STUDENTS INNOVATION COUNCIL-GITW BENGALURU

FIRST STUDENT TECHNICAL PAPER PRESENTATION GITW-2024

10 June, 2023

2:30 PM - 5:00 PM

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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FIRST STUDENT TECHNICAL PAPER PRESENTATION-GITW 2024

Visvesvaraya Technological University

Jnana Sangama, Belagavi-590 014, Karnataka, India

On 10th June 2024

A Report Prepared

By

STUDENTS INNOVATION COUNCIL-GITW BENGALURU

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Innovate, Collaborate and Create.

First Student Technical Paper Presentation -GITW 2024

True innovation is a collaborative explosion, creating a bundle of ideas that illuminate the path of progress!!

Students Innovation Council-GITW is Organizing

One Day Student Technical Paper Presentation.

MONDAY 10 JUNE-2024

FROM 2 PM TO 4 PM

NOTE: Full Technical Paper as per the format should be uploaded on or before 31st May 2024.

Attractive Prize for the Best Paper!

1.Link for Registration for Paper Presentation

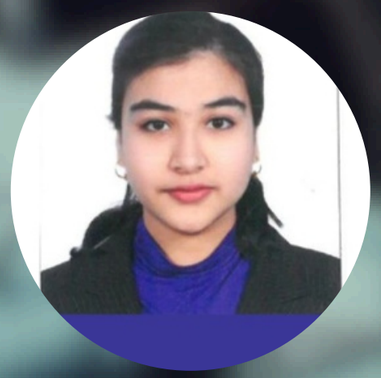
https://forms.gle/66YkQAx4krMDUPHA7

2.Link for downloading Standard Format for Paper Preparation

https://docs.google.com/document/d/1pbF0Klv-O_owljT86keSVYDFyci7UEXp/edit?usp=sharing&ouid=108590563339731126976&rtpof=true&sd=true

3.Link for Paper Submission

https://forms.gle/KFGTiwtc1g9avjYq7



Ms.WAJEEHA KHAN
Student Coordinator, SIC-GITW
For any query contact on +91 9739369207

Ms.ZAINAB TAJ
Student Coordinator, SIC-GITW
For any query contact on +91 7892071153

Mrs.RUKSANA BANU
Assistant Professor
Coordinator, SIC-GITW

Dr.MOHAMMED NAVEED
Assistant Professor
Convener, SIC-GITW

Dr.FAHEEM AHMED KHAN
PRINCIPAL

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PROGRAM SCHEDULE

"First Student Technical Paper Presentation-2024" organised by Department of Computer Science & Engineering on 10-June-2024 from 1:30PM to 4:00 PM.

Program Hosting:	Ms.Wajeeha Khan
Invocation:	Ms.Ayman Siddiqa
Welcome Address:	Ms. Wajeeha Khan
Presidential Address:	Dr.Faheem Ahmed Khan, Principal, GITW.
Vote of Thanks:	Ms. Zainab Taj

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First Student Technical Paper Presentation-2024 on 10/06/2024 from 1:30 PM to 4:00PM

S.N	Group No.	USN	Student Name	Guide Name	Schedule	Title of the Paper
1	GROUP 1	1WT23CS034	Rabiya Uzma SA	Dr.HM Parvez Ahmed	1:50 PM to 2:00PM	NANOROBOTES Our Future Medicines
2		1WT23CS050	Umme kaunain			
3		1WT23CS052	Umme kulsum T			
4		1WT23CS015	Chandana Hegde			
5	GROUP 2	1WT23CS020	Farheen Firdous	Dr.Mohammed Naveed	2:00 PM to 2:10PM	Effect of Heat Treatment on Ultimate Tensile Strength of Metal Matrix Composites
6		1WT23CS003	Ayman Siddiqa			
7		1WT23CS009	Asfiya Fathima			
9	GROUP 3	1WT23CS056	Wajeeha khan	Dr.Zaheerudin S P	2:10 PM to 2:20PM	RADIO ASTRONOMY
10		1WT23CS001	Afiya Zuha			
11		1WT23CS014	Bushra Fatima			
13	GROUP 5	1WT23CS012	Shaik Aatika Kulsum	Dr.Zaheerudin S P	2:20 PM to 2:30PM	Design and Development of a multi-purpose Low-cost Mobile Robot
14		1WT23CS047	Tasmiya Fathima			
15		1WT23CS043	Simran			
16	GROUP 6	1WT23CS058	Zainab Taj	Dr.Zaheerudin S P	2:30 PM to 2:40PM	STELLAR EVOLUTION
17		1WT23CS036	Ruchitha .P			
18		1WT23CS037	Sana Munir			

S.N	Group No.	USN	Student Name	Guide Name	Schedule	Title of the Paper
19	GROUP 7	1WT23CS026	Kulsum F	Dr.Zaheerudin S P	2:40 PM to 2:50PM	THE NORTHERN LIGHTS OF OUR SKY
20		1WT23CS039	Saniya Subhan			
21		1WT23CS047	Tasmiya Fathima KA			
22		1WT23CS014	Varshini VH			
23	GROUP 9	1WT23CS038	Sandhya Devi	Dr.Zaheerudin S P	2:50 PM to 3:00PM	PHYSICS FOR ANIMATION
24		1WT23CS036	Ruchitha .P			
25		1WT23CS058	Zainab Taj			
26	GROUP 10	1WT23CS020	Farheen Firdous	Dr.HM Parvez Ahmed	3:00 PM to 3:10PM	RHODAMINE B
27		1WT23CS058	Zainab Taj			
28		1WT23CS042	Sidra Kaleem			
29		1WT23CS030	N.Zoya			
30	GROUP 11	1WT23CS016	Deekshita P	Mrs. Shahuriya Khanum	3:10 PM to 3:20PM	5G TECHNOLOGY AND ITS IMPACT ON CONNECTIVITY
31		1WT23CS048	Tejaswini			
32	GROUP 12	1WT23CS043	Simran	Dr.HM Parvez Ahmed	3:20 PM to 3:30PM	The role of Nanographene as an Electrode Materials in Li-ion Batteries-Synthesis, Characterization and fictionalization
33		1WT23CS030	N Zoya			
34		1WT23CS013	Bindu D G			

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STUDENTS INNOVATIVE COUNCIL-GITW BENGALURU

Minutes of Meeting

SIC-GITW/MOM/3rd June-2024

Attendees:

S.N	Name	Designation	Signature
1.	Dr. Mohammed Naveed	Convener, SIC-GITW	
2	Mrs. Ruksana Banu	Co-ordinator, SIC-GITW	
3	Ms. ASFIYA FATHIMA	Student Member	
4	Ms. AFIYA ZUHA	Student Member	
5	Ms AYMAN SIDDIQA	Student Member	
6	Ms. BUSHRA FATIMA	Student Member	
7	Ms. FARHEEN FIRDOUS	Student Member	
8	Ms. RABIYA UZMA S. A.	Student Member	
9	Ms. SARA SALITH	Student Member	
10	Ms. UMME KAUNAIN HURERA	Student Member	
11	Ms. UMME KULSUM T	Student Member	
12	Ms. WAJEEHA KHAN	Student Member	
13	Ms. ZAINAB	Student Member	

Agenda:

1. Introduction and Welcome
2. Discussion of Event Ideas
3. Announcement of Next Meeting

Meeting Proceedings:

Introduction and Welcome

The meeting was called at 9.50 PM by Convener, SIC-GITW. All attendees were welcomed, and the agenda was approved.

Discussion of Event Ideas

2nd Event: Student Paper Presentation on 10th June 2024.

The Discussion for the next event i.e Technical Paper Presentation was called by Dr. Mohammed Naveed. Making of E-Certificates, Posters and Making Google forms was said to taken up by the club Members. The IEEE Format was discussed and to review the Reports made by the participants was taken up by Ms. Zainab and Ms. Sara Salith. The Videography Ideas which consume less storage like Zoom or Google Meet was said to bring in.

The meeting concluded with vote of thanks by Dr. Mohammed Naveed, Assistant Professor, Dept. of Mechanical Engineering.

Announcement of Next Meeting.

The next meeting is scheduled on 7th June 2024.

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STUDENTS INNOVATIVE COUNCIL-GITW BENGALURU

Minutes of Meeting

SIC-GITW/MOM/7th June-2024

Attendees:

S.N	Name	Designation	Signature
1.	Dr. Mohammed Naveed	Convener, SIC-GITW	
2	Mrs. Ruksana Banu	Co-ordinator, SIC-GITW	
3	Ms. ASFIYA FATHIMA	Student Member	
4	Ms. AFIYA ZUHA	Student Member	
5	Ms AYMAN SIDDIQA	Student Member	
6	Ms. BUSHRA FATIMA	Student Member	
7	Ms. FARHEEN FIRDOUS	Student Member	
8	Ms. RABIYA UZMA S. A.	Student Member	
9	Ms. SARA SALITH	Student Member	
10	Ms. UMME KAUNAIN HURERA	Student Member	
11	Ms. UMME KULSUM T	Student Member	
12	Ms. WAJEEHA KHAN	Student Member	
13	Ms. ZAINAB	Student Member	

Agenda:

1. Introduction and Welcome
2. Discussion of Event Ideas
3. Announcement of Next Meeting

Meeting Proceedings:

Introduction and Welcome

The meeting was called at 10.50 PM by Convener, SIC-GITW. All attendees were welcomed, and the agenda was approved.

Discussion of Event Ideas

The work related to the events which were discussed last week was assigned to each of them.

2nd Event: Student Paper Presentation on 10th June 2024.

As per the Programme of schedule, Ms. Wajeeha Khan will be spearheading the hosting, Ms. Aiyman Siddiqua will be leading the invocation, Ms. Farheen Firdous and Ms. Rabiya Uzma will be managing the preparation of Google Docs. Ms. Afiya Zuha and Ms. Bushra Fathima will be responsible for the preparation of E-Certificates. Ms. Ayman Siddiqua, Ms. Kaunain Hurera, and Ms. Umme Kulsum T will be handling the video files and photographs. Ms. Zainab will deliver the vote of thanks.

The meeting concluded with vote of thanks by Mrs. Ruksana Banu, Assistant Professor, Dept. of CSE.

Announcement of Next Meeting.

The next meeting is scheduled on 12th June 2024.

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STUDENTS INNOVATIVE COUNCIL-GITW BENGALURU

STUDENTS FIRST TECHNICAL PAPER PRESENTATION-GITW 2024

Introduction:

Technical paper presentations play a crucial role in advancing knowledge, fostering professional development, promoting collaboration, gaining recognition, and contributing to the academic and professional growth of individuals and communities within various disciplines.

Student technical paper presentations are significant for several reasons:

1. Skill Development: Presenting a technical paper hones essential skills like public speaking, research communication, and academic writing. These skills are crucial for future careers in academia, research, or industry.

2. Knowledge Dissemination: It allows students to share their research findings, innovations, or ideas with peers and experts in their field. This contributes to the overall body of knowledge and fosters intellectual exchange.

3. Feedback and Critique: Presenting a paper offers an opportunity to receive constructive feedback from peers and mentors. This helps students refine their work, identify areas for improvement, and gain insights from different perspectives.

4. Networking: It provides a platform for students to network with professionals, researchers, and fellow students who share similar interests. Networking can lead to collaborations, mentorship opportunities, and exposure to new ideas and research directions.

5. Career Advancement: Participation in paper presentations enhances a student's academic and professional profile. It demonstrates their ability to conduct research, communicate effectively, and engage with scholarly communities, which are attractive qualities to potential employers or graduate schools.

6. Confidence Building: Presenting a paper in front of an audience improves confidence and presentation skills. It prepares students for future presentations, conferences, and job interviews where effective communication is crucial.

7. Recognition and Awards: Many conferences and symposiums recognize outstanding student presentations with awards or scholarships. Winning such accolades can boost a student's confidence and provide recognition for their hard work.

Overall, student technical paper presentations play a vital role in academic and professional development by fostering learning, collaboration, and the dissemination of innovative ideas. They prepare students for future challenges and opportunities in their chosen fields.

Distinguished guests seated on the platform

Dr. Faheem Ahmed Khan, Principal of GITW; Dr. Mohammed Naveed, Assistant Professor in the Department of Mechanical Engineering and the Convener of the event; Mrs. Ruksana Banu, Assistant Professor in the Department of Computer Science & Engineering and the Coordinator of the event and Mrs.Farha Mubeen, Assistant Professor in the Department of Computer Science & Engineering and the Judge for the event They are observed on the stage.

The event was overseen by student member Ms. Wajeeha Khan.

WK : Good afternoon,

I am Wajeeha Khan, SIC student member. I am delighted to welcome you all to today's event on STUDENTS FIRST TECHNICAL PAPER PRESENTATION GITW 2024. Let's invoke the event by the blessing of almighty. I'd Like to invite Ayman Siddiqa to lead us in prayer.

Event's invocation by student member Ms. Ayman Siddiqa.

The event's invocation was conducted by student member Ms. Ayman Siddiqa, who recited Surah-Al-Fateha from the Holy Quran.

I seek refuge in Allah from Satan, the accursed.

In the name of Allah, the Entirely Merciful, the Especially Merciful. Praise be to Allah, the Lord of all the worlds. The Entirely Merciful, the Especially Merciful, Sovereign of the Day of Recompense. You alone we worship, and You alone we ask for help. Guide us on the Straight Path, the path of those who have received Your grace; not the path of those who have brought down wrath upon themselves, nor of those who have gone astray.

Welcome address delivered by Ms. Wajeeha Khan.

WK : We are honored to have with us our esteemed Principal, Dr. FAHEEM AHMED KHAN, our respected judge, Mrs. FARHA MUBEEN, our convener of SIC GITW Dr. MOHAMMED NAVEED, our Coordinator SIC GITW, Mrs. RUKSANA BANU and all our talented freinds.

A special welcome goes to our student members who are taking part in presenting their technical paper. Your dedication and hard work are truly commendable. Your presence is greatly appreciated. Thank you for joining us. Let's have a wonderful and inspiring event.

Now we have presidential address by our Principal, Dr. Faheem Ahmed Khan.

Presidential Address:

Presidential address by Dr. Faheem Ahmed Khan, Principal GITW.

Thank you sir for your valuable presidential address.

WK : We have paper presentation by Group 1: Rabiya Uzma, Umme kaunain, Umme kulsum T and Chandana Hegde.

We have paper presentation by Group 2: Farheen Firdous, Ayman siddiqa and AsfiyaFatima .

We have paper presentation by Group 3: Wajeeha Khan, Afiya Zuha & Bushra Fatima.

We have paper presentation by Group 5: Sheik Aatika Kulsum, Tamiya Fatima & Simran.

We have paper presentation by Group 6: Zainab Taj, Sana Munir & Ruchitha P.

We have paper presentation by Group 7: Kulsum F, Saniya Subhan, Tamiya Fatima & Varshini VH

We have paper presentation by Group 9 : Sandhill Devi, Ruchitha P & Zainab Taj.

We have paper presentation by Group 10 : Farheen Firdous, Zainab Taj & Sidra Kaleem.

We have paper presentation by Group 11 : Deekshita P & Tejaswini

And lastly We have paper presentation by Group 12: N Zoya, Simran & Bindu G.


GPS Map Camera
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Long 77.60683°


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NORTHERN LIGHTS


5G TECHNOLOGY AND ITS IMPACT
5G


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"Animating Reality:
The Physics Behind
Captivating Animation"
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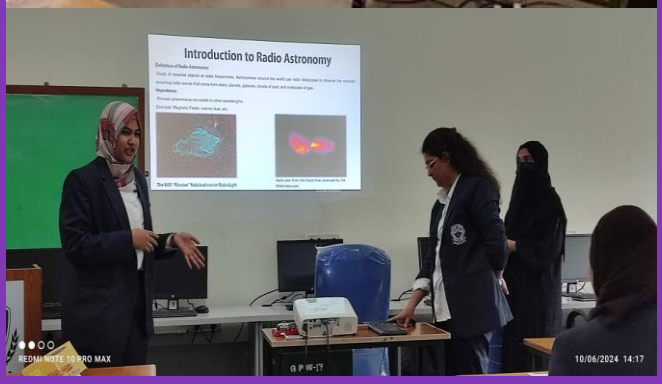

Glimpse of students presenting their technical paper.

As we come to the end of the event, it's time to express our gratitude. I request Zainab Taj SIC member To deliver vote of thanks.

Vote of Thanks:

Vote of Thanks by student member Ms. Zainab Taj.

Good afternoon, everyone

As we draw this wonderful program to a close, it is my honour and privilege to deliver the vote of thanks. This event would not have been possible without the collective effort of many dedicated individuals. Allow me to express my gratitude to all those who contributed to making this occasion a grand success.

First and foremost, I would like to express my deepest gratitude to our esteemed Principal, Dr. Faheem Ahmed Khan for his unwavering support and guidance. Your vision and leadership are the cornerstones of our institution. Thank you for always being a pillar of strength and inspiration.

A heartfelt thank you to our Convener Dr. Mohammed Naveed, and Coordinator Mrs. Ruksana Banu, for their meticulous planning and flawless execution. Your dedication and hard work behind the scenes have ensured that every aspect of this event ran smoothly. I truly appreciate your tireless efforts and commitment.

A special Thanks to our student Members of innovative club who worked diligently to make this event a success. Your enthusiasm, creativity, and hard work have added immense value to this program. Thank you for your active participation and for embodying the spirit of teamwork and collaboration.

To the faculty and other staff members, your support and cooperation have been invaluable. Whether it was through providing logistical assistance, sharing your expertise, or simply being there to lend a helping hand, your contributions have made a significant difference. We are grateful for your unwavering support.

I thank all the participants for presenting their technical paper. Your enthusiasm and engagement are what make these events truly special. Your energy and curiosity are the lifeblood of our institution, and we thank you for making this event lively and memorable.

And last but certainly not least, once again I want to express my sincere thanks to each and every one of you for your invaluable contributions and for making this event a resounding success. It is through our collective efforts that we are able to achieve such wonderful outcomes. Let's continue to work together, support one another, and strive for excellence in all our future events.

Thank you all once again, and I hope you have a great day ahead.

Group photo of Students Innovation Council-GITW.

Dr. Mohammed Naveed, Assistant Professor in the Department of Mechanical Engineering and the Convener of the event; Ms.Ayman Siddiqa, Ms.Sara Salith, Ms Afiya Zuha, Ms. Umme Kaunain Hurera, Ms. Rabiya Uzma, Ms.Farheen Firdose, Ms.Umme Kulsum T , Ms.Wajeeha Khan, Ms.Zainab Taj and Mrs. Ruksana Banu, Assistant Professor in the Department of Computer Science & Engineering and the Coordinator of the event (from left clockwise).

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Attendance Report for the event "First Student Technical Paper Presentation-2024" organised by Department of Computer Science & Engineering on 10-June-2024 from 1:30PM to 4:00 PM.

Second Semester B Section Physics Cycle

S.N	USN	Name of the Candidate	Signature
1	1WT23CS001	AFIYA ZUHA	Afiya Zuha
2	1WT23CS002	AISHWARYA PATIL	Aishwarya
3	1WT23CS003	AYMAN SIDDIQA	Ayman Siddiqa
4	1WT23CS004	AKSHAYA J.R.	Akshaya. J.R.
5	1WT23CS005	ALMAS ANJUM	
6	1WT23CS006	AMEENA A. SYED	
7	1WT23CS007	AMEENA TAJ	Ameena. Taj
8	1WT23CS008	APOORVA H.M.	
9	1WT23CS009	ASFIYA FATHIMA	Asfiya
10	1WT23CS011	AYESHA QURATUL AIAN	
11	1WT23CS013	BINDU D. GUDLAR	
12	1WT23CS014	BUSHRA FATIMA	
13	1WT23CS015	CHANDANA HEGDE P.	Chandana Hegde. P
14	1WT23CS020	FARHEEN FIRDOUS	
15	1WT23CS021	JYOTHI BASAVARAJ KADAKOL	
16	1WT23CS022	KAVITHA J.A.	Kavitha. J.A
17	1WT23CS025	KEERTHI P.	
18	1WT23CS027	MALLIKA N.	
19	1WT23CS028	MANASA S.	Manasa. S
20	1WT23CS029	MEGHA G.	
21	1WT23CS030	N. ZOYA	
22	1WT23CS032	POOJA RAOSAHEB JADHAV	
23	1WT23CS033	PRIYA	
24	1WT23CS034	RABIYA UZMA S. A.	
25	1WT23CS038	SANDIYADEVI V.	Sandiya devi
26	1WT23CS040	SARA SALITH	

27	1WT23CS042	SIDRA KALEEM	Sidra Kaleem
28	1WT23CS045	SOUBHAGYA	
29	1WT23CS049	TEJASHWINI KALLAPPA JAMBALAGI	
30	1WT23CS050	UMME KAUNAIN HURERA	
31	1WT23CS051	UMME KULSUM d/o Adil Pasha	Kulsum
32	1WT23CS052	UMME KULSUM d/o Tahreem Pasha	
33	1WT23CS056	WAJEEHA KHAN	
34	1WT23CS057	ZABRAIN TARANNUM	Zabrain Tarannum
35	1WT23CS059	ZUHA ZAMAN	
36	1WT23IS003	DIVYASHREE E.	
Second Semester A Section Chemistry Cycle			
37	1WT23CS010	ASHWINI	
38	1WT23CS012	BHOOMIKA M.	
39	1WT23CS016	DEEKSHITHA P.	Deekshitha.P
40	1WT23CS017	DEEPTHI SRINIVASA	Deepthi
41	1WT23CS018	DHANUSHREE R.	Dhanushree.R
42	1WT23CS019	DISHA B.G.	Disha
43	1WT23CS023	KAVYA N.	
44	1WT23CS024	KEERTHANA T.R.	Keerthana.T.R
45	1WT23CS026	KULSUM F.	Kulsum.F
46	1WT23CS035	RANJITHA N.S.	Ranjitha N.S.
47	1WT23CS036	RUCHITHA P.	Ruchitha.P
48	1WT23CS037	SANA MUNIR	
49	1WT23CS039	SANIYA SUBHAN	Saniya
50	1WT23CS041	SHARADA KUMARI J.	Sharada
51	1WT23CS043	SIMRAN	Simran
52	1WT23CS044	SIRI A.C. NAIK AC	
53	1WT23CS046	SUPRITA GURU NAIK	Supritha
54	1WT23CS047	TASMIYA FATHIMA KHANUM AZEEZ	Tasmiya
55	1WT23CS048	TEJASHWINI	Teju
56	1WT23CS053	VARSHITHA A.S.	Varshitha A.S
57	1WT23CS054	VIJAYA LAKSHMI R.	Vijayalakshmi R.

58	1WT23CS055	VYSHALINI	Vyshalini
59	1WT23CS058	ZAINAB TAJ	
60	1WT23IS001	ANKITHA GURU G.K. AB	
61	1WT23IS002	CHANDANA T. AB	
62	1WT23IS004	INDUMATHI R. AB	
63	1WT23IS005	JYOTHI MANJUNATH GULYANAVAR	Jyothi
64	1WT23IS006	KEERTHANA R.	Keerthana.R
65	1WT23IS007	MEHAK TAJ	Mehak Taj
66	1WT23IS008	MONIKA R.	Monika.
67	1WT23IS009	PRARTHAVI S.P.	Prarthavi S.P.
68	1WT23IS010	RITU V. CHETTY AB	
69	1WT23IS011	SARITHA A.	Saritha
70	1WT23IS012	SHAIK AATIKA KULSUM	Aatika
71	1WT23IS013	SUSHMITHA R.	
72	1WT23IS014	VARSHINI V.H.	Varshini. V. H

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Certificate of Participation

This is to Certify that Ms. Farheen Firdous Engineering Student in the Department of Computer Science , Ghousia Engineering College has participated in **First Student Technical Paper Presentation 2024,** organised by the Department of Computer Science and Engineering held on **10-June-2024.** This certificate is awarded in recognition of his/her active involvement and contribution to the event.

Mrs.Ruksana Banu
Coordinator, SIC

Dr.Mohammed Naveed
Convenor, SIC

Dr. Faheem Ahmed Khan
Principal

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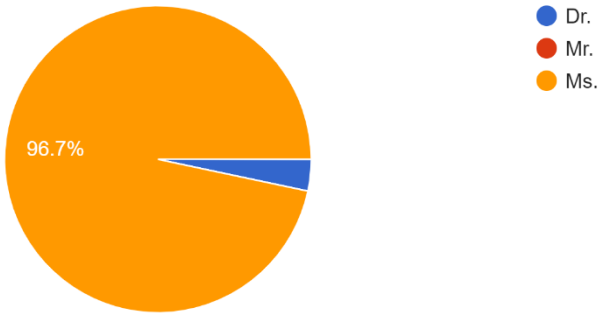
Title

30 responses



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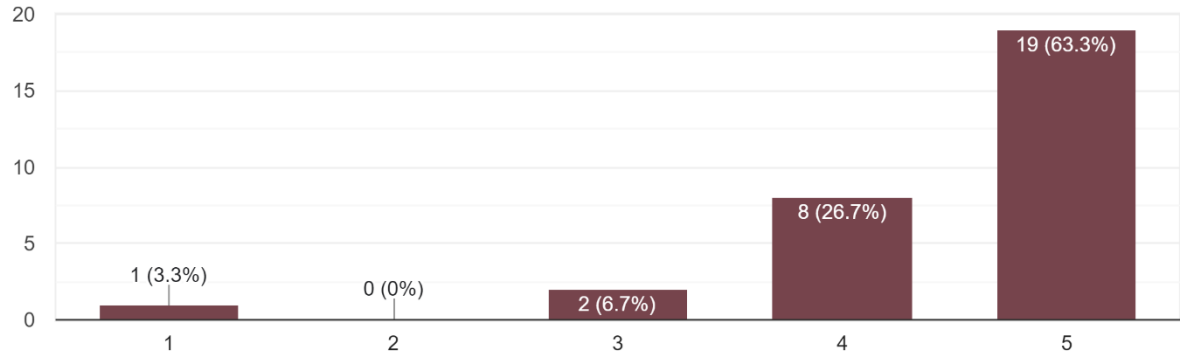

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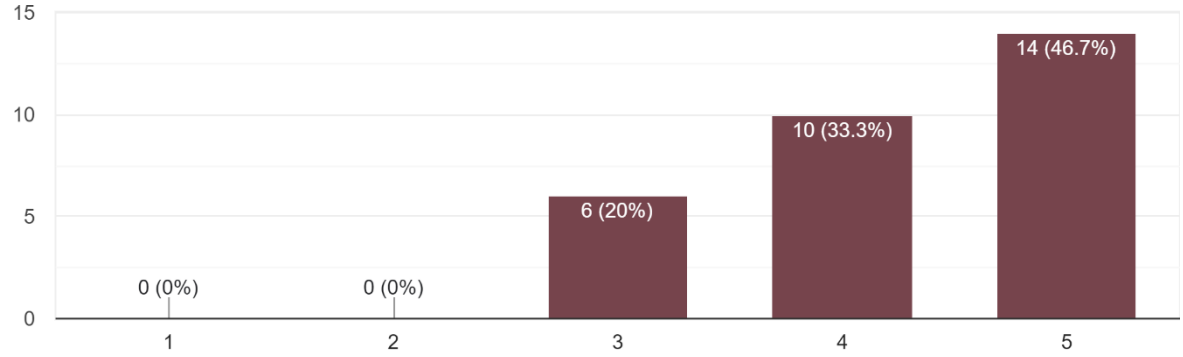

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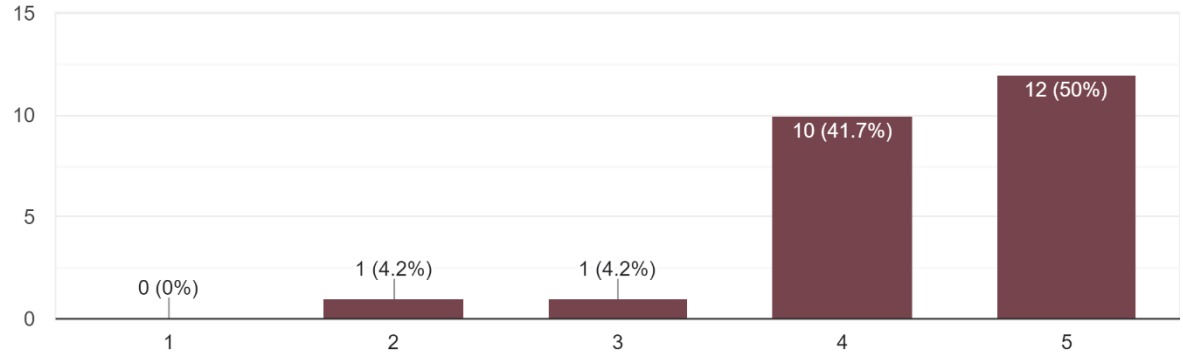

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SIC/GITW/10th May-24/ Ref.No:

To:

Mrs. Farha Mubeen
Assistant Professor, Dept. CSE
GITW-Bangalore 560029.

I hope this letter finds you in good health and high spirits. I am writing to extend an invitation to you to act as a judge for the "**FIRST STUDENT TECHNICAL PAPER PRESENTATION-GITW 2024"** scheduled on 10/06/2024 from 2:00 PM to 4:00 PM.

The technical paper presentation is an integral part of our college annual GIT FEMINA 2024 event, providing a platform for students to showcase their research and innovative ideas. Your role as a judge would involve assessing the content, presentation skills, and technical proficiency demonstrated by the participants. A detailed agenda and judging criteria will be provided prior to the event to ensure clarity and transparency in the evaluation process.

Your confirmation of participation at your earliest convenience would be greatly appreciated. Please let us know if you have any specific requirements or preferences that we should accommodate.

Thank you for considering this invitation. We sincerely hope that you will honor us with your presence and contribute to the success of our event. Should you have any questions or require further information, please do not hesitate to contact.

Looking forward to your positive response.

Dr. Faheem Ahmed Khan

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Justification Parameters:			
Group No & Title of Paper			
S.N	**Parameters**	**Max.Marks**	**Marks Allotted**
1	Presentation Skills (Communication skill, body language etc.,)	30	
2	Subject Knowledge	10	
3	Overall Presentation	10	
4	Total Marks	**50**	
Group No & Title of Paper			
S.N	**Parameters**	**Max.Marks**	**Marks Allotted**
1	Presentation Skills (Communication skill, body language etc.,)	30	
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4	Total Marks	**50**	
Group No & Title of Paper			
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1	Presentation Skills (Communication skill, body language etc.,)	30	
2	Subject Knowledge	10	
3	Overall Presentation	10	
4	Total Marks	**50**	
Name & Signature of the judge			

NANOROBOTS

Dr Parvez Ahmed[1], Rabiya Uzma Sa[2], Umme Kaunain Hurera[3], Umme Kulsum T[4], and Chandana Hegde[5]

[1] Head of Department chemistry, VTU/GITW-Bengaluru, Karnataka, India.
[2, 3, 4, 5] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.
rabiyauzma21@gmail.com[2], Ummekaunain06@gmail.com[3], smamatha5686@gamil.com[4], ummekulsum10122004@gmail.com[5]

ABSTRACT

Nanorobotics offers an emerging frontier in biomedicine, holding the potential to revolutionize diagnostic and therapeutic applications through its unique capabilities in manipulating biological systems at the nanoscale. Following PRISMA guidelines, a comprehensive literature search was conducted using IEEE Xplore and PubMed databases, resulting in the identification and analysis of a total of 414 papers. The studies were filtered to include only those that addressed both nanorobotics and direct medical applications. Our analysis traces the technology's evolution, highlighting its growing prominence in medicine as evidenced by the increasing number of publications over time. Applications ranged from targeted drug delivery and single-cell manipulation to minimally invasive surgery and biosensing. Despite the promise, limitations such as biocompatibility, precise control, and ethical concerns were also identified. This review aims to offer a thorough overview of the state of nanorobotics in medicine, drawing attention to current challenges and opportunities, and providing directions for future research in this rapidly advancing field.

Keywords: Nanomaterial, nanotechnology, nanorobotics, blood clotting, cancer, corona virus

I. INTRODUCTION

Nanorobotics, a field merging nanotechnology with teleoperated and autonomous robotics, presents ground breaking solutions that are unattainable with conventional robotics. A nanorobot, also known as a nanomachine, is a miniature mechanical or electromechanical device designed to perform specific tasks at the nanoscale level. Contrary to nanorobotics, nanoparticles are tiny particles with unique properties, used for applications like drug delivery. Nanorobotics involves designing molecular-scale robots for tasks such as targeted medical procedures. The former is about passive materials, while the latter introduces active, controllable machines at the nanoscale. These miniature robots, due to their size, offer unique opportunities for operations at molecular and cellular levels.

The trend toward miniaturization in medical robotics has been gathering considerable momentum, and the potential impacts of this trend on the field of biomedicine are profound. Beyond the realm of macroscale medical robotics, the exploration of small-scale medical robotics, ranging from several millimetres down to a few nanometres in all dimensions, has intensified. These micro and nanoscale robots have been investigated for diverse biomedical and healthcare applications, including single-cell manipulation and biosensing, targeted drug delivery, minimally invasive surgery, medical diagnosis, tumour therapy, detoxification, and more.

By providing innovative ways to interact with biological systems at the cellular level, nanorobots promise to revolutionize various sectors of medicine, from diagnostics to treatment. The unique capabilities of nanorobots have opened up a new paradigm for problem-solving in biomedicine, enabling innovative approaches to challenges that were previously insurmountable. The potential to precisely manipulate biological materials at a cellular level has expanded the horizons of diagnostic and therapeutic procedures, bringing forth solutions that are more targeted, efficient, and minimally invasive.

This paper conducts a systematic review of the use of nanorobots in the medical field, with a specific focus on their applications and limitations in cancer treatment, dentistry, and cell therapy. We recognize that the field is continually evolving, and while our focus is on these three areas at present, the scope of this review could be adjusted to encompass emerging trends and breakthroughs. Through this exploration, we aim to provide a comprehensive overview of the current state of nanorobotics in medicine, trace the trajectory of this transformative technology, and highlight key challenges and potential solutions, providing direction for future research in this exciting and rapidly developing field.

A. Nanomaterials

Nanomaterials refers to a material at least one of its dimensions is in nanoscale and their size varies from1-100nm Nanomaterials are having three-dimensional structure shows different physical, optical, electrical

and magnetic properties when compare to bulk materials. 1nm = 10^{-9} m or one millionth of diameter of human hair.

B. Nanotechnology

Nanotechnology is the science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometres.

Richard P. Feynman said "

"There are plenty of rooms at the bottom"

If we arranged the atoms in coal we can make the diamond"

"*if we arranged the atoms in sand we can make the computer chips"*

"if we arranged the atoms in dirt, water and air we can make the potato"

- Moving atoms and molecules as Feynman envisaged in 1959 till it seems to lie at the heart of all the aspirants. The particle sizes alone constituting the parameter for distinguishing chemistry from nanoscience Condensed matter of physicist, Material scientist and many 'born again' chemist have converted to new religion of Nanotechnology

C. History Of Nanotechnology

"Nanotechnology is an art of manipulating matter at the nanoscale"

- 2000 year ago, Greeks and Romans were used Sulphide Nanocrystals to dye hair
- 1000 ears ago Gold Nanoparticles of different sizes used to produce different colour in stained glass windows
- 1959 -"There are plenty of rooms at the bottom" by R Feynman
- 1974 – Taniguchi uses the term nanotechnology first time
- 1981- Scanning tunnelling microscope was discovered
- 1985 –Bucky ball was discovered
- 1986 -AFM was discovered
- 1991 Carbon nanotubes by S. Lijima
- 1999- Nano medicines Book was written by R. Feritas
- 2000- "National Nanotechnology initiative "launched

II. NANOROBOTICS

- A Nano robot, then, is a machine that can build and manipulate things precisely at anatomic level.
- Imagine a robot that can pluck, pick and place atoms like a kid plays with LEGO bricks, able to build anything from basic atomic building blocks (C, N, H, O, P, Fe, Ni, and so on).
- While some people dismiss the future of Nano robots as science fiction, you should realize that each of us is alive today because of countless Nano robots operating within each of our trillions of cells
- We give them biological names like a "ribosome," but they are essentially machines programmed with a function like "read messenger RNA to create a specific protein."

A. How Nanorobotics Work?

1.Nano robots are made by using
Bio compatible Nano
Components such metals like
Gold, Silver, Tin etc.
2. organic Proteins,
Polynucleotide are used

Nanorobotics are design along with nanorobotics arms, telescoping Manipulator.

Blue cones in the robot show the sonar that hears "ACOUSTIC WAVES*"*

Nanorobotics get the power directly from blood stream. But due some abstriction in the blood, Energy will get externally by acoustic Signals

Doctor. Keep drag the robots through ultrasound signals during endoscopy/laparoscopy

B. Applications Of Nanorobotics

- Breaking up blood clots.
- Fighting cancer.
- Helping the body clot.
- Parasite removal.
- Breaking up kidney stones.
- Cleaning wounds.

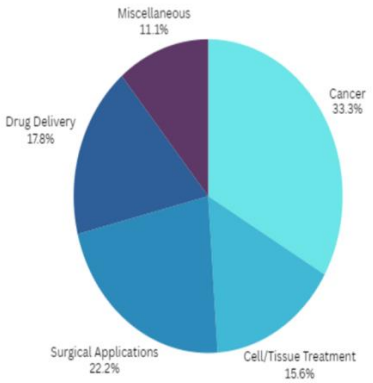


Fig 1. Applications of nanorobotics in medicine

Breaking up blood clots

- Blood clots can cause complications ranging from muscle death to a stroke. Nano robots (also called Nano robots) could travel to a clot and break it up. This application is one of the most complex and sophisticated uses for Nano robots.

- This application is one of the most complex and sophisticated uses for Nano robots. The robot must be able to remove the blockage without losing small pieces in the bloodstream, which could by chance travel somewhere else in the body and cause more problems.

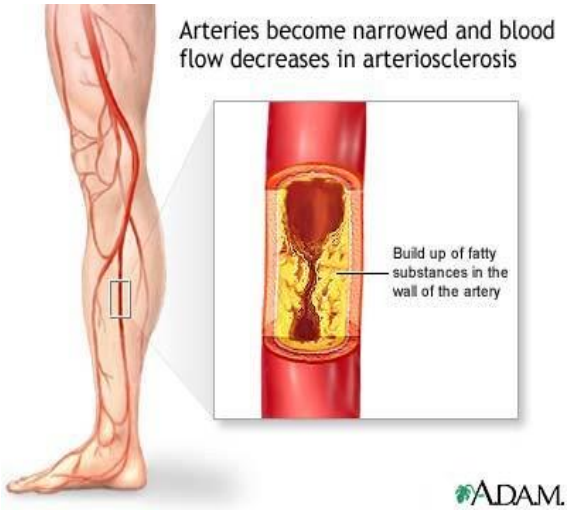


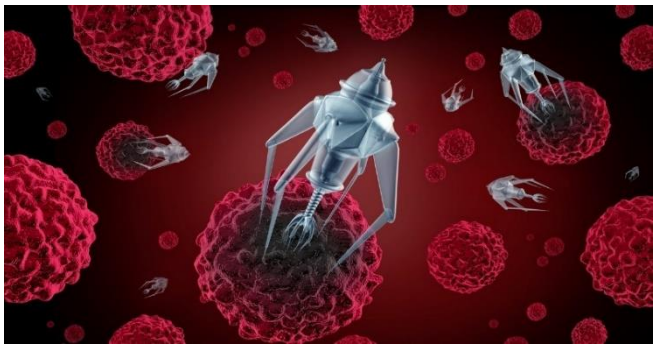
Fig 2. Breaking up of blood clotting

Fighting Cancer

- Doctors hope to use Nano robots to treat cancer patients.
- The robots could either attack tumours directly using lasers, microwaves or ultrasonic signals or they could be part of a chemotherapy treatment, delivering medication directly to the cancer site.
- Doctors believe that by delivering small but precise doses of medication to the patient, side effects will be minimized without a loss in the medication's effectiveness.

Helping the body clot

- One particular kind of Nano robot is the clot to cyte, or artificial platelet.
- The clot to cyte carries a small mesh net that dissolves into a sticky membrane upon contact with blood plasma.
- According to Robert A. Freitas, Jr., the man who designed the clot to cyte, clotting could be up to 1,000 times faster than the Body's natural clotting mechanism.



_ Fig 3. Nanorobots to treat cancer

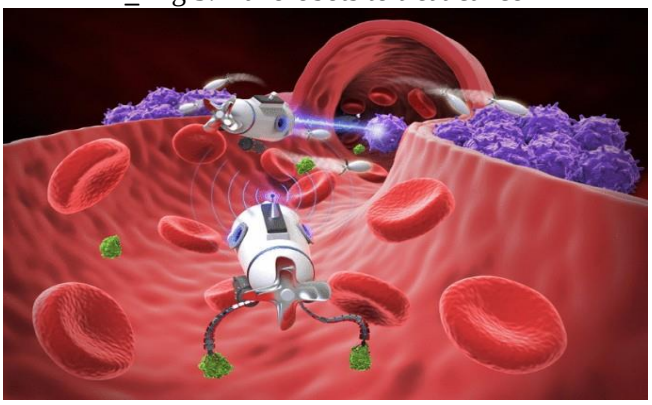


Fig 4. Nanorobots to heal body clotting

Parasite removal

- Nano robots could wage micro-war on bacteria and small parasitic organisms inside a patient. It might take several Nano robots working together to destroy all the parasites.

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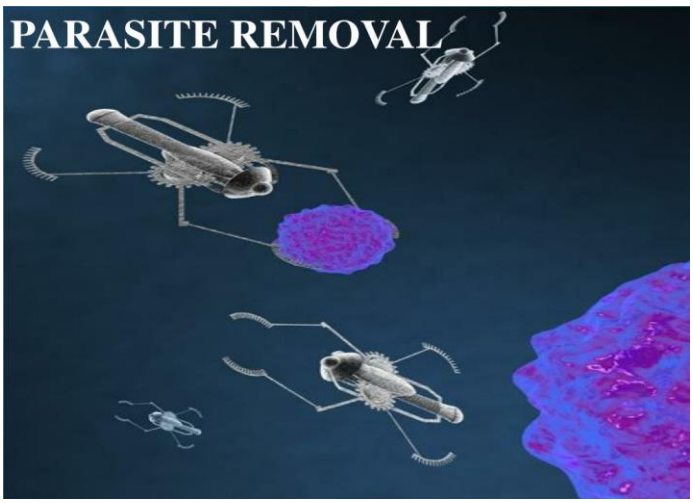

Fig 5. Parasite removal

Breaking up kidney stones

- Kidney stones can be intensely painful the larger the stone the more difficult it is to pass. Doctors break up large kidney stones using ultrasonic frequencies, but it's not always effective.
- A Nano robot could break up a kidney stones using a small laser.

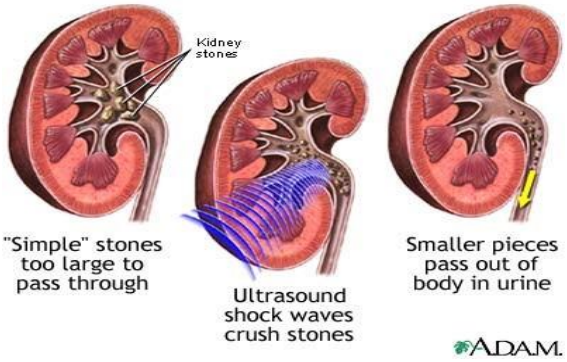

Fig 6. Breaking of kidneys

Cleaning Wounds

- Nano robots could help remove debris from wounds, decreasing the likelihood of infection. They would be particularly useful in cases of puncture wounds, where it might be difficult to treat using more conventional methods.

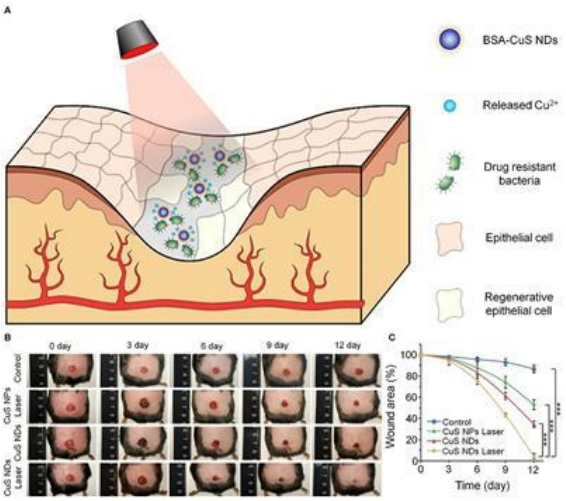

Fig 7. Cleaning wounds

C. SCOPE OF NANOROBOTICS IN FUTUTURE:

Corona virus can also be cured using Nanorobotics in future.

III. CONCLUSION

- Nanotechnology has a lot of advantages in different kinds of activities and becomes more present in our lives.
- The Nano robots are used in heart surgery, due to this the number of risks and side effects behind it is reduced.
- The same technique is used in various treatments like cancer, breaking kidney stones, breaking liver stones, parasite removal only with slight modification.

Within ten years several advanced technologies should be made from this nanorobotics.

- Nanorobotics is an upcoming field interconnecting various areas of science and technology.
- In the future, nanorobots could revolutionize medicine. Doctors could treat everything from heart disease to cancer using tiny robots the size of bacteria, a scale much Smaller than today's robots.
- Robots might work alone or in teams to eradicate disease and treat other conditions. Some believe that semiautonomous nanorobots are right around the Corner -- doctors would implant robots able to patrol a human's body, reacting to any problems that pop up
- The advantages and applications of nanorobots in medicine and engineering technologies outweigh the challenges and hurdles it presents during the development process.
- It is clearly seen from the examples of biological molecular motors and bio nanorobotics that it is difficult but possible to develop such systems.
- Nanorobots have the capacity to precisely release drugs in the body for targeted delivery.
- Nanobots have great potential within the pharmaceutical industry to optimize drug delivery.

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Effect of Heat Treatment on Ultimate Tensile Strength of Metal Matrix Composites

Farheen Firdous[1], Aiyman Siddiqa[2], and Asfiya Fathima[3]
Department of Computer Science & Engineering, GITW/VTU, Bengaluru, Karnataka, India
farheenfirdous2020@gmail.com[1], aiymansiddiqa56@gmail.com[2], asfiyaa682@gmail.com[3]

ABSTRACT

Aluminium alloy-based particulate-reinforced composites have a large potential for a number of engineering applications. Interest in reinforcing Al alloy matrices with ceramic particles is mainly due to the low density, low coefficient of thermal expansion and high strength of the reinforcements and also due to their wide availability. Among the various useful aluminium alloys, aluminium alloy 6061 is typically characterized by properties such as fluidity, castability, corrosion resistance and high strength-weight ratio. This alloy has been commonly used as a base metal for MMCs reinforced with a variety of fibers, particles and whiskers. In recent years, considerable work has been done on graphite reinforced metal matrix composites which exhibit low friction, low wear rate and excellent ant seizing properties. In the light of the above, the present paper aims at developing aluminum-based metal matrix composites and characterize ultimate tensile strength property. Al6061 based composites were prepared by vortex method of liquid metallurgy route, and since the presence of only hard particulate reinforcement in composite leads to poor surface finish and higher tool wear. Therefore, composites were prepared with both hard reinforcement (SiC) and soft reinforcement (Gr). The amount of reinforcement was varied from 2wt% to 4wt% in steps of 2wt% Gr, keeping constant 5wt%SiC.

Keywords: Hybrid metal matrix composites, vortex casting technique, heat treatment, ultimate tensile strength.

I. INTRODUCTION

Metal matrix composites (MMCs) are increasingly becoming attractive materials for advanced aerospace applications because their properties can be tailored through the addition of selected reinforcements. In particular, particulate reinforced MMCs have recently found special interest because of their specific strength and specific stiffness at room or elevated temperatures. It is well known that the elastic properties of metal matrix composites are strongly influenced by micro structural parameters of the reinforcement such as shape, size, orientation, distribution and volume fraction. The introduction of a ceramic material into a metal matrix produces a composite material that results in an attractive combination of physical and mechanical properties which cannot be obtained with monolithic alloys. There is an increasing need for knowledge about the processing techniques and mechanical behavior of particulate MMCs in view of their rising production volumes and their wider commercial applications.

II. METHODS AND MATERIALS

A. Composite Preparation

Al6061 based composites were prepared by vortex method of liquid metallurgy route. A quantity of 3kgs of Al6061 alloy was used each time in an electric melting furnace with graphite crucible for melting with furnace temperature set at 710^0C. Silicon carbide, graphite reinforcements and the permanent molds of cast iron were heated in order to reduce the effect of chilling during solidification. Degassing of the melt was done with commercially available tablets of hexachloroethane (C_2Cl_6). After degassing, the preheated SiC and Gr were added slowly into the vortex while continuing the stirring process up to 10minutes.The amount of reinforcement was varied from 2wt% to 4wt% in steps of 2wt%, keeping constant 5wt%SiC.

B. Evaluation of Ultimate tensile Strength.

Tensile test was performed on all samples of heat treated and unheat treated AL6061 and its hybrid composites using computerized Universal Tensile Machine. The samples were prepared as per ASTM standard.

III. Results And Discussion

A. Al6061 Matrix Alloy and Simple Composite under different Heat Treatment Conditions.

The variation of ultimate tensile load with 5wt% of SiC particles in the matrixAl6061 in as cast condition under different heat treatment conditions is shown in fig.1

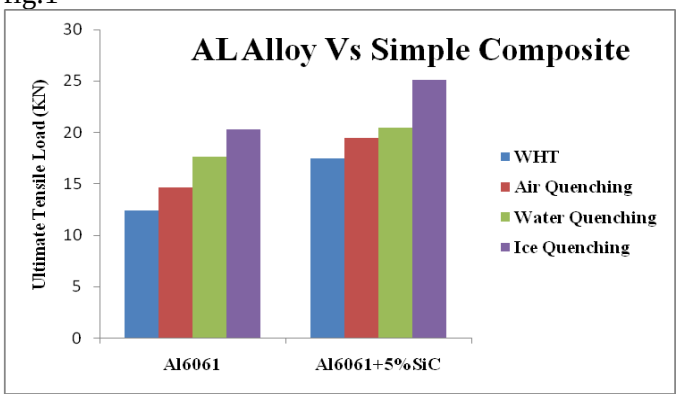


Fig. 1 Variation of ultimate tensile load of Al6061-SiC composites

It is observed that with addition of SiC in the matrix alloy, there is a significant improvement in the ultimate tensile load of the composites. Heat treatment has a profound influence on the ultimate tensile load of the matrix alloy as well as simple composite. An improvement of around 101.9% was observed in Al6061-5wt%SiC composites for ice quenching, when compared with the unreinforced and unheat treated Al6061 matrix alloy.

B. Simple Composite and Hybrid Composites without Heat Treatment

The variation of ultimate tensile load with increased content of Gr from 2wt% to 4wt% in step of 2wt% at constant 5wt% of SiC particles in the matrixAl6061 in as cast condition is shown in fig.2.

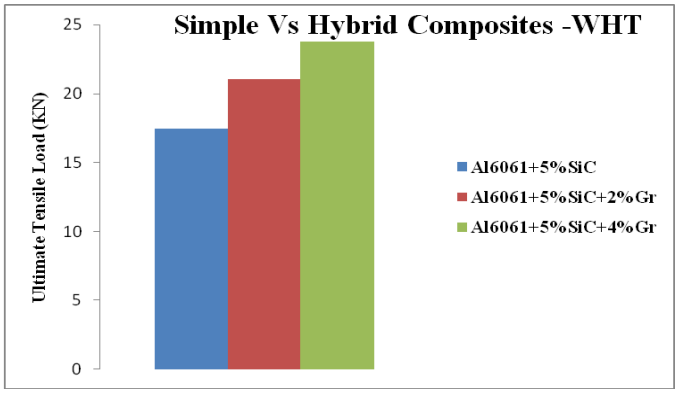
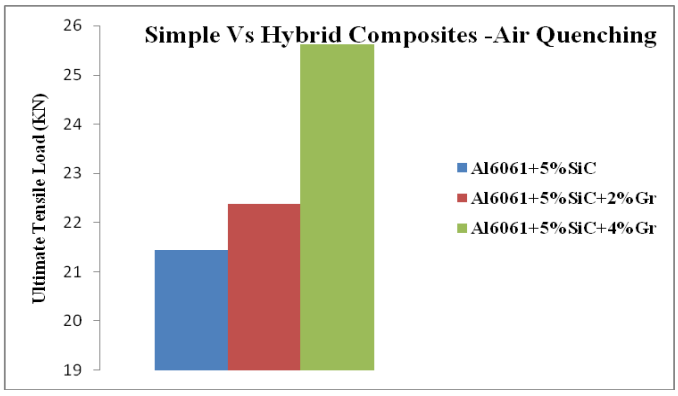


Fig. 2 Variation of ultimate tensile load of Al6061-SiC and Al6061-SiC-Gr composites without heat treatment.

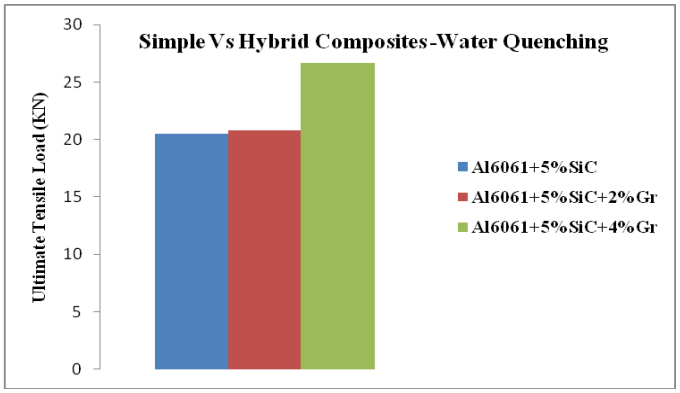
It is observed that with addition of graphite in the matrix alloy, there is a significant improvement in the ultimate tensile load of the composites. In fact, as the graphite content is increased from 2% to 4%, the ultimate tensile load increases by about 36.23% when compared with the Al6061-SiC reinforced Al6061 matrix alloy.

C. Simple Composite and Hybrid Composites under Different Heat Treatment Conditions.

The variation of ultimate tensile load with increased content of Gr from 2wt% to 4wt% in step of 2wt% at constant 5wt% of SiC particles in the matrixAl6061 in as cast condition under different heat treatment conditions with different quenching media is shown in fig. 3 (a-c).



(a)



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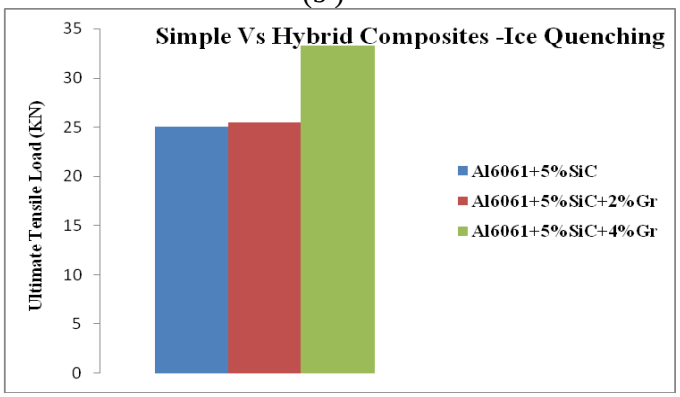

(c)

Fig 3 (a-c) variation of ultimate tensile load of Al6061-SiC and Al6061-SiC-Gr composites under different heat treatment conditions.

It is observed that with addition of graphite in the matrix alloy, there is a significant improvement in the ultimate tensile load of the composites under different quenching medium.

In fact, as the graphite content is increased from 2% to 4%, the ultimate tensile load increases by about 19.49% for air quenching, about 30.2% for water quenching and about 32.53% for ice quenching, when compared with the Al6061-SiC reinforced Al6061 matrix alloy.

The maximum increase in ultimate tensile load of about 90.59% was seen in Al6061-5wt% SiC-4wt% Gr ice quenched hybrid composites, when compared with the unheat treated Al6061-5wt%SiC reinforced composite.

For a solutionising temperature of 530^0C, for duration of 1hr, significantly alters the ultimate tensile load of both the matrix alloy and its composites. Improved ultimate tensile load of the matrix alloy Al6061 and Al6061-SiC composites on heat treatment can be attributed to the formation of intermetallic precipitates namely Mg_2Si during the ageing process of heat treatment. The amounts of precipitates, the size of precipitates are the deciding factors for improvement in mechanical properties. These factors are dominantly controlled by cooling during quenching, which will promote more formation of intermetallic precipitates. Among the quenching media adopted in the present study, water and ice quenching tends to promotes formation of favorable intermetallic precipitates during the ageing process, owing to the rapid cooling process during quenching. This factor supports the experimental results of the present study.

The improvement in ultimate tensile load of composites can be attributed due to hard SiC particulates that impart strength to the matrix alloy, thereby enhancing resistance to tensile stresses. Also, the graphite particulates acting as barriers to dislocations in the microstructure.

This trend is similar with the result of other researchers (reference of A. Ramesha etal, “Effect of Particulate Reinforcements on the Mechanical Properties of Al6061-WC and AL6061-GR MMCs”, Journal of Minerals & Materials Characterization & Engineering, Vol. 10, No 12, pp.1141-1152, 2011 jmmce.org, USA.)

IV. Conclusion

Al6061-SiC-Gr hybrid composites have been successfully produced by vortex method. Addition of SiC in the matrix alloy increases ultimate tensile load of the composites. Also, with addition of graphite in the matrix alloy, there is a significant improvement in the ultimate tensile load of the composites. Heat treatment has a significant effect on ultimate tensile load of Al6061 matrix alloy and its hybrid composites.

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RADIO ASTRONOMY

Wajeeha Khan[1], Afiya Zuha[2], and Bushra Fatima[3]
[1,2,3] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.
Wajeeha.khan1104@gmail.com[1], Afiyazuha9379@gmail.com[2], Srafath2000@gmail.com[3]

ABSTRACT

Astronomy is a fascinating subject because it helps to probe the wonders of universe such as black holes, exploding stars, and colliding galaxies. New discoveries are being made at a rapid pace due to the advanced technology and probes available. While it is possible to appreciate astronomy with images and qualitative descriptions, it helps to gain access to the deeper level of beauty and understanding it using astrophysics with the application of laws of physics to comprehend celestial phenomena it can provide. This not only gives a greater appreciation for the wonders of the universe, but also allows for the perception of hidden regularities and connections among phenomena of the universe.
Keywords: Radiations, Galaxies, Evolution, Magnetism, Cosmic Dust

I. INTRODUCTION

Radio astronomy is a branch of astrophysics that explores the universe through the observation and analysis of radio waves emitted by celestial objects. It detects radio emissions, which can reveal unique information about the cosmos. These emissions come from a variety of sources, including stars, galaxies, black holes, and even the remnants of the Big Bang. The development of radio astronomy began in the 1930s with the work of Karl Jansky, who discovered radio waves emanating from the Milky Way. Since then, radio telescopes have become indispensable tools for astronomers, providing insights into some of the most fundamental questions about the universe's structure, composition, and evolution. One of the key advantages of radio astronomy is its ability to penetrate cosmic dust clouds, which can obscure visible light. This allows astronomers to study regions of the universe that are otherwise hidden from view. Radio waves are not affected by Earth's atmosphere, making it possible to observe celestial objects day and night, regardless of weather conditions. In this paper, an effort is made to delve into the principles of radio astronomy, the technology behind radio Telescopes, and the ways in which radio observations have transformed the understanding of the cosmos.

II. PRINCIPLES OF RADIO ASTRONOMY

Radio astronomy relies on the detection of radio waves emitted by celestial objects. These waves can arise from a variety of physical processes, including thermal radiation from stars, synchrotron radiation from high-energy particles, and molecular transitions in interstellar gas. The primary instrument used in radio astronomy is the radio telescope, which consists of a large, dish-shaped antenna that collects radio waves and focuses them onto a receiver. The receiver amplifies the signals and converts them into electrical currents, which can then be analyzed to produce images and spectra of the observed objects. One of the key concepts in radio astronomy is spectral line emission.

Certain atoms and molecules emit radio waves at specific frequencies, known as spectral lines, which can be used to identify the chemical composition and physical conditions of the emitting gas. For example, the 21-centimeter hydrogen line is commonly used to study the distribution and dynamics of interstellar gas clouds. Radio interferometry is another important technique in radio astronomy, which combines signals from multiple telescopes to achieve higher resolution images. By correlating the signals from different telescopes, astronomers can overcome the limitations of individual telescopes and obtain detailed images of celestial objects.

III. 3.GALACTIC MAGNETIC FIELD

The origin of galactic magnetic fields is explained by two opposing concepts Enrico fermi put forward the hypothesis of relic magnetism which arose shortly after the big bang. In 2006 Japanese astronomers supported this concept after conducting series of studies.

Fig.3.1: Galaxy NGC 5775 and its Magnetic Field are seen together

According to fermi galaxy captured and amplified these magnetic flows resulting in the field we observe today. Astrophysicist Eugene parker explained galactic magnetism by the circular motion of the plasma and galaxies in their clusters later this model of galactic dynamo was developed by other scientists. This work we present the reanalysis of the data in the context of new VLA observations at 8.46 GHz, which allow us to account for the Faraday rotation. The radio sources and pulsars, and polarization of starlight. Within distances of about 500 parsecs from the solar system the magnetic field is directed towards galactic longitude l≈ 45, while at distances extending over a few kilo parsec its average direction is towards l≈ 90. Seen on a large scale the magnetic field in the Galaxy may be directed parallel to the galactic plane and along the spiral arms. The field may consist of a regular component and a random component with small scale variations of about 50 parsec in size. A new, much-improved model of the alactic magnetic field (GMF) is presented. We use the WMAP7 Galactic synchrotron emission map and more than 40,000 extragalactic rotation measures to constrain the parameters of the GMF model, which is substantially generalized compared with earlier work to now include an out-of-plane component and striated-random fields. The new model provides a greatly improved fit to observations. Consistent with our earlier analyses, the best-fit model has a disk field and an extended halo field. Our new analysis reveals the presence of a large, out-of-plane component of the GMF; as a result, the polarized synchrotron emission of our Galaxy seen by an edge-on observer is predicted to look intriguingly similar to what has been observed in external edge-on galaxies. We find evidence that the cosmic-ray electron density is significantly larger than given by GALPROP or else that there is a widespread striated component to the GMF.

Fig.3.2: Data of NGC 5775 Galaxy

The interpretation of these observations has severe limitations: weak polarized signal at 1.49 GHz excludes a reliable determination of Faraday rotation.

Basic properties of NGC 5775 (from LEDA

names	NGC 5775
	UGC 9579
R.A.$_{2000}$	$14^h53^m57\overset{s}{.}6$
Decl.$_{2000}$	$03°32'40\overset{''}{.}0$
type	Sbc
incl.	$86°$ [b]
pos.angl.	$145°$
distance	26.7 Mpc [a]
	$1' \simeq 7.8$ kpc

[a] Dahlem et al. 1995
[b] Irwin 1994

This work we present the reanalysis of the data in the context of new VLA observations at 8.46 GHz, which allow us to account for the Faraday rotation.

I. COSMIC EVOLUTION

Radio astronomy also plays a crucial role in studying the evolution of the universe over cosmic time scales. By observing distant galaxies and quasars, astronomers can probe the early stages of galaxy formation and the growth of supermassive black holes

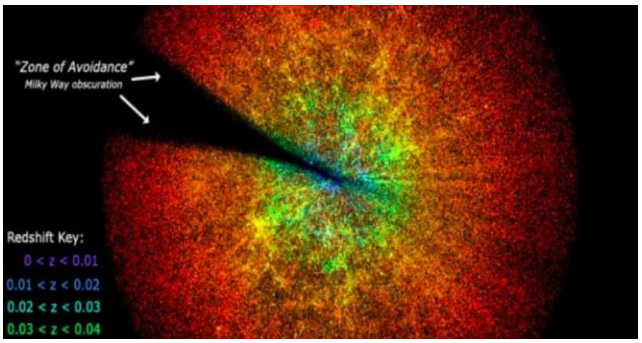

Fig.4: Astronomical Redshift

Furthermore, radio observations of distant galaxies allow astronomers to study the evolution of galaxies over billions of years. By measuring the redshift of radio emissions, astronomers can determine the distance and age of galaxies, providing clues about their formation and evolution. The cosmic microwave background (CMB) provides another remarkable result that is not only consistent with the idea of inflation, but is also highly suggestive that the universe itself could have arisen from nothing via quantum mechanical fluctuations in empty space The largest regions that can have collapsed significantly due to local gravitational attraction at early times are those that are the size of the horizon the distance across which light can have traveled over the time available since the Big Bang. This provides a "ruler" that can be used to determine the geometry of the universe by observing how "big" such regions appear to our measuring apparatus here on earth. If light travels in straight lines, such regions should appear to be about one degree across today. If light were to bend outward as it goes back toward the source, such regions would appear to be smaller than a degree, and if light were to converge as it goes back to the source, such regions would appear to be bigger than a degree across.

II. CONCLUSION

Radio astronomy is a powerful tool for studying the universe's magnetic fields, cosmic evolution, and fundamental physical processes. By combining observational data with theoretical models, astronomers continue to unravel the mysteries of the cosmos, and understanding.

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Design and Development of a multi-purpose Low-cost Mobile Robot

Zaheerudin S P[1], Shaik Aatika Kulsum[2], Tasmiya Fathima K[3], and Simran[4]
[1] Head of Department of Physics, VTU/GITW-Bengaluru, Karnataka, India.
[2,3,4] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.
shaikaatika61@gmail.com[2],tasmiyaazeez1@gmail.com[3],suhanasimran07@gmail.com[4]

ABSTRACT
This paper presents the design and development of a low-cost mobile robot, addressing the need for accessible robotics solutions. By leveraging off-the-shelf components and open-source platforms, the platform aims to democratize robotics technology while maintaining performance. The robot's structure, control system, sensor integration, communication, and user interface are detailed, highlighting its adaptability for research, education, and outreach. Results demonstrate smooth mobility, efficient power usage, precise control, accurate perception, reliable communication, and intuitive user interface. Through continued refinement, low-cost robotics solutions offer potential for widespread adoption and application across industries.

Key words: cost effective, multi-functional

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I . INTRODUCTION

responding to the pressing need for accessible robotics solutions. By leveraging cost-effective components and streamlined manufacturing processes, our aim is to create a platform that democratizes access to robotics techn27ology without compromising performance. Central to our approach is the integration of off-the-shelf components and open-source platforms, allowing for efficient resource utilization and minimizing development costs. Through this endeavor, we seek to bridge the gap between cost and accessibility in robotics, empowering a diverse range ofusers to leverage the benefits of mobile robots for various applications. According to Nikolaus Correll, Bradley Hayes, and Amir Deghani: [1] Mobile robots are integral to the field of robotics, offering versatility in navigating dynamic environments,

II. General Design Considerations

This robotic platform is designed to balance size, cost, and functionality, making it versatile for research, education, and outreach. The size of the robot is optimized to be easily transportable yet capable of accommodating various sensors and processing units. By using off-the-shelf components, we keep costs low while ensuring flexibility in design. The chassis is spacious enough to house a single-board computer and can support additional devices like a laptop or mini PC.

Cost-effectiveness is paramount, aiming to be approximately one-tenth the cost of commercial counterparts. Achieving this involves leveraging inexpensive sensors, actuators, and pre-built bodies, while developing the electronics internally. The use of

This paper embarks on the design and development of a low-cost mobile robot,

small, affordable sensors and the option to utilize a laptop as the main processing unit further reduce costs. Functionality is tailored for multipurpose use across different domains. The robot supports a wide array of sensors and processing units, allowing easy reconfiguration for specific tasks. It is designed for both indoor and outdoor operation, with removable sensors catering to various applications. According to Peter Corke: Mobile Robot Control provides essential algorithms for controlling mobile robots, vital for their effective operation. This approach ensures adaptability and versatility in tackling diverse research, educational, and outreach activities.

Fig-1:Monitoring and Controlling the Multi Mobile Robot in Outdoor

III BASIC STRUCTURE

According to Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki, and Sebastian Thrun [3]. Mobile Robot Control Architectures delves into the fundamental concepts shaping the control strategies of mobile robots. The robot structure revolves around its chassis, akin to a skeleton providing the framework for other components. This chassis accommodates wheels or tracks for locomotion and houses the internal parts securely. Power is sourced from a rechargeable battery, supported by a charging circuit to maintain its charge, and a power distribution system ensures all components receive adequate power.

At the heart of the control system lies a microcontroller or single-board computer, akin to the robot's brain, overseeing movement and behavior. Motor drivers regulate wheel or track movement, while a sensors interface connects various sensors to the microcontroller, facilitating environmental perception.

The robot employs an array of sensors for environmental awareness: ultrasonic sensors for obstacle detection, cameras for visual input, LiDAR for mapping, and an IMU for motion and balance sensing. According to Alonzo Kelly and Vladimir Sukhoy [4] Sensors play a pivotal role in mobile robotics, Communication is facilitated through wireless modules like Wi-Fi or Bluetooth, enabling interaction with other devices or remote control. Software, including an operating system and robot control software, interprets sensor data for informed responses.

Fig-2 : Finding metal ore

A user interface allows human interaction, ranging from simple button-and-light interfaces to smartphone apps or remote controls. Additional features, such as LEDs for status indication, buzzers for auditory feedback, or supplementary sensors, augment the robot's capabilities based on its intended application. Together, these components synergize to enable the robot to navigate, perceive, and execute tasks efficiently while maintaining cost-effectiveness.

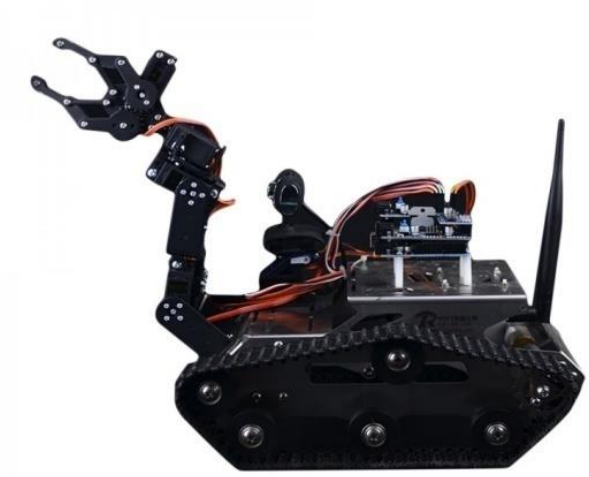

Fig-3:WIFI Mobile Robot

4 RESULTS

ASPECT	RESULT
Mobility	Smooth navigation on various terrains
Power Efficiency	Extended battery life with efficient charging
Control System	Precise control over movement and behaviour
Sensor Integration	Accurate perception of surroundings
Communication	Reliable wireless communication
Software Performance	Efficient execution of navigation algorithms
User Interface	Intutive interaction for users

IV. CONCLUSION

In conclusion, the development of a low-cost mobile robot offers promising prospects for expanding access to robotics technology. By prioritizing affordability without sacrificing functionality, this project has successfully demonstrated the feasibility of creating versatile robots capable of navigating diverse environments. Through the integration of cost-effective components, efficient power management systems, and advanced sensor technologies, the robot

exhibits robust performance in mobility, perception, and communication. Moving forward, the continued refinement of low-cost robotics solutions holds tremendous potential for empowering individuals and organizations to leverage the benefits of robotics technology across various applications and industries.

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STELLAR EVOLUTION

Zaheerudin S P[1], Zainab Taj[2], Ruchitha P[3] and Sana Munir[4]

[1] Head of Department of Physics,VTU/GITW-Bengaluru, Karnataka, India.

[2,3,4] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.

wittyzed@gmail.com[1], jszu4146@gmail.com[2],ruchitha4737@gmail.com[3], sanamunir1605@gmail.com[4]

ABSTRACT

Embark on a journey through the life stories of stars, from their humble beginnings in gas clouds to thseir dramatic endings. Explore how stars are born, evolve, and eventually fade away, leaving behind remnants that shape the universe. Delve into the fascinating world of stellar evolution. Join us as we uncover the mysteries of the cosmos, one star at a time.

Keywords: White dwarf, red giants, Main sequence.

I.INTRODUCTION

Stellar evolution is the process by which stars undergo changes throughout their lifetimes, from birth to death, driven by the interplay of gravitational forces and nuclear fusion reactions within their cores." Let's delve into its key aspects:

A. Birth of Stars

Stars are born within vast clouds of gas and dust called molecular clouds. These clouds, composed mostly of hydrogen and helium with traces of heavier elements, are the stellar nurseries of the universe. Within these molecular clouds, regions of higher density, known as stellar nurseries or nebulae, give rise to the birth of stars through a process called star formation. The birth of a star is known as Nova means New.

Gravity plays a crucial role in the birth of stars. As regions within the molecular cloud become denser due to gravitational collapse or external triggers like shockwaves from supernovae or the compression caused by nearby stars, the gravitational force becomes stronger, pulling gas and dust inward. Over time, this gravitational collapse leads to the formation of a dense core known as a protostar.

As the protostar continues to accumulate mass from its surrounding disk of material, its core temperature rises. When the temperature and pressure at the core reach a critical point, nuclear fusion ignites, marking the beginning of the star's main sequence phase. This phase is characterized by a delicate balance between inward gravitational forces and outward thermal pressure generated by nuclear fusion in the core, which fuels the star and provides the energy necessary to neutralize gravitational collapse. [6]

B. Death of Stars

Stars are not eternal; they undergo a transformation as they exhaust their nuclear fuel. The fate of a star is determined primarily by its initial mass.

For low to medium-mass stars, like our Sun, the peak of their life cycle involves the transition into a white dwarf. As these stars deplete their hydrogen fuel in their cores, they undergo a series of evolutionary stages, including expansion into a red giant phase and shedding their outer layers into space, forming beautiful planetary nebulae. Eventually, the core collapses into a compact, dense remnant known as a white dwarf, supported against gravitational collapse by electron decay pressure [1].

In contrast, massive stars, those several times more massive than the Sun, follow a different path. Once they exhaust their nuclear fuel, their cores collapse under their immense gravity. This collapse triggers a catastrophic explosion known as a supernova, which can briefly outshine entire galaxies. The remnants of these explosions may form neutron stars or black holes, depending on the mass of the parent star [7].

Note: The birth and death of stars are fundamental processes that not only shape the evolution of galaxies but also contribute to the enrichment of the universe with heavy elements and the formation of new stellar systems, planets, and potentially life itself.

II.ANOTOMY OF A STAR

Stars consist of several layers: the core, where nuclear fusion occurs, generating energy; the radiative zone, where energy is transported outward by radiation; the convective zone, where energy is transported through convection; the photosphere, which is the visible surface of the star; and the outer atmosphere, which includes layers like the chromosphere and corona.

A.Types of Stars:

Stars come in different sizes, masses, and spectral types. They are classified based on their luminosity, temperature, and spectral characteristics. Main sequence stars like our Sun fuse hydrogen into helium in their cores. Giant and supergiant stars are larger and more luminous, while white dwarfs are small, dense remnants of low to medium-mass stars.

Stars can be categorized into **seven spectral types** according to the temperature of their surfaces, ranging from the hottest to the coolest: O, B, A, F, G, K, and M. O stars are the most luminous and hottest, while M stars are the least luminous and coolest. [3] As discussed in the table below:

TABLE I
Understanding Stellar Evolution through Hertzsprung-Russell Diagrams and Colour-Magnitude Diagrams.

Surface Temperature (Kelvin)	Colour	Luminosity	Typical Lifespan (years)
>30,000	Blue	High	Few million
10,000 - 30,000	Blue white	High	Few million to 100 million
7,500 -10,000	White	Moderate	Few hundred million
6,000 - 7,500	White yellow	Moderate	Few Billion
5,200 - 6,000	Yellow	Moderate	Few Billion
3,700 - 5,200	Orange	Low to Moderate	Few billion to 20 billion
<3,700	Red	Low	Trillions

A Hertzsprung-Russell diagram (HRD) is one of the most useful tools that astronomers use to study the evolution, particularly life cycle and characteristics of stars. Stars are classified based on their luminosity, temperature and evolutionary stage.
Typically, HRDs can be plotted as the temperature of the star against its luminosity. [2]

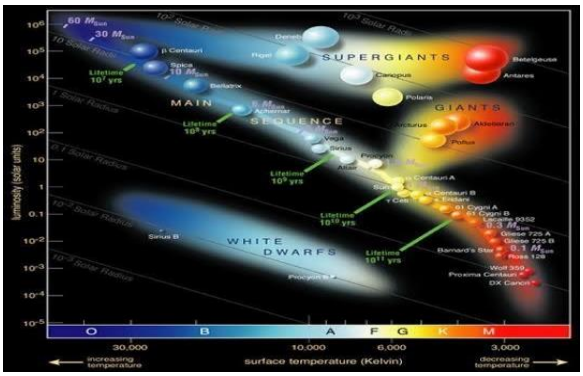

Figure 1: HR Diagram on Star.

An alternative way to present the same information is via a colour-magnitude diagram (CMD). Here, the colour index of a star (typically B-V) is plotted against its absolute magnitude (typically in the V filter). The brighter a star is, the more negative its magnitude.
For example, a star with M=-2.5 is brighter than a star with M=+2.5.

In the HR diagram, the hottest, brightest stars lie in the **upper left**, and the coolest, dimmest stars lie in the **lower right**. Stars in the upper right of the diagram are extremely bright despite having low surface temperatures. This requires the stars to have large surface areas; these are the red giants and super giants, with radii many times that of the Sun. Stars in the lower left of the diagram are extremely faint despite their high temperatures; these stars are small, with radii much smaller than that of the Sun, and are known as white dwarfs. The most common stars are those on the main sequence, the region where stars spend the majority of their lives. Main sequence stars burn hydrogen into helium, via **nuclear fusion**, in their cores. The position of a star on the main sequence depends on its **mass**. The lower mass stars (from the mass of the Sundown to about 0.08 solar masses) are cooler and dimmer and occupy the lower right of the main sequence. The higher mass stars (from about 2 to 50 solar masses) are hotter and brighter and occupy the upper left of the main sequence.

Main sequence: Most stars, including the Sun, plot in a band which runs from the top-left to the bottom-right of the chart. Stars in this area of the chart are in the main-sequence stage of their lives. We can use the chart to see that the temperature of main-sequence stars increases with brightness. This is because the star's mass controls both its temperature and brightness at this stage.

Red giants: Red giant and red supergiant stars fall in the top-right of the chart. This tells us they are brighter than main sequence stars but also redder and cooler. This is because they expand and cool as they reach the

final stages of their lives. However, because of their large size, they remain very bright. [5]

White dwarf: These are the remnants of low to medium mass stars, including our Sun, after they have exhausted their nuclear fuel. They are located in the lower left corner of the diagram, with high surface temperatures but low luminosities.

Stars tend to spend about 90% of their life in the main-sequence stage. After this, they evolve into giant stars for the remaining 10 % of their lives. Finally, they will either explode as a supernova or become white dwarf stars.

Note: stars' surface temperatures are plotted on the x-axis (horizontal axis). Stars' luminosity is plotted along the y-axis (vertical axis). Be aware that the x-axis of the H-R diagram does not always use the temperature. It can also use spectral class (OBAFGKM), or colour. However, all show the same relationship with a star's luminosity. We can use class, colour, or temperature because stars are considered blackbody sources.

III CONCLUSION

The birth and death of stars are fundamental processes that not only shape the evolution of galaxies but also contribute to the enrichment of the universe with heavy elements and the formation of new stellar systems, planets, and potentially life itself.

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THE NORTHERN LIGHTS OF OUR SKY

Zaheerudeen S P[1] Kulsum F [2], Saniya Subhan [3], Tasmiya Fathima K [4], and Varshini VH [5]

[1] Head of Department of Physics, VTU/GITW-Bengaluru, Karnataka, India.

[2,3,4] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.

wittyzed@gmail.com[1],kulsumf130@gmail.com [2],Saniyasubhan789@gmail.com[3],Tasmiyaaziz1@gmail.com [4],Varshinivarshumudugoadu208@gmail.com [5]

ABSTRACT

This paper provides an overview of aurora borealis. The aurora borealis, known commonly in North America as "northern lights," is one of the most fascinating of all natural phenomena. The aurora is an optical phenomenon of the upper atmosphere. It should not be confused with another light that is emitted by the gases of the upper atmosphere, the airglow. Aurora may be considered a transient optical phenomenon; airglow appears to be present at all times and is distributed over the entire globe. In this paper, the general description of auroras and the radio studies of aurora are discussed. The algorithm is based on the current understanding of the physical origin of the aurora. This natural display is mainly caused by high-energy electrons originating in the Sun and entering the Earth's atmosphere in narrow regions centered on the magnetic poles. These electrons collide with atmospheric atoms which are excited to higher energy levels. The excited atoms emit rapidly varying visible light in a curtain-like volume as they return to lower energy levels thereby creating the aurora. By simulating these light emissions along with the spatial and temporal distribution of the entering electrons, we can render the major visual aspects of auroral displays. This approach also allows the representation of time-dependent features that characterize the dynamic nature of the aurora. The applicability of this auroral model for artistic and research purposes is illustrated through comparisons of synthetic images with photographs of real auroral displays.

Keywords: Displays, Computer science, Electrons, Computational modelling, Sun, Acceleration, Physics, Computer simulation

I.INTRODUCTION

The earth is constantly bombarded by energy from outer space. Sunlight is the most visible and common example. Other parts of this bombardment are invisible, such as cosmic rays, X-rays and atomic particles that stream out from the sun in all directions. These atomic particles, protons and electrons constitute the solar wind. A small fraction of these solar wind particles interacts with the earth's magnetic field. As a result of these interactions, plasma particles are guided and accelerated to regions around the magnetic north and south poles. These fast energetic particles then collide with high-altitude atmospheric atoms and molecules resulting in light emission. This natural phenomenon is known as the aurora borealis, or 'northern lights', and aurora australis (its less familiar southern counterpart).

The aurora is considered by many to be one of the most fascinating and mysterious of nature's displays fascinated writers, philosophers, poets and scientists over the centuries. Although descriptions and investigations are more prevalent in northern cultures, which live along the region known as the 'auroral oval', we can also find descriptions in the Bible and in the ancient texts of Greek, Roman and Chinese writers and philosophers. Mankind has been puzzled by the origin of this phenomenon for centuries. The main visual aspects of the aurora, involving the excitation of atmospheric particles indirectly by the solar wind, have only been understood in the twentieth century. Although several theories regarding the aurora have been recently validated by space-born instrumentation.

Fig1: Aurora borealis

A. Why 2024 is the best year to see the northern lights

There have been many wonderful northern lights shows in the last years but one stands out! 10th May 2024 was a night that the whole world will remember for a long time! We witnessed the strongest aurora borealis and australis in 21 years!

Fig 2: Northen lights in iceland

A high period of intense solar activity is expected to give the northern lights some extra oomph this year, providing aurora hunters with the best chances of catching a stronger, more powerful show in places like Iceland and Norway. And travellers rejoice: this year the world's most spectacular light show will be visible in larger areas of the USA and Europe

Fig 3: Northen lights in norway

Experts at NASA predict that the sun is about to reach a solar maximum – its highest period of activity in an 11-year cycle. This means that major disturbances from solar storms will make 2024 a super season for the northern lights, and those who head north will be treated to exceptionally bright, brilliant and more frequent celestial shows. Plus, when storms produce more energy, the auroral zone expands, increasing the likelihood of seeing the lights in areas they're not typically visible

b. Witnessing the northern lights in the uk was truly magical: pawan kumar

Actor-director Pawan Kumar's family vacation in The UK took a magical turn when he unexpectedly Witnessed the Aurora Borealis or the Northern Lights. On Saturday, a solar storm had triggered and unusual Event, bringing the Northern Lights, typically visible. In countries like Norway, Sweden, Finland and Iceland, to lower latitudes. Speaking to us

along with his wife danseuse Sowmya and the Rest of his family. "From the terrace, we could only see a faint light but then, we drove to a dark place in the city to see the spectacle in all its glory. When you've seen the sky one-way all Your life, seeing the colour pop, is indeed magical Experience," he says

II. DO OTHER PLANETS GET AURORAS?

In our solar system, only three other planets are known to have Aurora Jupiter, Saturn and Uranus. These planets have aurora because like earth other planet possess magnetic field and sufficient solar wind our

solar system lacks either magnetic field or Strong solar wind particle density.

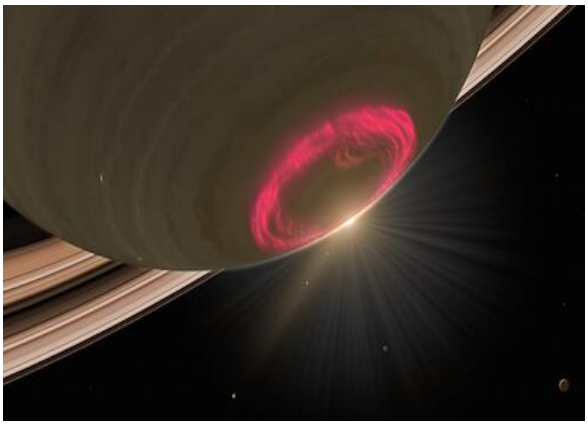

Fig4: Circular, red lights on lacks spole of Saturn.

The terrestrial magnetic shield acts as a barrier, protecting the Earth from energetic particles and radiation in the hot solar wind. Most of these energetic particles are deflected around the Earth by the magnetosphere, but some get trapped. Electrons trapped in the Earth's magnetic field are accelerated along the magnetic field toward the polar regions and then strike the atmosphere to form the aurora.

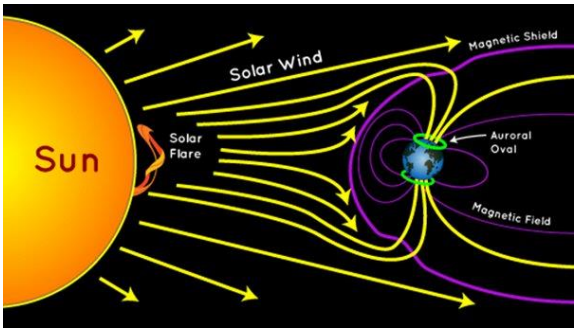

Fig 5: A side view of the earth and magnetosphere showing some of the important regions

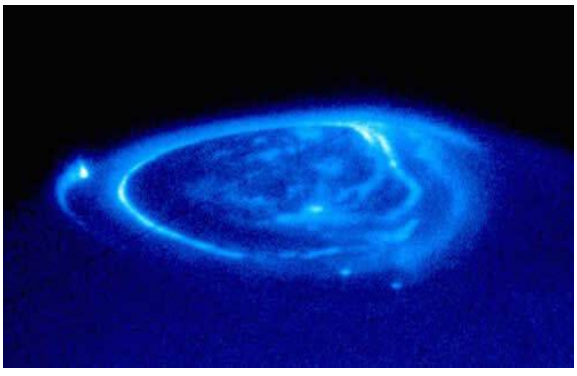

Fig 6: blue lights on Jupiter

III. MAGNETS ARE THE KEY

The origin of the aurora is 93 million miles (149 million km) from Earth at the Sun. Energetic particles from the Sun are carried out into space along with the ever-present hot solar wind. This wind sweeps supersonically toward Earth through interplanetary space at speeds ranging from 300 to over 1000 km per second, carrying with it the solar magnetic field. The solar wind distorts the Earth's magnetic field to create the Auroral Spectrum

Since the aurora is characterized by its storm-like behaviour, the variations of spectral ratios (Figure 8a) and intensities (Figure 8b) according to the auroral heights are given in the literature as average values. According to Romick and Belon,26 these vertical spectral and intensity profiles are a good approximation of the vertical emission profile. For these reasons our simulation of the auroral spectrum consists of sampling the spectral curves presented in using the heights of the deflection points as the sampling parameter.

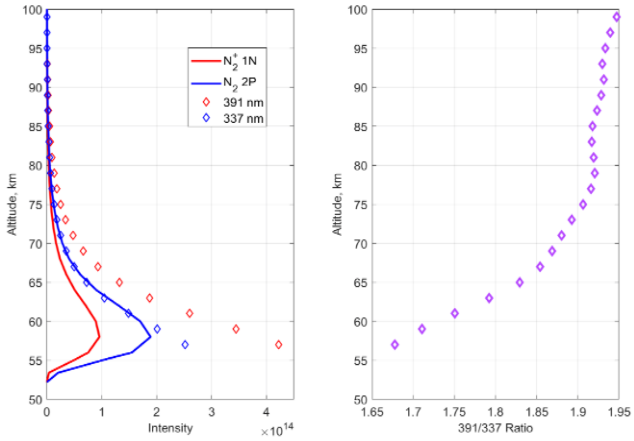

Fig 8:(a) Spectral emission curve, (b)Auroral intensity profile along various form

The particles, which stream down the magnetic field of the Earth, reach the neutral atmosphere in a rough circle called the auroral oval. This circle, or annulus, is cantered over the magnetic pole and is around 3000 km in diameter during quiet times. The annulus grows larger when the magnetosphere is disturbed. The location of the auroral oval is generally found between 60 and 70 degrees north and south latitude

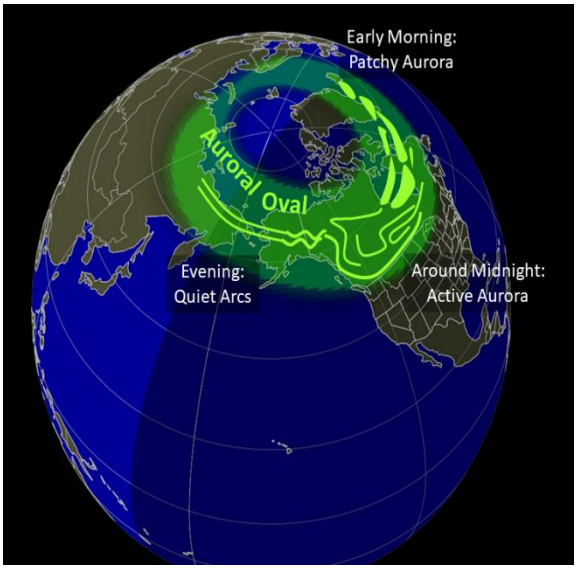

Fig 7: comet-shaped magnetosphere. Energetic electron spiral down the geomagnetic field

As mentioned earlier, the spectral variety of auroral displays is further contributed to by several weaker light emissions at other wavelengths across the visible spectrum. For the purpose of simulating the aurora, however, a viable approach is to focus on the bright emissions (at 630.0 nm, 557.7 nm, 427.8 nm), which are most obvious to the casual observer. The spectral variety seen in the aurora can then be simulated by mixing the components of this triad in various ratios. As the data for other wavelengths become available, they can be easily incorporated in our simulations and accounted for during the rendering process. That causes the aurora borealis

IV.CONCLUSION

"In conclusion, this research has delved into the captivating phenomenon of the aurora borealis, shedding light on its intricate mechanisms, cultural significance, and potential implications for space weather forecasting. Through a comprehensive review of literature and analysis of data, we have gained insights into the dynamic interplay of solar winds, Earth's magnetic field, and atmospheric conditions that give rise to the mesmerizing display of lights in the polar regions.

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Many beautiful pictures have been published in articles and books.

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PHYSICS FOR ANIMATION

Zaheerudin S P[1] , Sandiya Devi V [2], Zainab Taj [3], and Ruchitha P[4]

[1] Head of Department of Physics , VTU/GITW-Bengaluru, Karnataka, India.

[2,3,4] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.

wittyzed@gmail.com[1] ,Sandhyaqv685@gmail.com[2] , jszu4146@gmail.com[3] , ruchitha4737@gmail.com[4]

ABSTRACT

Ever wondered how your favorite animated characters defy the laws of physics? In this report, we dive into the fascinating world of physics behind animation. From gravity defying stunts to realistic motion, we explore the principles of motion, forces, and energy that bring animated worlds to life.

Keywords - Motion , Gravity , Kinematics , Dynamics , Force.

I.INTRODUCTION

Plays a crucial role in creating realistic and captivating animations. It helps animators bring their characters and Physics worlds to life by making them move in a way that feels believable and natural.

One of the key principles in animation is gravity. We all know that gravity pulls things downward, right? Well, animators use this principle to make their characters move realistically. By understanding how objects fall and how gravity affects them, animators can make their characters' movements look more authentic and grounded.

But it doesn't stop there! Newton's Laws of Motion also come into play. These laws describe how objects move and interact with forces. Animators use these laws to make their characters jump, run, and even perform epic stunts. It's like giving their animations a dose of real-world physics!

Have you ever noticed how objects in animations seem to have weight and momentum? That's because animators use the concept of momentum to create smooth and fluid movements. By understanding how momentum works, they can make their characters'actions flow seamlessly from one frame to another.

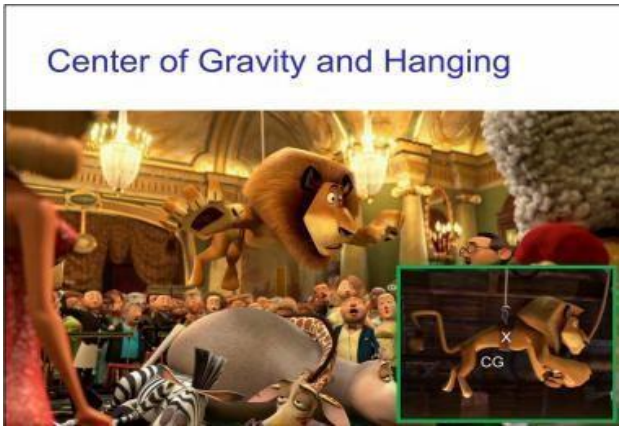
And let's not forget about the fun stuff like elasticity! You know, when things stretch, bounce, or squish? Animators use the principles of elasticity to give their characters that extra bit of flexibility and expressiveness. It adds a touch of whimsy and brings their animations to life in a playful way.

So, physics is like the secret ingredient that makes animations feel realistic, dynamic and captivating. It's the
behind scenes magic that gives life to the characters we love and the worlds we get lost in.

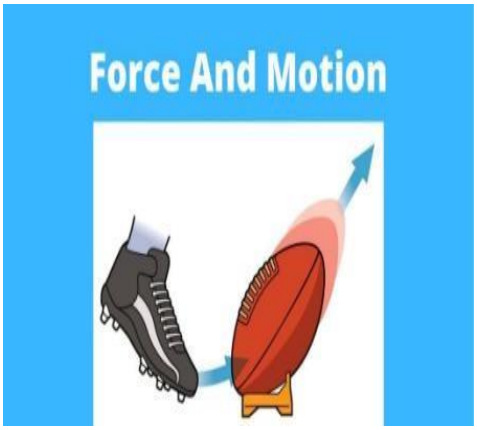
II.EXPERIMENT

How physics principles like gravity, motion and force influence the movement and behaviour of animated characters :-

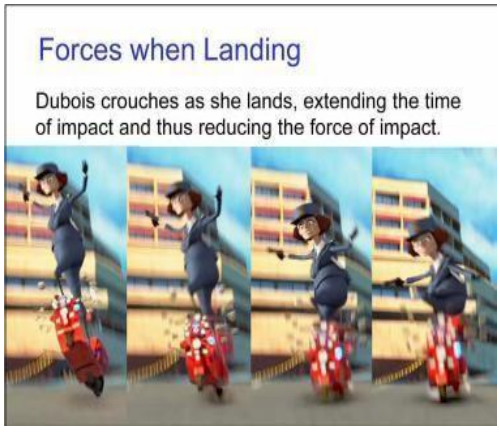
First up, we have gravity. Just like in the real world, animators use the concept of gravity to make their characters move realistically. Gravity pulls things downward, so it affects how characters jump, fall, and interact with their environment.By understanding gravity, animators can make their characters' movements feel grounded and believable.when a character jumps or falls, they follow the laws of gravity, which gives them a sense of weight and natural movement .



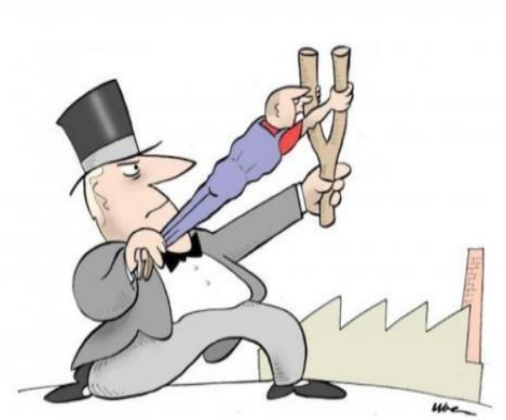
Next, we have motion and forces. Animators use Newton's Laws of Motion to create lifelike animations. These laws describe how objects move and interact with forces. For example, when a character runs, the animators apply Newton's laws to make sure the character's movements look natural and follow the laws of physics.By applying these principles, they can make characters run, jump, or fly in a way that feels natural and believable to the viewer.



Momentum is another important concept. It's all about how objects keep moving once they're set in motion. Animators use momentum to create smooth and fluid movements for their characters. It helps the animations flow seamlessly from one frame to another, making the characters' actions look more realistic.

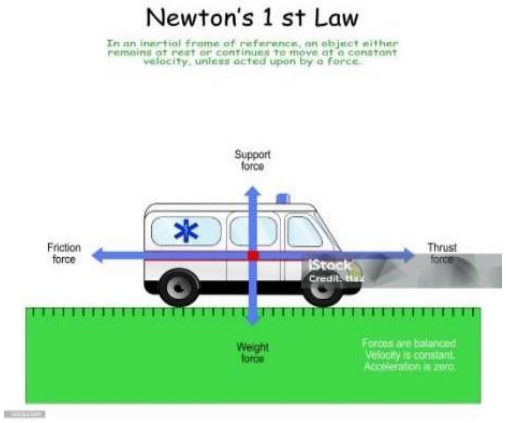


And let's not forget about the fun stuff like elasticity! When characters stretch, bounce, or squish, animators use the principles of elasticity. It adds a touch of whimsy and expressiveness to their animations . Think of how a cartoon character's face can stretch in exaggerated ways to show surprise or happiness. It's all thanks to the physics of elasticity!

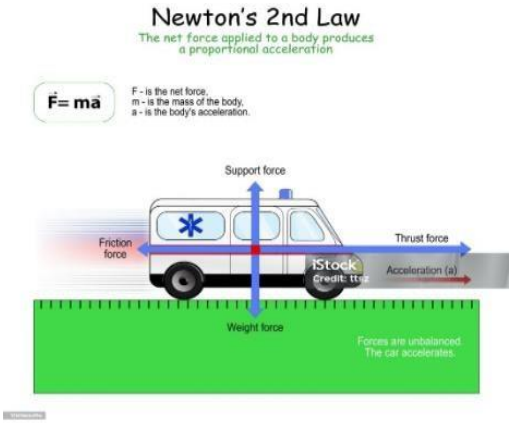


How Newton's 3 laws applied in animation :-

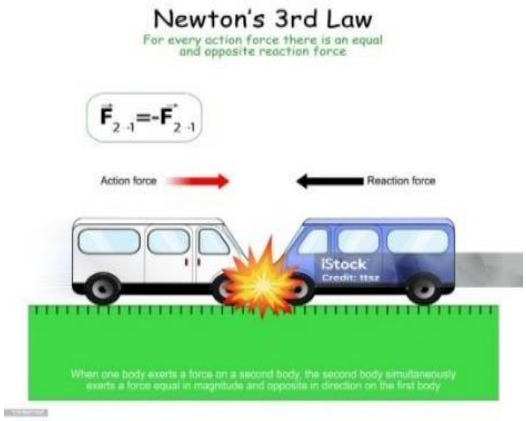
Newton's First Law of Motion, also known as the law of inertia, states that an object at rest will stay at rest, and an object in motion will stay in motion unless acted upon by an external force. In animation, this law is used to create realistic movements for characters. For example, if a character is standing still, they won't start moving unless something like a push or a kick is applied to them .



Newton's Second Law of motion is all about how force . mass and acceleration are related . The formula is F=ma , where F represents force , m represents mass and a represents acceleration . In animation , this law helps animators determine how much force is needed to make a character move or change their speed . It helps create those awesome action – packed scenes !



Lastly , we have Newton's Third Law of Motion , which states that for every action , there is an equal and opposite reaction . This law is used in animation to create realistic interactions between characters and objects . For example , if a character pushes a heavy object , they will experience an equal and opposite force pushing back on them , helps animators create interactions between characters and objects that feel authentic .



By understanding and applying these laws of motion, animators can create animations that follow the rules of physics and look incredibly realistic. It's like they're bringing the laws of the physical world into the animated world!

There are plenty of popular animated films that showcase the application of physics in creating realistic and captivating animations. Here are a few examples:

The Incredibles - This action-packed film features characters with superpowers, but the physics behind their movements and actions are still taken into account. From Mr. Incredible's incredible strength to Elastigirl's flexibility, the animators used physics principles to make their movements feel believable and grounded.

Moana - In this adventurous film, the animators paid close attention to the physics of water. From the way the waves crash against the shore to the movement of Moana's boat, the animation captures the realistic behavior of water, making the film visually stunning.

Big Hero 6 - This superhero film incorporates physics in a fun and exciting way. The character Baymax, a lovable healthcare robot, uses his inflatable body to move and interact with the environment. The animators had to consider the physics of air pressure and elasticity to make Baymax's movements look realistic and entertaining.

These are just a few examples, but there are many more animated films that showcase the application of physics in creating captivating animations.

III.RESULT AND DISCUSSION

Simulation techniques play a crucial role in physics-based animation. Rigid body dynamics simulations allow for realistic object interactions, collisions, and constraints, making animations feel more dynamic and natural. Cloth simulations enable the realistic movement and behavior of fabrics and clothing, adding a layer of realism to character animations. Particle systems simulate phenomena such as smoke, fire, and explosions, creating visually stunning effects that enhance the storytelling.

Fluid dynamics simulations are particularly important in animation, as they enable the realistic depiction of fluids like water, smoke, and fire. By incorporating principles such as viscosity, surface tension, and turbulence, animators can create fluid animations that convincingly mimic real-world behavior. This adds a level of realism and immersion to scenes involving water splashes, fiery explosions, or atmospheric effects like fog or mist.

IV.CONCLUSION

To sum it up, physics is like the secret ingredient that animators use to make their animations come alive. It helps them create movements that feel natural and realistic, whether it's a character jumping, falling, or interacting with objects. Physics is what gives animations that wow factor, making them visually

stunning and captivating for viewers. So, the next time you watch an animated film or show, remember that physics is behind the magic that brings those characters and worlds to life!

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RHODAMINE B

H M Parvez Ahmed[1], Zainab Taj [2], Zuha Zaman[3], Farheen Firdous[4], Sidra Kaleem [5]

[1] Head of Department of Chemistry, VTU/GITW-Bengaluru, Karnataka, India.

[2,3,4,5] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.

parru63@gmail.com[1], jszu4146@gmail.com[2], shaikzuha827@gmail.com[3], farheenfirdous2020@gmail.com[4], sidrakaleem335@gmail.com [5]

ABSTRACT

The use of food dye is harmful and now prohibited, yet it remains in use due to its low cost and abundance. Rhodamine B (RhB) is commonly used in foods like chili powder and oil, being colourless at 10^{-7} M. Detecting RhB at ultra-low concentrations is crucial for safety. Surface-enhanced Raman scattering (SERS) is excellent for such detection, providing molecular fingerprints. This study synthesized silver nano-cubes by reducing Ag+ in ethylene glycol, forming a thin film as a SERS active substrate. RhB was detected at 10^-10 M with this sensor. The linear regression between Raman intensity and RhB concentration from 10^{-4} to 10^{-10} M was highly reliable (R2 = 0.99). The substrate was effective after 60 days in dark storage. This silver nano-cube could be a potential substrate for detecting RhB in food at very low concentrations.

Keywords: Plasmonic; Rhodamine B; Sensor; Silver nano-cube; Surface-enhanced Raman scattering

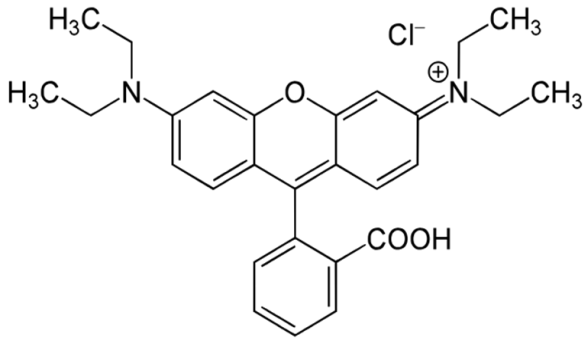
I. INTRODUCTION

Rhodamine B (RhB) is a chemical compound with the formula C28H31ClN2O3. It is used in synthetic dyes, dyeing silk, jute leather, cotton, wool, cosmetics, textiles, and plastic industries. Due to its low cost, RhB is frequently used for food colouring, such as in chili powder or chili oil. However, accumulating data have reported its harmful effects on human health, including irritation to the skin, eyes, and respiratory system, and carcinogenicity. Therefore, it is urgent to develop a rapid and sensitive method for RhB detection. Many methods are used to detect RhB, including high-performance liquid chromatography (HPLC), spectrophotometry, fluorometry, enzyme-linked immunosorbent assays (ELISA), electrochemical detections, and surface-enhanced Raman scattering (SERS). However, traditional methods such as HPLC, spectrophotometry, and fluorometry are time-consuming and require expensive instruments not usually used in in-situ analysis. Additionally, electrochemical detection and ELISA methods need large sample volumes (100–500 µL) for meaningful results. In contrast, SERS is a simple and rapid method that can detect trace analytes at ultralow concentrations as fingerprints.

II. STRUCTURE

1. Rhodamine B is a xanthene dye with the molecular formula $C_{28}H_{31}ClN_2O_3$.
2. Its structure includes a central xanthene ring system with various functional groups attached, including a carboxy phenyl group and a di methyl amino group.
3. Its molecular weight is 479.0 g/mol

ITS STRUCTURE IS



III. EFFECTS OF RHODAMINE

Rhodamine B, while useful in various scientific and industrial applications, poses several health and environmental risks. Here are the specific effects and associated hazards:

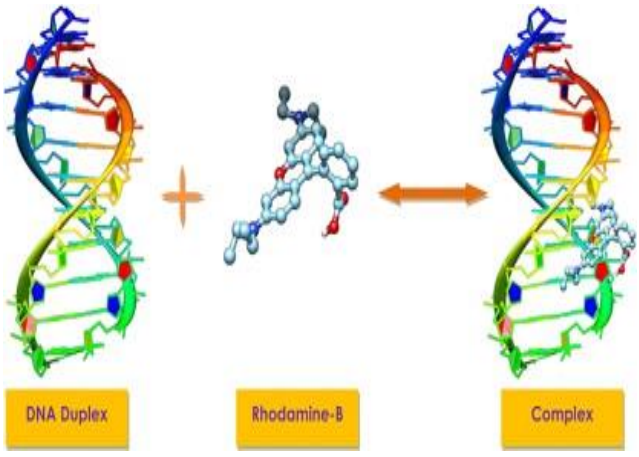
A. Acute Toxicity:

Ingestion: Can cause gastrointestinal distress, nausea, and vomiting.
Inhalation: May irritate the respiratory tract, causing coughing, shortness of breath, and sore throat.
- Skin Contact: Can lead to skin irritation, redness, and rash.
- Eye Contact: Causes severe eye irritation, redness, and potential damage to the cornea.

B. Chronic Exposure:

- Carcinogenicity: Classified as a potential carcinogen. Long-term exposure in animal studies has shown an increased risk of cancer.

Researchers have identified that if food containing this chemical is consumed regularly, it can cause damage to the cerebellum tissue in the brain and to the brainstem that connects the brain to the spinal cord. These damages can lead to functional abnormalities and can hinder humans' motor functioning
There is recent evidence that Rhodamine B damages the kidney, liver and increases the risk of stomach tumour. 'It is not a food colour but is toxic to the human body and is a carcinogen'



C. Environmental Effects:

1. Rhodamine B is harmful to aquatic organisms. It can accumulate in water bodies, leading to toxic effects on fish and other aquatic
2. Rhodamine B is a hazardous colored effluent that negatively affects aquatic plants.
3. Contamination: Improper disposal of Rhodamine B can lead to environmental contamination, affecting water sources and soil quality.
4. Bioaccumulation: The dye can accumulate in the food chain, potentially impacting wildlife and ecosystems.

IV. APPLICATIONS OF RHODAMINE B

- ✓ Rhodamine B is an amphoteric dye commonly used as a fluorochrome.
- ✓ Rhodamine B is used in biology as a staining fluorescent dye, Rhodamine B is tenable around 610 nm when used as a laser dye.
- ✓ Rhodamine B is exempted from the requirement of a tolerance when used as a dye in accordance with good agricultural practice as inert (or occasionally active) ingredients in pesticide formulations applied to animals.
- ✓ Rhodamine B is being tested for use as a biomarker in oral rabies vaccines for wildlife, such as raccoons, to identify animals that have eaten a vaccine bait. The rhodamine is incorporated into the animal's whiskers and teeth.
- ✓ Fluorescence Microscopy: Utilized as a tracer dye due to its bright fluorescence.
- ✓ Flow Cytometry: Applied in assays to detect and quantify biological molecules.
- ✓ Water Tracing: Used in hydrology to trace and study water flow and contamination.
- ✓ pH Indicator: Functions as a pH indicator in certain chemical assays.
- ✓ Color Enhancement: In some cases, unscrupulous producers might use Rhodamine B to give food items, such as sweets, snacks, or beverages, a more vibrant and appealing color.

- ✓ Illicit Adulteration: It can be used to adulterate spices like chili powder and turmeric to enhance their color and appearance.

V. PROBLEMS

Legal and Regulatory Issues

- ➢ Issues Regulatory Bans: Rhodamine B is banned in food products by regulatory agencies like the U.S. FDA, European EFSA, and other national health authorities. Using it in food is illegal and subject to severe penalties.
- ➢ Public Health Violations: Illicit use in food products can lead to public health crises, undermining consumer trust and safety.
- ➢ Legal Consequences: Companies or individuals caught using Rhodamine B in food products face legal action, fines, and potential shutdowns.

Economic and Social

- ➢ Impact Consumer Trust: Discovery of Rhodamine B in food can lead to loss of consumer trust in food safety regulations and brands involved.
- ➢ Market Impact: Recalls and bans on contaminated products can cause significant financial losses for producers and distributors.
- ➢ Public Health Costs: Treatment of health issues resulting from exposure can lead to increased healthcare costs and economic burden on the public health system.

VI. CONCLUSION

In conclusion, Rhodamine B (RhB), a widely used synthetic dye with associated health hazards, demands rapid and sensitive detection methods, especially concerning its illicit use in food colouring. Surface-enhanced Raman scattering (SERS), exemplified by silver nano-cubes, offers promise for detecting RhB at ultra-low concentrations. Urgent reinforcement of legal measures, coupled with heightened public health education, is crucial. Embracing advanced detection technologies like SERS can mitigate health risks, ensure food safety, and reduce environmental contamination, safeguarding public health and consumer trust.

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5G TECHNOLOGY AND ITS IMPACT ON CONNECTIVITY

Mrs. Shahuriya Khanum[1], Deekshitha p[2], and Tejashwini[3]

[1] Head of Department, VTU/GITW-Bengaluru, Karnataka, India.

[2,3]First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.

Deekshithap823@gmail.com[1], Tejashwinis904@gmail.com

ABSTRACT

5G technology represents the fifth generation of mobile networks, offering significant advancements over its predecessors in terms of speed, latency, and connectivity. This technology employs innovations such as millimeter waves, small cells, and massive MIMO, enabling faster data transmission and more reliable connections. The impact of 5G on connectivity is profound, facilitating enhanced mobile broadband, ultra-reliable low-latency communication, and massive machine-type communication. These capabilities unlock new potentials in various sectors, including healthcare, automotive, and entertainment, by enabling applications like remote surgery, autonomous vehicles, and immersive virtual reality experiences. Additionally, 5G supports the proliferation of the Internet of Things (IoT), driving the development of smart cities and industrial automation. Despite its benefits, 5G also raises concerns about cybersecurity, data privacy, and the digital divide. As countries continue to deploy and adopt 5G infrastructure, the technology is poised to drive economic growth, transform industries, and reshape the way we connect and interact with the digital world.

Keywords:
Ultra-reliable low-latency communication (URLLC), Massive machine-type communication (mMTC), Virtual reality (VR), Cybersecurity, Data privacy, Digital divide, Economic growth.

I . INTRODUCTION

In the ever-evolving landscape of telecommunications, 5G technology stands as a beacon of progress, poised to redefine the way we connect, communicate, and interact with the world around us. As the fifth generation of mobile networks, 5G represents a leap forward in terms of speed, capacity, and connectivity, promising to revolutionize not just our smartphones but also our industries, cities, and daily lives.

At its core, 5G technology builds upon the foundation laid by its predecessors, offering enhancements that address the growing demands of our increasingly interconnected society. Unlike its predecessors, 5G is not

not only the technical intricacies of this groundbreaking technology but also its broader implications for society, economy, and culture. By doing so, we can harness merely an evolution but a revolution, introducing novel techniques and architectures to deliver unprecedented levels of performance.

The key to 5G's transformative potential lies in its technical innovations, which include advancements such as millimeter-wave spectrum utilization, massive multiple-input multiple-output (MIMO) antenna arrays, and network virtualization. These technologies enable 5G networks to achieve multi-gigabit-per-second data rates, ultra-low latency, and massive connectivity, paving the way for a plethora of new applications and services.

Moreover, 5G technology is not limited to smartphones and tablets but extends its reach to diverse industries, from healthcare and transportation to manufacturing and entertainment. By enabling seamless connectivity and real-time data exchange, 5G has the power to catalyze innovation and drive efficiency across various sectors, ushering in an era of smart cities, autonomous vehicles, and immersive experiences.

However, realizing the full potential of 5G requires more than just technological prowess. It demands a collaborative effort involving governments, regulatory bodies, telecommunications companies, and industry stakeholders to address challenges such as spectrum allocation, infrastructure deployment, and cybersecurity.

As the world eagerly embraces the dawn of the 5G era, it is essential to understand the transformative power of 5G to create a more connected, intelligent, and prosperous future for all.

II. EVOLUTION OF WIRELESS TECHNOLOGY

G. Marconi, an Italian inventor, unlocks the path of recent day wireless communications by communicating the letter 'S' along a distance of 3Km in the form of three dot Morse code with the help of electromagnetic waves. After this inception, wireless communications have become an important part of present-day society. Since satellite communication, television and radio transmission has advanced to pervasive mobile telephone, wireless communications has transformed the style in which society runs. The evolution of wireless begins here [2] 1. It shows the evolving generations of wireless technologies in terms of data rate, mobility, coverage and spectral efficiency. As the wireless technologies are growing, the data rate, mobility, coverage and spectral efficiency increases. It also shows that the 1G and 2G technologies use circuit switching while 2.5G and 3G uses both circuit and packet switching and the next generations from 3.5G to now i.e. 5G are using packet switching. Along with these factors, it also differentiate between licensed spectrum and unlicensed spectrum. All the evolving generations use the licensed spectrum while the Wi-Fi, Bluetooth and WiMAX are using the unlicensed spectrum. An overview about the evolving wireless technologies is below:

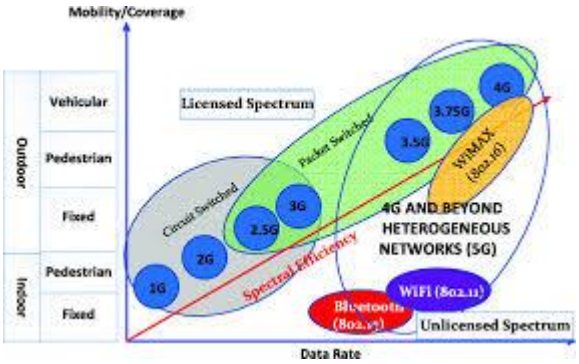

Fig 1. – Evolution of wireless technologies.

Evolution of wireless technologies.

A. 1G

The 1st generation was announced in initial 1980's. It has a data rate up to 2.4kbps. Major subscribers were Advanced Mobile Phone System (AMPS), Nordic Mobile Telephone (NMT), and Total Access Communication System (TACS). It has a lot of disadvantages like below par capacity, reckless handoff, inferior voice associations, and with no security, since voice calls were stored and played in radio towers due to which vulnerability of these calls from unwanted eavesdropping by third party increases [7].

B. 2G

The 2nd generation was introduced in late 1990's. Digital technology is used in 2nd generation mobile telephones. Global Systems for Mobile communications (GSM) was the first 2nd generation system, chiefly used for voice communication and having a data rate up to 64kbps. 2G mobile handset battery lasts longer because of the radio signals having low power. It also provides services like Short Message Service (SMS) and e-mail. Vital eminent technologies were GSM, Code Division Multiple Access (CDMA), and IS-95 [3], [7].

C. 2.5G

It generally subscribes a 2nd generation cellular system merged with General Packet Radio Services (GPRS) and other amenities doesn't commonly endow in 2G or 1G networks. A 2.5G system generally uses 2G system frameworks, but it applies packet switching along with circuit switching. It can assist data rate up to 144kbps. The main 2.5G technologies were GPRS, Enhanced Data Rate for GSM Evolution (EDGE), and Code Division Multiple Access (CDMA) 2000 [3], [7].

D. 3G

The 3rd generation was established in late 2000. It imparts transmission rate up to 2Mbps. Third generation (3G) systems merge high speed mobile access to services based on Internet Protocol (IP). Aside from transmission rate, unconventional improvement was made for maintaining QoS. Additional amenities like global roaming and improved voice quality made 3G as a remarkable generation. The major disadvantage for 3G handsets is that, they require more power than most 2G models. Along with this 3G network plans are more expensive than 2G [3], [7]. Since 3G involves the introduction and utilization of Wideband Code Division Multiple Access (WCDMA), Universal Mobile Telecommunications Systems (UMTS) and Code Division Multiple Access (CDMA) 2000 technologies, the evolving technologies like High-Speed Uplink/Downlink Packet Access (HSUPA/HSDPA) and Evolution-Data Optimized (EVDO) has made an intermediate wireless generation between 3G and 4G named as 3.5G with improved data rate of 5-30 Mbps [3].

E. 3.75G

Long-Term Evolution technology (LTE) and Fixed Worldwide Interoperability for Microwave Access (WIMAX) is the future of mobile data services. LTE and Fixed WIMAX has the potential to supplement the capacity of the network and provides a substantial number of users the facility to access a broad range of high-speed services like on demand video, peer to peer file sharing and composite Web services. Along with this, a supplementary spectrum is accessible which accredit operators manage their network very compliantly and offers better coverage with improved performance for less cost [4]– [7].

F. 4G

4G is generally referred as the descendant of the 3G and 2G standards. 3rd Generation Partnership Project (3GPP) is presently standardizing Long Term Evolution (LTE) Advanced as forthcoming 4G standard along with Mobile Worldwide Interoperability for Microwave Access (WIMAX). A 4G system improves the prevailing communication networks by imparting a complete and reliable solution based on IP. Amenities like voice, data and multimedia will be imparted to subscribers on every time and everywhere basis and at quite higher data rates as related to earlier generations. Applications that are being made to use a 4G network are Multimedia Messaging Service (MMS), Digital Video Broadcasting (DVB), and video chat, High-Definition TV content and mobile TV [2], [4]– [6].

G. 5G

With an exponential increase in the demand of the users, 4G will now be easily replaced with 5G with an advanced access technology named Beam Division Multiple Access (BDMA) and Non- and quasi-orthogonal or Filter Bank multi carrier (FBMC) multiple access. The concept behind BDMA technique is explained by considering the case of the base station communicating with the mobile stations. In this communication, an orthogonal beam is allocated to each mobile station and BDMA technique will divide that antenna beam according to locations of the mobile stations for giving multiple accesses to the mobile stations, which correspondingly increase the capacity of the system [8]. An idea to shift towards 5G is based on current drifts, it is commonly assumed that 5G cellular networks must address six challenges that are not effectively addressed by 4G i.e. higher capacity, higher data rate, lower End to End latency, massive device connectivity, reduced cost and consistent Quality of Experience provisioning [22], [23]. These challenges are concisely shown in Fig. 2 along with some potential facilitators to address them. An overview of the challenges, facilitators, and corresponding design fundamentals for 5G is shown in Fig. 2 [20]. Recently introduced IEEE 802.11ac, 802.11ad and 802.11af standards are very helpful and act as a building blocks in the road towards 5G [9]–[13]. The technical comparison between these standards is shown in table 1 and the detailed comparison of wireless generations is shown in table 2.

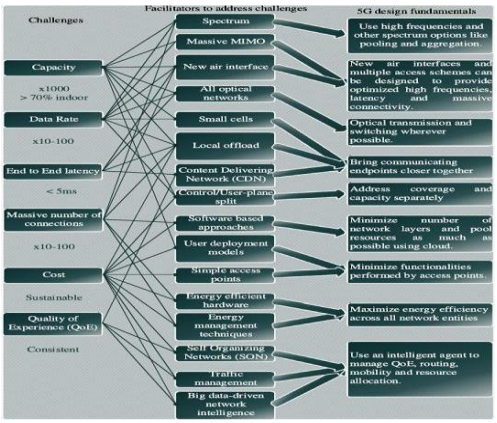

Fig. 2- 5G challenge, facilitators, and design fundamental

Standard	Freq Band	Bandwidth	Modulation	Max Data Rate
802.11	2.4 GHz	20 MHz	DSSS,FHSS	2 Mbs
802.11b	2.4 GHz	20 MHz	DSSS	11 Mbs
802.11a	5.0 GHz	20 MHz	OFDM	55 Mbs
802.11g	2.4 GHz	20 MHz	DSSS,OFDM	55 Mbs
802.11n	2.4 GHz, 5.0 GHz	20 MHz,40 MHz	OFDM	600 Mbs
802.11ac	5.0 GHz	20 MHz,40 MHz, 80 MHz,160 MHz	OFDM	6.93 Gbs

TABLE 1- Technical comparison between recent 802.11 standards

Technology	1G	2G/2.5G	3G	4G	5G
Bandwidth	2kbps	14-64kbps	2mbps	200mbps	>1gbps
Technology	Analog cellular	Digital cellular	Broadbandwidth/ CDMA/IP Technology	Unified IP and seamless combo of LAN/WAN/WLAN	4G+WWWW
Service	Mobile telephony	Digital voice, Short messaging	Integrated high quality audio, video and data	Dynamic information access, variable devices	Dynamic information access, variable devices with AI capabilities
Multiplexing	FDMA	TDMA/CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit/ circuit for access network and air interface	Packet except for air interface	All packet	All packet
Core Network	PSTN	PSTN	Packet network	Internet	Internet
Handoff	Horizontal	Horizontal	Horizontal	Horizontal & Vertical	Horizontal & Vertical

Table 2- Evolution of wireless technologies

III. KEY FEATURES OF 5G TECHNOLOGY INCLUDE:

1. Higher Speeds: 5G networks offer significantly faster data speeds compared to previous

generations, reaching peak speeds of several gigabits per second (Gbps). This enables faster downloads, smoother streaming, and quicker response times for applications and services.

2. Low Latency: 5G reduces latency, or the time it takes for data to travel from the sender to the receiver, to as low as a few milliseconds. This ultra-low latency is crucial for real-time applications such as gaming, video conferencing, and autonomous vehicles.
3. Increased Capacity With 5G, networks can support a much larger number of connected devices simultaneously. This higher capacity is essential for accommodating the growing number of Internet of Things (IoT) devices, smart sensors, and connected machinery.
4. Enhanced Connectivity: 5G employs advanced technologies like beamforming and massive multiple-input multiple-output (MIMO) to improve connectivity. These techniques optimize signal transmission, reduce interference, and extend coverage, ensuring a more reliable and consistent connection.
5. Spectrum Efficiency: 5G utilizes a wider range of frequency bands, including millimeter waves, to transmit data. By leveraging higher frequencies, 5G networks can deliver more data in less time, improving overall spectrum efficiency.
6. Network Slicing: This feature allows network operators to partition their infrastructure into multiple virtual networks, each tailored to specific applications or user groups. Network slicing enables customization of services based on varying requirements for speed, latency, and bandwidth.
7. Edge Computing: 5G networks leverage edge computing capabilities to process data closer to the source, reducing latency and improving response times for critical applications. This distributed computing model enables real-time processing of data at the network edge, enhancing performance and efficiency.

8. Security Enhancements: 5G incorporates improved security measures to protect data and communications against cyber threats. Enhanced encryption, authentication mechanisms, and network segmentation help safeguard sensitive information and ensure the integrity of communications.

These key features collectively enable 5G technology to deliver unparalleled performance, reliability, and scalability, paving the way for a wide range of innovative applications and services across industries.

IV. TECHNICAL ASPECTS

Technical aspects of 5G technology encompass a range of innovations and advancements that distinguish it from previous generations of wireless networks. Some key technical aspects include:

1. Millimeter Waves: 5G utilizes higher-frequency bands, including millimeter waves (mmWave), to transmit data. These frequencies offer greater bandwidth and faster data rates, enabling ultra-fast communication.
2. Small Cells: 5G networks rely on a denser deployment of small cells, which are low-power, short-range base stations. Small cells increase network capacity and coverage, especially in urban areas with high user density.
3. Massive MIMO: Multiple Input Multiple Output (MIMO) technology is expanded in 5G to include massive MIMO, which employs a large number of antennas at both the base station and the user device. Massive MIMO enhances spectral efficiency, increases network capacity, and improves coverage.
4. Beamforming: Beamforming is a technique used in 5G to focus radio waves in specific directions, directing signal transmission to individual users or devices. This improves signal strength, reduces interference, and enhances network efficiency.
5. Network Slicing: 5G introduces network slicing, a virtualization technique that allows a single physical network infrastructure to be partitioned into multiple virtual networks, each tailored to different applications or user groups. Network slicing enables customization of services based on specific requirements for speed, latency, and reliability.
6. Virtualization and Cloud-Native Architecture: 5G networks leverage network virtualization and cloud-native architectures to improve flexibility, scalability, and resource utilization. Virtualization separates network functions from underlying hardware, allowing for dynamic allocation of resources and efficient management of network services.

7. Edge Computing: Edge computing is integrated into 5G networks to process data closer to the source, reducing latency and improving response times for time-sensitive applications. By moving computing resources closer to the network edge, edge computing supports real-time processing of data and enables low-latency applications such as IoT, autonomous vehicles, and augmented reality.
8. Advanced Modulation Techniques: 5G employs advanced modulation techniques, such as quadrature amplitude modulation (QAM), to increase data throughput and spectral efficiency. These techniques enable higher data rates and more efficient use of available spectrum.
9. Network Function Virtualization (NFV): NFV is a key component of 5G architecture, allowing network functions to be implemented in software rather than dedicated hardware appliances. NFV improves agility, scalability, and cost-effectiveness by decoupling network functions from proprietary hardware platforms.
10. Network Synchronization: 5G networks require precise synchronization to ensure accurate timing and coordination of signals across distributed base stations. Synchronization techniques such as time-division duplexing (TDD) and frequency-division duplexing (FDD) are employed to synchronize transmissions and receptions within the network.

These technical aspects collectively enable 5G technology to deliver high-speed, low-latency, and highly reliable wireless connectivity, supporting a wide range of applications and services across various industries and use cases.

V. IMPACT ON MOBILE CONNECTIVITY

The impact of 5G technology on mobile connectivity is profound and multifaceted, revolutionizing how we access and interact with information and services on mobile devices. Here are some key aspects of its impact:

1. Enhanced Speed and Bandwidth: 5G delivers significantly faster data speeds and greater bandwidth compared to previous generations of mobile networks. This enables users to download and upload content at unprecedented rates, stream high-definition videos with minimal buffering, and enjoy seamless online gaming experiences.
2. Ultra-Low Latency: One of the most significant advancements of 5G is its ultra-low latency, which reduces the delay between sending and receiving data to mere milliseconds. This near-instantaneous responsiveness enables real-time communication and interaction, making activities like video conferencing, online gaming, and remote control of IoT devices smoother and more immersive.
3. Improved Coverage and Connectivity: 5G networks utilize advanced technologies such as beamforming and massive MIMO to enhance coverage and connectivity. This means fewer dead zones, stronger signals indoors and in urban areas, and more reliable connections even in crowded environments with many users simultaneously accessing the network.
4. Support for IoT Devices: 5G networks are designed to accommodate the massive proliferation of Internet of Things (IoT) devices, ranging from smart sensors and wearables to connected appliances and industrial machinery. With its increased capacity and ability to handle a vast number of simultaneous connections, 5G enables the seamless integration and communication of IoT devices, driving innovation in smart homes, smart cities, and industrial automation.
5. Empowerment of Mobile Applications and Services: The high-speed, low-latency nature of 5G opens up new possibilities for mobile applications and services across various sectors. From augmented reality (AR) and virtual reality (VR) experiences to cloud gaming, telemedicine, and autonomous vehicles, 5G technology enables a wide range of innovative and data-intensive applications that were previously impractical or impossible on mobile devices.
6. Economic and Social Impact: 5G technology is expected to stimulate economic growth and drive innovation, creating new opportunities for businesses and entrepreneurs. It also has the potential to bridge the digital divide by improving connectivity in underserved areas and enabling access to essential services such as education, healthcare, and financial services through mobile devices.

Overall, 5G technology has a transformative impact on mobile connectivity, ushering in a new era of high-speed, low-latency, and highly reliable wireless communication that unlocks boundless opportunities for individuals, businesses, and society as a whole.

VI. 5G TECHNOLOGY IN OTHER INDUSTRIES

5G technology is poised to revolutionize various industries by enabling faster, more reliable, and highly responsive connectivity. Here's how 5G is expected to transform different sectors:

1. Healthcare: 5G facilitates remote patient monitoring, telemedicine, and real-time communication between healthcare professionals and patients. It enables the transmission of large medical imaging files, such as MRI scans, for rapid diagnosis and treatment planning. Additionally, 5G supports the development of innovative healthcare applications like augmented reality (AR) for surgical training and remote surgery.
2. Automotive: In the automotive industry, 5G enables vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication, enhancing road safety and enabling advanced driver assistance systems (ADAS) and autonomous driving functionalities. 5G also supports connected car services, such as real-time traffic updates, remote diagnostics, and over-the-air software updates.
3. Manufacturing: 5G technology facilitates the implementation of smart factories and Industry 4.0 initiatives by providing ultra-reliable, low-latency communication (URLLC) for real-time control of manufacturing processes and machinery. It enables the deployment of IoT devices and sensors for predictive maintenance, quality control, and supply chain optimization.
4. Entertainment and Media: 5G enhances the delivery of high-definition video streaming, gaming, and immersive media experiences, such as virtual reality (VR) and augmented reality (AR). It enables faster downloads and reduced buffering times for streaming services, as well as the development of interactive gaming and entertainment applications.
5. Retail: In the retail industry, 5G technology enables personalized shopping experiences, augmented reality (AR) product visualization, and cashier-less checkout systems. It supports the deployment of IoT devices for inventory management, supply chain optimization, and smart shelving systems that automatically track product availability and pricing.
6. Smart Cities: 5G plays a crucial role in the development of smart cities by enabling connected infrastructure, IoT sensors, and real-time data analytics for urban planning and management. It supports smart transportation systems, intelligent traffic management, environmental monitoring, and public safety applications such as video surveillance and emergency response.

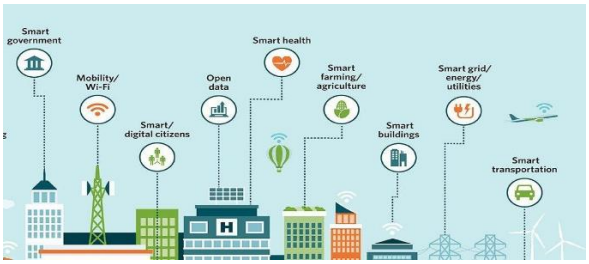

Fig. 3- Smart city

7. Education: In the education sector, 5G facilitates remote learning, virtual classrooms, and interactive educational content delivery. It enables real-time collaboration among students and educators, as well as access to online resources and digital learning platforms from anywhere with high-speed, low-latency connectivity.
8. Finance: 5G technology enables faster and more secure mobile banking services, digital payments, and financial transactions. It supports the development of innovative fintech applications, such as mobile wallets, peer-to-peer lending platforms, and robo-advisors, while ensuring robust cybersecurity measures to protect sensitive financial data.

Overall, 5G technology has the potential to transform various industries by enabling new capabilities, improving operational efficiency, and driving innovation across sectors.

VII. CONCLUSION

In conclusion, 5G technology represents a monumental leap forward in connectivity, offering unprecedented speed, reliability, and versatility. With its higher speeds, ultra-low latency, and increased capacity, 5G has the potential to revolutionize how we connect, communicate, and interact with the digital world. The impact of 5G on connectivity is

profound and far-reaching, spanning across various industries and sectors. From healthcare and automotive to manufacturing, entertainment, and smart cities, 5G technology enables a wide range of innovative applications and services that were previously impractical or impossible. By facilitating remote patient monitoring, autonomous vehicles, smart factories, immersive media experiences, and connected infrastructure, 5G empowers individuals, businesses, and communities to unlock new opportunities, drive efficiency, and enhance quality of life. However, realizing the full potential of 5G requires collaboration and investment from governments, regulatory bodies, telecommunications companies, and industry stakeholders. Addressing challenges such as spectrum allocation, infrastructure deployment, cybersecurity, and digital divide is essential to ensuring equitable access and maximizing the benefits of 5G technology for all. As countries worldwide continue to roll out 5G networks and embrace the possibilities of a connected future, it is crucial to recognize the transformative impact of 5G on connectivity and to harness its capabilities responsibly to create a more connected, intelligent, and prosperous world for generations to come.

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The role of Nanographene as an Electrode Materials in Li-ion Batteries-Synthesis, Characterization and fictionalization

Dr. Parvez ahmed[1], Simran[2], Bindu D Gudlar[3], N Zoya[4]

[1] Head of Department of Chemistry, VTU/GITW-Bengaluru, Karnataka, India.

[2,3,4] First year engineering students, Department of computer science & engineering, VTU/GITW-Bengaluru, Karnataka, India.

ABSTRACT

As the energy demand increase tremendously all over the world and available fossil fuel energy resource depleting very fast, the need of alternate energy sources is essential. Batteries are best alternate to meet these challenges. Several portable batteries are available in the market and having varieties of applications in field of communication, medical sciences, Electric vehicles etc. Among the different category, Li-ion battery is one which have wide range of applications. Li-ion batteries composed of graphite and Li intercalated electrodes having an output voltage 3.7V. In our present work, an effort has been made to improve the performance of Li-ion battery by replacing graphite anode with nanographene anode. New developed Graphene anode is characterized with SEM, EDAX, XRD etc. and fictionalized by charging and discharging cycle to study the efficiency of the newly fabricated battery.

Key words: Graphene battery, Nanographene, Li-ion battery.

I. INTRODUCTION

Energy demand rapidly increasing as the human being are becoming more and more dependent on each and every activities. But the natural energy sources like fossil fuel resources is depleting very fast and exhausting day by day and may exhaust in another 50 years.

the need of alternate energy sources is essential to meet this high demand. Apart from solar energy whose efficiency purely depends on seasonal variation, Batteries are best alternate energy sources.

Batteries based on electrochemical reactions are the most widely used devices for storage of electric current.Portable source of energy are the key component in vital sector including electronic devices, power backup, electric vehicles, emergency power supply, microchips, wireless communications devices such 4G mobile phone etc.Hence understanding present key technology of batteries and discovering of new batteries is an impotent for further improving existing technology.

Since Graphene is a wonderful materials with the ability to change the world. As bulletproof armor, ultralight aeroplane and space elevator etc. nanotechnology is bringing to reality to power out the world. Having developed and produce a single layer Graphene of Graphene oxide and used as electrode material for the batteries brings a new era of battery technology.

A. Why Graphene as an electrode materials?

Graphene has unique physicochemical properties like high surface area, good bio-compatible, strong mechanical strength, excellent thermal conductivity and fast electron transportation.The use of Graphene in the manufacturing of rechargeable batteries could be a great leap towards energy efficiency. Using this material as an electrode for modern batteries would prevent devices overheating, increasing the life time of the battery and decreases the charging time. Graphene is a tougher and lighter material hence suitable materials for manufacturing of drone batteries as well

II. PREPARATION OF GRAPHENE ANODE

Preparation of Graphene slurry: Graphene slurry can be prepared by dispersing a known quantity of nanographene powder in required amount ethanol in presence water soluble and water insoluble binding agent such as polyvinyl pyrolidone (PVP) and polyvinyl butyral (PVB).

About 1-2 g PVB and 0.5 to 1 g of PVP dissolved in absolute alcohol such as ethanol for which about 5g of nanographene powder was added with continuously stirring by keeping the mixture over magnetic stirrer until a homogeneous slurry is obtained. The commercially available electrolyte copper foil about 10 μm thick is taken to prepare Graphene anode.Both the surface of the copper foil is cleaned with dilute acid followed by with an organic solvents to remove dust, dirt, oily and greasy particles and air dried.The slurry is deposited on both the surface by spray pyrolysis technique uniformly on both the side of the foil. The prepared electrode is air dried and annealed by using muffle furnace.

III. FABRICATION OF GRAPHENE BATTERY: THE COMPLETELY

discharged Li-ion battery is carefully opened to separate anode and cathode. The Graphite anode is replaced with the newly prepared Graphene anode. The anode and cathode should be separated with a synthetic separator winch is previously soaked in LiPF6 electrolyte.

The anode and cathode assembly are fold into several layers and rapped with Kapton tape. Finally, the electrodes are sealed in a PVC sleeve with proper electric wiring.

IV. RESULT AND DISCUSSION

The Electrode prepared by the above procedure is subjected characterized by taking Scanning electron micro graphs and EDAX in order to ascertain the external morphology, chemical composition, crystalline structure and orientation of materials making up the sample. The data are collected over selected area-of the surface sample, two dimensional images are generated.

The average diameter of the nanoparticles was confirmed to range from 50–70 nm. Figure 2b shows that the lateral dimension of the Graphene nanosheets varies from 50 to 150 nm, indicating the relatively low quality of the material. However, the thickness of the Graphene sheets is about a few nanometers, which is beneficial for applications that require high specific surface area and electrical conductivity. EDX profile of graphene (Fig. 1C) is exhibited the signals corresponding to C and O with wt. % of 64 and 36 respectively.

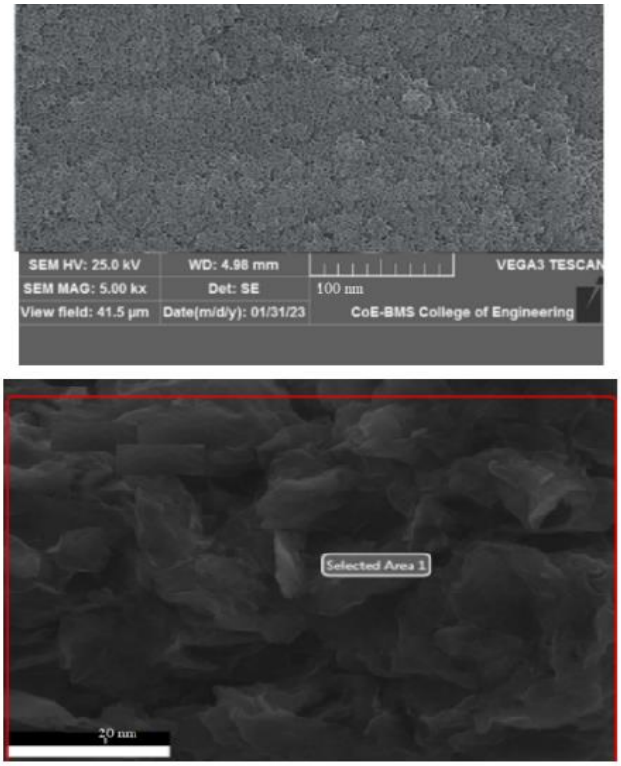


Fig. 4(a) SEM images of nanographene

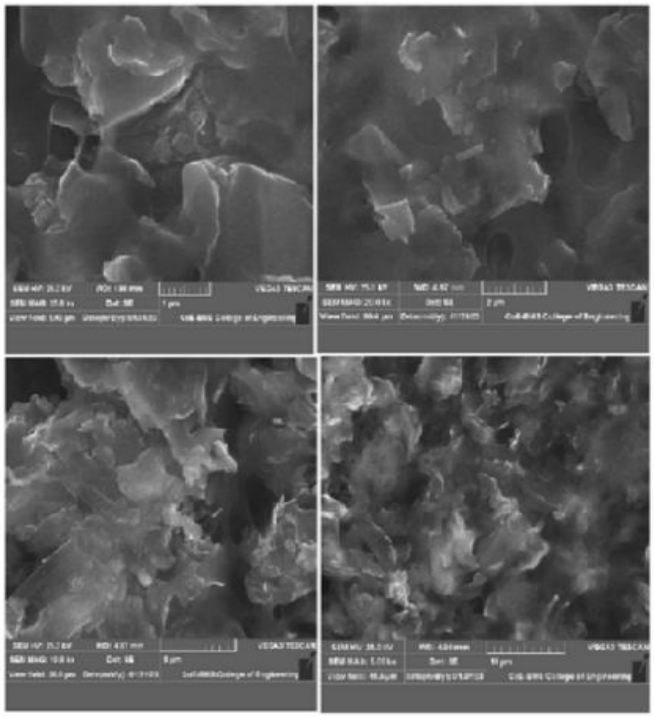


Fig. 4(b) shows SEM images of nanographene of diameter varies from 1-10 micrometer and thickness few nanometer

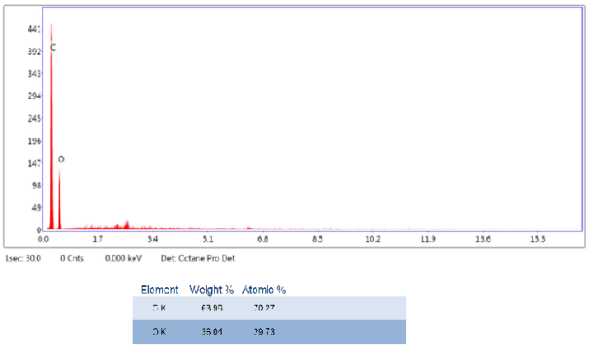


Fig.5, EDAX of nanographene

V. CHARGE/ DISCHARGE CYCLE

Graphene, the atomic-scale single layer of carbon atoms bound together in a honeycomb lattice arrangement, might become one of the world's most useful materials but they are not fully commercially available. The extensively enhanced performance and life cycle advantages when fabricating Graphene-based batteries over traditional LIBs are surely worth the huge resource investments of last decade.

Sl/No.	Time in minutes	Percentage of discharge	Voltage
1	0	100	4.6
2	10	100	4.4.
3	20	100	4.2
4	30	100	4.05
5	40	98	3.97
6	50	97	3.94
7	60	95	3.87
8	70	90	3.83
9	80	85	3.75
10	90	75	3.63
11	100	65	3.44
12	110	55	2.84
13	120	35	2.0
14	130	30	1.9

The Graphene battery after proper fabrication is subjected charging and discharging process by using amicisense battery capacity voltmeter.The results obtained by Graphene electrode battery well compered with ordinary Li-ion batteries.Graphene based Li-ion battery shows

Some remarkable results like high voltage when compare to LIB's (4.6V >< 3.7V) and allows for high charge and discharge rates,stable long-term cycling and even economical affordability. Hence this technology is the most promising one for reaching new ground-breaking achievements in the field of lithium ion batteries and to develop the next-generation energy storage devices

5.1 Charging /discharging cycle of Graphene battery

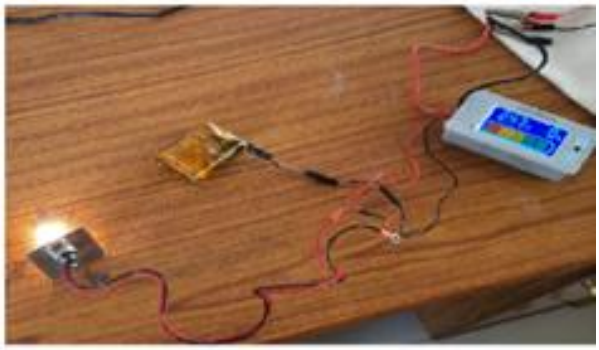
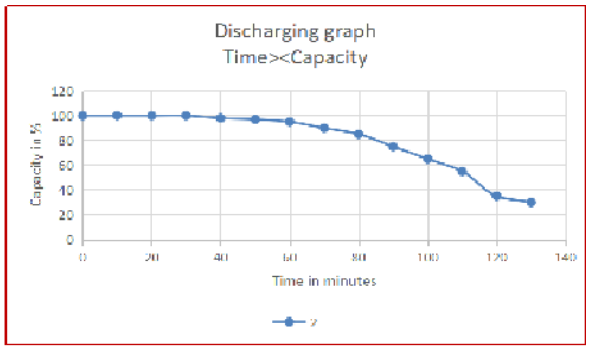


Fig.6 Discharging of graphene battery.

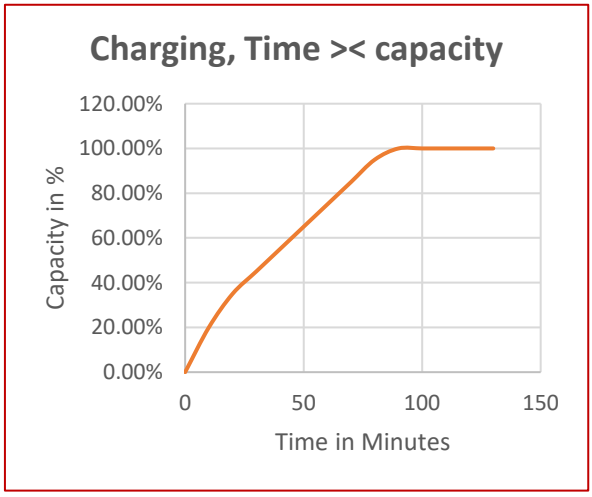
Fig.7 Fully charged graphene battery with voltage of 4.88 V

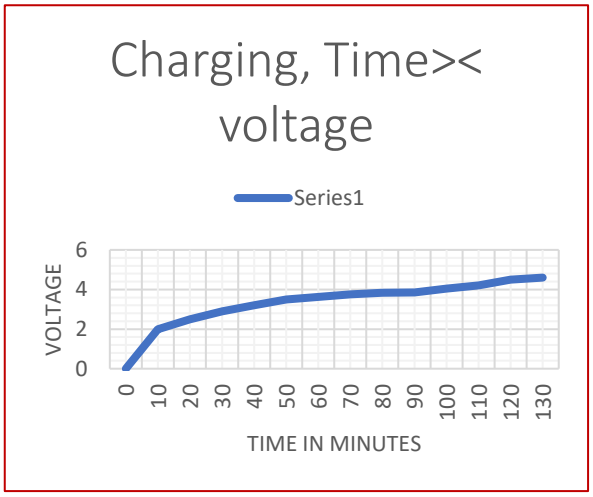
5.2 Charging /discharging cycle

5.21 discharging



5.22 Charging





VI. CONCLUSION:

We have successfully developed a prototype Graphene battery by replacing the graphite anode with nanographene coated anode. From the result obtained by the experiments it is concluded that Graphene is promising candidate in the construction of modern batteries using as either anode or cathode. In our present studies it is found that the graphene battery is high performance battery when compare to of Li-ion battery. The output voltage of graphene battery is 4.6 V ><3.7 Charging and discharged efficiency is comparatively good , capacity of the battery is constant after the voltage reached to 3.8V, will not by die off suddenly when the voltage drop. Charging/discharging cycles are good with good efficiency if about 87% . Hence Graphene battery is the next generation rechargeable battery and the best alternate for electric vehicles

Sl/No.	Time in minutes	Percentage of discharge	Voltage
1	0	0.0%	0.0
2	10	20	1.9
3	20	30	1.95
4	30	40	2.0
5	40	50	2.85
6	50	60	3.44
7	60	70	3.63
8	70	75	3.75
9	80	80	3.83
10	90	100	3.85
11	100	100	4.05
12	110	100	4.2
13	120	100	4.5
14	130	100	4.6

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