECLARATION

We, students of Eighth Semester, B.E, Mechanical Engineering, CMR Institute of Technology, declare that the project work titled **"Multiple Parameter Control Automated Robot for Farming"** has been carried out by us and submitted in partial fulfillment of the course requirements for the award of degree in **Bachelor of Engineering in Mechanical Engineering** of **Visvesvaraya Technological University, Belagavi,** during the academic year 2019-2020.

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Place: Bengaluru

Date:

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Technical Project Report

On

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ABSTRACT

Agricultural automation using robotics is an attempt to reduce the burden of maintaining a farm for small scale and large scale alike by automating the most commonly performed tasks such as sowing of seeds, watering of plants. In addition to all of the above the architecture used is modular i.e. there is a pick and place arm which is free to move in circular and vertical direction, mounting this arm on a moving platform gives this system freedom of movement along 3-axis.

Automation is the technique, method or system of operating or controlling a process by highly automatic means, as by electronics devices, reducing human intervention to a minimum. Modular architecture refers to the design of any system composed of separate components that can be connected together. The beauty of modular architecture is that you can replace or add any one component (module) without affecting the rest of the system. The area of digital electronics and intelligent systems, automation-using robots has become one of the fastest developing application-based technologies in the world.

In many parts of India even today, agriculture techniques are ancient which results in loss of produce as well as wastage of raw materials. With the Automated Farming Robot, the aim is to reduce wastage of raw materials such as water as well as bring in automation to reduce manual labor. Having sensors enables the farmer to remotely monitor the condition of soil and be able to make decisions to improve crop quality and yield. Many of the issues caused due to manual labour and old inefficient techniques can be overcome with implementation of simple technology. Thereby reducing the cost while increasing productivity.

CONTENTS

FIGURE CONENTS

CHAPTER 1

INTRODUCTION

1.1 Motivation

The agriculture sector employs nearly half of the workforce in the country. However, it contributes to 17.5% of the GDP (at current prices in 2015-16). Over the past few decades, the manufacturing and services sectors have increasingly contributed to the growth of the economy, while the agriculture sector's contribution has decreased from more than 50% of GDP in the 1950s to 15.4% in 2015-16. The agricultural yield (quantity of a crop produced per unit of land) is found to be lower in the case of most crops, as compared to other top producing countries such as China, Brazil, and the United States. Agricultural growth has been fairly volatile over the past decade, ranging from 5.8% in 2005-06 to 0.4% in 2009-10 and -0.2% in 2014-15. Such a variance in agricultural growth has an impact on farm incomes as well as farmers' ability to take credit for investing in their landholdings.

Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This has led to depletion and exhaustion of soils resulting in their low productivity. The average yields of almost all the crops are among the lowest in the world. This is a serious problem that can be solved by using more manures and fertilizers.

Although India is the second-largest irrigated country of the world after China, only one-third of the cropped area is under irrigation. Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic India cannot achieve sustained progress in agriculture unless and until more than half of the cropped area is brought under assured irrigation. This is testified by the success story of agricultural progress in Punjab Haryana and the western part of Uttar Pradesh where over half of the cropped area is under irrigation! Large tracts still await irrigation to boost agricultural output.

In spite of the large scale mechanization of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using simple and conventional tools and implements like a wooden plough, sickle, etc. Little or no use of machines is made in ploughing, sowing, irrigating, thinning and pruning, weeding, harvesting threshing, and transporting the crops. This is especially the case with small and marginal farmers. It results in huge wastage of human labour and in low yields per capita labour force. There is an urgent need to mechanize the agricultural operations so that wastage of labour force is avoided and farming is made convenient and efficient. Agricultural implements and machinery are a crucial input for efficient and timely agricultural operations, facilitating multiple cropping and thereby increasing production.

1.2 Problem Statement

Low cost and affordable remote monitored Agri - horticulture system.

Overwatering can cause crop damage if done on a prolonged basis. Likewise, starting an irrigation cycle too late or not running the system for a long enough period of time is considered under watering and can cause reduced yields and poor crop quality which can affect the price. Looking at these problems in depth is the key to minimizing their financial and practical impact on the crop.

Broadcasting is a method of sowing seeds which is practised across the majority of Indian farms but the disadvantages are that it is a time consuming and labour intensive process. dropping seeds behind the plough is another technique used for man crops in India, which again is time consuming and labour intensive. if farmers had access to modern technology these practices could be eliminated and thereby the yield can be increased while decreasing the time it takes to sow seeds. Sowing seeds at proper distances can greatly increase the chances of successful germination, under the current methods practised, the seeds are dropped at random which also results in the usage of a large quantity of seeds. thereby having a mechanism that can accurately drop seeds with appropriate spacing is a necessity.

Not having real time information regarding crop and soil conditions is one of the causes of low yield. if farmers are provided with the means to obtain data from the soil and crops they can take better measures to improve the quality of the crops and be better prepared for adverse weather conditions.

Labour intensive practices in farming have an economic effect on small farmers. not having the financial ability to employ labour and not being to do all the work greatly reduces the quality of the crop and also reduces the yield. Having a low cost mechanism that makes work easier and eliminates the need to employ additional labour will greatly turn around the current situation.

1.3 Objective

Soil moisture-based control systems use soil moisture sensors to measure the actual soil moisture. This method is accurate because it is actually measuring the moisture level in the soil instead of calculating what should be the moisture level. Soil moisture control systems tell the grower when to begin an irrigation cycle and tell him when the soil moisture level reaches field capacity.

1.4 Literature Review

“A smart farming concept based on smart embedded electronics, internet of things and wireless sensor network,” tells us how we can use IOT and microelectronics can assist humans in farming through a means of a robot. Mobasshir Mahbub published this in 2020.

Design and development of parallel robot arm for handling paper pot seedlings in a vegetable trans planter” was presented by K.Rahul , Hifjur Raheman, Vikas Paradkar of Agriculture and food engineering department IIT Kharagpur 2019 which tells us about a complete mechatronic approach in designing and developing a robotic arm for handling paper pot seedlings in a trans planter.

In “Robotic Farming System Using Multiple Robot Tractors in Japan Agriculture” Noboru Noguchi, Oscar C. Barawid explains how we can co-ordinate tractors by programming them and making them do their jobs more efficiently.

“A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda” tells us how we can implement about industry 4.0 in farming which was published by Laurens Klerkx, Emma Jakku, Pierre Labarthe in 2019.

“Development of an autonomous mobile plant irrigation robot for semi structured environment” Published by A.O.Adeodu, O.P.Bodunde, I.A.Daniyan, O.O.Omitola, J.O.Akinyoola, U.C.Adie in 2019 spoke about an autonomous robot as how it carries out the irrigation system of a farm with two-way communication between the user and machine.

“Multi-objective path planner for an agricultural mobile robot in a virtual greenhouse environment” which was published by Mohd Saiful Azimi Mahmud, Mohamad Shukri Zainal Abidin, Zaharuddin Mohamed, Muhammad Khairie Idham Abd Rahman, Michihisa Iida talks about a particular path planned for a agri-mobile robot to following certain set of instructions and execute them.

“Agricultural robots for field operations: Concepts and components”, the research tells us to focus on fusing sensors for adequate localisation and sensing, which was published by Avitar Bechar in 2014.

“Farming in the Era of Industry 4.0” published by Anja-Tatjana Braun, Eduardo Colangelo, Thilo Steckel prioritises on bring the concept of using industry 4.0 into agriculture.

CHAPTER 2

METHODOLOGY

2.1 Principle

In CNC system, a dedicated computer is used to perform all the essential functions as per the executive program stored in the computer memory. The system directs commands to servo drives to drive the servo motor & other output devices like relays, solenoids, etc. to initiate the operations such as motor starting & stopping, coolant on & off, tool changing, pallet changing, etc. and other miscellaneous functions.

Once the system gives, it becomes necessary to ensure that the particular function has been completed. "Feed Back Devices" do this. Continuous feedback device like linear scale, encoder, resolver, etc. are used as a position feedback of the motor. Some sensors like proximity switch, limit switch, pressure switch, flow switch and float switch, etc. are used as feedback devices to monitor the different operations. Thus, all operations of CNC machine are monitored continuously with appropriate feedback devices. Therefore, that CNC system is called as "Closed Loop" system. In case of failure in any failure feedback, the system generates a "Fault Message."

The principles of CNC operation.

- Movement of X, Y, Z-axis are controlled by a motor, which supplies either Alternating current or Direct current.
- Movement of the machine is done by giving commands.
- All the operations are carried out by codes like speed, feed, depth of cut, etc.
- For each operation separate code is available.
- The warning system is available to save guard the various operations and components.

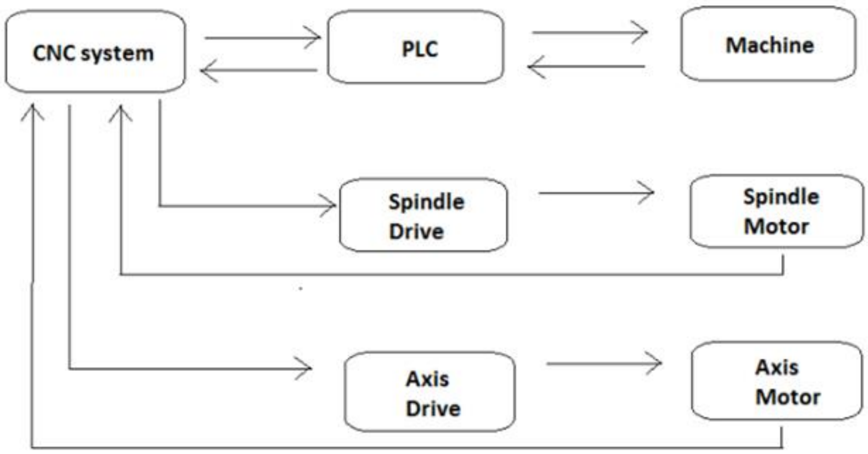

Fig 2.1: Schematic layout of a CNC working principle

2.1.1 3-D Cartesian Co-ordinate System

A Cartesian coordinate system for a three-dimensional space consists of an ordered triplet of lines (the axes) that go through a common point (the origin), and are pair-wise perpendicular; an orientation for each axis; and a single unit of length for all three axes. As in the two-dimensional case, each axis becomes a number line. For any point P of space, one considers a hyperplane through P perpendicular to each coordinate axis, and interprets the point where that hyperplane cuts the axis as a number. The Cartesian coordinates of P are those three numbers, in the chosen order. The reverse construction determines the point P given its three coordinates.

Alternatively, each coordinate of a point P can be taken as the distance from P to the hyperplane defined by the other two axes, with the sign determined by the orientation of the corresponding axis. Each pair of axes defines a coordinate hyperplane. These hyperplanes divide space into eight trihedral, called octants.

There are no standard names for the coordinates in the three axes (however, the terms abscissa, ordinate and applicate are sometimes used). The coordinates are often denoted by the letters X, Y, and Z, or x, y, and z. The axes may then be referred to as the X-axis, Y-axis, and Z-axis, respectively. Then the coordinate hyperplanes can be referred to as the XY-plane, YZ-plane, and XZ-plane.

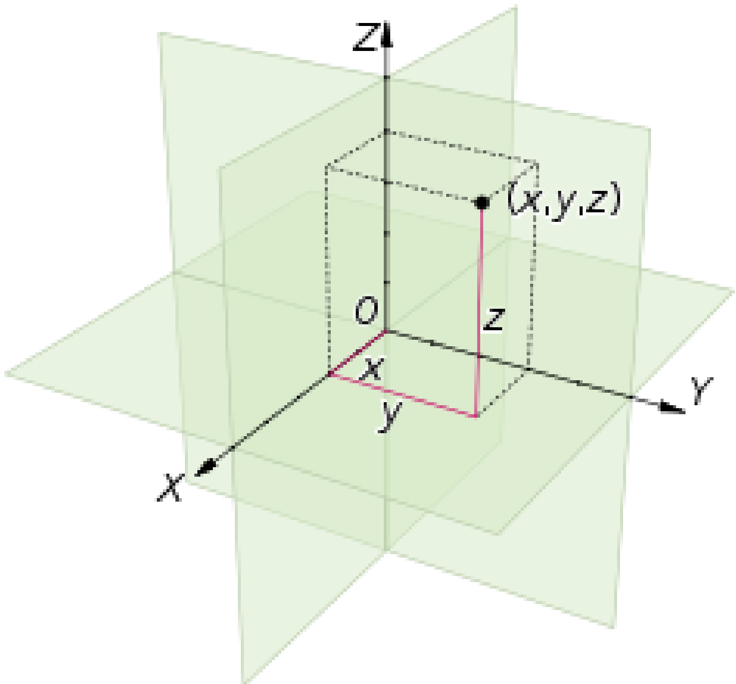

Fig 2.2: 3-D Cartesian System

2.2 3-D Printer Axis X, Y and Z

It is a challenge to represent three physical dimensions on a sheet of paper, but any point in space must be represented by providing three coordinates, which are usually listed in the order X, Y, Z. Each coordinate provides information about a single direction, or axis, each of which is perpendicular to the other two. One coordinate would indicate position along a line, two in a plane, and three in space.
In 3D printing, printers use different mechanisms to manoeuvre in a particular axis. However, the two common systems are Cartesian and delta. They both employ the FDM technology but have varying mechanisms of navigating the extruder within the printing space. In fused deposition modelling (FDM), a hot end deposits polymer to create layers. This process is highly dependent on the 3D printer axes X, Y, and Z. Depending on the printer in question, the hot end will move in one, two, or all three of these axes.

The 3D printer axis system, therefore, enables a 3D printer's operation and give the object depth and design. If there were only two axes, let us say the X and Y-axes, then your object design would be flat. It would be like printing with an inkjet printer, as your print would have no depth. Normally, the X and Y-axes correspond to lateral movement while the Z-axis corresponds to vertical motion. To avoid confusion, assume you are standing in front of your FDM 3D printer, the tool moving up and down is the Z-axis. Your X-axis is the tool moving left or right, and the tool moving in and out (from your standing position) is the Y-axis.

In this project, we have used the same principle of 3-D Cartesian system of a 3-D Printer which consists of a X, Y and Z axis as shown in figure below. The main gantry beam of our autonomous robot acts as a representative of X-axis while the lower alumina skeletal rectangular base represents the motion along Z and Y axis.

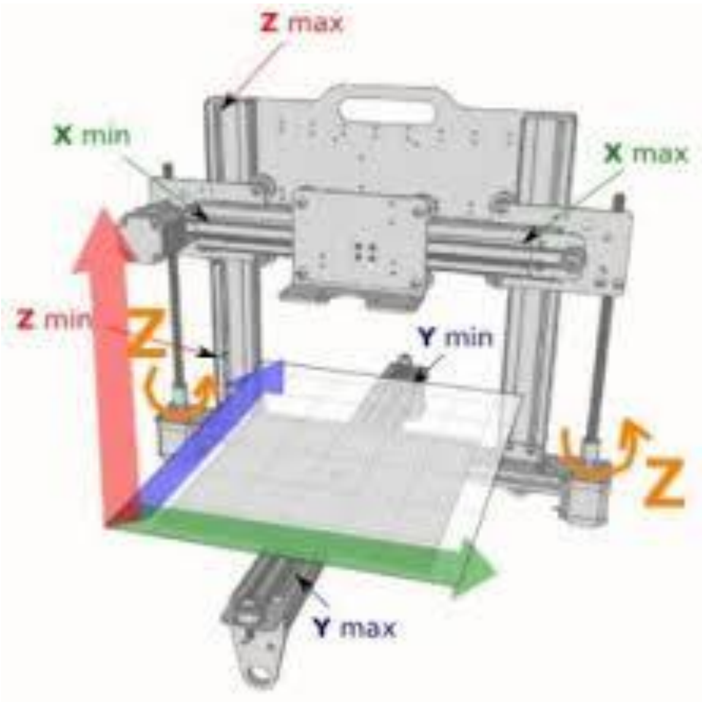

Fig 2.3: 3 Axes System of a 3-D Printer

CHAPTER 3

Design and Material aspects

3.1. Aluminium metal

Aluminium is supplied in a variety of different grades depending on the alloying element. Each grade displays specific properties and characteristics making aluminium an extremely versatile metal Aluminium properties differ between grades depending on the alloy present giving each grades certain, unique characteristics.

Within the family of metals only silver, copper and gold have better electrical conductivity. Also the thermal conductivity of aluminium is very high, while its melting point is just above 660°C. An important property of aluminium that makes it different from iron and steel is aluminium does not contain iron. As a result it is not magnetisable or is only paramagnetic, which means that it has no external magnetic characteristics

Few important characteristics of aluminium:

- **Low density**
  The density of aluminium is approximately one third that of steel. Because of its low density, it is commonly used in applications that require strong but lightweight materials. Some of these applications include manufacturing vehicles and aircraft, where the lightweight nature of aluminium helps to conserve fuel.
- **Simple to process**
  Despite being a sturdy metal, aluminium is flexible and can be easily formed and reworked into different shapes. There are different processes used to rework aluminium. The most common methods are rolling, drawing and extrusion.
- **Smooth surface**
  Aluminium forms a protective coating almost instantly when exposed to air. This thin coat bonds firmly to the metal, aiding its resistance to corrosion. With other surface treatments like anodising, the smooth surface of aluminium can be further improved and protected, making aluminium a great option in finishing structures or equipment.
- **Lower dimensional tolerances**
  The lower dimensional tolerance of aluminium helps saves time in producing the different parts and assembling them, hence favours its use in construction.
- **Not magnetisable**
  Aluminium can be used in high voltage applications as it is not magnetisable, because of this characteristic, it is used in long distance electricity lines and electronics. It can also be used in shielding sensitive electronic devices.
- **Can be decoratively anodised very well (dependent on the alloy)**
  Anodising aluminium has multiple benefits. The most apparent is the lasting aesthetic appeal that comes with anodising. The process is cost-effective and does not peel,

allowing the finish to last longer, and therefore is commonly used for finishing because of its decorative qualities.

- **Good machinability (dependent on the strength and alloying elements)**
  Generally, aluminium is easy to work into complex shapes from one piece of extruded aluminium without any mechanical joinery necessary. Some of its applications using this method include baseball bats, heat exchangers, and refrigeration tubing. Aluminium can also be joined, soldered, welded, and brazed. Clips, bolts, rivets, adhesive, and other fasteners and joining methods can be used when machining and joining aluminium, as is the case with aircraft components.
- **Recyclability**
  Contrary to what most people think, aluminium is a 100% recyclable and during the recycling process, it retains all of its original properties. During production, it is more cost-effective to use recycled metal than prime metal out of the ground and so, during production, as much recycled material is used as possible.

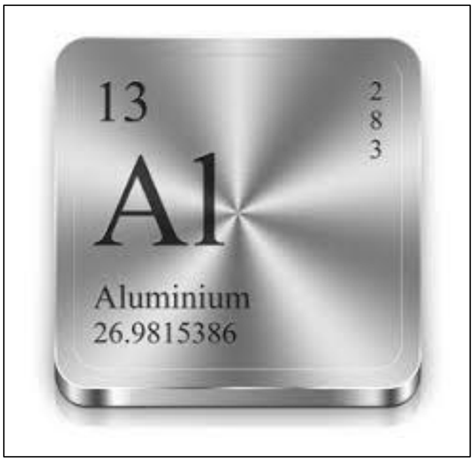

Fig 3.1: Al Periodic Table

3.2 Usage of Aluminium over Steel

1) Strength to weight ratio: Aluminium is typically not as strong as steel, but it is also almost one third of the weight. This is the main reason why aircraft are made from Aluminium.

2) Thermal Conductivity: Aluminium has a much better thermal conductivity (conductor of heat) than stainless steel. One of the main reasons it is used for car radiators and air conditioning units

3) Workability: Aluminium is fairly soft and easier to cut and form. Due to its resistance to wear and abrasion, Stainless can be difficult to work with. Stainless steels are harder and are especially harder to form than aluminium.

4) Cost: Aluminium is typically cheaper than stainless steel.

3.3. Few applications of Aluminium

1) Transportation

Aluminium is used in transportation because of its unbeatable strength to weight ratio. Its lighter weight means that less force is required to move the vehicle, leading to greater fuel efficiency. Although aluminium is not the strongest metal, alloying it with other metals helps to increase its strength. Its corrosion resistance is an added bonus, eliminating the need for heavy and expensive anti-corrosion coatings.

While the auto industry still relies heavily on steel, the drive to increase fuel efficiency and reduce CO2 emissions has led to a much wider use of aluminium. Experts predict that the average aluminium content in a car will increase by 60% by 2025.

High-speed rail systems like the Shinkansen in Japan and the Maglev in Shanghai also use aluminium. The metal allows designers to reduce the weight of the trains, cutting down on friction resistance.

Aluminium is also known as the 'winged metal' because it is ideal for aircraft; again, due to being light, strong and flexible. Today, modern aircraft use aluminium alloys throughout, from the fuselage to the cockpit instruments. Even spacecraft, such as space shuttles, contain 50% to 90% of aluminium alloys in their parts.

Fig 3.2- Shinkansen E6 train

2) Construction

Buildings made with aluminium are virtually maintenance free due to aluminium's resistance to corrosion. Aluminium is also thermally efficient, which keeps homes warm in winter and cool in summer. Aluminium also has a pleasing finish and can be curved, cut and welded to any desired shape, it allows modern architects unlimited freedom to create buildings that would be impossible to make from wood, plastic, or steel.

The first building in which aluminium was widely used was the Empire State Building in New York, built in 1931. Today, aluminium is regularly used in the construction of high-rise buildings and bridges. The lighter weight of aluminium makes it easier, faster and more convenient to work with. It also helps reduce other costs. A building constructed of steel would require much deeper foundations due to the added weight, which would drive up construction costs.

3) Electrical

Although it has just 63% of the electrical conductivity of copper, aluminium's low density makes it the best option for long distance power lines. If copper was used, support structures would be heavier, more numerous, and more expensive. Aluminium is also more ductile than copper, enabling it to be formed into wires much more easily. Lastly, its corrosion-resistance helps protect wires from the elements.

In addition to power lines and cables, aluminium is used in motors, appliances, and power systems. Television antennae and satellite dishes, even some LED bulbs are made of aluminium.

4) Consumer goods

Smartphones, tablets, laptops, and flat screen TVs are being made with an increasing amount of aluminium. Its appearance makes modern tech gadgets look sleek and sophisticated while being light and durable. It is the perfect combination of form and function which is critical for consumer products. More and more, aluminium is replacing plastic and steel components, as it is stronger and tougher than plastic and lighter than steel. It also allows heat to dissipate quickly, keeping electronic devices from overheating.

Apple uses predominantly aluminium parts in its iPhones and MacBook which can be seen in the figure depicted below

Fig 3.3–Aluminium body of the Apple Mac-book

Interior designers enjoy using aluminium as it's easy to shape and looks great. Furniture items made from aluminium include tables, chairs, lamps, picture frames and decorative panels.

The foils used in kitchen is aluminium, as well as pots and frying pans are frequently made from aluminium. These Aluminium products conduct heat well, are non-toxic, resistant to rust, and are easy to clean.

3.4. BILL OF MATERIALS

It is very important to have the needed materials in order to complete the model. So the list below shows the bill of materials which is needed for the assembly and thereby for the successful working of the model

- Aluminium extrusion rods
- Hammer nut
- Machine screw
- Stepper motor
- Stepper motor drivers
- Timing belt
- Stepper motor cables
- Bore pulley
- 62322 bearing
- Lead screw with coupler nut
- Coupler
- Power supply

3.5. CAD MODELS

1) Fixed bed

It is important to have a fixed bed which will act as a sturdy base to the whole setup. Without having a solid structure of the bed, assembling the other components like the tracks, gantry and the cross slide will not be possible. Below is the top view and side view of the fixed bed

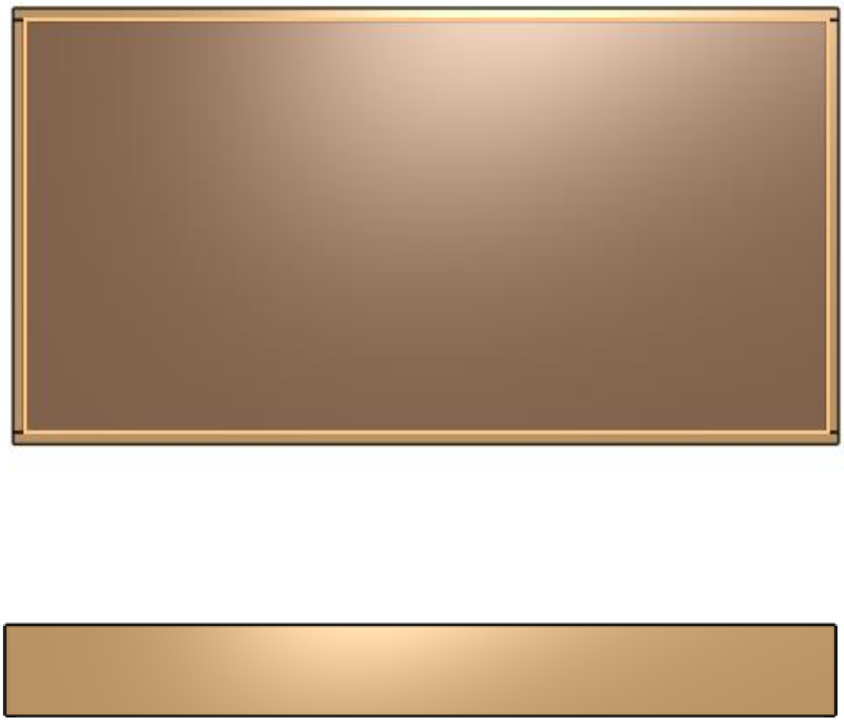

Fig 3.4- Top and side view of the fixed bed

2) Tracks

The **tracks** allow the gantry to move precisely along the x-axis. They are designed to attach to a raised bed or similar supporting infrastructure. Each track is composed of a long aluminium extrusions positioned end-to-end to form a total track length based on the overall size needed. The tracks allow the motion of the gantry along the x-axis,

The figure below show how the track looks invidually and also once it is assembled along the either sides of the fixed bed.

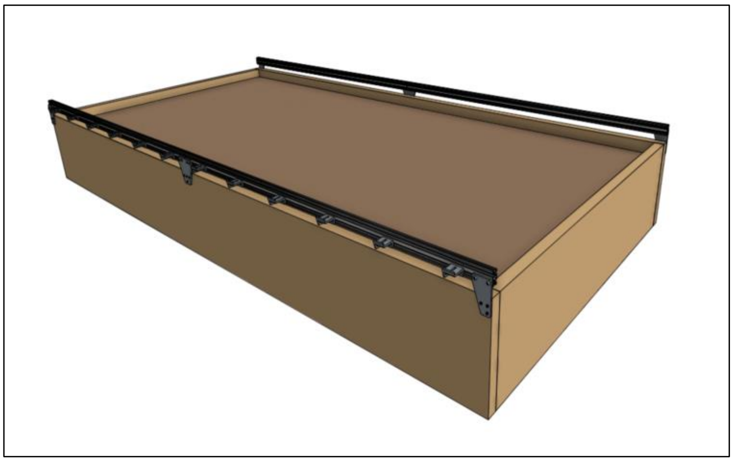

Fig 3.5 - Track being assembled to the body

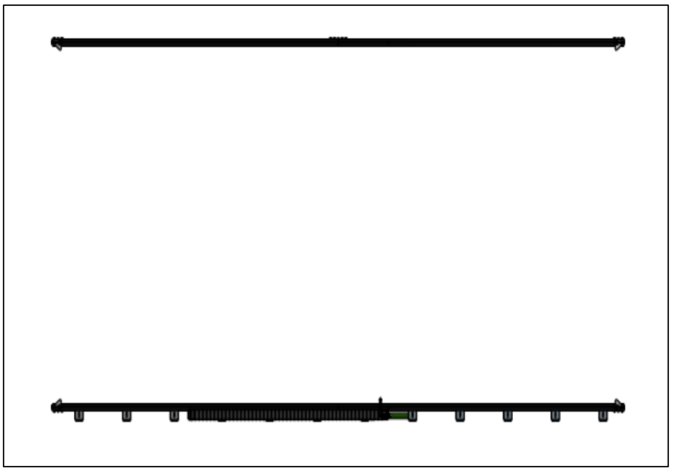

Fig 3.6- Individual Tracks

3) Gantry

The gantry is another important component in the assembly. The main purpose of the gantry is that it allows the motion of the cross-slide along the y-axis

Fig 3.7- Detailed view of the Gantry

The three parts once assembled makes the core functioning unit of the whole system. Even if the tools function in a right manner but if there is a failure in any one of the above components like the track or the gantry, it leads to the failure of the system.

Last but not the least the fixed bed should be made tough and strong to hold onto all the components. It can be compared to the pillar of a building.

Below mentioned figures are the different profile views of the assembled structures with the bed, tracks and the gantry unit.

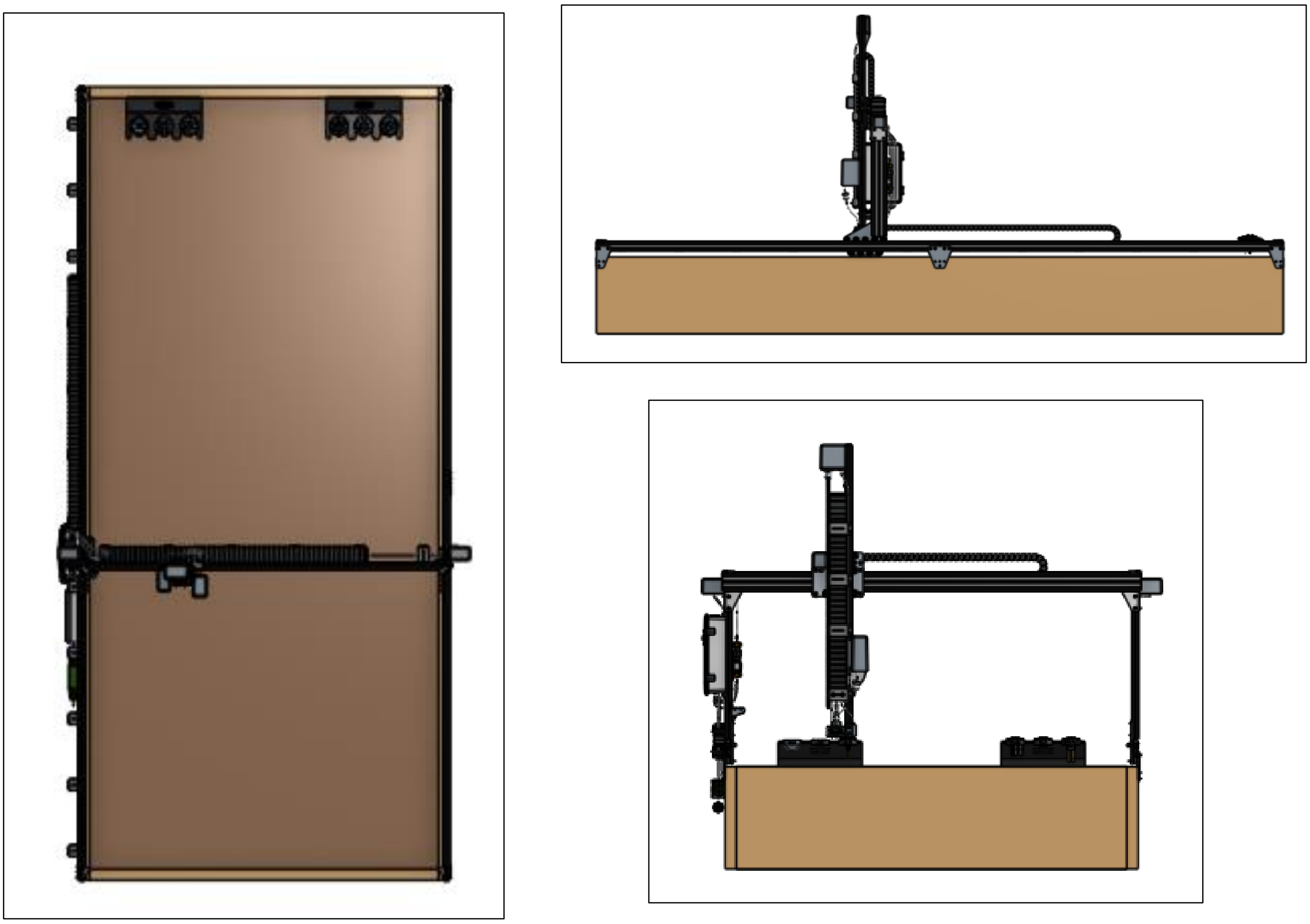

Fig 3.8- Top and side profiled view of the assembled unit

CHAPTER 4

COMPONENTS

4.1 Aluminium Extrusion Rods

Track extrusions are the primary structural component of the tracks sub-assembly. They can be combined end-to-end in order to create longer tracks. The gantry v-wheels roll along the track extrusions, allowing it to move in the x-direction.

Length required for the project - 6m

Extrusion dimensions - 20*20 mm

Material – 6063-T5 aluminium

Surface Treatment – sandblasted and clear anodized

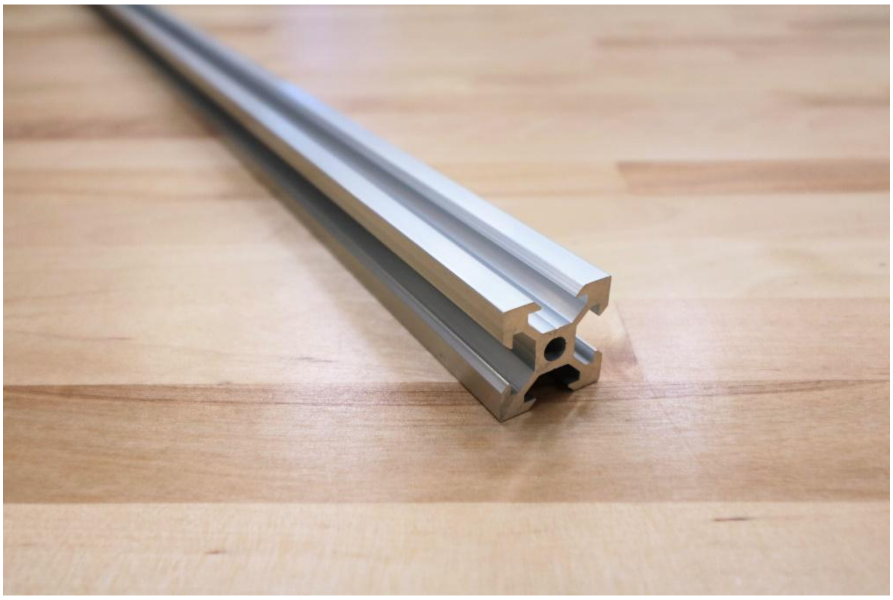

Fig 4.1: Aluminium Extrusion Rods

4.2 Nylon Bearings

The polycarbonate V-wheels or Nylon ball bearings are precision machined to allow them to move in the X, Y, and Z directions smoothly and precisely. Each wheel comes pre-assembled with two stainless steel rubber-sealed ball bearings and one M5 precision shim.

Wheel Material - Clear polycarbonate
Wheel Dimensions - 23.9mm OD, 16mm ID, 10.23mm thickness
Bearing Trade Name - SS-625-2RS
(SS = stainless steel, 625 = bearing size, 2RS = two rubber seals)
Bearing Material - Stainless steel
Bearing Dimensions - 16mm OD, 5mm ID, 5mm thickness
Bearing Seal - Rubber sealed

Precision Shim Material - Stainless steel
Precision Shim Dimensions - 10mm OD, 5mm ID, 1mm thickness
Quantity - 15

Fig 4.2: Nylon Ball Bearings

4.3 NEMA 17 Stepper Motor

These powerful 200 resolution stepper motors allow us to move precisely in the X, Y, and Z directions.

Motor Resolution - 200 steps/revolution (1.8 deg/step)
Winding Type - Bipolar
Voltage - 12V
Current Draw - 1.68A max
Shaft Diameter - 5mm diameter
Mount Hole Pattern - 4x M3 holes, standard NEMA 17 pattern
Motor Connector - 6pin connector (only 4 pins used)
Encoder Connector - 8pin connector
Encoder Resolution - 360 lines/revolution
Encoder Output - Differential
Quantity - 3

Fig 4.3: NEMA 17 Stepper Motor

4.4 A4988 Stepper Motor Driver

This stepper motor driver lets you control one bipolar stepper motor at up to 2 A-output current per coil. The board has a simple step and direction control interface and five different step resolutions, which are full-step, half step, quarter-step, eighth-step, and sixteenth step.

Minimum operating voltage: 8 V.
Maximum operating voltage: 35 V.
Continuous current per phase: 1 A.
Maximum current per phase: 2 A.
Minimum logic voltage: 3 V.
Maximum logic voltage: 5.5 V.
Micro step resolutions: 1, 1/2, 1/4, 1/8, 1/16.
Size: 0.6″ × 0.8″.
Weight: 1.3 g.
Quantity: 3

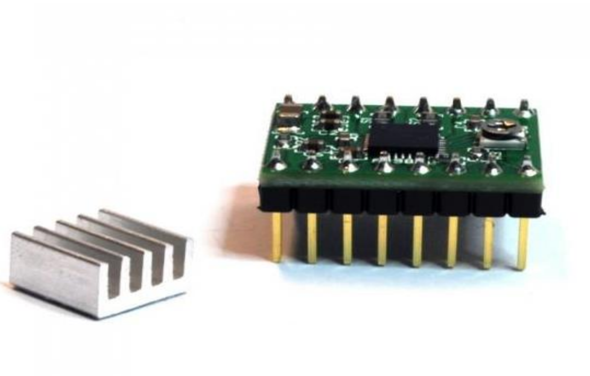

Fig 4.4: A4988 Stepper Motor Driver

4.5 Power Supply

Linear regulated 12VDC power supplies regulate the output using a dissipative regulating circuit. They are extremely stable, have very low ripple, and have no switching frequencies to produce EMI.

Input Voltage - AC 90 - 264V 50 / 60Hz.

Output Voltage - 12V DC, 30A, and 360Watt.

Output Voltage adjustment range - 20%.

Output Voltage Type - DC Current.

Shell Material - Metal Case / Aluminium Base.

Dimension - 210 x 110 x 50 mm Approx.

Fig 4.5: Power supply unit

4.6 Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.

Microcontroller - Microchip ATmega328P .

Operating Voltage - 5 Volts.

Input Voltage - 7 to 20 Volts.

Digital I/O Pins - 14 (of which 6 can provide PWM output).

Analog Input Pins – 6.

DC Current per I/O Pin - 20 mA.

DC Current for 3.3V Pin - 50 mA.

Flash Memory - 32 KB of which 0.5 KB used by bootloader.

SRAM - 2 KB.

EEPROM - 1 KB.

Clock Speed - 16 MHz.

Length - 68.6 mm

Width - 53.4 mm.

Weight - 25 g.

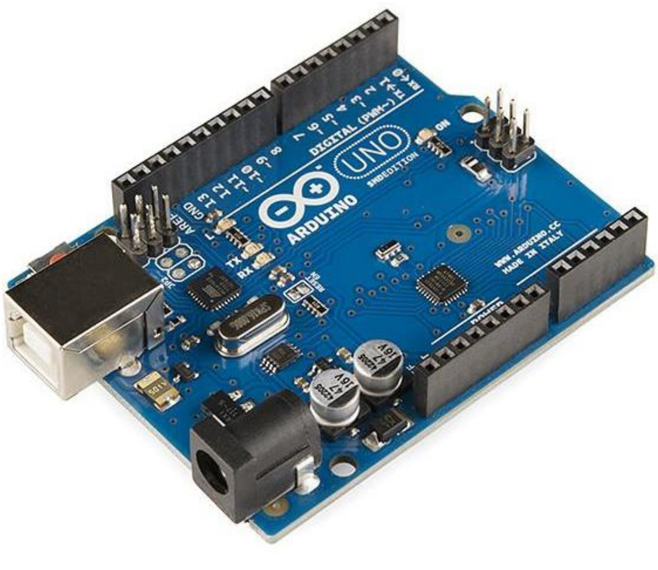

Fig 4.6: Arduino Uno

4.7 Solenoid Valve

This 24V valve controls the flow of water from the ground water pipe to the water nozzle.

Operation – Normally closed.
Working Pressure Range – 0.02-0.8 Mpa.
Flow direction – one-way.
Input Voltage – 24V.
Current Draw – 160 mA.
Power Consumption - 3.84 W.

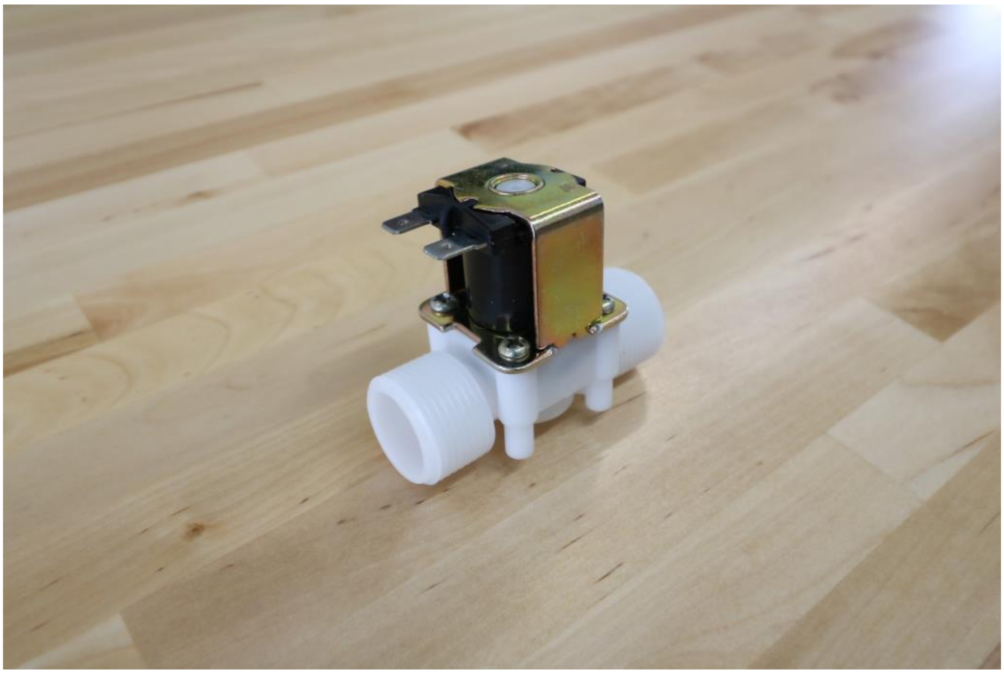

Fig 4.7: Solenoid valve

CHAPTER 5

Projected model and conclusion

5.1. Projected model

India's agriculture is composed of many crops, with the foremost food staples being rice and wheat. Indian farmers also grow pulses, potatoes, sugarcane, oilseeds, and such non-food items as cotton, tea, coffee, rubber, and jute. Each of the crops are grown in different conditions and need different amounts of water and fertilisers for the needed growth. The farmers in our country, coming to the cultivation know each and every process well through the years of experience they have. Along with the experience they have and the model made by us, the faming process can be made easy and also more refined.

The project made by us is a Multiple Parameter control automated robot for farming. This device does not replicate a farmer but it helps and assists a farmer coming to the process of farming.

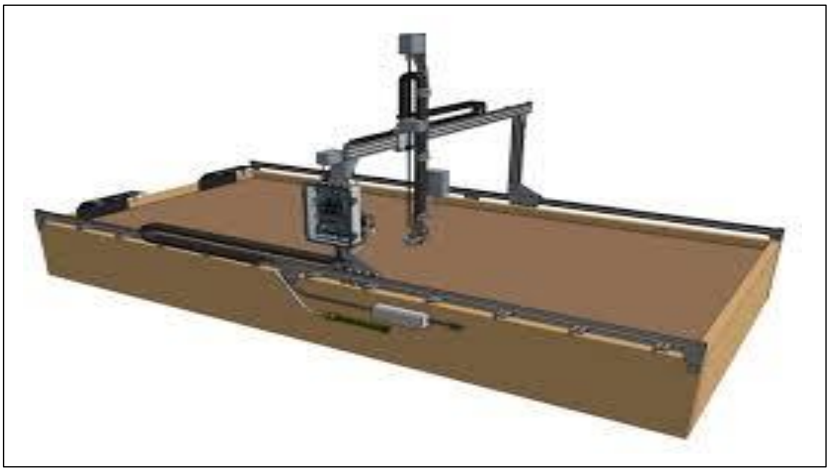

Fig 5.1- Sample of the projected model

With the help of this model, we mainly are focusing on in checking the PH and moisture content of the soil followed by the seeding and watering processes.

Initially the device helps in checking the PH and moisture content of the given area of land. Based on the determined values the farmer will get a good idea about the soil conditions and also can plan the cultivation process. With the help of the additional tools mounted to the device, the seeds are dropped in the respective points and once that is done, it moves onto the watering of the seeds. The amount of water provided to the crops must be of the needed and correct amount as excessive water can kill the crops. Due to this reason it is important to keep track of the moisture content of the soil which can be tracked by the device and based on the values got, the farmer can decide on the amount of water needed for the crops.

5.2. Conclusion

As mentioned in this report, the information regarding the 'Multiple Parameter Control Automated Robot for Farming' was collected from various sources. The Possible methods for the operation, sequence of farming activities, technology available and other information related to the functioning of the model were sourced .The Bill Of Materials was prepared and vendors were identified. Research was done on available systems, their pros and cons. Thought was put into using methods and parts that would develop the most cost effective, and efficient model and basic 3D model was prepared.

A prototype that can perform basic operation will be built in one week's time and tested.

CHAPTER 6

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