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DESIGN OF SMART SOLAR GRASS CUTTER AND PESTICIDES SPRAY ROBOT

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Abstract: Grass cutting devices are getting increasingly popular these days. Pollution is a result of human activity, as seen by our daily lives. IC engines were employed in older models of lawn cutters, and as a result of their increased environmental effect, IC engine propelled cutters are more expensive. The cost of maintaining a traditional machine is higher. Pesticide sprayers come in a variety of shapes and sizes in India. However, the most commonly used sprayer is a backpack sprayer, which is preferred by farmers since it is less expensive, simpler to operate, and most importantly, less time consuming. To circumvent these limitations, we propose to design a new sort of solar-powered lawn cutter that sprays pesticides at different times depending on the colour. The goal of our project is to develop a solar-powered lawn cutter that saves electricity and minimises labour. In our project, a microcontroller is used to operate the many functions of a lawn cutter. In addition, the lawn cutter contains an obstacle sensor that detects obstacles. The grass cutter is self-contained and does not require any special skills to operate.

I. INTRODUCTION

An agricultural robot is a robot deployed for agriculture purposes. The main area of application of robots in agriculture today is at the stage. Emerging applications of robots or drones in agriculture include weed control, cloud seeding, planting seeds, harvesting, environmental monitoring and soil analysis. According to Market Research Engine, the agricultural robots market is expected to reach $75 billion by 2025. Fruit picking robots, driverless tractor / sprayers, and sheep shearing robots are designed to replace human labour. In most cases, a lot of factors have to be considered (e.g., the size and colour of the fruit to be picked) before the commencement of a task. Robots can be used for other horticultural tasks such as pruning, weeding, spraying and monitoring. Robots can also be used in livestock applications (livestock robotics) such as automatic milking, washing and castrating. Robots like these have many benefits for the agricultural industry, including a higher quality of fresh produce, lower production costs, and a decreased need for manual labour. They can also be used to automate manual tasks, such as weed or bracken spraying, where the use of tractors and other manned vehicles is too dangerous for the operators.

DEMAND IN THE MARKET

There are concerns over the amount of labour the agricultural sector needs. With an aging population, Japan is unable to meet the demands of the agricultural labour market. Similarly, the United State currently depends on a large number of immigrant workers, but between the decrease in seasonal farmworkers and increased efforts to stop immigration by the government, they too are unable to meet the demand. Businesses are often forced to let crops rot due to an inability to pick them all by the end of the season. Additionally, there are concerns over the growing population that will need to be fed over the next years. Because of this, there is a large desire to improve agricultural machinery to make it more cost efficient and viable for continued use.

CURRENT APPLICATIONS AND TRENDS:

While robots have already been incorporated in many areas of agricultural farm work, they are still largely missing in the harvest of various crops. This has started to change as companies begin to develop robots that complete more specific tasks on the farm. The biggest concern over robots harvesting crops comes from harvesting soft crops such as strawberries which can easily be damaged or missed entirely. Despite these concerns, progress in this area is being made.

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II. LITERATURE SERVEY

1.Agricultural robots for field operations: Concepts and components" by Avital Bechar, Clement Vigneault

This journal represents the, developments and innovation in agricultural robots for field operations, and the associated concepts, principles, limitations and gaps. Robots are highly complex, consisting of different sub-systems that need to be integrated and correctly synchronised to perform tasks perfectly as a whole and successfully transfer the required information. Extensive research has been conducted on the application of robots and automation to a variety of field operations, and technical feasibility has been widely demonstrated. Agricultural robots for field operations must be able to operate in unstructured agricultural environments with the same quality of work achieved by current methods and means. To assimilate robotic systems, technologies must be developed to overcome continuously changing conditions and variability in produce and environments. Intelligent systems are needed for successful task performance in such environments.

The robotic system must be cost-effective, while being inherently safe and reliable human safety, and preservation of the environment, the crop and the machinery are mandatory. Despite much progress in recent years, in most cases the technology is not yet commercially available. Information-acquisition systems, including sensors, fusion algorithms and data analysis, need to be adjusted to the dynamic conditions of unstructured agricultural environments. Intensive research is needed on integrating human operators into the system control loop for increased system performance and reliability. System sizes should be reduced while improving the integration of all parts and components. For robots to perform in agricultural environments and execute agricultural tasks, research must focus on: fusing complementary sensors for adequate localisation and sensing abilities, developing simple manipulators for each agricultural task, developing path planning, navigation and guidance algorithms suited to environments besides open fields and known a-priori, and integrating human operators in this complex and highly dynamic situation.

Agricultural Robot" by Kavita Zole, Sanghasevak Gedam, Aditya Dawale, Kiran Nikose, Jayant Hande

In this article present design agricultural robot which is based on electronic and mechanical (Mechatronics) platform that perform advance agriculture process. This paper strives to develop a robot capable of performing operation like automatic ploughing and seed dispensing. We have developed an electromechanical vehicle which is steered by DC motor to drive wheels. The farm is cultivated by the automated system, depending on the crop considering particular row and specific columns. This project controlled by remotely and solar panel is used to charge DC battery. In this journal author tried to present related work of agricultural robot as labour problem can be reduced as compared to the manual and tractor based sowing time, energy required for this robot machine is less. At the same time by using solar energy environment pollution can also be reduced. Development and Automation of Robot with Spraying Mechanism for Agricultural Applications. This is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial Farm.

Development of Smart Pesticide Spraying Robot" by Pvr Chaitanya, Dileep Kotte, A. Srinath, K. B. Kalyan

This article presents the management of food crops includes very close surveillance, particularly with regard to the treatment of Illnesses, which will cause severe effects after harvest. Disease is recognized in crops as the shift or deficiency of the plants ordinary functions that will generate certain symptoms. The disease that causes agents in plants is mainly defined as any agent's pathogens Most of these pathogenic agents signs are seen in the leaves, stems and branches of the crops. Consequently, the diagnosis of disease and the proportion of disease produced in crops is compulsory for effective and successful plant cultivation. This can be done through taking input images using camera, analysing them using machine learning process. This displays the disease presented on the leaf, stem or plant

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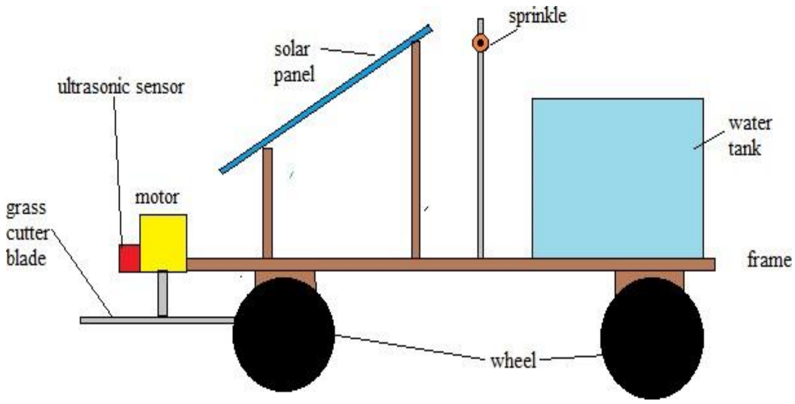
III. METHODOLOGY

Block diagram:



DESIGN OF THE SYSTEM:

DESIGN:
CAD: -

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.
Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.
CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.
CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.
CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding,and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely usedto produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormouseconomic importance, CAD has been a major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.

USES:
Computer-aided design is one of the many tools used by engineers and designers and is used in many ways depending on the profession of the user and the type of software in question.
CAD is one part of the whole Digital Product Development (DPD) activity within the Product Lifecycle Management (PLM) processes, and as such is used together with other tools, which are either integrated modules or stand-alone products, such as:
Computer-aided engineering (CAE) and Finite element analysis (FEA)
Computer-aided manufacturing (CAM) including instructions to Computer Numerical Control (CNC) machines
Photorealistic rendering and Motion Simulation.
Document management and revision control using Product Data Management (PDM).
CAD is also used for the accurate creation of photo simulations that are often required in the preparation of Environmental Impact Reports, in which computer-aided designs of intended buildings are superimposed into photographs of existing

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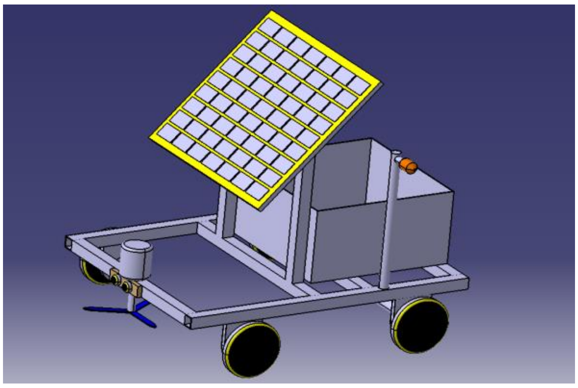
environments to represent what that locale will be like, where the proposed facilities are allowed to be built. Potential blockage of view corridors and shadow studies are also frequently analysed through the use of CAD.

TYPES:
There are several different types of CAD, each requiring the operator to think differently about how to use them and design their virtual components in a different manner for each.
There are many producers of the lower-end 2D systems, including a number of free and open-source programs. These provide an approach to the drawing process without all the fuss over scale and placement on the drawing sheet that accompanied hand drafting since these can be adjusted as required during the creation of the final draft.
3D wireframe is basically an extension of 2D drafting (not often used today). Each line has to be manually inserted into the drawing. The final product has no mass properties associated with it and cannot have features directly added to it, such as holes. The operator approaches these in a similar fashion to the 2D systems, although many 3D systems allow using the wireframe model to make the final engineering drawing views.
3D "dumb" solids are created in a way analogous to manipulations of real-world objects (not often used today). Basic three-dimensional geometric forms (prisms, cylinders, spheres, and so on) have solid volumes added or subtracted from them as if assembling or cutting real-world objects. Two-dimensional projected views can easily be generated from the models. Basic 3D solids don't usually include tools to easily allow motion of components, set limits to their motion, or identify interference between components.

There are two types of 3D Solid Modelling:

Parametric modelling allows the operator to use what is referred to as "design intent". The objects and features created are modifiable. Any future modifications can be made by changing how the original part was created. If a feature was intended to be located from the centre of the part, the operator should locate it from the centre of the model. The feature could be located using any geometric object already available in the part, but this random placement would defeat the design intent. If the operator designs the part as it functions the parametric modeler is able to make changes to the part while maintaining geometric and functional relationships.

Direct or Explicit modeling provide the ability to edit geometry without a history tree. With direct modelling, once a sketch is used to create geometry the sketch is incorporated into the new geometry and the designer just modifies the geometry without needing the original sketch. As with parametric modelling, direct modelling has the ability to include relationships between selected geometry (e.g., tangency, concentricity).
Top end systems offer the capabilities to incorporate more organic, aesthetics and ergonomic features into designs. Freeform surface modelling is often combined with solids to allow the.



IV. DESIGN OF THE SYSTEM

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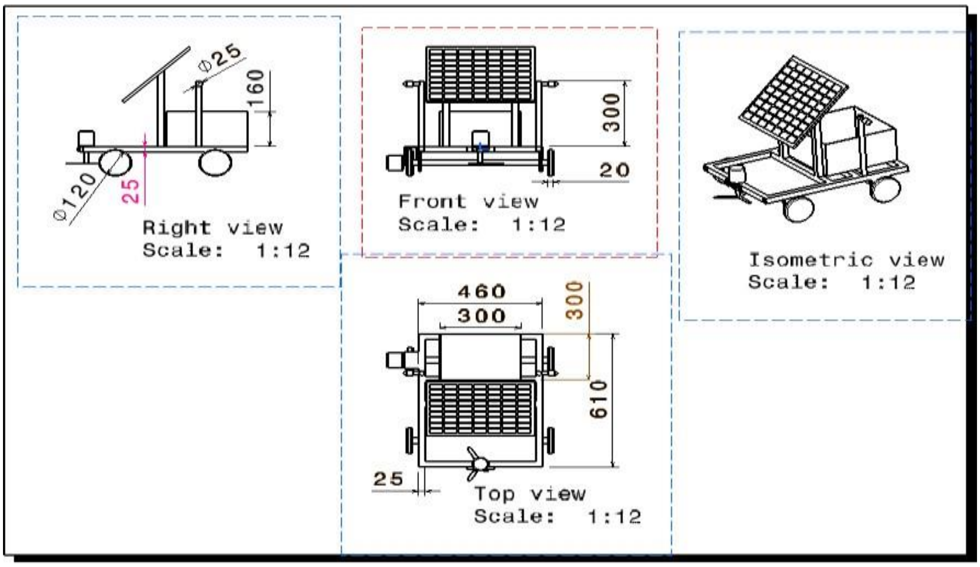

CAD may be used to design curves and figures in two- dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space. CAD is also used for the accurate creation of photo simulations that are often required in the preparation of Environmental Impact Reports, in which computer-aided designs of intended buildings are superimposed into photographs of existing environments to represent what that locale will be like, where the proposed facilities are allowed to be built. Potential blockage of view corridors and shadow studies arealso frequently analysed through the use of CAD.

COMPONENTS USED:

DC motors

After many other more or less successful attempts with relatively weak rotating and reciprocating apparatus Prussian Moritz von Jacobi created the first real rotating electric motor in May 1834. It developed remarkable mechanical output power. His motor set a world record, which Jacobi improved four years later in September 1838. His second motor was powerful enough to drive a boatwith 14 people across a wide river. It was also in 1839/40 that other developers managed to build motors with similarand then higher performance.The first commutator DCelectric motor capable of turning machinery was invented byBritish scientist William Sturgeon in 1832. Following Sturgeon's work, a commutator-type direct-current electricmotor was built by American inventor Thomas Davenport, which he patented in 1837. The motors ran at up to 600 revolutions per minute, and powered machine tools and a printing press. Due to the high cost of primary battery power, the motors were commercially unsuccessful and bankrupted Davenport.

CALCULATIONS:

Total water storing capacity of water tank- 5 litres.,Hence weight of the tank is given by,
Density= Mass/Volume.
For Five litre of water tank mass of the tank
=1000*0.01=10kg.
Total mass of the panel=2kg. Total mass of the framework=4kg. So, Total weight =16 kg.
Total force is calculated by
F=m*a
= (16*9.81)
=157N
So, on each wheel load is equals to (157/2) =78.5N

We are using four-inch diameter (101.6mm) wheels hencethe total required torque is calculated as,

T=F*R = (78.5*0.0508) =3.9878 N-m **A**

For 12V and 12A DC battery motor, P=V*I = (12*2) =24Watt.

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Now each motor generated torque for 30 r.p.m.is given by,P=2*3.141*(30) *T/60
Hence calculated torque is,T=7.693 N-m **B**
From the above Calculations **B>A**, hence the design is safe

V. CONCLUSION

In this semester we have successfully designed the CADmodel using CATIA V5 R20 software and selected the material required and also done all the required calculation for this.

VI. FUCTURE SCOPE

- As this is prototype when we go for large scale production it will increase atomization of agriculture.
- When we improve the storage capacity and use different cutters, we can cut different types of grass.

VII. REFERENCES

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