

**Criterion II – Teaching-Learning and Evaluation****Key Indicator : 2.3 Teaching-Learning Process**

2.3.1 Student centric methods, such as experiential learning, participative learning and problem-solving methodologies are used for enhancing learning experiences

**PROBLEM SOLVING METHODOLOGIES**

Sr. No.	Description	Page No
1.	Prototype developed	2-11
2.	Case studies	12-20
3.	Industry supported/sponsored	21-37
4.	Research paper publication	38-69



**Prototype developed sample**

Prototype: Automatic Bhel Making Machine

Department: Mechanical Engineering

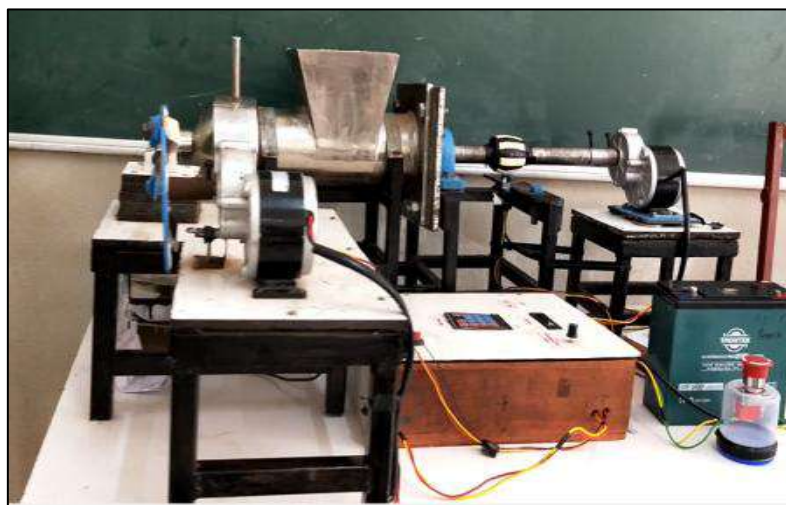
Year 2019-20



Prototype: Automated Dough Making and rolling Machine for Food Industry

Department: Mechanical Engineering

Year 2018-19





Prototype: Onion dehydrating system  
Department: Mechanical Engineering  
Year 2018-19



11/ Prototype developed 2021-22 Sample

A  
PROJECT REPORT  
ON  
“DESIGN AND DEVELOPMENT OF  
E PLASTIC CRUSHER”

Submitted in partial fulfilment of the requirements for the degree of  
Bachelor of Technology  
In

**Electrical Engineering**

SUBMITTED BY

Mr. KAMBLE ROHIT PRAKASH (18141036)

Mr. YEWALE SUYOG ASHOK (18141050)

Miss. JADHAV SHRADHA SIDHAPPA (19142002)

Mr. PAWAR PRASHANT ATMARAM (19142029)

UNDER THE GUIDANCE OF

Mr. S.D.PAWAR



DEPARTMENT OF ELECTRICAL ENGINEERING  
ANNASHEB DANGE COLLEGE OF ENGINEERING AND  
TECHNOLOGY, ASHTA.

2021-2022



## CERTIFICATE

This is to certify that the project report entitled "**DESIGN AND DEVELOPMENT OF E PLASTIC CRUSHER**" submitted by

Mr. Kamble Rohit Prakash (18141036)

Mr. Yewale Suyog Ashok (18141050)

Miss. Jadhav Shradha Sidhappa (19142002)

Mr. Pawar Prashant Atmaram (19142029)

as the record of the project work carried out by them, is accepted as the Project Report in partial fulfilment of the requirements for the award of degree of Bachelor of Technology in Electrical Engineering from Annasaheb Dange College of Engineering & Technology, Ashta, during the academic year 2021- 2022.

Place: Ashta

Date: 23.04.2022

  
(Mr. S.D. PAWAR)


**GUIDE**

  
(Dr. GOPINATH.S)

**HEAD OF DEPT.**

  
(Dr. VIKRAM S. PATIL)

**DIRECTOR**

  
**EXTERNAL EXAMINAR**



## ABSTRACT

Dynamic Plastic is the most useful surveyed materials in this current reality, yet it causes damage to environment. The reusing of waste plastic recovers the material, which can be used to make new plastic things like holders, plastic woods, and particle sheets. To make this happen, first the waste plastic needs to be demolished into little pieces setting it up for proper transportation and further it is reused. This major improvement of a plastic shredder to reuse the waste plastic found in the public power school of development, Akure, Ondo State, Nigeria conditions. The shredder has the different units like fixing unit, the power transmission unit, crushing unit and the machine frame. The presentation of the machine was considered, and test results which is making it sensible. Medium scale finance supervisors can use this machine for waste management in the waste plastic reusing business. This machine can be used for taking out plastic waste into a little reasonable size. The edges of the shredder are worked with a shock that they progress forward through the power during the cutting of plastic parts. Little drops of annihilated plastics are reused in different ways. The convincing idea for this approach is sharp and cut off. As required, the utilization of an outstanding machine can nearly diminish the work cost. This will fittingly diminish the internment and dumping of waste on the earth.

**Keywords:** - Waste administration, Shredding machine, reuse.



Hardware:

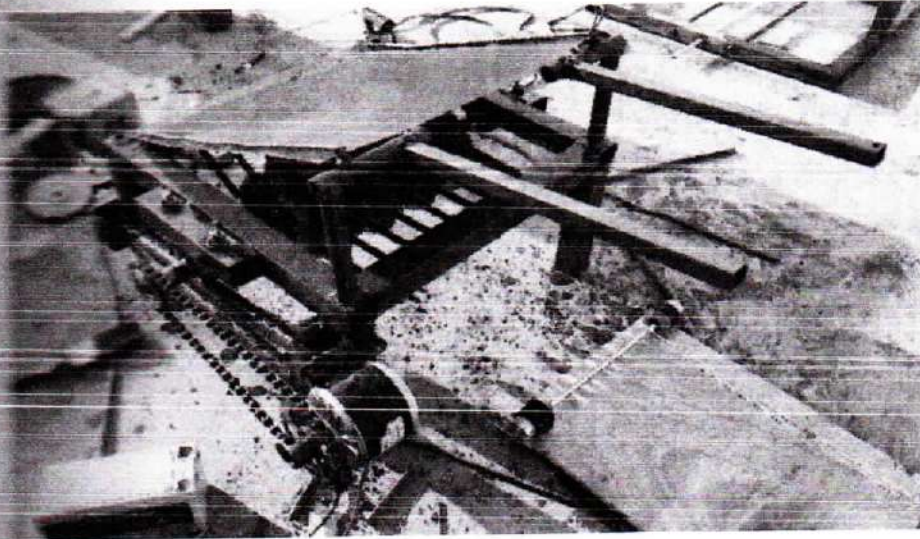


Figure 3.5: Crushing Chamber

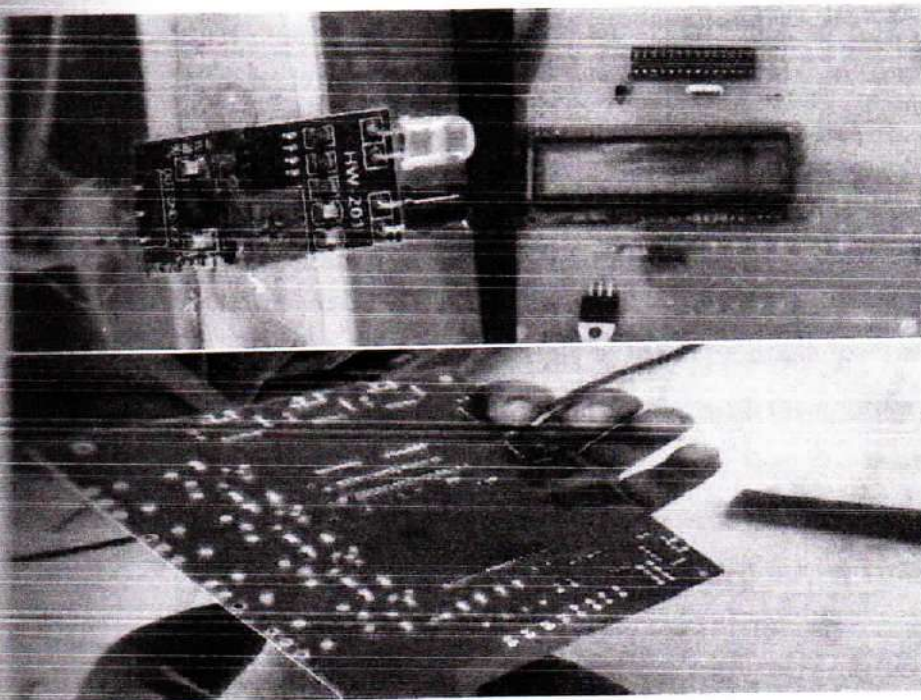


Figure 3.6: PCB Soldering with basic Arduino circuit

### 5.1 Conclusion:

The plastic crusher is an ideal equipment for recycling PET bottles. The screen size employed in the crusher design is minimal because materials larger than 8mm cannot pass through it easily.

The results We got from the waste plastic obliterating machine execution further show that the machine could be extraordinarily useful in encountering exactly the same thing where Plastic is capable of reducing the giant. plastic crusher is only suitable for small-scale plastic recycling HDPE, LDPE, PVC, and PET bottles have 90 percent efficiency, 85 percent for LDPE, 45 percent for PVC. This analysis directly implies that the equipment suitable for crushing Plastic bottles.

The machine is hence recommended for use by medium-scale financial specialists managing reused plastic.



## Prototype developed

The faculties of Civil Engineering Department, has developed 3 models which will be useful for students enhancements, Experimental work, consultancy work. In this regards, three models listed are as follows:

### 1. Law of Moment Equipment

The Principle of Moments states that when a body is balanced, the total clockwise moment about a point equals the total anticlockwise moment about the same point.

If the algebraic sum of moments of all the forces acting on the body about the axis of rotation is zero, the body is in equilibrium. According to the principle of moments, in equilibrium:

Sum of anticlockwise Moments = Sum of clockwise moments.



#### 1) Law of Moment Equipment:

Faculty Member: Mr. K. K. Shinde



#### 2) Shear Centre of A Channel Section Equipment:

Faculty Member: Mr. B. V. Mane



#### 3) Bond Wrench Test Equipment :

Faculty Member: Mr. R. A. Patil, Mrs. V. A. Lande, Ms. P. S. Kadam



## **2. Shear Centre of A Channel Section Equipment**

For a simple cross section, if the shear load is applied at any arbitrary point on the cross section then the cross section undergoes two types of deformations, viz. flexural and torsional. The shear center is the only point on the cross section such that the beam will undergo only bending deformations without any torsion, if the shear force is applied through the shear center; and if pure torque is applied through center of twist (for simple cross sections, centre).

The Shear centre is a point where a shear force can act without producing any twist in the section. At Shear centre of a section the applied force is balanced by the set of shear forces obtained by summing the shear stresses over the section.

Shear centre is also known as the centre of twist. When the load does not act through the shear center, in addition to bending, a twisting moment will develop in the section. The location of the shear center is independent of the direction and magnitude of the transverse forces.

## **3. Bond Wrench Test Equipment**


Masonry brick is one of the important constituents in construction industry efforts have been made around the globe to utilize waste from various industries in brick production as alternative building materials to conserve the natural resources.

Bricks utilizing these wastes have different characteristics. Therefore, studies of these newly developed bricks are essential, especially on the compatibility of these materials with commonly used mortars for developing appropriate structural performance. Measurement of bond strength in masonry is substantially important when subjected to in-plane and out-of-plane bending. Bond strength of the masonry developed from penetration of hydration product in the form of calcium silicate-hydrates (C-S-H) from the mortar into the masonry units through the surface pores.





## **Case study sample**

	ANNASAHEB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY, ASHTA	
	DEPARTMENT OF MECHANICAL ENGINEERING	
	ISE-1 : Case Study (Activity 2 <sup>nd</sup> )	
	ACADEMIC YEAR: 2020-21	SEMESTER-I
	CLASS: SY-A	MARKS: 10
SUBJECT: Thermodynamics		

INSTRUCTIONS: All the questions are compulsory.

Group Number	Roll numbers
1	1 to 5
2	6 to 10
3	11 to 15
4	16 to 20
5	21 to 25
6	26 to 30
7	31 to 35
8	36 to 40

Q. No.	Questions	Unit No.	CO								
1	<p>Among following system specify with reason either system open/closed/Isolated</p> <table><tr><td>G1) I.C. Engine</td><td>G2) Domestic Refrigerator</td></tr><tr><td>G3) Thermal Power Plant</td><td>G4) Electric water heating system</td></tr><tr><td>G5) Steam Turbine</td><td>G6) Condenser</td></tr><tr><td>G7) Electric Bulb</td><td>G8) Compressor</td></tr></table>	G1) I.C. Engine	G2) Domestic Refrigerator	G3) Thermal Power Plant	G4) Electric water heating system	G5) Steam Turbine	G6) Condenser	G7) Electric Bulb	G8) Compressor	1	1MEPC203_2
G1) I.C. Engine	G2) Domestic Refrigerator										
G3) Thermal Power Plant	G4) Electric water heating system										
G5) Steam Turbine	G6) Condenser										
G7) Electric Bulb	G8) Compressor										
2	<p>Make Detail Report of above allotted System</p> <ul style="list-style-type: none"><li>➤ Detail Specifications</li><li>➤ Advance Trends (Refer Research Paper, Journals etc.)</li></ul>	1	1MEPC203_2								
3	<p>Apply steady flow energy equation for following system</p> <table><tr><td>G1) Condenser</td><td>G2) Steam Turbine</td></tr><tr><td>G3) Nozzle</td><td>G4) Boiler</td></tr><tr><td>G5) Compressor</td><td>G6) Condenser</td></tr><tr><td>G7) Steam Turbine</td><td>G8) Nozzle</td></tr></table> <p>➤ Make List of actual applications of allotted system.</p>	G1) Condenser	G2) Steam Turbine	G3) Nozzle	G4) Boiler	G5) Compressor	G6) Condenser	G7) Steam Turbine	G8) Nozzle	1	1MEPC203_2
G1) Condenser	G2) Steam Turbine										
G3) Nozzle	G4) Boiler										
G5) Compressor	G6) Condenser										
G7) Steam Turbine	G8) Nozzle										





# ISE-I

PAGE NO.: 1.

DATE: / /

5.Y. B.Tech [Mechanical]

Sem III [odd sem]

Sub :- Thermodynamics

Name :- Sanskar Saga  
Tadhav

Roll no. :- 116

URN no. :- 20111013

Q1. Specify with reason. Electric Water Heating System either open system, closed system or isolated system.

→ Electric Water heating system:-

Electric water heating system (elements) is used to heat up the water stored in a storage tank for supplying of cold or hot water specific pipe lines are fitted with the storage tank. This means there are inlet cold water and outlet hot water pipe to control the flow of water, a valve is installed.

Mainly water heating system are classified into two systems is

- ① Open system
- ② Closed system

① Open system :

An open water heater system is when water that increased its volume and pressure due to that

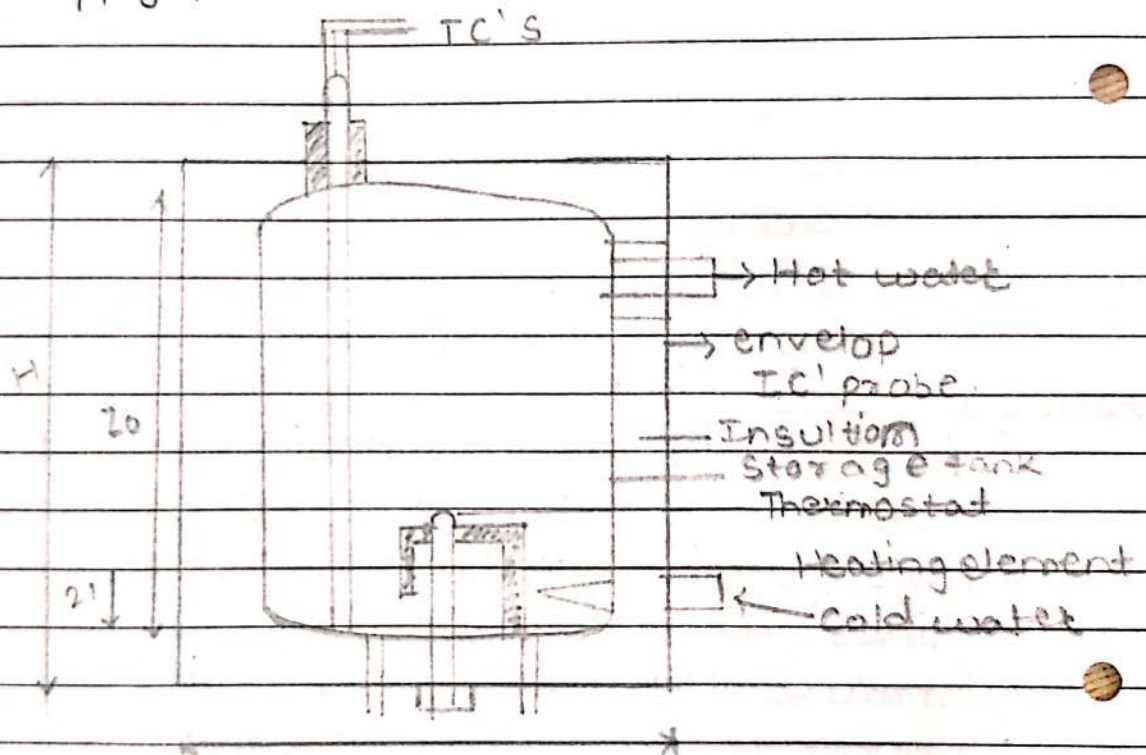
**ADCET**





heating freely goes from the storage tank into the water supply line and eventually into the main water system if pressure is high enough.

This is happening if there are no valve a way. Since nothing stopped the water from expanding, the pressure in open system is always s to supply pressure.



## (2) Closed system

Closed loops are essentially a hotwater recirculating system that conserves both energy and water. Energy is required to heat water too many branches or piping in the delivery system, hot water wire have a cooling effect on water as heat disappears through the pipes.



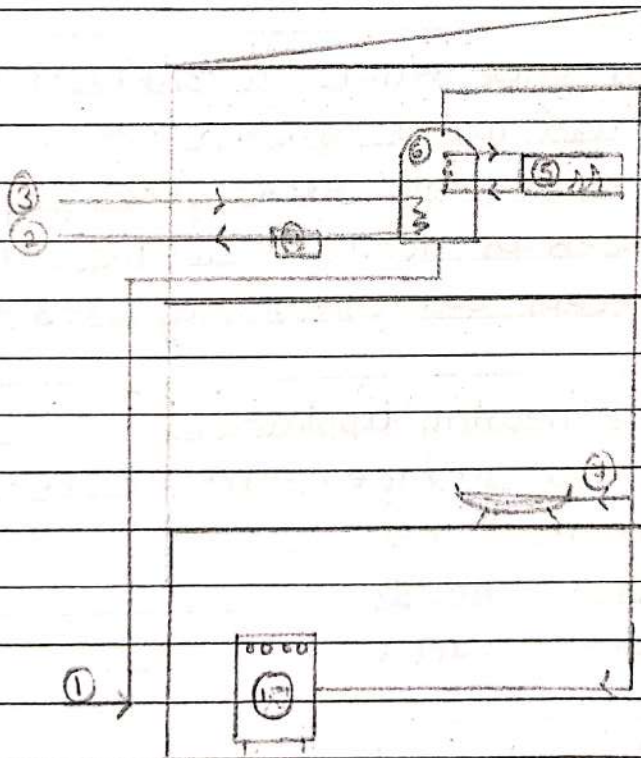


Q2. Make a detail report on Electric water heating system.

### → Electric water heating system

Water heating is a heat transfer process that uses an energy source to heat water above its initial temperature. Typical domestic uses of hot water include cooking, cleaning, bathing, and space heating. In industry, hot water and water heated to steam have many uses.

### Diagram Illustration





Here:

- ① Municipal water feed
- ② Fluid from water storage tank to external heat source; per heat source can be the ground, sun or air via heat pump or thermodynamic solar panel.
- ③ Fluid from heat pump, or thermodynamic solar panel to water storage tank.
- ④ Pump, actuator, controller and other parts
- ⑤ Water heater
- ⑥ Water storage tank
- ⑦ Hot water to domestic appliances.

Appliances that provide a continual supply of hot water are called water heaters, hot water heater, hot water tanks, boiler, heat exchangers, geysers, or calorifiers. Fossil fuels such as natural gas, liquefied petroleum gas, oil, or solid fuels are commonly used for heating water.

### Types of water heating appliances

- ① Electric tank-type storage water heater.
- ② Tankless water heater
- ③ Electric shower heads
- ④ Solar water heaters

Reference :-

<https://en.m.wikipedia.org>



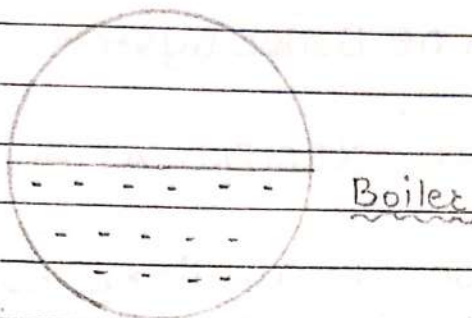


PAGE NO.:

DATE: / /

Q3. Apply steady flow energy equation for 'Boiler'.

→



• Boiler required heat so  $Q = +ve$  but boiler do not get work, hence  $W = 0$

• There is no difference in velocity therefore,  
 $\Delta K.E = 0$

• And  $z_1 = z_2 \therefore \Delta P.E = 0$

where  $Q$  - heat,  $KE$  - Kinetic energy

$W$  - work,  $P.E.$  - Potential energy

By applying steady flow energy equation

$$Q - W = m[g(z_2 - z_1) + (h_2 - h_1) + \frac{v_2^2 - v_1^2}{2}]$$

$$Q - 0 = m[g(0) + (h_2 - h_1) + \frac{0}{2}]$$

$$Q = m(h_2 - h_1)$$

Therefore the steady flow energy equation for the system Boiler is  $Q = m(h_2 - h_1)$



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Q4. List out detail application of Boiler System

→ Application of Boiler System.

### 1] OPERATING RECIPROCATING PUMPS :-

In case of auxiliary boilers, where the amount of feed water required is less, a steam driven reciprocating positive displacement pump is generally used. It is used as selecting a feed water pump.

### 2] FOOD PLANT :-

Food should usually be heated or boiled through out process; so this industrial sector clearly desires lots of thermal energy. However, some steam applications square measure still stunning; example - potato process.

### 3] OPERATING STEAM ENGINES :-

The main function of a steam boiler is producing, storing and troubling the vapour. The liquid contained boiler is nothing but a shell and the heat energy produced. While burning of fuel will be moved to water, and then it converts into of the required pressure as well as temperature.

Then steam engines operates.





PAGE NO.:

DATE: / /

#### 4] OPERATING STEAM TURBINE :-

A steam power plant consists of boiler, steam turbine and generator, and other auxiliaries. The boiler generates steam at high pressure and high temperature. The steam turbine converts the heat energy of heat steam into mechanical energy.

#### 5] Industrial process work in chemical engineering :-

Boiler may be a main operating element of thermal power plants. Water is helpful and low cost medium for transferring heat to a method.

6] For producing hot water required to be supplied to room in very cold areas.

7] In thermal power stations.

8] The heat content of the steam is large and thus it is suitable for process heating in many industries like sugar mills, textile mills, dairy industries and also in chemical industries.

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## **Industry sponsored/supported project sample**



Ghanashyam Chendke &lt;gmc\_mech@adcet.in&gt;

**Fwd: SRPG UG - PROJECTS SELECTED FOR FUNDING**

1 message

Shivtej Jadhav <shivtejjadhav2104@gmail.com>  
To: gmc\_mech@adcet.in

Thu, Feb 16, 2023 at 9:34 AM

@ShivtejJadhav

----- Forwarded message -----

From: Shivtej Jadhav <shivtejjadhav2104@gmail.com>  
Date: Sat, Apr 23, 2022, 5:49 PM  
Subject: Fwd: SRPG UG - PROJECTS SELECTED FOR FUNDING  
To: <mansoonxerox@gmail.com>

----- Forwarded message -----

From: Vikram <v.thakur@ishraeq.in>  
Date: Sat, Dec 18, 2021, 11:09 AM  
Subject: SRPG UG - PROJECTS SELECTED FOR FUNDING  
To:  
Cc: Pankaj Sareen <ps@ccs.gen.in>, <antonyaroulraj@gmail.com>

KIND ATTN:

- SRPG UG 11- Kunal & TEAM
- SRPG UG 08- Kanishkar H & TEAM
- SRPG UG 47- Pritam Mitra & TEAM
- SRPG UG 49- NILANGSHUK CHAUDHURI & TEAM
- SRPG UG 02- Sahil Hemakant Bhosale & TEAM
- SRPG UG 54- KRIPA HARIHARAN N S & TEAM
- SRPG UG 58- P Allan Mark & TEAM
- SRPG UG 68- Shivtej Anil Jadhav & TEAM
- SRPG UG 61- Omkar Shrihari Kharade & TEAM
- SRPG UG 42- SUBBIAH AN & TEAM
- SRPG UG 22- ROHAN M & TEAM

Dear Students Members,

Congratulations!

We are happy to communicate to you all that the above mentioned Projects has been approved for sanctioning of Project Grant through Foundation for ISHRAE.

Please note that we have already released the 1<sup>st</sup> Instalment amount to your local ISHRAE Chapter, kindly get in touch with them if not received by you.

<https://mail.google.com/mail/u/2/?ik=687e7c5775&view=pt&search=all&permthid=thread-P%3A1757958933558713705&siml=msg-P%3A1757958933...> 1/2



Also start the work on your project and we do require an interim project report before the release of the 2<sup>nd</sup> installment amount along with the relevant bills.

The Interim Project report will be reviewed by the SRPG Committee members.

Trust ok.

Thanks & regards,

Vikram Singh Thakur

Assistant Manager

Indian Society of Heating Refrigerating and Air-Conditioning Engineers

(ISHRAE)

1103-1104, 11<sup>th</sup> Floor, Chiranjiv Tower 43, Nehru Place,

New Delhi-110019





**Sant Dnyaneshwar Shikshan Sanstha's,  
Annasaheb Dange College of Engineering and Technology, Ashta.  
Department of Mechanical Engineering**

**A**

**PROJECT PRESENTATION ON**

**“Development and performance evaluation of ginger washing,  
peeling machine and efficient drying of ginger”**

**Guided by :-**  
**Prof. Y. P. Ballal**  
**Prof. G. M. Chendake**

**Presented By :-**

1. Datta Vikas Sutar (S00098673)
2. Shivtej Anil Jadhav (S00098670)
3. Akhilesh Ankush Kadam (S00098783)
4. Abhishek Mahesh Patil (S00098672)



**A  
PROJECT REPORT  
ON  
“DEVELOPMENT AND PERFORMANCE EVALUATION OF  
GINGER WASHING , PEELING MACHINE AND EFFICIENT  
DRYING OF GINGER”**

Submitted in partial fulfilment of the requirement for the degree of  
**Bachelor of Technology  
In  
Mechanical Engineering**

**SUBMITTED BY**

MR. DATTA VIKAS SUTAR	(18111068)
MR. SHIVTEJ ANIL JADHAV	(18111087)
MR. ABHISHEK MAHESH PATIL	(18111097)
MR. SAURABH NARAYAN YADAV	(18111100)
MR. AKHILESH ANKUSH KADAM	(18111088)
MR. VISHVAJIT SATISH KADAM	(18111098)

**UNDER THE GUIDANCE OF  
Mr. Y. P. BALLAL**



**DEPARTMENT OF MECHANICAL ENGINEERING  
ANNASAHAB DANGE COLLEGE OF ENGINEERING & TECHNOLOGY, ASHTA,  
DIST: SANGLI, MAHARASHTRA, INDIA.**

**2021-22**



Ginger drier:



Ginger Washer:



Date: 28th March 19

To Whom It May Concern

Subject: Official sponsorship of Team of Students for the Project "Design and Fabrication of Digger for Banana crop Planter".

1. Vipul kadam
2. Sahil Jadhav
3. Vivek Gurav
4. Kaustubh Mane
5. Shreyas Jagtap.

I write to confirm that the above student is in receipt of official financial sponsorship from us. The sponsorship covers the period 2018-2019. The sponsorship covers technical and financial support during the development of the project during the tenure every individual performed well and technical abilities are appreciated. In case if require any further information please do not hesitate to contact me.

Deccan Farm Equipment Pvt. Ltd.

  
Chairman / Managing Director

Mr Pushkar Bharat Patil  
Director



Factory: C-35, M.I.D.C. Shirol, Kolhapur-416122. Maharashtra (India).

Email: sales@deccanequipments.com

Phone: +91-230-2468004



No.

Date: 15-07-16

To,

The Principal,

Annasaheb Dange College of Engineering and Technology, Ashta

Subject:- Regarding sponsorship of students Project.

Respected Sir,

With reference to above subject we are pleased to inform you that we have taken decision to sponsor project titled "**Design and Development of Automated Dough Ball Making and Rolling Machine Food Industry**" for Final Year Mechanical Engineering Students mentioned below,

1. Mr. Kamirkar Rushikesh Maruti
2. Mr. Oulkar Rohan Ramchandra
3. Mr. Patil Tushar Tukaram
4. Mr. Karande Amol Shivaji
5. Mr. Kelaskar Suraj Ananda

We would like to clarify that all technical information, data required and guidance related to above project will be provided by our company along with required financial support.

All physical, soft, hard and intellectual material produced during this project work will be solely property of company. Students are allowed to refer the generated data while writing academic project report. Publication of any data in any form for other purpose must be with prior consent of company.

Thanking you,

Yours faithfully,

*A.R.Chavan*

Mr. A.R. Chavan

Managing Director

**CERTIFICATE OF COMPLETION**

This is certified that the final year project batch of B.E. (Mechanical Engineering) of Annasaheb Dange College of Engineering and Technology, Ashta affiliated to Shivaji University, Kolhapur have worked for the project "Design and Development of Automated Dough Ball Making and Rolling Machine for Food Industry." For partial fulfillment of B.E.(Mechanical Engineering) degree course the academic year 2018-19.

The project batch comprises the following students,

1. Mr. Kamirkar Rushikesh Maruti
2. Mr. Oulkar Rohan Ramchandra
3. Mr. Patil Tushar Tukaram
4. Mr. Karande Amol Shivaji
5. Mr. Kelaskar Suraj Ananda

All the members of project batch worked hard for completion of work. They have successfully completed the work. The work done by the project is extremely useful for food industry.

Place : Shirala.

Signature:

R.R. Charan.

Date: 09/04/2019 Designation: Managing Director.

Full Office Address: Shri Sai Bakers, Plot no.7, A-12, MIDC Shirala(MS)415408

Ph. 9970013377.



पद्मभूषण क्रांतिवीर डॉ. नागनाथअण्णा नायकवडी हुतात्मा किसान अहिर सहकारी साखर कारखाना लि;

नागनाथअण्णानगर, वाळवे, ता. वाळवा, जि. सांगली. (महाराष्ट्र राज्य) पिन : - ४१६ ३१३

Padmabhushan Krantiveer Dr. Nagnathanna Nayakawadi Hutatma Kisan Ahir Sahakari Sakhar Karkhana Ltd;

Nagnathannagar, Walve, Tal. Walwa, Dist. Sangli (Maharashtra State) Pin- 416 313



E-mail : ast\_hkl@bsnl.in, hutatmassk@gmail.com Web : hutatmasugars.com Phone : (02342) 267538 /40 /41 Fax : (02342) 267539

Ref.No:PKDNNHKASSK/Time/2018-2019/

Date :- 20/08/2018

To,  
The Project Coordinator,  
ADCET Ashta,  
HOD, Department of Mechanical Engineering,  
At - Ashta, Tal:Walwa, Dist:Sangli

**Sub - Regarding Permission for Project work &  
Sponsorship for project work**

Respected Sir,

With reference to the above subject, as per your request we here by allowed to your following 5 students for Project work in "Design & Development of Oil Skimmer" our sugar factory.

**Sr.No.**

**Students Name.**

- |    |                             |
|----|-----------------------------|
| 1. | Mr.Mali Omkar Gajanan.      |
| 2. | Mr.Jadhav Amit Sunil.       |
| 3. | Mr.Bramhane Ganesh Somnath. |
| 4. | Mr.Kadam Sourabh Sanjay     |
| 5. | Mr.Bagwan Imran Sadik.      |

Thanking you,

Yours faithfully,

( D.J.Patil )

Managing Director.



# DAZZLE DYNACOATES PVT. LTD.

707, Pratap Estate, MADHAVNAGAR. SANGLI 416 406.  
Ph. (0233) 2310394, 2310123 Tele Fax (0233) 2310503. Web [www.appliedcoatings.in](http://www.appliedcoatings.in)  
E-mail <info@appliedcoatings.in>

Ref No. DD/GEN/2019-20/019.

Date : 05-04-2019

## CERTIFICATE

This is to certify that, following students have done their project work in our organization at Madhavnagar.

The machine is working successfully as per our specifications. The behavior of students doing this period is appreciable.

TITLE : DESIGN AND DEVELOPMENT OF PROJECT SET-UP FOR  
THERMAL SPRAY COATING FOR TEXTILE ROLLER DRUM.

STUDENT NAME : 1) Ghodake Pritee  
2) Mali Neelam  
3) Patil Tapswini  
4) Koli Arati

For DAZZLE DYNACOATES PVT. LTD.



AUTHORISED SIGNATORY





ispg



1

Compose

Inbox

1,275

Starred

Snoozed

Sent

Drafts

24



Vivek



No recent chats

Start a new one

## ISPG-UG application has selected by ISHRAE Student Project Grant Committee. Inbox x

**Kundan S Adhikari** <asstsecy@ishra... Sat, Oct 20, 2018, 12:35 PM  
to me

**Reference No. ISPG\_UG\_114:**

Dear Mr. Gondkar V.S.,,

ISHRAE is pleased to inform you that your ISPG-UG application h  
Ishrae Student Project Grant Committee & the Grant Amount  
project is **INR 47000/-** to support the following project: Heat Tr  
for Surfaces with Different  
Dimple Shapes.

You are requested to contact your local ISHRAE Kolhapur Sangli S  
President / Student Chair for the sanction order and other formali

ADCET

- \* 'A' Grade Institute Accredited by NAAC
- \* NBA Accredited courses
- \* ISO 9001:2008 Certified Institute



Estd. 1999

Sant Dnyaneshwar Shikshan Sanstha's  
**ANNASHEB DANGE COLLEGE OF  
ENGINEERING & TECHNOLOGY**

(Approved by AICTE, New Delhi, Govt. of Maharashtra.  
Affiliated to Shivaji University, Kolhapur)

Ref. No. : Project / EE / 1435

Date : 03/08/2017

To,

HOD

Electrical Engineering Dept.

**Subject:** - Sponsorship for Project "Microcontroller Based Elevator for Books in Digital Library at ADCET, Ashta"

**Reference:** - Your letter to us for sponsorship

Respected sir,

With reference to above subject, we would like to offer sponsorship to above project for the students listed in your letter.

The sponsorship is of the 100% financial assistance estimated around Rs. 80,000/- as per your survey and demand. This is an Institute Sponsored Project categorized under Need Based Project.

This letter is issued for your information as well as to the concerned guide and listed students

Sr. No.	Name	Particular
Project Guide		
1.	Mr. V. B. Patil	Asst. Professor, Department of Electrical Engineering, ADCET, Ashta
List of Students		
1	Patil Kuldeep	BE Electrical
2	Pawar Abhishek	
3	Patil Yuvaraj	
4	Patil Digvijay	

Thanking you,



PRINCIPAL

# **Annasaheb Dange College of Engg. & Tech., Ashta.**

## **Central Library**

Date: 03/08/2017


To,  
Executive Director,  
A.D.C. E.T.,  
Ashta.

Sub. - Library Book Lift.

Respected Sir,

Enclosed please find herewith the design, proposal and tentative estimate for the installation of book lift in the library through student's project. The approximately estimate is Rs. 60,000/-. Kindly approve the proposal and oblige.

Thanking you.



A large, stylized handwritten signature in black ink, likely belonging to the Librarian, is written over a horizontal line. The signature is slanted and appears to be a combination of letters and a flourish.



A smaller, more compact handwritten signature in black ink, also likely belonging to the Librarian, is written to the right of the main signature.

Librarian

Equipment	Cost of equipment
Trolley	2000 Rs.
Total Framework	4000 Rs.
Wire ropes	200 Rs.
Nylon ropes	160 Rs.
Geared BLDC motor	10,000 Rs.
Civil work and other expenditures	10,000 Rs.
Approximate cost required	30,000 Rs.

Date-6/09/2017

To,  
Executive Director,  
A.D.C.E.T.,  
Ashta.

Sub-Library Book Lift,

Respected sir,

We the undersigned students of BE electrical have received sponsorship for our final year project titled "Microcontroller based Geared Brushless motor DC drive for elevator system" of Rs.60, 000/- from our institute.

As per your suggestion we have developed 3-D model in CATIA. For further development of our project we have planned to purchase Geared BLDC motor and other fabrication work. We require amount of Rs. 30,000 for same.

Kindly sanction.

Kuldeep Patil.

Digvijay Patil.

Yuvraj Patil.

Abhishek Pawar.

ATC  
to Release  
30,000/-  
Advance



**Annasaheb Dange College of Engineering and Technology, Ashta.**  
**Department of Electrical Engineering**  
**Expenditure Details of Sponsored Project**  
**Microcontroller Based Elevator for books in Digital Library at ADCET**

**Date:**

15/02/2018

To  
The Executive Director,  
ADCET, Ashta.

**Subject:** Regarding Sponsored Project Microcontroller Based Elevator for books in Digital Library at ADCET.

Respected sir,

We the undersigned students of BE Electrical Engineering have received sponsorship for the final year project from our institute to install Microcontroller Based Elevator for books in Digital Library at ADCET.

The first installment of Rs 30,000/- was taken and it is utilized. The details of expenditure are provided. We require the final installment of Rs. 40,000/- for accomplish the project.

Kindly sanction the same.

Yours Sincerely

Kuldeep Patil

Digvijay Patil

Yuvraj Patil

Abhishek Pawar

(BE Electrical Engineering)

Project Guide:  
Mr. V B Patil  
(Asst. Prof. EE)

Rs 20,000/-



## **Paper publication sample**

**Manthan Patil**

Engineering Student  
AnnaSaheb Dange College of Engineering  
& Technology, Ashta,  
India

**Rajesh Gawade**

Engineering Student  
AnnaSaheb Dange College of Engineering  
& Technology, Ashta,  
India

**Shubham Potdar**

Engineering Student  
AnnaSaheb Dange College of Engineering  
& Technology, Ashta,  
India

**Khushabu Nadaf**

Engineering Student  
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& Technology, Ashta,  
India

**Sanoj P. Suresh**

Assistant Professor  
AnnaSaheb Dange College of Engineering  
& Technology, Ashta,  
India

**Devabrata Sahoo**

Assistant Professor  
MIT School of Engineering  
MIT ADT University, Pune, 412201  
Maharashtra,  
India

# Effect of Vortex Generator on the Flow Field over a Conventional Delta Wing in Subsonic Flow Condition at Higher Angles of Attack

*Flow over a conventional delta wing has been studied experimentally at a subsonic flow of 20 m/sec and the flow field developed at higher angle of attack varying from 10° to 20° has been captured. A vortex generator is mounted on the leeward surface of the delta wing and its effect on the flow field is studied. The set of wing tip vortices generated over the delta wing is captured by the oil flow visualization and the streamline over the delta wing surface captured with and without a vortex generator are compared. Based on the qualitative results, the effect of the vortex generator on the lift coefficient is anticipated. Further, force measurement is carried out to quantitatively analyze the effect of vortex generator on the lift and drag coefficient experienced by the delta wing and justify the anticipation made out of the qualitative oil flow visualization tests. In the present study, the effect of mounting of a vortex generator is found to be minimal on the lift coefficient experienced by the delta wing. However, a significant reduction in the drag coefficient with increase in angle of attack was observed by mounting a typical vortex generator.*

**Keywords:** Subsonic, Lift, Drag, Vortex, Delta Wing.

## 1. INTRODUCTION

With the development of high speed aircraft, the importance of research related to delta wings have increased. Delta wings find usage in supersonic aircraft in order to reduce the wave drag. Although, delta wings are designed for high speed, they still have to take off and land at subsonic speeds. This makes it important to study the flow field over a delta wing and its performance in subsonic flow conditions. In supersonic flight conditions, delta wing reduces wave drag, however in subsonic flight conditions, delta wings are found to be advantageous in terms of lift generation. Delta wings are generally associated with two types of lift: Potential lift and Vortex Lift [1]. Potential lift is the lift generated due to the pressure difference across the surfaces of the delta wing while vortex lift is the additional lift generated due to the formation of wing tip vortices due to the geometry of the delta wing. The schematic of vortices generated over the delta wing moving at subsonic speed at a certain angle of attack shown in Figure 1. At higher angle of attack, the vortices generated at the wing tip of the delta wing results in formation of recirculation region on the leeward face of the delta wing. This recirculation region results in the generation of the vortex lift over the delta wing. As a

result of the generation of vortex lift, delta wing at low speeds and higher angle attack produces additional lift [2, 3]. However, there is limitation on the lift due to the existence of stall angle of attack [4]. Wing tip vortices also have their impact on general non-delta wings at subsonic speed as they lead to the generation of induced drag. The induced drag is reduced by the application of winglets and the performance of the wing is improved [5]. Similarly, numerous techniques have been used to improve the performance of delta wing [6, 8]. Successful enhancement of lift coefficient has been obtained by rounding off of the delta wing edges [9, 10]. Recent studies report an increase in the stall angle and smoothening of the stalling process by using an appropriate dimension sinusoidal delta wing [11, 13]. The vortex breakdown phenomena that leads to the stalling of the wing is controlled by various active controls thereby successfully increasing the efficiency of the delta wing [14]. The flow phenomena developing over the delta wing is unsteady in nature and various research studies are carried out focusing on the fluctuating vortex flow and the unsteady vortex breakdown location [15, 16]. Experimental studies have also been conducted and the aerodynamic parameters have been reported on body-wing configuration representing a generic flying vehicle where the wing shape is in delta formation [17].

As mentioned in the previous paragraph, various passive lift enhancement as well as drag reduction techniques over a delta wing have been already utilised and reported. However, the effect of additional vortex generator on the flow field over the delta wing at high

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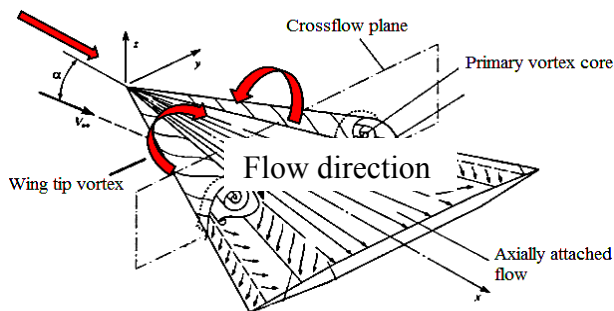
Correspondence to: Dr Devabrata Sahoo, Aerospace Engineering Department, MIT School of Engineering, MIT ADT University, Pune, Maharashtra, India-412201  
E-mail: devtapu@gmail.com

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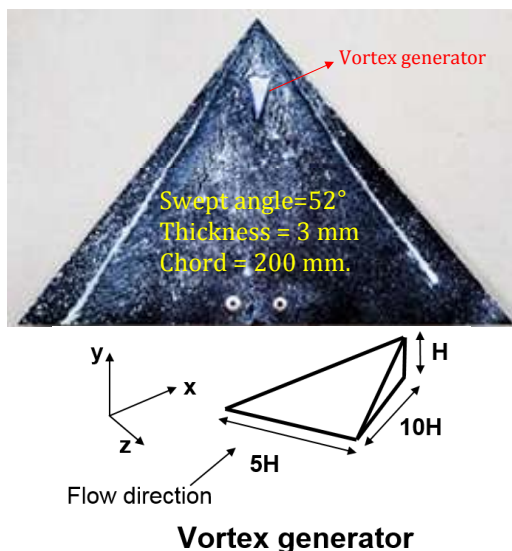
angle of attack is yet to be investigated to the best of the authors' knowledge. This research gap on the studies related to delta wings is the prime focus of the present investigation. In the present research, an attempt is made to experimentally study the effect of an additional vortex generator mounted over the wing surface on the flow field over a delta wing. The effect of mounting an additional vortex generator on the delta wing is investigated by conducting qualitative (oil flow visualization) and quantitative (lift and drag measurement) tests at a subsonic freestream flow of 20 m/s at different higher angles of attack ( $10^\circ$  to  $20^\circ$ ).



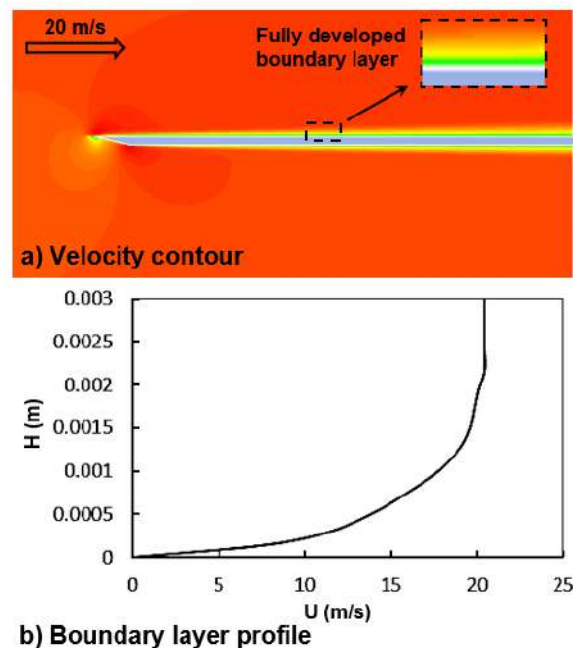
**Figure 1.** Flow over conventional Delta wing at certain angle of attack in subsonic condition.

## 2. TEST MODEL

A typical delta wing model with geometrical details similar to the delta wing used in [11] has been adopted for the present study. The adopted delta wing model has a critical stalling angle of 26 degree. The model adopted in the present research is made of black acrylic sheet having a thickness of 3 mm. The black colour sheet is used as it will be suitable for oil flow visualization tests (details discussed in the subsequent “experimental methodology” section). In order to study the effect of the vortex generator on the flow field, a typical single wedge type vortex generator is adopted and mounted on the leeward surface of the delta wing. The model photograph of the delta wing and the geometrical details of the delta wing and vortex generator are shown in Figure 2.



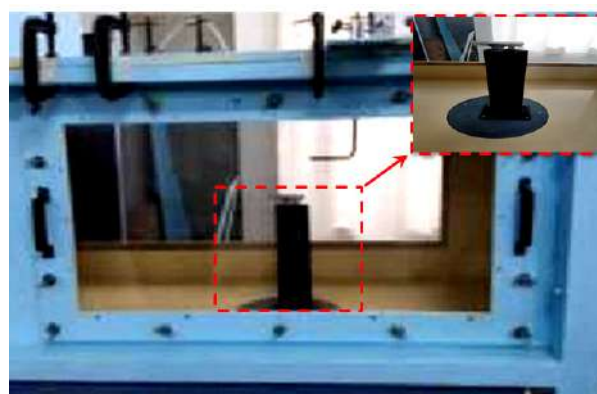
**Figure 2** Photograph and geometrical detail of the delta wing model and vortex generator adopted in the present investigation. ( $H = 0.002$  m)



**Figure 3** Computational result (a. Velocity contour and b. boundary layer profile) obtained over the flat plate in order to obtain the boundary layer height.



**Figure 4.** Photograph of the subsonic wind tunnel used in the present investigation.



**Figure 5.** Photograph of the test section of the subsonic wind tunnel along with the model mounting arrangement.

The geometry of the vortex generator utilised in the present research has been adopted from [12]. The height of the vortex generator is kept equal to the height of the fully developed boundary layer over the delta wing at the freestream velocity of the test condition (20 m/s). The boundary layer height is obtained by conducting

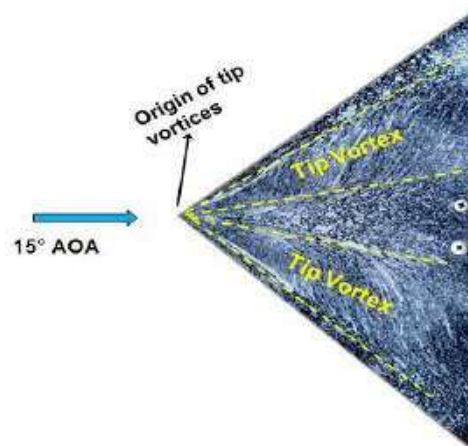
Computational Fluid Dynamics (CFD) simulation over a flat plate keeping the same flow conditions as adopted in the present research. The commercial CFD software ANSYS-FLUENT is used for conducting the simulation over the flat plate. The pressure based coupled solver is utilized adopting k- $\omega$  standard turbulence model. The location at which the boundary layer gets fully developed in the flat plate is considered as the location of mounting the vortex generator over the delta wing. The computed flow field captured over the flat plate showing the fully developed boundary layer and the computed boundary layer profile showing the height of the boundary layer is presented in Figure 3. From the boundary layer profile it can be observed that the boundary layer height is around 0.002 m. Hence the height of the vortex generator (H) adopted in the present investigation is also kept to be of 0.002 m. In the present study only one vortex generator has been used and parametric study of the vortex generator is not in the scope of the present research.

### 3. EXPERIMENTAL METHODOLOGY

The wind tunnel present in the aerodynamics lab of AnnaSaheb Dange college of Engineering and Technology, Ashta is utilized to perform the experiments. It is an open loop suction type subsonic wind tunnel having a test section cross section size of 60 X 60 cm and a length of 200 cm. The photograph of the subsonic wind tunnel and the close view of the test section with a complete model mounting arrangement is shown in Figure 4 and Figure 5, respectively. The maximum air-speed that can be generated by the subsonic wind tunnel at the test section is 50 m/s. In the present investigation, all the experiments are carried out at a free stream air velocity of 20 m/s. For quantitative analysis, the streamlines of the flow generated on the surface of the delta wing are captured using oil flow visualization. For the purpose of oil flow visualization, the black perplex glass sheet is used to fabricate the delta wing models. A mixture of Titanium dioxide and Oleic acid is made to spray over the model surface and generate the streamlines developed during the flow. Titanium dioxide is used because of its high cohesiveness property that will restrict the formation lumps in the mixture sprayed on the model surface. This will result in a formation of proper streamlines. Titanium dioxide is mixed with Oleic acid because of its high refractive index which will allow to have a better contrast on the streamline generated over the surface of the test model. Furthermore, for quantitative analysis the lift and drag coefficients generated by the delta wing with and without vortex generator are measured using a base mounted three component strain gage balance. The balance is powered by a DC voltage of 12 V and has a capacity of measuring axial and normal forces of 98 N each. The output is acquired using a PC based Data Acquisition System. Before performing the set of experiments in the present research, the subsonic wind tunnel as well as the strain gage balance have been suitably calibrated. The uncertainty of the drag and lift coefficients measured is found to be less than  $\pm 5\%$ .

### 4. RESULTS AND DISCUSSION

The subsonic flow over a simple conventional delta wing has been experimentally investigated. The tip vortices originating from the delta wing frontal tip are captured successfully using oil flow visualization. The variation in the size of the tip vortices with the increase in angle of attack has been clearly captured. Figure 6 shows the flow streamlines captured over the delta wing at an angle of attack of 15 degrees. The tip vortices can be marked and the gradual development of the vortices from the tip of the delta wing can be seen in Figure 6. As we move towards the downstream of the delta wing the increase in the size of the vortices can also be observed. The boundary of the tip vortices are marked in yellow dashed line for reference in Figure 6. These tip vortices create a suction effect on the upper wing surface (leeward side) and result in generation of an additional lift termed as vortex lift. The amount of the vortex lift generated by the delta wing depends on the strength of the tip vortices. Further, the change in the size of the tip vortices with increase in angle of attack from  $10^\circ$  to  $20^\circ$  has been captured and shown in Figure 7. It can be clearly seen that with increasing angle of attack, the size of the tip vortices and hence the strength of the vortices increases. This should result in an increase in the total lift coefficient generated by the delta wing at higher angle of attack.



**Figure 6 Surface flow captured over the Delta wing configuration at an angle of attack of  $15^\circ$ . Flow is from left to right with a free stream velocity of 20 m/s.**

Later, a vortex generator has been mounted at the flow separation location (found to be around 3.5 cm from the tip) on the leeward surface of the delta wing and the change in the flow field is studied. The flow streamlines over the delta wing with vortex generator are captured at different angle of attack ( $10^\circ$  to  $20^\circ$ ) using oil flow visualization and compared with those captured over the delta wing without any vortex generator. The captured streamlines are shown in Figure 7. It can be clearly seen that in both cases (with and without vortex generator), the size or strength of the tip vortices increases with increase in angle of attack. However, on comparing the streamlines side by side (see Figure 8) to study the effect of vortex generator on the vortex strength, minimal variation was observed. From Figure 8 it can be seen that the

size of the tip vortex is almost same for all the angle of attack tested in the present study regardless of mounting of a vortex generator. As a result it can be anticipated that the lift coefficient generated by the delta wing should remain similar with addition of single vortex generator on the leeward side of the delta wing.

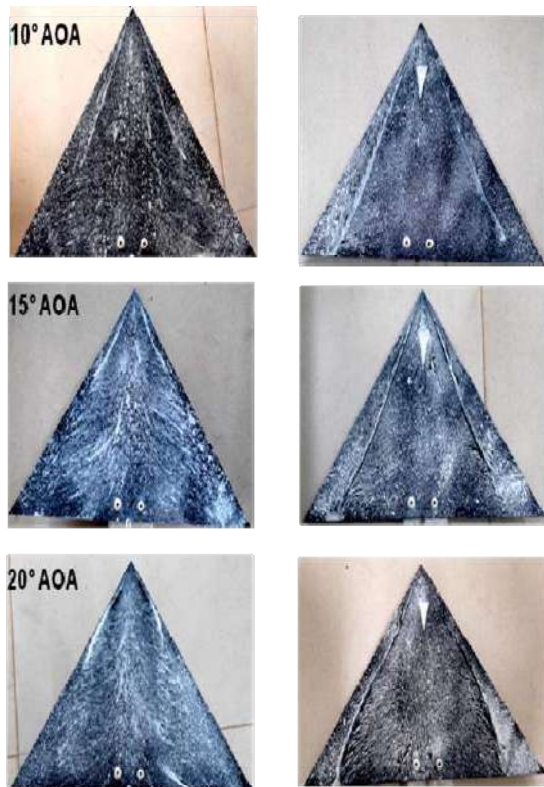


Figure 7 Result of oil flow visualization without and with vortex generator. Flow is from top to bottom with

Table 1 Drag and Lift Coefficient measured at different angle of attack values over a delta wing with and without vortex generator at a free stream velocity of 20 m/s.

Angle of attack (degrees)	Drag Coefficient ( $C_d$ )		Lift Coefficient ( $C_l$ )	
	Without vortex generator	With vortex generator	Without vortex generator	With vortex generator
10	0.3126	0.2782	0.8369	0.8522
12	0.4048	0.3491	0.9156	0.9184
14	0.4761	0.4516	0.9873	1.0111
16	0.5460	0.4971	1.0524	1.0423
18	0.6770	0.6120	1.1785	1.1638
20	0.7377	0.6688	1.2057	1.2230

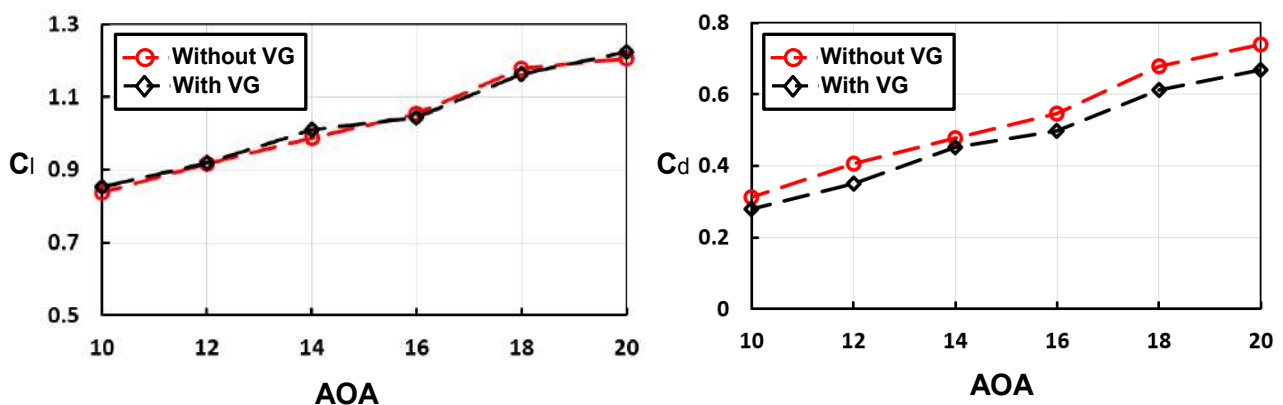


Figure 9 Effect of vortex generator (VG) on lift and drag coefficient experienced by the delta wing at different angle of attack (from 10 to 20 degrees).

freestream velocity of 20 m/s. The first coloumn shows the delta wing without an vortex generator and the second coloumn shows delta wing with a vortex generator mmounted.

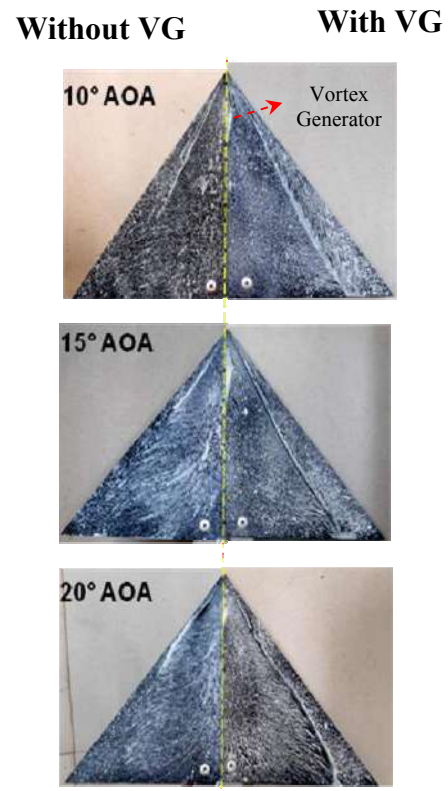


Figure 8 Comparision of the flow streamlines over the delta wing (with and without vortex generator. Flow is from top to bottom with a freestream velocity of 20 m/s. The left half of each figure shows the delta wing without an vortex generator and the right half of each figure shows the delta wing with a vortex generator mmounted.

Further, in order to confirm our anticipation from the qualitative (oil flow visualization) analysis through quantitative studies, the lift and drag coefficient have been measured by using a base mounted link based on 3-component strain gage balance. The coefficient values are measured at different angles of attack ( $10^\circ$  to  $20^\circ$  with an increment of  $2^\circ$ ) for the cases of delta wing with and without mounting the vortex generator. The reason behind testing the drag and lift coefficient measurements at higher angle of attack is due to the test model design and experimental limitation as the vibration of the model at zero angle of attack might give doubtful results at zero angle of attack. As the importance of the study of delta wings is generally at higher angle of attack, the present manuscript is focused on study of the flow field at higher angle of attack (10 to 20 degrees). The lift and drag coefficient values measured for both delta wing models (with and without vortex generator) are tabulated in Table 1. The variation in lift and drag coefficient with increasing angle of attack are plotted in Figure 9. Simultaneously, in order to investigate the effect of vortex generator on the flow field over the delta wing at different angle of attack, the variation of the lift and drag coefficient with addition of vortex generator is also plotted in Figure 9. As expected from the qualitative studies, the lift coefficient is observed to have minimal variation on adoption of a vortex generator. However, a significant reduction in the drag values with increasing angle of attack is observed on mounting of the vortex generator. The additional vortices generated by the vortex generator may not be affecting the strength of the already developed tip vortices but they might be affecting the separation angle of the tip vortices. The reduction in drag is only possible if the size of the wake behind the delta wing reduces which is possible if the flow separation angle or the tip vortex angle is reduced. The additional vortices formed by the vortex generator might be dragging the already developed tip vortices towards themselves (which is towards the wing surface). If it is the case then this phenomena will reduce the tip vortex angle (or the flow separation angle) thereby a reduction in the size of the wake will be observed. This will finally result in a reduction in the drag value experienced by the delta wing at different angle of attack. A deeper insight to this phenomena can be obtained by conducting smoke flow visualization tests and also capturing the flow field over the cross flow plane at different axial location along the delta wing surface. This can be included in the scope of future work.

## 5. CONCLUSION

Experiments have been carried out over a delta wing and the effect of mounting a vortex generator on the leeward side of the delta wing over the flow field is analysed. The vortex generator is found to have a minimal effect on the lift coefficient at all tested angles of attack. However, on mounting a vortex generator the drag coefficient values are found to be reduced at all the tested angle of attack. The qualitative results obtained from oil flow visualizations are well justified by the quantitative results obtained by measuring the lift coefficient values.

However, the effect of vortex generator on drag coefficient experienced at different angle of attack could not be completely justified from the qualitative analysis (oil flow visualization) conducted in the present study. The reason behind the reduction in the drag coefficient values by adopting a vortex generator has been proposed in the present paper. However, further in depth study is needed using other flow visualization techniques (smoke flow) to justify the phenomena responsible for the reduction in drag. In addition, the effect of location of the vortex generator on the flow field over the delta wing can also be included in the scope of future research.

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**УТИЦАЈ ГЕНЕРАТОРА ВРТЛОГА НА  
СТРУЈНО ПОЉЕ ОКО КОНВЕНЦИОНАЛНОГ  
ДЕЛТА КРИЛА У УСЛОВИМА ПОДЗВУЧНОГ  
СТРУЈАЊА ПРИ ВЕЋИМ НАПАДНИМ  
УГЛОВИМА**

**М. Патил, Р. Гаваде, Ш. Потдар, К. Надаф,  
С.П. Суреш, Д. Саху**

Рад приказује експериментално истраживање струјног поља по површини конвенционалног делта крила при подзвучном струјању од 20 м/сек и при већим нападним угловима од  $10^0 - 20^0$ . Генератор вртлога је постављен на заветринској страни делта крила и истражен је његов утицај на струјно поље. Генерисани вртлози визуализирају се струјним током уља по површини делта крила и врши се поређење вртлога са и без генератора вртлога. На основу квалитативних резултата предвиђа се утицај генератора вртлога на коефицијент силе узгона. Мерења силе се врше у циљу квалитативне анализе утицаја генератора вртлога на коефицијенте силе узгона и силе чеоног отпора код делта крила и предвиђања квалитативног испитивања визуализацијом токова уља. Утврђено је да постављени генератора вртлога има минимални утицај на коефицијент силе узгона. Међутим, вртложник има утицаја и на значајно опадање вредности коефицијента чеоног отпора при повећању нападног угла.

# Experimental Investigation of a Centrifugal Pump Working Under Gas-Liquid Two Phase Flow Condition

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Rushikesh Gawade, Shrikant Patil, Vinayak Nikam  
Dept. Of Mechanical Engineering  
Aannasaheb Dange College of Engineering and Technology,  
Ashta.

Rahul Gaji (Asst. Prof.)  
Dept. of Mechanical Engineering  
Aannasaheb Dange College of Engineering and Technology,  
Ashta.

**Abstract**— The centrifugal pump operation under gas-liquid two phase flow condition is a common problem in the oil and gas industry. Same problem is encountered in electrical submersible pumps. Moreover in the loss of coolant accidents (LOCA) the water in the pressurized water reactor flashes into steam and pump is operated in steam-water two phase flow condition. The performance of the centrifugal pump is found to be decreased under gas-liquid two phase flow condition. However, the limited literatures are available for the study. In this scenario, this paper presents the experimental work to investigate the performance of centrifugal pump operated in gas-liquid two phase flow condition. The performance of pump working in water phase flow condition is analyzed at different rotational speed to validate the result with standard performance characteristics. Then experiments are performed by introducing the air at inlet of a pump. The performance of a pump working under air-water flow condition is found to be deteriorated continuously from part load to overload operating condition.

**Keywords**—Centrifugal pump; single phase flow; two phase flow; performance.

## I. INTRODUCTION

In the nuclear industries, the coolant (water) is pumped under high pressure to a reactor core to remove the heat. The nuclear reactors have proven to be safe; however, there is always a chance of accidents leading to radioactive leakage. The emphasis in the nuclear industries and research organizations is on the understanding of the reliability and safety mechanism and accident situation. There are several hypothetical accident situations, which may give rise to core disruption and radioactive leakage. One of the most severe is LOCA, which may occur due to leakage of coolant in the reactor system components.

The centrifugal pumps are normally used to force the water in the coolant circuit. During the normal operation of the pump, there is only liquid flow through the pump passages and single phase analysis is used to study the performance of the pump. However, during operational transients or LOCA condition, the recirculating coolant of Pressurized Water Reactor (PWR) may flash into steam due to loss of line pressure [1]. The pressurized water now contains vapor, the amount of which will depend upon the extent of the transient or accident condition. Centrifugal pump become unable to generate the same head in gas-liquid two phase flow condition as that of the single phase flow case [1,2, 4]. Moreover, head is almost lost in the accident situation [1, 2]. From a PWR's safety point of view, it is therefore essential to understand such

phenomena and develop the capability for accurately predicting and improving the performance of PWR's Centrifugal Cooling Pump under the gas-liquid two phase flow conditions.

Similar situations also encountered in the process industry, production and transport of oil, which often is accompanied by natural gas. An important application of high economic significance is the pumping and transport of oil-gas mixture with the electric submersible pumps.

Over the period of time various researchers investigated the performance of a centrifugal pump under gas-liquid two phase operating condition. A numerical model of radial flow pump working with gas-liquid was developed by considering the air compressibility and fluid viscosity [3]. The video recording with high speed camera was employed to understand the physical phenomenon of gas-liquid interaction in the impeller [5]. In addition to this various flow pattern inside the multiphase (water-air) centrifugal pump was observed [9]. The numerical analysis was carried by various authors to understand the influence of gas void fraction on the performance of electric submersible pumps and flow physics in the flow domain of the pump [6,7,8].

In spite of the availability of good literatures, the lack of understanding of the flow dynamics of the centrifugal pump has been identified due to complex nature of gas-liquid two phase interactions. Moreover it is very important to investigate the characteristics of a Centrifugal Pump operated under gas-liquid two phase flow condition which is not commonly provided by the manufacturers. Therefore objective of this paper is to investigate the characteristics of the centrifugal pump working under gas-liquid two phase flow condition.

## II. EXPERIMENTAL SETUP

For the present study, end suction centrifugal pump with head, discharge and speed of 5 m, 1.3 lps and 1650 rpm respectively is selected. The Pump consists of closed impeller with five numbers of blades. The photographic view of the test rig is shown in Fig. 1. The test rig consists of hydraulic and pneumatic circuit.

### A. Hydraulic Circuit

A Hydraulic circuit consists of Booster pump, Centrifugal pump to be tested equipped with dimmer and energy meter, Sump and flow measuring tank. The discharge is measured by Rota meter connected at the outlet of Centrifugal pump which is calibrated with the flow measured by the measuring tank. The flow rate of water is controlled by the flow control valve.

A separate flow control valve is fitted at the outlet of booster pump. Booster pump is used to maintain the pressure at the inlet of centrifugal pump to be tested. The centrifugal pump is connected with the DC prime mover with the belt drive. The speed of the centrifugal pump is controlled by supplying variable voltage from dimmer.

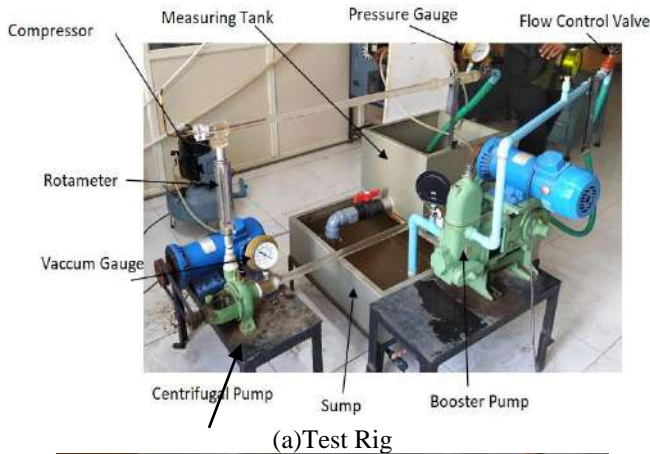


Fig.1. Photographic view of the Test rig

The electric power provided to prime mover is measured by the energy meter. The head developed by the centrifugal pump is evaluated from the pressure measuring devices connected at inlet and outlet of the centrifugal pump and total losses occurred. The speed of the pump is measured by the contact type of tachometer. The specifications of various measuring devices are listed in Table 1.

Table I. General Specification of Various Instruments

Parameters	Measuring Device	Range	Accuracy
Inlet Pressure	Vacuum gauge	0-760 mm of Hg	+/- 1 mm of Hg
Outlet Pressure	Pressure Gauge	0-1.06 kg/cm <sup>2</sup>	+/- 0.1 kg/cm <sup>2</sup>
Speed	Tachometer	0-5000 rpm	+/- 1 rpm
Discharge	Rotameter	0-12 lps	--

### B. Pneumatic Circuit

The pneumatic circuit of test rig consists of a Reciprocating compressor, Flow control valve, Venturimeter and Air entrainment system. The reciprocating compressor supplies the compressed air to the pneumatic circuit. The flow rate of air is controlled by flow control valve. The flow rate of air is measured by the venturimeter. The air entrainment system consists of a pipe whose outer periphery is drilled in such a way that it can create the air bubble diameter from 0.5 mm to 4 mm. The entrained air is mixed with the water at the inlet duct of a centrifugal pump.

The specification of venturimeter is as follows:

The inlet diameter of venturimeter: 25 mm

The throat diameter of venturimeter: 12.5 mm

The coefficient of discharge: 0.98

### III. RESULT AND DISCUSSION

The performance of a Centrifugal pump is obtained for single phase (water) and air-water two phase flow operating condition.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

#### A. Performance under single phase (water) operating condition

The performance of a centrifugal pump is obtained at different rotational speed i.e. 1350, 1500, 1650 and 1800 rpm.

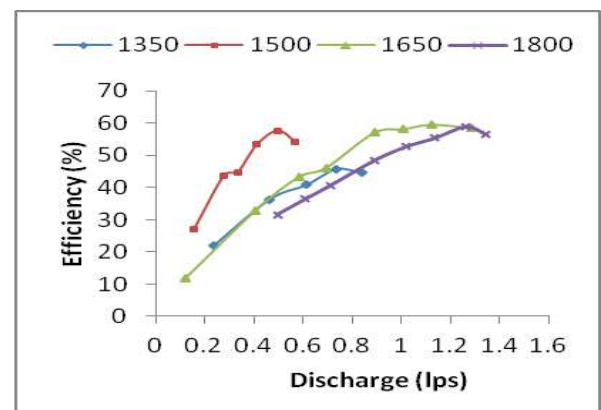
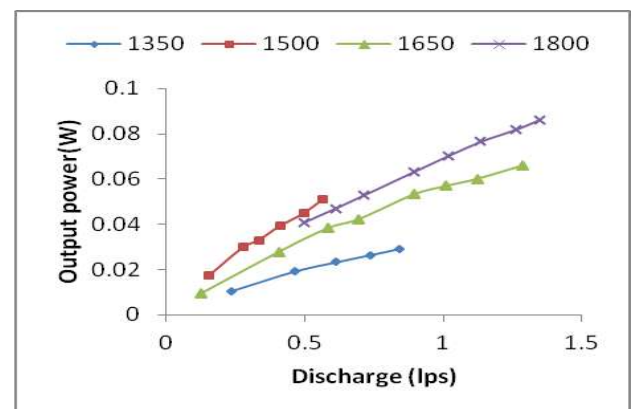
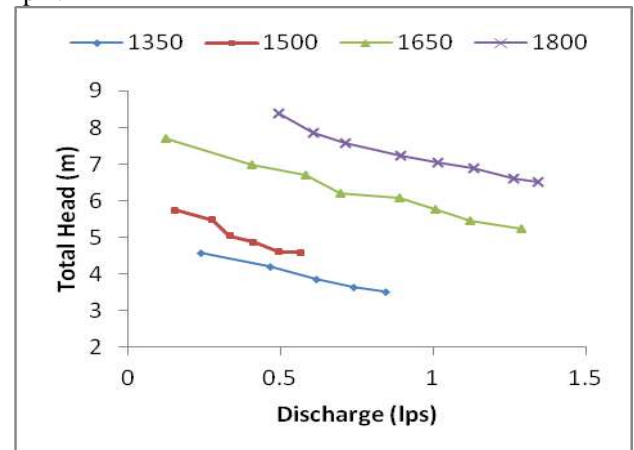


Fig.2. Performance of a centrifugal pump at different rotational speed

The discharge from the pump is altered by adjusting flow control valve and evaluated the performance parameters i.e. head, output power, input power and efficiency. The performance curve of a pump operated under water medium is shown in Fig. 2. All the curves follow the trends of standard centrifugal pump.

#### B. Performance under air-water two phase flow condition

The air is introduced in the hydraulic circuit of a centrifugal pump to analyze its performance. The flow control valve of an air is adjusted to keep the mass flow rate constant. By keeping the same mass flow rate of air i.e 2.45 kg/s, the discharge of water is varied and performance parameters of the pump are evaluated. The performance of a pump is analyzed for 1600 rpm rotational speed. The performance curve for both water phase and air-water phase is shown in Fig. 3.

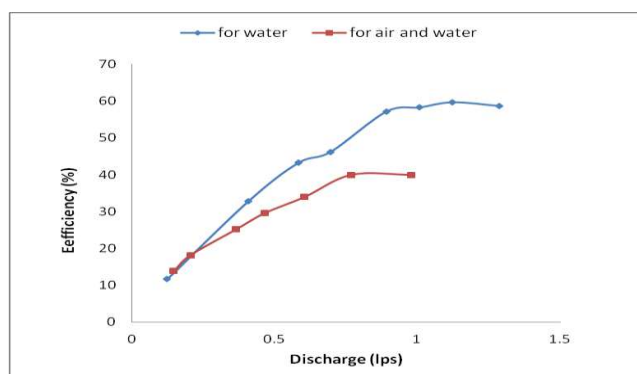
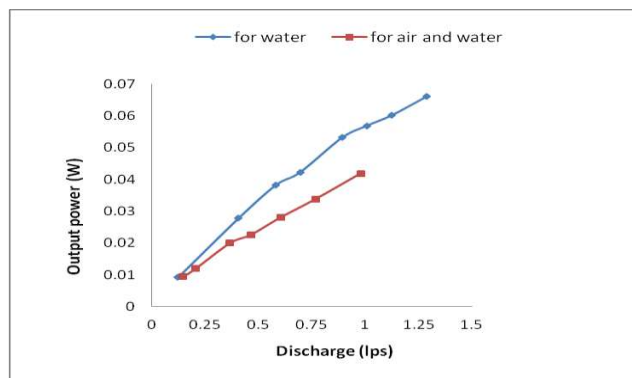
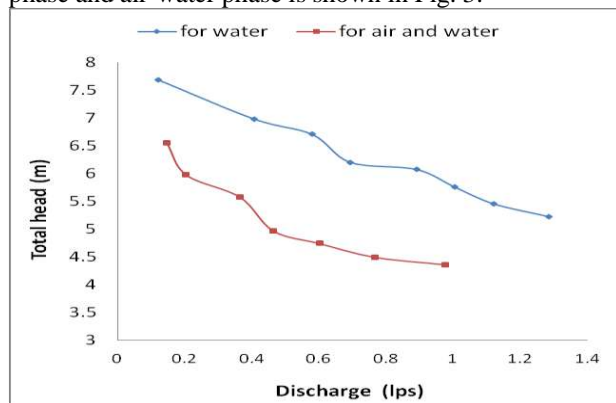


Fig.3. Performance of a centrifugal pump at air-water flow medium

The result showed that the head curve is continuously below to the curve obtained for water phase flow from part load to overload condition. The output power and efficiency of the pump for air-water is also below of the water phase flow from part load to overload condition. The drop in the efficiency of pump is due to increase of the hydraulic losses and accumulation of air pockets in the pump flow domain. The Best efficiency point (BEP) is shifted towards lower flow rates.

#### IV. CONCLUSION

In the present study, the operating characteristics of end suction centrifugal pump are carried out by experimental approach. The experiments are performed at water phase and air-water two phase flow operating condition. The performance of the pump is deteriorated by introducing the air. The head delivered by the pump is less in two phase flow condition as compared with water phase. The efficiency of the pump is decreased from 59.63 % to 39.95%. So it is highly recommended to optimize the centrifugal pump to increase its performance under air-water two phase flow condition.

#### ACKNOWLEDGMENT

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# Design of Hydraulic Micro Turbine and Application in Plumbing System

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**Abstract-** Energy is one of the most important components of economic infrastructure. In order to reduce the burden on energy sources, the thought of design of the micro turbine can be the ideal one, installing it in plumbing network having the effective head. Turbine generates the electrical energy which is further used as lighting of garden and parking. The turbine is created using plastic waste which is cheap and easily available. Considering today's scenario, it is very important to maintain the quality parameters of the water because turbine has to be installed in domestic plumbing system. Turbine is tested to find optimum head, velocity and losses that can be caused in plumbing system. All the losses are minor and negligible. It efficiently works in domestic plumbing system. This paper contains the review of hydraulic micro turbine. It is focusing on the design, working and environmental sustainability.

**Key words-** Micro turbine Mechanism, Environmental Sustainability, Electricity generation.

## INTRODUCTION

Water supply is the provision of water by public utilities, commercial organizations, community endeavors or by individuals, usually via a system of pumps and pipes. The hydraulic head in the water supply system is completely ignored. This hydraulic head can be used as hydropower generation media. Hydropower is cost-competitive renewable energy source that plays a strategic essential role in 21<sup>st</sup> century electricity crisis. Hydraulic head can be used to rotate the turbine which is installed in the domestic piping system. As the turbine rotates the energy will generate that energy is stored and further will be utilized as lighting purpose for gardening and parking. Need for generating electricity from hydropower is not a new concept but increasing demand of electricity these days give rise to the ideas for the innovation by using renewable energy resources i.e. Hydropower. Society is becoming more dependent on the exhaustible energy sources due to the industrialization and globalization. Due to this the danger of energy crisis is developing all over the world. So it is becoming very important to think upon the utilization of renewable energy sources to decrease the burden on exhaustible energy sources. Energy conservation and efficiency measures reduce the impact of energy development and can have benefit to society with changes in economic cost and with changes in the environmental effects. Contemporary industrial societies use primary and secondary energy sources for transportation and the production of many manufactured goods. Also, large industrial populations have various generation and delivery services for energy

distribution and end user utilization. Level of use of external energy sources differs across societies, along with the convenience, levels of traffic congestion, pollution sources and availability of domestic energy sources. Thousand of people in society are employed in the energy industry, of which subjectively influence and impact behaviors. The conventional industry comprises the petroleum industry the gas industry the electrical power industry the coal industry, and the nuclear power industry. New energy industries include the renewable energy industry, comprising alternative and sustainable manufacture, distribution and sale of alternative fuel.

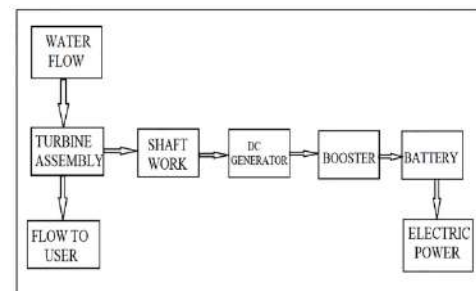


Fig.1 Block Diagram of Assembly.

## LITERATURE REVIEW

*D Hoffmann et al. (2013) [1] :*

In this paper, the authors used a rotational; radial-flux energy harvester incorporating a three-phase generation principle is presented for converting energy from water flow in domestic water pipelines. The energy harvester together with a power management circuit and energy storage is used to power a smart metering system installed underground making it independent from external power supplies or depleting batteries. The design of the radial-flux energy harvester is adapted to the housing of a conventional mechanical water flow meter enabling the use of standard components such as housing and impeller. The authors suggest a low-cost rotational radial-flux energy harvester based on a flow-driven impeller wheel and an electromagnetic energy converter incorporating a three-phase coil circuit. The energy converter was designed for easy integration with commercial water flow meters to harvest energy from water flow in domestic water pipe lines. The harvested energy is used for powering smart water meter systems.

*P. Padmarasan et al. (2016) [2]:*

In this paper author did a research work on how to generate power from metro water pipeline. The study showed that as the water moves from high to low elevation pressure builds in the pipe. The turbines convert that pressure into electricity via a generator on top of the pipes. The pressure in water flow produces potential energy which gets converted into mechanical energy which is further converted into electrical energy by generator. The generated power will be stored in the battery sources for the future use and also to satisfy the domestic needs. This project can also be implemented on any kind of environment such as urban areas and tall buildings where the velocity of water flow is higher. The purpose of their project was to capture unused energy in the drinking water systems of cities and towns and to turn that energy into useful electricity.

*B. Kowalska et al. (2016) [3] :*

They checked the possibility of energy utilization generated by drinking water as it flows through turbines integrated into pipes to power measuring devices for monitoring water networks. Apart from large turbines with relatively large diameters installed in transit pipes, they have started to appear solutions to be used in the case of smaller distribution pipes. Electricity obtained with their assistance may be used to power the monitoring devices (sensors). The authors suggest the power supply system for monitoring devices, a micro turbine integrated with electric generator and a system enhancing temporary flow rates via the turbine.

*Roshan Varghese Rajan et al. (2016) [4] :*

Author recommended the design and development of pico-hydro generation system using consuming water from water tank of residential buildings. Water flow in the domestic pipes has kinetic energy that has the potential to generate electricity for energy storage. An introduction of three new mechanical arrangements namely the air bladder for water pressure maintenance, U-tube piping and broad nozzle pipe end are included for better working and energy generation. It produces electricity with no fuel cost and low maintenance. They installed a mechanical arrangement to generate electricity from the potential energy possessed by water storage tank from a water head of even 3m and above very easily. This could be a reliable and eco-friendly form of energy, which can be generated to develop small scale hydro generation. This is very versatile power source that could be used to generate AC electricity even at remote places along around the globe.

*Marco Casini et al. (2015) [5] :*

In this paper authors recommended instead of photovoltaic and wind systems, nowadays in-pipe water to wire power systems are becoming particularly interesting for the integration of renewable resources at urban and building scale because of the potential to harness clean energy from excess head pressure in urban and domestic water pipelines. The article presents an overview of the different types of in-pipe hydro systems available on the market and illustrates their possible applications at the urban and building scale and

the benefits achievable in terms of energy production compared to other renewable such as photovoltaic and wind systems. In addition to providing clean energy, the application of these systems can help improving the management of water networks, allowing to monitor and adjust the water flows and to optimize overpressure, thus lengthening service life of all equipment.

*Salma Alarefi (2015) [6]:*

Authors suggested idea of harnessing power from water supply is to use the velocity or force (kinetic energy) of water flow to turn the micro turbine and generate electricity. The amount of power that can be generated depends on the water flow rate, water consumption, pressure as well as the generator. The system proposes embedding small turbines into water pipes to generate electricity. In this paper, a review of the available domestic micro- hydropower generation systems has been summarized. An experimental evaluation system of micro-hydropower generator for professional formation and research has been proposed. The paper details the design and construction of the proposed system including the design optimization. The author investigated the water consumption for a scenario of two occupier household relative to the electricity consumption.

#### ➤ *Micro turbine mechanism:*

The effective hydraulic head in the plumbing system is completely ignored. To utilize that head in effective manner we created a micro hydraulic turbine. The created turbine is installed in domestic plumbing system. The stored water from the overhead water tank flows through the plumbing network and the water jet hits the blades of turbine, turbine rotates and hydraulic energy is generated that energy is converted into mechanical energy and this energy is further converted into electrical energy by using DC motor. Initially only 2-3V voltage is generated. For increasing the voltage we used step-up booster which boost the voltage up to 11-13V. The battery is used to store the surplus power produced during operation of the turbine. The power produced may vary according to the flow of water. If the flow of water is varying during the day, the power produced by the turbine may also vary. Therefore, to maintain the continuous power supply battery along with an inverter and rectifier may be used. Electrical power is given by the product of mechanical power and the generator efficiency. The in-pipe water generator is an electrical power generating pipeline which can produce renewable energy completely clean, reliable low-cost electricity.

## METHODOLOGY

### 1) *Material Specifications:-*

- A) Casing – A PVC pipe casing of 6.5 cm diameter is provided, which is easily available, cheap in cost and non corrosive. The casing has inflow and outflow openings.
- B) Casing Pipe - Casing has inflow and outflow opening diameter of 2.5cm.
- C) Shaft - A 3.5mm diameter shaft is placed at the centre of turbine in the casing. Other side of shaft is

connected to DC motor which converts mechanical energy into electrical energy.

D) DC Motor - A DC motor of 12V and speed of 1200 rpm used for converting mechanical energy into electrical energy.

E) Turbine - A Hydraulic turbine is created from plastic material, having 8 numbers of blades.

F) LED - It is used to check generation of electricity.

G) Booster - A step-up boost converter is used, it converts input voltage of 2-3V DC to an output voltage of 11-13V DC.

H) Resistor - 1KΩ resistor is used to control the flow of current in circuit.

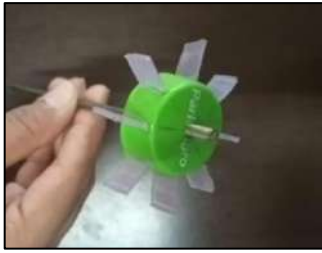


Fig.2: Shaft with Blades fixed on it



Fig.3: Turbine Enclosed in Casing

## 2) Calculations: -

### i) Calculation for Head & Velocity of jet-

Area of measuring tank = 0.12 m<sup>2</sup>

Volume = A X h = 0.012 m<sup>3</sup>

Time (t) = 14.6 sec

Q = Volume / Time = 8.2 x 10<sup>-4</sup> m/s

Dia. Of Pipe = 18 mm = 18x10<sup>-3</sup> m

a = (3.142/4) x d<sup>2</sup> = 2.54x 10<sup>-4</sup> m<sup>2</sup>

Q = a x v

V = 3.22 m/s

V<sub>th</sub> = (2gh)<sup>1/2</sup>

h = 0.528 m

### ii) Calculation for velocity of vane -

The type of impact of jet is series of plate mounted on the periphery of a wheel. The plates of wheel are normal to the jet.

$$\text{Efficiency} = \eta_{\max} = \frac{2(v-u)u}{v^2} = 50\%$$

$$\text{Velocity of vane} = u = \frac{v}{2} = \frac{3.22}{2} = 1.61 \text{ m/s}$$

### iii) Calculation for losses -

#### a) Loss of head due to friction in pipe -

By using Darcy Weisbach Equation,

$$hf = \frac{fLv^2}{2gd}$$

$$\text{Reynolds number (Re)} = \frac{\rho vd}{\mu} = 6.414 \times 10^4$$

$$\text{Relative pipe roughness} = \frac{\epsilon}{d} = 1 \times 10^{-4}$$

From Moody chart, Friction factor = 0.032

$$hf = 0.044 \text{ m}$$

#### b) Loss of head due to obstruction in pipe -

$$\text{Head loss} = \frac{(V_c - V)^2}{2g}$$

$$= \left[ \frac{v^2}{2g} \right] \left[ \frac{A}{C_c(A-a)} - 1 \right]^2$$

$$= 0.33 \text{ m}$$

#### c) Volumetric losses -

$$V_1 = 1000 \text{ ml}, V_2 = 980 \text{ ml}$$

$$\text{Loss} = 1000 - 980 = 20$$

$$\% \text{ loss} = \frac{20}{1000} \times 100$$

$$\% \text{ loss} = 2 \%$$

### iv) Calculation for Overall efficiency -

$$\eta_o = \frac{\text{Shaft power}}{\text{Water power}} \times 100$$

#### a) For motor,

Assume efficiency of 70 % i.e. 0.70

$$\eta_o = \frac{\text{Electrical O/P}}{\text{Shaft power}} \times 100$$

$$\therefore \text{Shaft power} = \frac{V \times I}{0.70} \times 100 = 166.28 \text{ Watt}$$

#### b) For turbine,

$$\eta_o = \frac{\text{Shaft power}}{\text{Water power}} \times 100$$

$$= \frac{166.28}{\rho Q g H} \times 100$$

$$= 0.5968$$

$$= 59.68 \%$$

$$\cong 60\%$$

### 3) Process of Working of Micro Turbine -

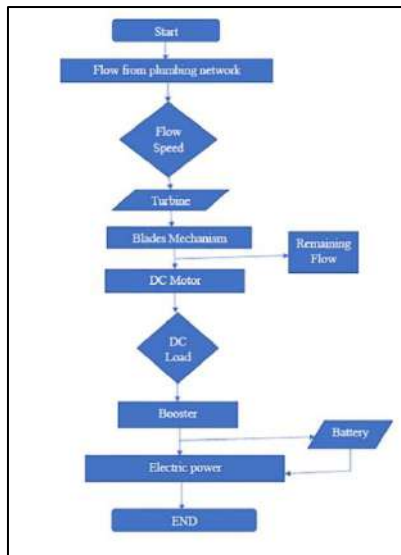


Fig.4 Flowchart of working Microturbine

## RESULT AND DISCUSSIONS

1. Optimum Head = 0.528 m
2. Velocity of Vane = 1.61 m/s
3. Velocity of jet = 3.22 m/s
4. Calculation of losses:
  - a. Loss of head due to friction in pipe ( $h_f$ ) = 0.044 m
  - b. Loss of head due to obstruction in pipe = 0.33 m
  - c. Volumetric losses = 2%
5. Overall Efficiency of Turbine = 60%

The algorithm for the evaluation of energy from the domestic plumbing system is a new concept. Above information provides the optimum head, velocity and all losses. But these all the losses are negligible. These losses are very minor losses don't effect on the overall efficiency of the turbine.

### 1. Advantages of System -

- It uses renewable source of energy.
- Free energy generation from pipe water.
- It is economical and does not require much investment.
- It requires very less maintenance.
- Design is simple and does not require any infrastructure.
- It generates clean, reliable, low cost electricity.

### 2. Cost Analysis :

Table 1: Cost Analysis

Sr. No.	Material	Specifications	Quantity	Cost(Rs)
1	Casing	Plastic- Dia. 6.5 cm	01	25
2	Shaft	3.5 mm Dia.	01	20
3	DC Motor	1200 rpm & 12 V	01	550
4	Booster	2 V to 12V Step-up Converter	01	80
5	Cutter	-	01	20
6	Fevikwik	-	04	20
7	LED Bulbs	5 mm Ultra Bright	02	05

8	Electric Wires	Length-10 cm	04	20
9	Resistor	1K $\Omega$ Carbon film	02	05
Total Cost =745Rs				

## V. CONCLUSION

Hydro power was the one of the first renewable energy, and therefore the most developed currently. To meet the energy requirement, various units have examined because of its advantages of proposing good performance as compared to conventional fossil fuel. A hydraulic turbine is rotary machine that converts kinetic energy and potential energy of water into mechanical work. Energy is generated by applying water pressure, to rotate the blades of micro turbines. Available head, specific turbine speed, and water flow are the key factors for the selection of appropriate turbine type under certain parameters. In this study, micro hydraulic turbine is considered as most suitable turbine type under certain parameters which includes: low flow rate, low pressure head & specific turbine speed. Less leakage and maintenance cost, the ability to reduce system shocks will prolong component life, reduce leakage from pipe joint and minimizes hydraulic system maintenance cost. The design of hydraulic turbine parts mainly depends upon the specific speed. Turbine parts should be properly designed in order to avoid cavitation because it lowers the turbine efficiency. Any ambiguity in the design parameters for the selection of turbines can cause decrease in turbine efficiency. As the purpose of these this project is primarily the selection of turbine under specific design parameters, however turbine's efficiency cannot be ignored. As the micro hydraulic turbine the required pressure is low below 10 meter, so after the completion of literature review, assumptions and calculations it is decided that micro hydraulic turbine is suitable because it operate at low head and low flow rate and as it has shown better results according to the parameters as compared to other turbines. The theoretical design and experimental results are computed for the performance characteristics of turbine and efficiency test in state full opening and opening (25%, 50%, and 75%). Under full load condition, the turbine works efficiently as compared to part load. Also as load increases the unit power increase. Important amongst all, hydraulic turbines are feasible to environment because it has no harmful effects on the atmosphere i.e. ozone depletion potential is very less or negligible. Hydropower development can uplift the living standard of rural communities.

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# Electrical Power Generation by using Suspension System and Regenerative Braking System of Off-Road Vehicle

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**Abstract:** Today's generation depends on automobile various reasons like transportation, traveling and other purposes. There are many kinds of vehicles available in the market for different usages. Considering today's scenario fuel costs are increasing but no one is reducing the use of vehicles. We are going to consider the loss in dissipation of vibration energy which takes place in shock absorbers of vehicles. Our suspension system will work more effectively in off-road, irregular roads. In this system we used spring, rack and pinion arrangement. Our main objective was to capture the energy which is wasted during the both expansion and compression of the suspension spring in the form of heat & which can be further utilized in the form of electrical energy. The developed energy is then used to recharge vehicle battery for further use. Project also involves the one of the braking systems which is nothing but the regenerating system. In this Project contains the electric motor for converting the losses which will take place on the suspension system during friction as well as in braking. Here motor acts as electric generator. The energy which lost during braking is given to the motor for further conversion. The losses which are fed to motor are shifted the rectifier circuit. Converted energy is stored in the battery. Energy stored in batteries during regenerative braking can be used for many applications.

**Keywords:** Power generation, suspension system, rack and pinion mechanism, regenerative braking system.

## 1. Introduction

Human made one of the most useful and important invention, that is the invention of automobiles. As per the demand of people there are many advanced systems generated in vehicles. Automobiles have taken an important role in today's generation. So, we come up with idea to make something different in this system coupling with our electrical engineering. In this project we are focusing on suspension system. Vehicles having suspension which plays important role in vehicles. Suspensions are mostly applicable for the off roads where roads are irregular. The main objective of project is to develop such a system which will convert those losses into useful applications. In our project we used two techniques to generate electricity.

- *Technique-1:* Electricity generation with the help of suspension.
- *Technique-2:* Regenerative Braking System

*Electricity generation with the help of suspension:* In this system we used spring, rack and pinion arrangement. The energy which is wasted during the both expansion and compression of the suspension spring in the form of heat & which can be further utilized in the form of electrical energy. The proposed system converts mechanical motion of the suspension and convert that motion into electrical energy. The developed energy is then used to recharge vehicle battery for further use.

*Regenerative braking:* Project also contains the one of the braking systems which is nothing but the regenerating system. Regenerative system is mostly used technique in electrical field so our main focus is to generate electric power from losses while braking. It is also known as the energy recovery system

## 2. Literature Survey

Sunny Wagh [1] Author describes a magnetic shock absorber that uses magnetic repulsion between dipoles to absorb vibrations and creates DC current by deploying magnets in a cylindrical shaped suspension with opposing poles. The charger and the battery both store the DC current output.

Rahul Uttamrao Patil, S. S. Gawade [2], "Design and static magnetic analysis of Electromagnetic regenerative shock absorber" Precision systems are electronic equipment systems. In moving vehicles for road conditions, there are occasional vibrations and impacts. As a result, the role of the shock absorber in the protection of electronic equipment in moving vehicles is critical. A thorough investigation of the design or evaluation of a shock absorber for the protection of electronic equipment systems in a hostile vibration-impact environment is presented in this study.

Yang Yang, Xiaolong He, Yi Zhang, 2018, They developed a technique based on the motor's maximal breaking force and needed breaking force to fully utilise the motor's breaking power. They ran simulations for three different breaking scenarios and discovered that the method they used improved the motor's operating efficiency and front braking power.

Zhijun, Dongdong, & Jingbo, 2017, They looked at how an electric vehicle's regenerative braking system works. They used

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the particle swarm optimization (PSO) technique to optimize the various parameters. Breaking strength, state of charge, battery charge capacity, and speed are the guiding parameters of their research. They came to the conclusion that the PSO model can improve vehicle stability and brake energy recovery.

### 3. Methodology

The main objective of project is to develop such a system which will convert those losses into useful applications. In our project we used two techniques to generate electricity. one is suspension system and another is regenerative braking system.

In this system we used spring, rack and pinion arrangement, Dc motor work as a generator, Voltage Tripler circuit, Battery, Inverter. The suspension system absorbs the small vibrations that occur in the vehicle. Rack and Pinion converts that linear motion into the vibration motion. Due the small vibration in the vehicle rack and pinion provides the input power. Due the pinion mechanism the linear force is converted into rotary movement, and this rotary force is applied to the dynamo through spur gear. Generator gets powered, and it produces electric energy by rotating mechanically. This energy is stored into the battery.

Vehicles driven by electric motors use the motor as a generator when using regenerative braking, it is operated as a generator during braking and its output is supplied to an electrical load; the transfer of energy to the load provides the braking effect. due to back emf in motor, motor works as brakes. In this system we attached generator to the friction brake of bike when brakes are applied the generator gets in contact with wheel of bike and rotates with the rotational motion of bikes wheel. the motor is operated as a generator during braking. When generator rotates it generate electricity and this generated electricity given to the energy storage device and then generated electricity utilized for other application of bikes.

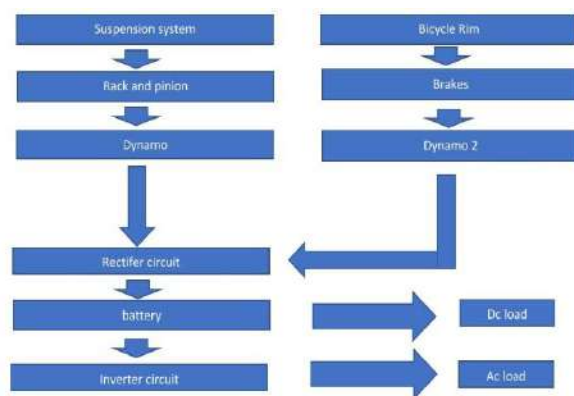


Fig. 1. Block diagram of proposed system

#### A. Hardware Requirements

##### 1) Rack & Pinion assembly

To convert linear motion to rotary motion and vice versa, a rack and pinion system is utilized. A circular spur gear, known as the pinion, meshes with a spur gear with teeth positioned in a straight line, known as the rack. A rack and pinion linear

actuator are made up of a pair of gears that convert linear motion into rotational motion. A circular gear known as "the pinion" engages teeth on a linear "gear" bar known as "the rack"; linear motion supplied to the rack causes the pinion to move, transferring the linear motion of the pinion into the translational motion of the rack.



Fig. 2. Rack and Pinion

##### 2) Spring

A spring is defined as a versatile body with the ability to twist when loaded and recover its original shape when the burden is removed. There are many different types of, but we used a helical compression spring.

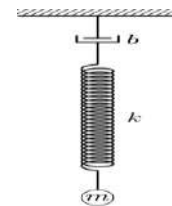


Fig. 3. Spring

Table 1  
Specifications of spring

Wire diameter	3.36mm
Spring index	15.76
Mean coil diameter	51.05 mm
Number of active coils	8

##### 3) Spur Gear

In the design of the project, two types of gear wheels have been used. Spur gears or straight cut gears are very simple. They contain a cylinder or disk with teeth that appear brightly. To view the gear 90 degrees from the shaft length (side) the tooth surface is straight and aligned with the rotating axis. Spur gear gears blend well only when fitted to compatible shelves. No axial thrust is caused by dental loads. Spur gears are best at medium speed but are usually noisy when running at high speeds.



Fig. 4. Spur gear

Table 2  
Gear specifications

Spur gears	2
Number of teeth	35 and 18
Addendum diameter	74.22mm and 43.3m
Module	2.0mm
Face width at base	4.16mm and 4.3mm

#### 4) DC motor



Fig. 5. DC motor

The dc generator produces electricity. The commutator mechanically reverses the connection of the stator loop to the external circuit. The flow current when the polarity of the voltage in the stator loop alters. The commutator in this process converts the generated alternating current voltage to pulsating direct current voltage

Table 3

Specification of DC motor	
RPM	200
Operating voltage	12v
Shaft diameter	3 mm
Torque	1 kg-cm
No-load current	300 (max)

#### 5) Battery

A battery is used to store the generated electricity. The size of 12V and 3Ah (3.30Ah) capacity batteries vary significantly based on the ampere hour they are designed to produce. The most common use for 12-volt batteries is in transportation applications such as automobiles and boats.



Fig. 6. Battery

#### 6) Inverter



Fig. 7. Inverter

An inverter is a circuit that converts dc into alternating current. The goal is to generate ac voltage when only one dc voltage source is available. A variable output voltage can be achieved by changing and maintaining the input voltage. Inverter gain is fixed. It provides a cheap and easy solution of powering devices that need ac power. Their purpose is to

provide a convenient and portable ac power source. A pure sine wave inverter is 5% less efficient, but this rating converts battery energy into a modified sine wave output.

#### 4. Calculation

Weight given=20 kg

Force (F)=mg=20\*9.8=196 n

Radius of gear =5cm= 50mm

$T=50 \times 10^{-3} \times 196 = 9.8 \text{ nm}$

*Output power (from suspension):*

Power =  $P = (9.8 \times 2\pi \times n) / (60)$ , if n=15 revolutions

$= (9.8 \times 2 \times 3.14 \times 30) / (60)$

$= 923.16 / 60 = 15.386 \text{ w}$

$= 15 \text{ w power generated per transition}$

Total power generated will be = forward + reverse

$= 15 + 15 = 30 \text{ w}$

*Output power (from generative braking)*

*Braking Energy:*

m = 5 kg, let N= 900 RPM

Radius of Wheel = 0.3 m

weight of tyre = 1.2 kg

Final velocity = 0

Initial velocity = 50 kmph = 13.8889 m/s

$E_b = 0.5 \times m \times (v_i^2 - v_f^2)$

$= 0.5 \times 5 \times (13.8889^2 - 0^2) = 482.25 \text{ J}$

*Electrical Output:*

Output voltage =7.4 volt

Output current range = 2 Amp

Time required to stop the vehicle = t = 5s

Speed of wheel= N= 900 RPM

$W = V \times I = 7.4 \times 2 = 14.8 \text{ w} = 15 \text{ w}$

Combined output from both systems

$30 \text{ w} + 15 \text{ w} = 45 \text{ w}$

Charging time: 3.30ah/3amp=1.1hrs

#### 5. Results



Fig. 8. Model of suspension and regenerative braking system

Fig. 8 shows the final result of Suspension and Regenerative braking system. This kit contains cycle rim, belt, motor, rack and pinion, Spur gear etc. by running above kit we got 9-10 volt output which is useful for further applications. We attached one

bulb with this circuit which glows when output generated.



Fig. 9. Assembly kit

## 6. Conclusion

We mainly conclude that, the energy which is wasted during both the expansion and compression of the suspension spring in the form of heat and losses are further utilized in the form of electrical energy.

It is observed that, suspension system is working more effectively in off-road, irregular roads. Main aim was to achieve

highest efficiency using regenerative braking system. Regenerative braking system is nothing but, the system which generates the power from losses in system. That power is stored in the battery. We attached a bulb on our project kit which is glowing on the generated energy.

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# Design and Development of Agribot

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**Abstract:** *The project aims on the design, development and the fabrication of the robot which can dig the soil, put the seeds, leveler to close the mud and sprayer to spray water, these whole systems of the robot work with the battery and the solar power. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest. The vehicle is controlled by Relay switch through IR sensor input. The language input allows a user to interact with the robot which is familiar to most of the people. The advantages of these robots are hands-free and fast data input operations. In the field of agricultural autonomous vehicle, a concept is being developed to investigate if multiple small autonomous machines could be more efficient than traditional large tractors and human forces. Keeping the above ideology in mind, a unit with the following feature is designed.*

**Keywords:** Agribot, Solar Powered robot, Multipurpose robot, Autonomous

## I. INTRODUCTION

Most countries in recent times lack sufficient skilled manpower, notably in the agriculture industry, it has a detrimental impact the growth of developing countries. The primary goal of automation in our country is to reduce manpower; the keyword in all industrial businesses generally refers to electrical, electronic and mechanical components. Automation eliminates a lot of time consuming manual labour and speeds up production. As a result, it is the moment to automate the sector in order to solve the problem in India, 70% of population is reliant on agriculture.

The robotic system is a four wheeled DC motor guided electromechanical (gives the impression of having its very own agency and artificial agent. A machine tends to the farm, which includes consideration specific columns and rows depending on the crop. The equipment may be controlled remotely, and a solar panel has been used to charge DC batteries.

## II. LITERATURE REVIEW

[1] With the advancement of technology in the twenty-first century, a variety of robots have been utilized in agricultural activities, ranging from the cultivation process to the production process. The design of an insecticide spraying robot has been explored by the author. This robot has the ability to take the place of a human agricultural worker in the field. The system is made up of a spraying motor that is powered by a battery. The Arduino board, which also processes inputs from ultrasonic sensors, controls the spray activity. The robot control flowchart is shown, as well as the experimental results.

[2] In another robot developed by Chaitanya et al. A web camera is interfaced with Arduino. Here live video is processed by video processor implemented with Raspberry Pi. Video processing algorithm is also implemented for diagnosing the diseases falling on the plant. The details of hardware circuit, programming and IOT interface implementation are presented.

[3] The author discusses the components of a pesticide spraying robot. The spraying approach enables the spraying project to be completed profitably and economically. The main goal of this project is to create a unique spraying device that assures complete inclusion of the identified article with the least amount of water. Spraying each objective separately reduces the amount of pesticide used.

[4] The author presents a prototype implementation of a seed spotting robot based on a black line following mechanism. The algorithm is described in terms of its construction, operation, and programming. The robot is constructed using an open-source Firebird microcontroller. The servo mechanism is designed to sow the

seeds in the proper location. The author has created a solar-powered semi-automated agricultural pesticides spraying robot that runs on an Android app. The paper includes details on mechanical modelling, system development, and an example of an Android app. The robot that has been constructed has proven to be a productive and efficient machine that is simple to manoeuvre and control. The robot can traverse a variety of terrains and soils. Johnson geared motor allows for precise navigation since it moves precisely in response to the pulses received and has no inertia, unlike a regular DC motor. Wireless technology allows for remote control of the robot (BLE, Wi-Fi). A smartphone app is used to control the robot movement as well as the spraying of pesticides. As a result, the robot control is simple and user-friendly, allowing farmers to effortlessly operate this sophisticated vehicle.

[5] The use of a radio frequency driven robot to sow seeds is demonstrated. The robot's RF receiver receives commands from a remote operator and performs motion-related activities such as forward, reverse, left, and right turns. Infrared sensors are also included in the Robot, which aid with obstacle detection and are notified by a buzzer as an auditory indicator.

[6] An autonomous seed sowing robot that avoids collisions is shown. The rotating wheels, seed, and other features of robot design. Graphical representations of the sowing disc and bucket, seed chamber, and storage tank are provided. Photographs of evolved robots are shown, with various operations indicated. This robot's obstacle detecting feature is an added bonus.

[7] It is given the design and fabrication of a seed sowing and grass cutting robot machine. The author provides information on major building components such as DC motors, bearings, gears, seed sowing discs, and buckets. The created machine has a lot of promise for enhancing planting output. Until recently, the tractor was the primary traction machine used in farming. The goal of this seed planting equipment will be accomplished with its customization. As a result, it is necessary to promote this technology and make it cheap to even small-scale farmers.

[8] The goal of the autonomous seed sowing robot is to boost output while reducing seed wastage and seed sowing time. Solar-powered DC motors are driven by an L298N driver circuit with an Arduino UNO control kit in this automatic seed sowing system. To detect the impediment in the path and the end of each row, an ultrasonic sensor is also fitted. The built robot additionally includes a GSM module that sends SMS when the mission is completed. The author has described the seed sowing robot's construction, operation, benefits, and drawbacks in detail.

[9] In the agriculture industry, equipment that demands less human work and time, as well as lower implementation costs, is critical. A seed sowing robot is a technology that assists farmers in spreading seeds in the desired spot, saving them time and money. One of the most important aspects of farming is seed sowing. It necessitates a significant amount of human labour as well as time. The goal of this project is to develop and build a smart seed sowing robot for the aforementioned duty. One robotic arm sows the seeds from the seeds container in this smart seed sowing robot. To acquire the appropriate positions for the robot arm, the mobile application is used to control it. As a result, this method uses a cleverly built mechanical mechanism to entirely automate the seed sowing procedure. This robot saves time and money by reducing the effort and overall cost of sowing seeds.

[10] The author discusses a step-by-step approach for designing and fabricating an autonomous seed sowing robot. The technique is described in depth, as well as the results of the experiments. The required depth of the seeds to be sowed should be raised by around 8 cm for better and stronger germination.

[11] A lot of work has gone into developing a wireless gesture control robot. The work achieved toward developing a future precision autonomous agricultural system was presented in this paper. Sowing seeds is a difficult farming activity that the robot completes. Because the robot is controlled by hand gestures, its mobility may be accurately regulated.

[12] Agricultural process automation is projected to have a favorable influence on the environment by reducing waste and enhancing food security while also maximizing resource use. Precision spraying is a technique for reducing pesticide losses while also lowering chemical residues in the soil. We designed a clever and unique electric sprayer that can be constructed by a robot in this study.

[13] The sprayer contains a crop sensing system that calculates leaf density using picture histograms (local binary pattern (LBP), vegetation index, average, and hue) and a support vector machine (SVM) classifier. This density can then be utilised as a reference value for a controller that controls the Sprayer's air flow, water rate, and water density. This perception system was designed and evaluated with a dataset that was made available to the scientific community, and it

is an important contribution.

[14] Robots, which are automated robots, are frequently utilised in machineries, industries, and the medical area. Robots are also utilised in agriculture to accomplish tasks such fruit picking, ploughing, and harvesting. These robots, on the other hand, are pre-defined, with mechanisms and capabilities already given. There is a danger that these robots will malfunction. If a robot makes a mistake, it can inflict a lot of damage, therefore automated robots always have disadvantages, whereas self-operated robots can be prevented from breaking down and exerting themselves.

[15] A thorough examination of various Human- Machine Interaction strategies based on gestures has been presented. An accelerometer can be used to capture gestures, however with the advancement of smartphones, its standalone application has become obsolete. Accelerometer-based technology that uses RF signals to operate a robotic car utilising a small 3-axis accelerometer.

[16] Radio frequency can travel over longer in the distances than infrared, many present technologies and transmission mediums rely only on it. The ultrasonic sensor detects any obstacles or the field end. If Robot 1 need seed for sowing, it transmits a request for assistance to another robot via the RF module.

[17] An accelerometer detects human hand movement; when the hand gestures towards the ground, the capacitance between the moving and stationary plates reduces as the dielectric (i.e. air) between them lowers, and the signal is conveyed to the microcontroller in analogue form. The received analogue signal is then fed into the microcontroller inbuilt ADC (Analog to Digital), which processes the signal before sending it to the RF module. The RF module will receive the signal from the microcontroller, which operates at 433 KHz.

[18] Both of the robots in the farms connect with each other by RF, sending data and their current positions on a constant basis. The signal is received from the transmitter as digital 4 bit data, which is then passed to the microcontroller, which processes it further before sending the signal to the lifting mechanism and wheel rotational driver.

### **III. METHODOLOGY**

The system is separated into two major sections: the first is the user section, and the second is the robot section. The first portion is a laptop or mobile device that communicates with the second part, which is the robot section. As a result, when compared to those who use a traditional large computer system, a laptop computer or a mobile phone will make the user section more convenient and portable. The User section and the Robot End can communicate in a variety of ways. The user section and the robot end communicate in a variety of ways. Signals that are required can be transmitted. Employing Radio Frequency technology or a Zigbee device (Zigbee is a wireless technology developed as an open world wide standard to support the system of low-cost, low-power internet of things networks) or Bluetooth technology.

They do, however, have a relatively limited range. To avoid the low range problem and to communicate quickly, we may bring all parts onto the internet platform, which is the basic idea of the internet of things. The Arduino IDE software is a cross-platform application that can be built in C and C++, and it can be used to connect the RGV to the internet in this case. The Arduino Integrated Development Environment (IDE) software is a virtual object database, also known as an object relational mapping (ORM), that may be used to create prototypes and Internet of Things applications. An integrated development environment (IDE) is a software application bundle that provides device programmers with a variety of software application and development possibilities. An IDE comes with built-in source code that may be edited, automation tools, and a debugger, which is a tool for finding and fixing software bugs. Using the Arduino IDE application, we can send commands and control the RGV.

The Arduino and Node MCU ESP 8266 microcontrollers are mounted on the main body structure of the robot, which serves as the supporting framework for the complete robotic vehicle, in the Remote Guided Vehicle. 100 RPM DC motors are attached to the wheels beneath the vehicle chassis body in this RGV. Each motor is powered by a 12V supply from an external battery source connected to the vehicle chassis. A relay driver connects the Node MCU (ESP8266) to the DC motors. A relay driver is linked to each 12 V DC motor for amplification purposes. A relay driver is nothing more than an electro-magnetic switch that is used to turn ON/OFF a low voltage circuit.

The microcontroller was programmed using the Arduino IDE software to allow the robot to run in the desired direction. This is the operation that is linked with it in manual mode. Sensors such as ultrasonic sensors and optical sensors that

are directly attached to microcontroller's Input/Output pins can be used. Ultrasonic sensors function on the same concept as bats, which use echolocation to catch prey and navigate in the dark.

#### IV. PROPOSED SYSTEM

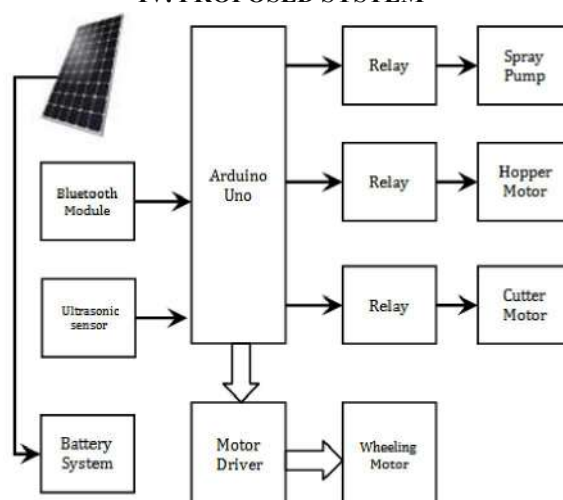


Fig 1. Block diagram Agribot

The block diagram of proposed multifunctional agricultural robot is shown in figure. The system consists of a controller that takes input from a Bluetooth module via Bluetooth remote controller. The data received by the Bluetooth module is processed by the controller and the actions taken are - control the motion of the robot, seed hopper start stop operation, sprayer on/off operation and cutter on/off operation. The system is also supported with the solar photovoltaic (PV) panel for battery charging purpose.

#### V. HARDWARE CONFIGURATION

##### 5.1 Arduino Uno



Fig 2. Arduino Uno

Arduino UNO is a commonly used open-source microcontroller board made by Arduino and based on the ATmega328P microprocessor. The board has digital and analogue input/output (I/O) pins that can be connected to a variety of expansion boards (shields) and other circuits. There are 14 digital pins and 6 analogue pins on the board. It may be programmed through a type B USB connector using the Arduino IDE (Integrated Development Environment). It accepts voltages between 7 and 20 volts and can be powered by a USB connection or an external 9-volt battery.

##### 5.2 PV Panel



Fig 3. PV cell

12V voltage  
20W of power  
1.5 amps of current

### 5.3 Battery



Fig 4. Battery

A lead acid battery with the following parameters was chosen for the created robot:

- Voltage – 12V
- Current rating – 1.3Ahr
- Type – sealed lead acid

### 5.4 Bluetooth Module



Fig 5. Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth.

### 5.5 Relay



Fig 6. Relay

4 channels 5V, 7A relay board is selected for interfacing actuators. These relays are controlled with Arduino Uno and the controlled device is water pump motor. As all the sensors are working on 5V voltage levels relay having control voltage of 5V is chosen.

### 5.6 Motor Drivers



Fig 7. Motor Drivers

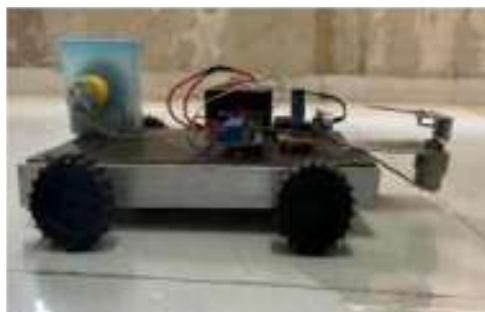
The L293D is a 16-pin motor driver IC that is widely used. It is mostly used to drive motors, as the name implies. A single L293D IC can drive two DC motors at the same time, and the two motors' directions can be regulated individually.

## VI. IMPLEMENTATION OF THE ROBOT:

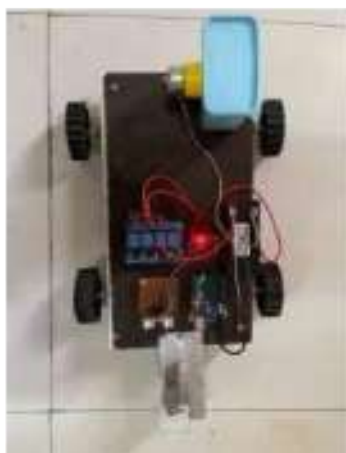
### 6.1 Front View



### 6.2 Side View



### 6.3 Top View



## **VII. FUTURE SCOPE**

Because of its utility in agriculture and ability to minimise workload, this sort of robot has a bright future.

- By lowering the amount of pesticide liquid that needs to be sprayed, it saves time and money.
- It will help farmers work in any season and under any circumstances.
- It would reduce the chance of farmers developing various respiratory and physical issues.
- It can be built to automatically collect and analyse data from the farming field, as well as perform pre-defined tasks.
- Increasing the usage of renewable energy sources like wind power will also assist to lessen the demand for more batteries.
- Voice-controlled navigation can be employed for robotic motions.
- To increase the performance of IoT-based smart agriculture systems, modern technologies such as AI and machine learning can be combined.
- Autonomous robots based on artificial intelligence (AI) can be created expressly for agricultural applications.
- Machine learning may be used to analyse video to evaluate agricultural conditions, such as examining the condition of a leaf to see whether it has been attacked by pests and then ordering the machine to take the right action.

## **VIII. CONCLUSION**

This describes the multifunctional agricultural robot. The built robot can be controlled over Bluetooth via the user's mobile phone app. A prototype model is used to demonstrate the three functions of seed planting (seed flinging), insecticide/pesticide spraying, and crop cutting.

The robot is powered by a battery that is charged using solar PV panels. As a result, the robot is environmentally beneficial. The complete system is made more user-friendly by the mobile app for robot control.

This robot will undoubtedly reduce human effort in the agricultural field, allowing farmers to perform multiple tasks with a single system.

The potential for robot-enhanced productivity in agriculture is enormous, and robots are increasingly appearing on farms in various forms and in increasing numbers. Other issues with autonomous farm equipment are likely to be solved by technological advancements. Although this technology may be in our future, there are compelling reasons to believe that it will not simply replace the human driver with a computer. It may necessitate a reassessment of crop production methods. Crop production can be done more efficiently and affordably using a swarm of small machines rather than a few giant ones. One of the advantages of the smaller machines is that they may be more acceptable to those who do not work on farms. Agriculture tasks are tedious, risky, and need intelligence and quick, yet very repeated decisions; hence, robots can effectively replace human operators. Machines can accurately detect higher-quality items (colour, firmness, weight, density, ripeness, size, and form). Robots have the potential to improve our lives, but they also have drawbacks. In our country's current scenario, all agricultural machines are operated manually since using a petrol engine or tractor is expensive, and farmers can't work for long periods of time manually. To prevent this problem, we need some kind of power source system to run.

- Create a prototype model of a drilling and seed sowing machine system using the restricted resources and budget available.
- If this initiative is successful, it will give farmers with a low-cost multipurpose solution.

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# Vehicle Accident Prevention System Embedded with Alcohol Detector

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**Abstract:** This project's major goal is "Drunk Driving Detection." Number of accidents occur nowadays because of the driver's or the person who drives the vehicles. As a result, drunk driving is a major reason of accidents in almost every country throughout the world. The Alcohol Detector in Car project is intended to confirm the safety of those who sit inside the car. The Alcohol Detection with Car Controlling project assists in controlling the vehicle if the driver has drunk alcohol. Inside the car, an alcohol breath analyser project should be installed. In another example, if the driver is not drunk when he is starting the vehicle and the engine is started, but driver starts drinking while driving, the sensor detects alcohol in his/her breath and the engine is stopped after some time, preventing the car from accelerating any further and allowing the driver to guide it to the roadside. To showcase the principle, we use an Arduino family microcontroller like Arduino uno interfaced with an alcohol sensor, an LCD display, and a dc motor in this system. So, in this case, the alcohol sensor is utilized to continuously monitor the user's breath and provide data to the microcontroller. When a high alcohol signal from the alcohol sensor is detected, the microcontroller shows an alcohol detection note on the LCD display and stops the small dc motor to illustrate engine lockup. To start the engine, the system requires a push button. If alcohol is discovered while starting the engine, it do not start at all. If alcohol is detected after the engine has started, the system locks the engine.

**Keywords:** Arduino UNO, MQ3 sensor, Relay, Buzzer, GPS Module, GSM module.

## I. INTRODUCTION

Street safety is the becoming a major social issue across the world, mainly in India. Drink and drive are currently a true general common issue that is likely to grow as one of the most essential issues. The key motivation for this challenge is "drunk driving detection." Because the number of incidents caused by the driver's or the individual driving the car is increasing. As a result, drunken driving is a significant cause of mishaps in all nations all over the world. As a result, the framework reduces the number of streets mishappens and fatalities caused by intoxicated driving in the future. Since the Drunk Driving Detection and Car Ignition Locking Using Arduino plans to remedy that using automated, simple, non-invasive liquor wellbeing checks in vehicles, drunk driving is the cause of most deaths. When the level of alcohol in the car reaches a permissible breaking point, an alcohol sensor is installed on the steering wheel, and the vehicle's ignition and motor are turned off. Even though driving while inebriated is prohibited and penalized in almost every country, many people/youths continue to disobey the rules and feel compelled to drink and drive.

The main goal of this Project and alcohol detection system is to create a system that can reduce the number of accidents caused by driver's non-careless behaviour. The project starts with the detection of alcohol intoxication using an alcohol sensor (MQ-3) that acts as a Breathalyzer and estimates the blood alcohol content. Breath alcohol concentration is a measure of the amount of alcohol in a person's body. MQ-3 is connected to the Arduino board through an interfacing. Buzzer, and relay are all external components. Arduino monitor the amount of alcohol in the air. From the corresponding values, calculates alcohol concentration in percentage. If the estimated percent exceeds a certain threshold, The driver is notified with an alarm via an alarm and the relay if the threshold is exceeded.

## II. METHODOLOGY

The fig 1 describes the block diagram of the components used to the driver's alcohol detection. Arduino UNO is the major component that controls the model's overall functions. The alcohol sensor detects alcohol based on human breath, which means that if the driver has drunk alcohol, the sensor's green LED will blink, and an analogue signal will be sends to the Microcontroller. The alcohol sensor will record both analogue and digital measurements, but because a threshold must be specified, we will use analogue readings. In this paper, a real time driver's monitoring system is proposed to detect the alcohol intake. The Arduino UNO is the central component of the concept, and it is responsible for all the system's functions. The Arduino UNO determines whether the alcohol content is above or below the threshold based on digital data from an external ADC. The driver's condition is determined by its output. When the driver is identified as being Out of control, the buzzer turns ON, Red light LED starts glowing, and a message is delivered to the designated person. The relay's primary function is to turn off the engine's power supply if the driver is found to be unawares. To

begin, as soon as the driver enters in the car and turns on the car engine, the alcohol sensor detects the driver's alcohol level; if the alcohol concentration is above the threshold, the car's power supply is instantly turned off via a relay, preventing the driver from turning on the car. If the MQ-3 sensor detects no alcohol concentration at first, the engine fires up and the car begins to drive. When the vehicle is turned on and any alcohol content is discovered in the middle of the journey the driver is warned through a buzzer. The vehicle's speed steadily decreases until it comes to a complete halt. The message alert is delivered to the authorised user via the Twilio application when this procedure takes place. This is done to notify the authorised user of the driver's current state.

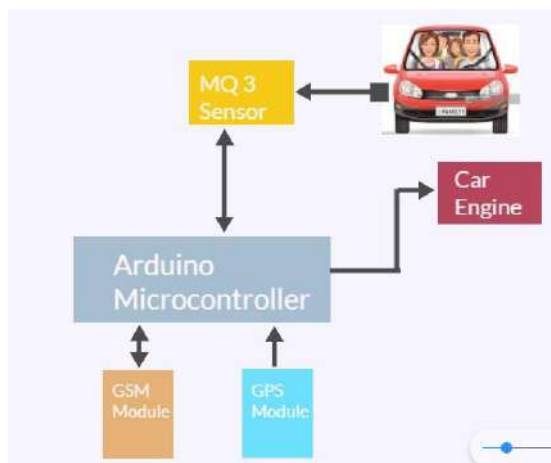
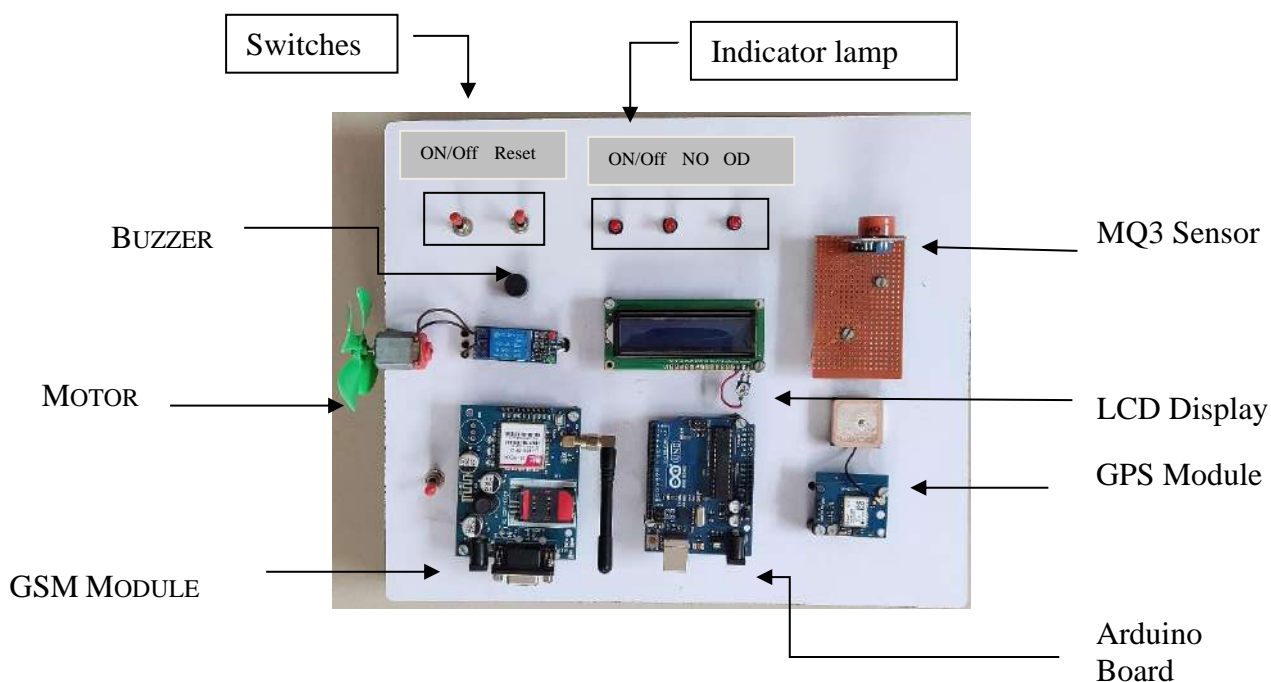


Fig 1

### III. CASE STUDY

As shown in fig 2, In block diagram of project its clearly seen that how project works. In given algorithm first driver or any person who is trying to start car first driver give the car ignition, then Alcohol sensor i.e.MQ3 check alcohol level in car. If alcohol level is below the Threshold value which is set by car owner or person who maintain the safety then car is stars without any interruption,

If alcohol level is car is above the threshold value, then 1<sup>st</sup> start buzzer and making beep sound then after some time red led starts glowing. This is the one part of hardware working and other hand GSM module Available in system is send SMS to Owner Also we used GPS to detect the actual position of car in terms of latitude and longitude.



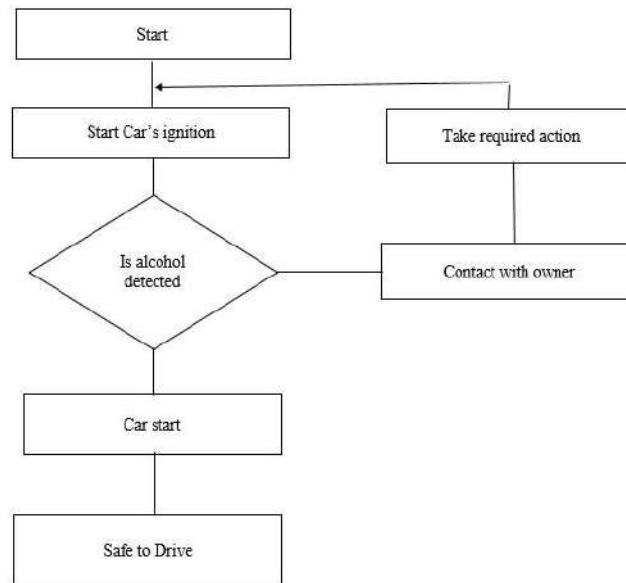


Fig 2 Algorithm

## Simulation Results:

Above figure shows the output of our project in terms of binary/logical coding

If alcohol is not detected by MQ3 sensor means (logic 0) then by default car is in running condition so logic became high (logic 1) and red-light LED indicator is dark, so logic is low (logic 0) and vice versa.

when alcohol is detected by system If alcohol is detected by MQ3 sensor means (logic 1) then by default car is stopped so logic became Low (logic 0) and red-light LED indicator is dark, so logic is High (logic 1)

Fig 3 Simulation Result

Input (logical)	Motor Output	LED output
<b>Logic 0</b> When alcohol is not detected by system	<b>Logic 1</b> Motor is rotating	<b>Logic 0</b> LED is not glow
<b>Logic 1</b> When alcohol is detected by system	<b>Logic 0</b> Motor stops rotating	<b>Logic 1</b> LED is starts glowing

## IV. RESULT

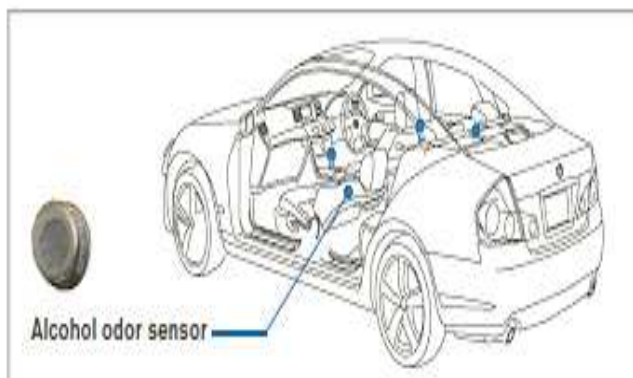


Fig 4 Position of sensor

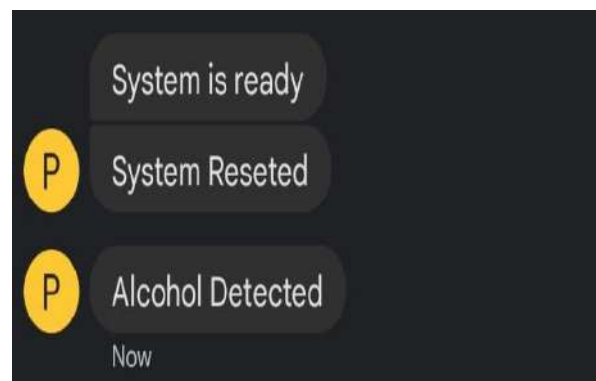


fig 5 SMS sending output



Fig 6 Actual Output

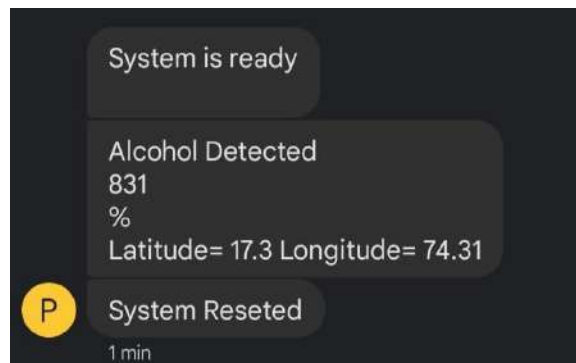


fig 7 SMS sending output

A highly Sensitive alcohol sensor is built into the gear knob and front of drivers face which is exactly above the steering of the car which can detect the availability of alcohol in the respiration of the driver's body as driver trying to start driving. When the alcohol-level detected is above the set value of threshold, the system automatically locks the transmission and stop the car. A "drunk-driving" buzzer alert is also provided and the car navigation system also available. Additional alcohol sensors are also placed near to the driver's and passenger seats to detect the availability of alcohol in the air inside the vehicle. When alcohol is detected, the system gives voice alert as well as message alert.

## V. CONCLUSION

The project's system implemented in this project can be treated as breath analyser for alcohol detection. To prevent "Drunk and Drive" cases this system is of great importance. This system turns OFF the vehicle engine as soon as alcohol is detected. The system does not start until a master reset is activated by the administrator of the vehicle. This would significantly improve the road safety as well as safety of driver.

## VI. FUTURE SCOPE

The concept presented through this project work can be extended further for vehicle control through cloud as well as for developing autonomous vehicle. The autonomous vehicle may be shifted between manual and auto mode by doing the breath analysis.

For reducing the mis operation of system, we can be able to add a greater number of sensing devices like we can be able to place one camera to top of the steering to detect the drivers eye blinking to check sleepiness of driver.

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