MARATHA VIDYA PRASARAK SAMAJ'S
KARMAVEER ADV. BABURAO GANPATRAO
THAKARE COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

PRESENTS

TECHNICAL MAGAZINE

MECH SPARK

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Institute Vision

To be internationally accredited, Multidisciplinary, and Multi-collaborative institute working on technology enabled platform fostering innovations and patents through state-of-art academic system designed by highly qualified faculty for the development of common masses at large

Institute Mission

To educate and train common masses through undergraduate, post graduate, research programs by inculcating the values for discipline, quality, transparency and foster career and professional development for employment thereby contributing to the development of society

Department Vision

To be the centre for excellence and centre of learning for innovation, incubation and research in the domain of product design, thermal engineering and manufacturing technology thereby path finder for professionalism, entrepreneurship and new knowledge contributing to the common masses.

Department Mission

To educate and train undergraduate and post graduate students in Mechanical Engineering by inculcating the values for discipline, quality and transparency and profession development in the job and self-employment emphasis industry-based practices.

Program Education Objectives (PEO's)

PEO1: To prepare technocrats that can satisfy the need of mechanical and allied industries.

PEO2: To develop critical thinking, problem solving skills, research aptitude and career and professionalism among the students.

PEO3: To improve and expand technical and professional skills of students through effective teaching-learning and industry interaction.

Program Specific Outcomes (PSOs)

PSO1: Ability to design, analysis and problem-solving skills using basic principle of mechanical engineering.

PSO2: Ability to impart technical and professional skills through industry institute interaction

PSO3: Develop practical skills for the benefits of society.

Objectives of Magazine

1. Primary objective of the magazine is to provide a wide platform to the aspiring engineers to showcase their technical knowledge and to explore innovative ideas.
2. This magazine is intended to bring out the hidden literary talents in the students and teachers to inculcate strong technical skills among them.

Design and development of an automatic cattle feeder for smart agriculture purpose.

The cattle need to be fed. It is a simple statement, but one that resonates with every cattle producer. To make this necessary task easier for farmers, the concept of automatic cattle feeding system came into existence. Automatic Cattle Feeding System is a robotic feeding system which consists of a battery-operated robotic vehicle that is capable of feeding an equal amount of feed. The feed is manually loaded in the feeder and it follows the feed fence through a pre-determined route until it reaches the feeding fence at a pre-determined distance where it places the feed through a sliding door. To ensure the precise, timely and adequate feeding of cattle of each group, this project is applicable in an agricultural country like Nepal where the lack of manpower in cattle farming has an adverse effect on dairy production. The main objective is to design automatic cattle feeding system that moves around the fence to distribute the feed uniformly. With the application of line following robot, remarkable changes can be brought to this field. The use of infrared and ultrasonic sensor ensures precise line following and an exact determination of feed point. The use of Bluetooth module helped to control and switch off the whole system whenever there is any issue in the hardware. With the application of Automatic Cattle Feeding system uniformity in feed distribution can be maintained.

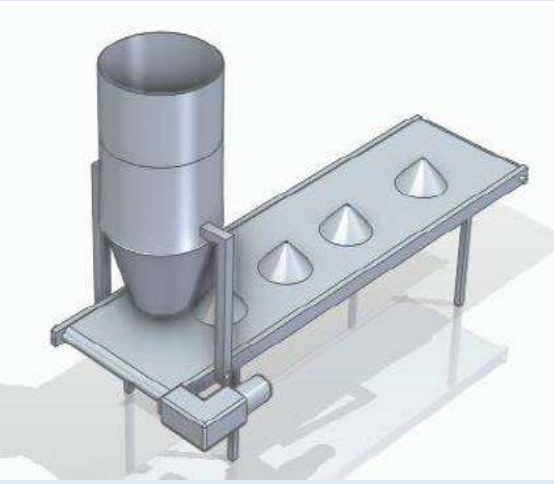
Objectives of work

1. To allow feeding of cattle with automation in timely manner and with precession and less wastage.
2. To reduce cost of labor for feeding cattle.
3. To characterize feeding pattern of cattle.
4. To ensure timely and adequate feeding of cattle group wise.

The various components present in the proposed automated cattle fodder system are listed. The system consists of a battery power supply which acts as an energy source for supplying electricity to the system. Gear Motor which helps for operation of the conveyor and feeder gate mechanism respectively. The feeder motor which then fall in conveyor that carry the chopped feed, from that it moves to the conveyor. This is provided with a controller & timer base system for cattle food to the box which kept in front of the cattle and helps the entire system to be in the closed loop, Control unit which consist

of timer controller. This is used to control the number of feeding cycle time at an interval of time and integrate all these systems together and make the entire system as the closed loop system.

Proposed Design:-



Prepared by: -

1. Kunal Bachhav
2. Ghayal Aniket
3. Gunjal Shivraj
4. Aniket Khairnar

Students of Final year Engineering
Department of Mechanical Engg.
M.V.P.S's K.B.T. College of Engineering, Nashik

Design and Development of Automatic Bike Indicator using GPS Navigation System

The Main aim of the work is to design and development of Automatic turning bike indicator. Indicator is for two-wheeler which is being powered for bike battery itself and turn automatically when there is turn on the way. It is one of the most economical method for reducing the number of accidents. There were various forms of automatic indicator in the past through which the existing form has evolved. Studies are still going on for making indication system more economical and easier to use. Though the system is a low cost and is very efficient in highways, it needs more research to be very correct at all types of roads & intense traffic. Here Introducing a new innovative concept. In this project the turning of indicator will be based on GPS Navigation system.

Problem Statement

Now-a-days people who are driving their vehicles on the roadways are not properly using their vehicle's indicator while turning. In peak hours and in traffic times people are rushing with their vehicle and forgot to use their indicator this leads to an accident while sudden turning and braking without a proper indication. In order to overcome these types of problems, an automatic turning on/off bike indicators using offline GPS navigation system is proposed.

Objectives of work

- To adopt technology for new automation.
- To prepare the model of automatic bike indicator.
- To improve safety on roadways while driving.
- To develop low cost automatic indicator.
- To reduce the number of accidents which occurs due to improper usage of bike indicators.
- To make everyone follow the traffic rules.
- To create awareness in public about traffic rule.

Material Selection

1. OLED Display:

Functions: OLED Display is used to display the direction to turn and also the turn.

Reason for select: It saves the battery, Compact in size, easily available.

Cost of the OLED Display: Approximately Rs.500 to 700.

Make: Waveshare OLED

2. ESP 32 Development Board:

Functions: This provides WIFI (and in some models) dual mode Bluetooth connectivity to embedded device, used for controlling purpose.

Reason for select: Battery connectivity, easy to use, easily available, Heart of the system.

Cost of the board: Approximately Rs.600 to 800.

Make: SquadPixel

3. Voice recognition circuit:

Functions: To convert voice into electrical signal.

Reason of selection:

Cost of the circuit: 1000-1500

Make: Sunrobotics Pvt. Ltd.

4. Buck Converter:

Functions: Buck convertor is used to regulate the voltage between 3.3v to 5v.

Reason for select: Efficiently converts a high voltage to high voltage (ESP 32 development board operating voltage is between 3.3v to 5v.)

Cost of the board: Approximately Rs.100 to 300.

Make: Daktronics Pvt. Ltd.

5. Channel Relay:

Functions: Two channel relay is used to turn on or turn off the bike indicator based on the input received from the ESP 32 development board.

Reason for select: Compact in size, easily available in the market.

Cost of the board: Approximately Rs.200 to 400.

Make: Robot Banao

6. Power Supply 12V:

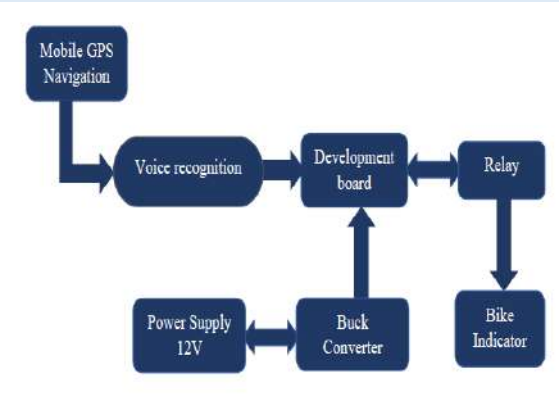
Functions: A 12v battery required for power supply to system.

Cost of the battery: Approximately Rs.1500. (As bike has its own battery so this Expense can be eliminated)

Make: Amaron Pvt. Ltd.

Construction

GPS navigation is used to select path of destination where the user wants to travel. So, user need to put final destination of the journey in GPS application in mobile. It will give alert before turn of 100m in the form of voice. Voice recognition converts this voice to electrical signal and send it to development board. The 12V battery is used to provide power in the system. buck convertor is placed between power supply and development board. The main function of buck convertor is to convert 12V into 5V because development board require 5V supply. Then the development board send signal to the channel relay. Relay is used to operate the switch to make indicator turn it on and off.



Working

The proposed system works in an offline and online i.e. It might or might not require internet connection based on location (City or village). By turning on the connection to the board, it will generate the hotspot/Bluetooth and it will be connected with the Mobile Phone. Also, A Voice detection device will be turned on. So, suppose we want to go home by our bike, then we'll set the location of the phone on Google map. After setting the location, navigation will start. When turning is available in the way to destination before 100 meters the assistant will tell that turn is 100 m. From bike. That voice of the assistant will be recognised by voice recognition device, and send required signal to ESP development board. Further Development board process the information and sent signal to Relay that will turn on the indicator of respective side. After the turn taken indicator will be turned off automatically after 2 sec. Thus, the proposed work would help the people during the rush hours and also during the emergency situations to avoid accidents.

Prepared by:-

1. Handore Aditya
2. Sonawane Tejas
3. Karmase Aniket
4. Suryavanshi Mohan

Students of Final year Engineering
Department of Mechanical Engg.
M.V.P.S's K.B.T. College of Engineering, Nashik

Design and Development of Drone with Multi-Tilt Rotor Mechanism

Drones have slowly but steadily emerged as a research and commercial hotspot because of their widespread applications. Due to their agility, compact size, and ability to integrate multiple sensors, they are mostly sought for applications that require supplementing human effort in risky and monotonous missions. Despite all of these advantages, rotorcrafts, in general, are limited by their endurance and power-intensive flight requirements, which consequently affect the time of flight and operational range.

One of the potential solutions to increase the endurance of VTOL rotorcrafts (Vertical Take-Off and Landing Vehicles) was to exploit the thrust vectoring ability of the individual actuators in multi-rotors, which would enable take-off and hovering as a VTOL vehicle and flight as a fixed-wing aircraft. The primary aim of this paper is to layout the overall design process of a multi tilt-rotor drone from the initial conceptual sketch to the final fabricated prototype. The novelty of the design lies in achieving thrust vectoring capabilities in a fixed-wing platform with minimum actuation and no additional control complexity. The design process of a Multi Tilt-Rotor Drone. First, a new configuration scheme with the tilting rotors is designed. Then, the detailed nonlinear mathematical model is established, and the parameters are acquired from designed experiments and numerical analyses. For control design purposes, the dynamics equation is linearized around the hovering equilibrium point, and a control allocation method based on trim calculation is developed. To deal with the actuator saturation and uncertain disturbance problems for the Multi Tilt-Rotor Drone, an improved flight control law based on the combination of the robust servo actuators, optimal control and state of the art microcontroller with custom flight control software is proposed. The with thrust vectoring capabilities aiming to substantially increase the flight range and endurance compared to the conventional aircraft rotorcraft configurations are presented.

Drones have been in use across the world for decades at the time, the drones have been cantered on their use in military surveillance and active combat, but with

technological advancements in the 19th and 20th centuries, modern drones were born.

Drones now have many functions, ranging from monitoring climate change to carrying out search operations after natural disasters, photography, filming, and delivering goods. But their most well-known and controversial use is by the military for reconnaissance,

surveillance and targeted attacks. Despite the fact that modern drones are highly

effective and equipped with all the necessary technologies to maintain stability while in flight, however practically all quadcopter drones have a tendency to lean forward while moving. This makes it difficult for them to transport payloads in a stable manner.

In traditional drones, pitch is achieved by varying the rpm of the rotors; as a result,

the entire structure of the drone is slanted while in operation. If a payload is being carried from the drone, that sensitive payload should not experience that tilt, or else numerous difficulties may arise.

Hence, there exists a need to provide Multi Tilt Rotor Drone with Failsafe System.

The present invention will provide better alternative solutions to the conventional ways and to overcome the drawback of the above-mentioned conditions and problems.

Objective of Work

• The main objective of the present work is to provide Multi Tilt Rotor Drone with Failsafe System which has four rotors to provide enough propulsion for balanced lift-off, landing, and cruising.

• Improve Transportation Efficiencies

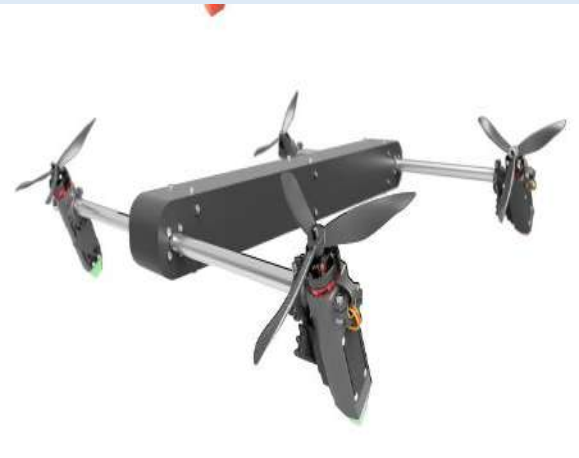
• Environmentally clean

• Emergency use

• Safer transportation

• Logistics and Transportation

Complete Assembly of Drone



Components

1. Motor
2. Propeller
3. Battery
4. Voltage Converter
5. Servo
6. Electronic Speed Control Unit
7. Transmitter and Receiver
8. Accelerometer

9. Teensy 4.0

10 Software

Arduino IDE + Teensyduino

Prepared by:-

1. Yash Sonawane
2. Suyash Sonawane

Students of Final year Engineering
Department of Mechanical Engg.
M.V.P.S's K.B.T. College of Engineering, Nashik

Experimental evaluation performance of vapour absorption system at different loads and analysis different results

The vapour absorption refrigeration system is one of the oldest methods of producing refrigerating effect. In the early years of the 20th century, the vapor absorption cycle using water-ammonia systems was popular and widely used, but after the development of the vapor compression cycle it lost much of its importance because of its low coefficient of performance. The principle of vapour absorption was first discovered by Michael Faraday in 1824 while performing a set of experiments to liquefy certain gases. The first vapour absorption refrigeration machine was developed by a French scientist, Ferdinand Carre, in 1860. This system may be used in both the domestic and large industrial refrigerating plants. Absorption refrigerators are a popular alternative to regular compressor refrigerators where electricity is unreliable, costly, or unavailable, or where noise from the compressor is problematic; or where surplus heat is available.

General Introduction

Vapour Absorption Refrigeration Systems (VARS) belong to the class of vapour cycles similar to vapour compression refrigeration systems. However, unlike vapour compression refrigeration systems, the required input to absorption systems is in the form of heat. Hence these systems are also called as heat operated or thermal energy driven systems.

Similar to vapour compression refrigeration systems, vapour absorption refrigeration systems have also been commercialized and are widely used in various refrigeration and air conditioning applications. Since these systems run on low-grade thermal energy, they are preferred when low-grade energy such as waste heat or solar energy is available. Since conventional absorption systems use natural refrigerants such as water or ammonia they are environment friendly.

The function of compressor in the vapour compression system is to continuously withdraw the refrigerant vapour from the evaporator and to raise its pressure and hence temperature, so that the heat absorbed in the evaporator, along with the work of compression, may be rejected in the condenser to the surroundings In vapor – absorption system, the function of the compressor is accomplished in a three – step process by the use of the absorber, pump and generator.

As Absorption unit become more popular not only in industry but also on a domestic

level, their simulations become more important. Thisenables better understanding of the complex thermodynamic behavior which such system exhibit and for that various mathematical model have been created in the past.

Nowadays, investigation of ammonia water (H2O-NH3) systems is becoming more important especially with the introduction of efficient generator-absorber heat exchanger (GAX) absorption units. Although the latter systems are in principle the same, they require additional devices which in themselves require thermodynamic modelling.

Objectives of Work

1. To find coefficient of performance of the system.
2. To compare the COP before changing the absorber volume and after changing absorber volume.
3. To make effective refrigeration making use of Solar Energy.
4. Effect of change in refrigerant on vapour absorption.
5. Propose a solution to college's HVAC&R laboratory.

Components of Machine

A. Refrigeration components

1. Evaporator
2. Condenser

B. Regeneration Components

1. Absorber
2. Generator

C. Additional Components

1. Pump
2. Expansion Devices
3. Solar Panel

Prepared by:-

1. Kapadnis Neha
2. Kelkar Lokesh
3. Khaire Pranali
4. Khairnar Sushan

Students of Final year Engineering
Department of Mechanical Engg.
M.V.P.S's K.B.T. College of Engineering, Nashik

Study of Tribological Behaviour of Al / SiC / ZrO2 Hybrid Composites Fabricated Through Squeeze Casting Technique

The key step in the engineering design process is thought to be material selection. Engineering materials produced to order have developed as a result of the need to enhance material behaviour, both structural and nonstructural

Before choosing a material for an engineering application, the cost of the material, the viability of the processing processes, the chemical, physical, and mechanical qualities, and environmental considerations must all be taken into account. Metals are regarded as one of the most alluring engineering materials since their qualities can be enhanced through alloying with other elements and a variety of heat treatment techniques. The metals have good electrical and thermal conductivity in addition to having relatively high stiffness, modulus, strength, toughness, ductility, and formability. High density and potential strength loss brought on by negative environmental impacts like corrosion, hydrogen embrittlement etc., are the main shortcomings in using metals.

Among the metal family, nonferrous metals including aluminium, copper, lead, nickel, titanium, and their corresponding alloys have many industrial applications. Aluminum and its alloys are among the nonferrous metals that have a wide range of uses in industries like the automotive, aerospace, structural, marine, etc. aluminum has a density of only 2.7 g/cm3, which is about one-third that of steel (7.8 g/cm3). Pure aluminium lacks strength and is soft and ductile, making it unsuitable for a variety of applications. However, aluminium alloys offer increased strength to weight ratio. Corrosion resistance is another vital trait possessed by aluminum and its alloys.

The combination of these unmatched qualities attracts design engineers to aluminium alloys. Aluminum and its alloys are primarily produced through the casting process. After casting, they are additionally put through the extrusion and heat treatment processes to enhance their characteristics. Annealing, homogenising, solution heat treatment, natural ageing, and artificial ageing, sometimes known as precipitation hardening or age hardening, are the usual heat treatment procedures used on aluminium and its alloys. The AA2024, AA6061, and ALM24 heat treatable aluminium alloys of the 2000, 6000, and 7000 family are frequently used as matrix materials for creating AMC.

Since aluminium 6000 series alloys have an unmatched level of corrosion resistance and high workability behaviour, they are used to make brake components, valves, racing bike frames, etc. An alloy of aluminium from the 6000 family with a moderate strength and strong corrosion resistance is called AA6061. These alloys are intensively studied because of their technological significance and capacity to increase strength levels through the age-hardening process. The strongest alloy in the aluminium 6000 family is called AA6082, and it is relatively recent. It is lightweight, has great corrosion resistance, is easy to work with, and is weldable. It is discovered that AA6082 prevails over low carbon steels and AA6061 in several structural applications. However, because to their poor wear resistance, aluminium alloys are limited in their applications.

Introduction to Composites Materials

According to research, a composite material is a structural substance made up of two or more constituents that have been joined at the macroscopic level but are still insoluble in one another. Reinforcement is one of the phases of the composite. The matrix is the phase of the composite where the reinforcement is inserted. The reinforcement material have the shape of flakes, fibres, or particles. The matrix materials offer the appropriate support and orientation for the reinforcements while the reinforcement materials provide the composites their strength and stiffness. The properties of composites are determined by the interaction between the matrix and the reinforcement materials. By functionalizing the reinforcements, it may be possible to strengthen the bond between the matrix and the reinforcement.

High stiffness and strength to weight ratios, as well as improved fatigue life and corrosion and wear resistance, are benefits of composite materials. The composite materials can be divided into three basic categories, specifically Polymer Matrix Composites (PMC), Ceramic Matrix Composites (CMC), and Metal Matrix Composites, depending on the matrix material used (MMC).

Metal matrix composites

Metals like aluminium, magnesium, copper, titanium, nickel, etc., create the metallic matrix in Metal Matrix Composites (MMC). Ceramics in the form of particulates is a frequent reinforcing phase used in metal matrixes. Additionally, continuous fibres and whiskers are used as reinforcements. Metals such as tungsten, molybdenum, lead, and other metallic phases are used as reinforcing materials. Adding hard ceramic reinforcement particles to the matrix can

help soft metals that typically lack strength and thermal resistance to some level. The matrix could accommodate reinforcements in a variety of sizes, from micron to nanoscale.

MMCs' decreased density, enhanced stiffness and specific strength, enhanced high-temperature performance, and enhanced wear resistance are their main advantages. The characteristics of the matrix and the reinforcing phase have a direct impact on the improved properties displayed by the MMCs. The strength to density ratios of metals like steel, aluminium, titanium, etc. range from 26 to 27 MNm/kg, but when silicon carbide particles are added to an aluminium matrix at a volume percentage of 25 (vol.%), the strength to density ratio rises to almost 40 MNm/kg. Based on the type of reinforcement and the matrix materials used, MMCs could be categorised.

Particle reinforced MMCs, continuous fiber reinforced MMCs, and short fiber or whisker reinforced MMCs are the three categories of MMCs based on the type of reinforcement materials utilised. MMCs are categorised as aluminum-based MMCs, magnesium-based MMCs, copper-based MMCs, titanium aluminum-based MMCs, nickel-based MMCs, etc. depending on the type of matrix material used. Attached Figure displays various matrix and reinforcing materials that were employed in the creation of metal matrix composites.

Objectives of Work

Thus, the objective of this project is to evaluate the wear resistant properties of aluminum base composite and check their feasibility for give cam-shaft operating condition by optimizing their performance characteristics and tribological properties. Optimization means maximizing desirable function and minimizing undesirable phenomenon. Tribological properties of, aluminum alloy (ADC 12)) reinforced with Silicon Carbide (SiC) particles with Zirconium Oxide (ZrO2) i.e., composites are studied by using Taguchi technique in MINITAB18 software. Taguchi technique provides a simple efficient and systematic approach to optimize designs for performance, quality and cost. Also, the objective of this project is to formulate the mathematical model to analyse the tribological properties of composite. Composite is prepared by reinforcing SiC with ZrO2 in Aluminium (ADC 12) aluminum alloy matrix in varying percentage. Effect of reinforcing on composite behavior is also being studied. Third objective is to improve wear performance of cam shaft bearing by

replacing aluminum alloy lining by ALUMINIUM (ADC 12)/SiC with ZrO2 composite.

Prepared by:-

1. Zade Vivek
2. Jadhav Saurabh
3. Shinde Monali
4. Borgude Pratiksha

Students of Final year Engineering

Department of Mechanical Engg.

M.V.P.S's K.B.T. College of Engineering, Nashik

Prevention of flowers and fruits of grapes from moisture and water droplets by application of psychometry

Since we all know that grapes farming is one of the most difficult crops to farm. In four month period of farming, there are various critical stages where rainwater is very harmful for grapes such as in flowering stage and sugaring stage. Water droplets which are remains inside the bunch of grapes will highly damage the grape quality and production. So, we have to take strict action over it to avoid such damage to save crops as well as initial capital invested by farmers.

Heat transfer rate between the water trapped in bunch of grapes and the processed air is the main element of our proposal. For this we have to increase heat transfer rate as much as we can. By using cooling coil and heating coil the effect of sun burning and water droplet trapping inside the bunch of grapes we are going to eliminate. In this project we are going to dehumidify the water droplets and dew over the grapes and the bunch in flowering stage and sugaring stage of grapes, cool and humidify the grapes bunch at the stage of sun burning and flash the water away from the bunch and leaves of the grapes by air blowing effect.

In Grapes farming, there are various critical stages where rainwater is very harmful for grapes such as in flowering stage and sugaring stage. Water droplets which are remains inside the bunch of grapes will highly damage the grape quality and production. So, we have an idea that if we blow cooled and dehumidified air over the grapes bunch, then water droplets inside the bunch will get dehumidified bunch get dried. So that we can save lot of money for spraying various fertilizers. And also, in case of sun burning of grapes, we can blow cool and humidified air over grape bunch so that harmful heating effect on grapes will get reduced. By using this technique farmers will able to improve grapes quantity and quality also and gains more profit.

In various states of India, grapes farming is a significant agricultural industry. If properly managed, grape production can be quite profitable. This comprehensive guide includes information on how to start a grape plantation in India, as well as detailed information on the climate, soil, varieties, plant protection, management, harvesting, and post-harvest procedures.

Grapes, a member of the Vitaceae fruit family, are farmed for commercial purposes all year round in India. It is grown from north to south of the peninsula

of India, from Punjab, Madhya Pradesh, Haryana, J & K, Mizoram to Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, and Kerala. It is adapted to tropic, subtropical, and mild-tropical climate conditions. Among them, Maharashtra and Tamil Nadu play a significant role in the nation's overall production.

According to a study, a cup of grapes contains 90 calories without any fat, cholesterol, or sodium. Its 20% sugar content is natural, abundant in calcium, wealthy, and full of various vitamins and nutrients. The color of grapes makes them rich in antioxidants, polyphenols, and fiber, all of which have significant health advantages, in addition to being a fantastic source of vitamins C and K. More than 80% of the grapes grown worldwide are used to make wine, while 10% are prepared for the food and raisin sectors and the remaining 20% are utilized for table usage. Even though India's share of the grape export market is very small, the pace is growing

Objectives of Work

- To reduce the fertilizer, use and initial cost invested by farmers to get more profit.
- To preserve or improve the quality and quantity of grapes.
- To dehumidify the water droplets and dew over the grapes and the bunch in flowering stage and sugaring stage of grapes.
- To cool and humidify the grapes bunch at the stage of sun burning.
- To flash the water away from the bunch and leaves of the grapes by air blowing effect

Working

In this experimental set up, there is tractor operated air blower which will operate on the PTO shaft of tractor. There is connection by universal joint to PTO shaft and the set-up shaft. Components of this set are shaft, pulleys, generator, v belts, fan, boom shape fabrication, heating plates, humidifier, stand for mounting the assembly, bearings and universal joint. Two pulleys are mounted on the shaft in which first one will run the generator and second pulley will rotate the fan for blowing the air. Above the fan there is humidifier and heating plate mounted for blowing the required dry and heated air. Shaft is supported by two bearings at each end. Electricity generated by the generator is used for the heating the plate. Boom shape fabrication is used to impinge the air at desired target.

When we give the input to shaft of machine, it will rotate generator and fan. When heating plate gets heated, ambient air is passed over the heating plates which

processed in the humidifier to get dehumidified air. Due to this combined effect, we will get the dry and heated as the output. When this processed air is blown over the wet grapes bunch, it will result in drying the bunch and our desired output is achieved.

Components

1. Heating plate
2. Dehumidifier
3. Generator
4. Blower fan

Advantages:

1. Reduce disease pressure, as clusters dry quickly after dew or rainfall in an open coverage,
2.Increase spray coverage and effectiveness,
3.Improve fruit quality (increased phenolic compounds and colour in red wines),
4. Cool and Humidify grapes bunch at the time of sun burning,
5. Dehumidify the water droplets and dews over the grapes bunch in flowering stage,
6. Flash away the water from grape bunch by air blowing effect,
7. Reduce the fertilizer use and initial cost invested by farmers,
8. Preserving or Improving the quality and quantity of grapes

Limitations:

1. Maintaining Temperature effect near the contact zone is little difficult,
2. Need high electric supply for heat generation at heating coil,
3. We have to remove the water droplets after every rain cycle,
4. Initial cost is high.

Applications:

1. It is used for cool and humidify grapes bunch at the time of sun burning.
2. It is used for dehumidify the water droplets and dews over the grapes bunch in flowering stage.
3. It is used where rainfall is maximum and grape crop is farm during rainy season.

Prepared by:-

1. Bundelkhandi Nishant
2. Deshmukh Atharva
3. Gaikwad Omkar
4. Kaklij Ritesh

Students of Final year Engineering
Department of Mechanical Engg.
M.V.P.S's K.B.T. College of Engineering, Nashik

EDITORIAL TEAM

DR. V. C. SHEWALE	EDITOR IN CHIEF
MR. V. V. SHINDE	CO- EDITOR
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