



EEE ASSOCIATION

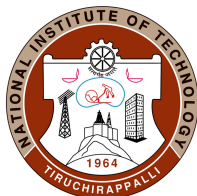


TRONICALS

Vol 7
Issue 1

Cover Story:

ELECTRIC PATHWAYS



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI



Message from the H.O.D.



Dr. V. Sankaranarayanan

I AM DELIGHTED TO WRITE A BRIEF MESSAGE FOR THE FIRST ISSUE OF TRONICALS FOR THIS ACADEMIC YEAR, THE NEWSLETTER OF THE EEE DEPARTMENT. THE DEPARTMENT STRIVES TO PREPARE ITS STUDENTS TO EXCEL IN THEIR CAREERS AND CONTRIBUTE TO THE EVER-GROWING WORLD OF TECHNOLOGY.

THIS EDITION OF TRONICALS HIGHLIGHTS THE VARIOUS ACHIEVEMENTS OF THE FACULTY AND STUDENTS OF THE DEPARTMENT, DISCUSSES SOME OF THE UPCOMING TECHNOLOGIES IN THE FIELD AND ALSO GIVES AN INSIGHT INTO THE VARIOUS MILESTONES THAT HAVE BEEN ACHIEVED IN THE PAST YEAR.

THE DEPARTMENT HAS ALWAYS ENCOURAGED ITS STUDENTS AND FACULTY TO TAKE UP PROJECTS IN THE CORE DOMAIN AS WELL AS INTERDISCIPLINARY TOPICS. WHICH STATE OF THE ART INFRASTRUCTURE ALLOWS STUDENTS AND RESEARCH SCHOLARS TO CONDUCT RELIABLE AND CONCRETE RESEARCH EXPERIMENTS WHICH LEAD TO THE FRUITFUL ACADEMIC OUTPUT.

THE EEE ASSOCIATION HAS BEEN INVOLVED IN IDEATING AND ORGANISING A DIVERSE SET OF EVENTS AND ACTIVITIES THAT ARE INFORMATIVE, INNOVATIVE AND BRING OUT THE CREATIVITY IN STUDENTS. TECHNICAL WORKSHOPS, SEMINARS, TECHNICAL CONTESTS, QUIZZES, EXHIBITIONS AND THE SYMPOSIUM CURRENTS ARE ONLY SOME OF THE RESPONSIBILITIES THAT ARE CARRIED OUT BY THE ASSOCIATION.

ON THAT NOTE, I WELCOME ALL THE STUDENTS AND FACULTY TO THE DEPARTMENT OF EEE!

Message from the F.A.



Dr. Josephine R. L.

ON BEHALF OF THE EEE ASSOCIATION, I WISH TO EXTEND MY WARMEST GREETINGS TO THE EEE FAMILY OF NITT. I TAKE IMMENSE PLEASURE TO BE THE FACULTY ADVISOR OF THIS ASSOCIATION WHICH IS FILLED WITH INNOVATIVE AND YOUNG DRIVEN MINDS. THE ASSOCIATION HAS ACTIVELY CONDUCTED SEVERAL TECHNICAL WORKSHOPS, EVENTS FOR SCHOOLS AND COLLEGES, QUIZZES AND SEMINARS, AND VARIOUS OTHER HUMANITARIAN ACTIVITIES FOR SOCIETY. THE PAST FEW YEARS HAVE BEEN FILLED WITH UNFORESEEN CHALLENGES BUT THAT HAS NOT DETERRED OUR DEDICATION AND MOTIVATION TO STRIVE FURTHER IN THIS ASSOCIATION.

TRONICALS IS A MEDIUM TO BROADCAST THE ACTIVITIES AND ACCOMPLISHMENTS OF ENTHUSIASTIC STUDENTS AND DISTINGUISHED FACULTY. WITH HIGHLY TALENTED DRIVEN OFFICE BEARERS AND MEMBERS OF THE ASSOCIATION, I AM SURE WE CAN ATTEND EVEN GREATER HEIGHTS THIS YEAR. I CREDIT THE EDITORIAL TEAM FOR THEIR VALUABLE EFFORTS IN CURATING THIS MAGAZINE. I HOPE ALL OF YOU ENJOY READING THIS EDITION.

EDITORIAL TEAM



VISION AND MISSION OF THE DEPARTMENT



ABOUT:

THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING, NIT, TIRUCHIRAPPALLI WAS STARTED IN THE YEAR 1964. IT OFFERS ONE UNDER-GRADUATE PROGRAMME (B.TECH.), TWO POST-GRADUATE PROGRAMMES (M.TECH. IN POWER SYSTEMS AND POWER ELECTRONICS) AND ALSO RESEARCH PROGRAMMES (M.S. AND PH.D.) IN THE VARIOUS FIELDS OF ELECTRICAL AND ELECTRONICS ENGINEERING. AFTER THE INSTITUTE BECAME NIT, THE DEPARTMENT HAS GROWN NOT ONLY IN TERMS OF STUDENT AND FACULTY STRENGTH, BUT ALSO IN IMPROVING THE LABORATORY FACILITIES FOR THE TEACHING AND RESEARCH PURPOSES. THUS, THE DEPARTMENT HAS DEDICATED AND STATE OF THE ART TEACHING / RESEARCH LABORATORIES. THE DEPARTMENT IS RECOGNIZED FOR EXCELLENCE IN RESEARCH (FIRST DEPARTMENT IN NIT-T TO BE ACCORDED QIP STATUS FOR PH.D. PROGRAMME), TEACHING AND SERVICE TO THE PROFESSION.

THE FACULTY MEMBERS HAVE STRONG SENSE OF RESPONSIBILITY TO PROVIDE THE FINEST POSSIBLE EDUCATION FOR BOTH GRADUATE AND UNDERGRADUATE STUDENTS. THE ACADEMIC STRENGTH OF THE FACULTY IS REFLECTED BY THE ALUMNI, MANY OF WHOM ARE IN THE TOP ECHELONS OF INDUSTRY AND ACADEMIA BOTH IN INDIA AND ABROAD.

VISION:

TO BE A CENTRE OF EXCELLENCE IN ELECTRICAL ENERGY SYSTEMS.

MISSION:

- EMPOWERING STUDENTS AND PROFESSIONALS WITH STATE-OF-ART KNOWLEDGE AND TECHNOLOGICAL SKILLS.
- ENABLING INDUSTRIES TO ADOPT EFFECTIVE SOLUTIONS IN ENERGY AREAS THROUGH RESEARCH AND CONSULTANCY.
- EVOLVING APPROPRIATE SUSTAINABLE TECHNOLOGIES FOR RURAL NEEDS

CONVOCATION 2021

B.Tech (Total 102)

Honours: 4

Graduands: 98

M.Tech Power Systems (Total 22)

First Class With Distinction: 7

First Class: 15

M.Tech Power Electronics (Total 19)

First Class With Distinction: 11

First Class: 8



Total number of
graduands from
Electrical and
Electronics Engineering
this year was 143

A decorative graphic featuring three blue graduation caps with orange tassels and orange streamers, arranged around a central white rectangular area. The background is light blue with vertical stripes.

2021 PHD SCHOLARS

CONGRATULATIONS
TO ALL THE SCHOLARS AND THEIR GUIDES.

ELECTRICAL AND ELECTRONICS ENGINEERING

NAMES OF THE GUIDE	ROLL NUMBER	NAME	TITLE OF THESIS
DR. SISHAJ P SIMON	407113051 9TH APRIL 2021	ROHIT RAJAN EAPEN	Economic Demand Response Management of a Secondary Distribution System
DR. SISHAJ P SIMON	407116004 24TH AUGUST 2021	MOHAMMED MANSOOR O	Design, Experimentation, Performance and Feasibility analysis of Solar Photo-voltaic Mirroring System
DR. G. SARAVANA ILANGO CO-GUIDE: DR. M. JAYA BHARATA REDDY	407115001 24TH DECEMBER 2020	B PRADEEP KUMAR	Investigation of Effective Schemes for Detecting Array Faults and Module Degradation in PV Systems
DR. S. MOORTHY	407115003 19TH FEBRUARY 2021	ADITYA S	Digitally Controlled Oscillator for a Frequency Synthesizer in Reconfigurable RF Front-Ends
DR. M. VENKATAKIRTHIGA	407115004 19TH MARCH 2021	SRIVIDHYA S	Studies on Microgrid Planning with High Penetration of Synchronous Generators
DR. S. SUDHA	407115005 26TH JULY 2021	D UMA MAHESWARI	Investigations on Two-Level Routing Techniques to Enhance the Lifetime of Clustered Wireless Sensor Network
DR. S. SENTHIL KUMAR	407115006 20TH JULY 2021	BHOREDDY MALAKONDAREDDY	Analysis, Design and Testing of Control Schemes for Grid-Tied Photo-Voltaic Systems for Performance Enhancement

NAMES OF THE GUIDE	ROLL NUMBER	NAME	TITLE OF THESIS
DR. DHANALAKSHMI K / ICE	407115007 15TH JUNE 2021	APPIKONDA M DURGA KUMAR	Modelling and Control of DC - DC Converter With Voltage Multiplier Cells for Photovoltaic System Application
DR. M.P. SELVAN	407117005 23RD AUGUST 2021	BOKKISAM HANUMANTHA RAO	Investigations on Framework of Transactive Energy Market for Residential Community Microgrid
DR. C. NAGAMANI CO-GUIDE: DR. G. SARAVANA ILANGO	407117006 21ST JUNE 2021	RAJESH K	Certain Investigations for Improved Performance of a Permanent Magnet Brushless DC Motor Drive
DR. K. SUNDARESWARAN	407117007 17TH MAY 2021	SATHEESH KRISHNAN G	Development, Implementation and Analysis of Modified Swarm Intelligence Techniques towards Maximum Power Point Tracking in Photovoltaic Systems
DR. S. ARUL DANIEL	407118011 11TH SEPTEMBER 2021	VENKATESH BODDAPATI	Design and Feasibility Assessment of Autonomous, Grid-Connected Energy Systems
DR. N. KUMARESAN CO-GUIDE: DR. S. SENTHIL KUMAR	407915051 12TH JULY 2021	MAHABOOB SUBAHANI	Operation and Control of Self-Excited Induction Generator and Associated Power Electronic Controllers for DC Supply System
DR. V. SANKARANARAYANAN	407913052 14TH SEPTEMBER 2021	D MENAGA	Nonlinear Control of Single-Stage Grid-Connected Photovoltaic System

CURRENTS 2020-2021

(DAY 1)

CURRENTS INAUGURATION

The 31st edition of Currents took place virtually this academic year from 26th - 28th of February. The EEE Association's three-day national level symposium typically encompasses seminars, technical contests and quizzes, exhibitions, workshops, and paper presentations. The Currents'21 inauguration ceremony took place on the morning of 26th, graced by the HoD, faculty, EEEA members and the student community.

With 250+ students attending the ceremony, Dr Nambi Seshadri - Professor in the ECE department of the University of California- San Diego, was the Guest of Honour, and he is also a proud Alumni of batch'82. His special lecture titled "Personal reflection on a career in Wireless Communications" was delivered right after the ceremony, followed by a short Q&A session by the students.

WORKSHOP 1 - MACHINE LEARNING

For ML enthusiasts, the workshop's team of the EEE Association conducted the Machine Learning workshop on the first day of the symposium. The entire workshop was divided into two sessions. During the first session of the workshop, Introduction to the theoretical concepts of Image Processing, OpenCV, Perceptron, multilayer Perceptron, Haar Cascade for face detection was explained to the participants. During the second session, Deep Learning, Convolutional Neural network concepts were briefly explained. Later, the concepts behind the Google Colab IDE and how the IDE can work on ML Algorithms were explained.

(DAY -2)

During the second day of the symposium, two Events (Dhruva and Code Currents) and a PCB Designing workshop were conducted. The day was made special and memorable by the honourable Special Guest, Dr Venkatesh Prasad. He is an alumnus of batch'80. Dr Prasad is a Senior Technical leader and member of the technology advisory board of Ford Motor company. He enlightened the young minds with his lectures on "Career Pathways & Engineering Internships". He also shared his life journey from being a student of NIT Trichy and other Achievements.

EVENT 1: DHRUVA

Dhruva is an event that tests one's creativity and wit through a series of arbitrary challenges designed to make the participants to think outside the box. For Currents '21, there were 125 registrations from over 20 colleges across India. The first round of Dhruva '21 consisted of puzzles and riddles designed to test their ability to solve problems, with no preset route to solve, while facing a time crunch. The top 16 participants from the first round were shortlisted for the second round. The second round involved a group of debate topics that were provided to the participants. They were expected to balance both sides of the argument equally and were evaluated on balance between both sides, the quality of the arguments and the use of wit. The top 3 candidates were given certificates and a cash prize.

EVENT 2: CODE CURRENTS

Code currents is an online coding contest conducted by CodeChef in association with the Currents symposium. For Currents'21, the event was conducted on 27th February. It is a coding contest based on algorithms, data structures and problem-solving. It provided participants with a set of coding challenges that test their logical skills in programming. The participants must solve them by coding programs in any one of the programming languages. The programs were tested with sample test cases and checked for logical correctness. Participants were ranked according to the most problems solved. The Winners of the event were declared based on certain judging criteria.

EVENT 3 - CAPTURE CURRENTS :

Capture Currents is an online photography event. There were two rounds in the event. In each round, the participants were given a theme, and they had to post the photographs on Instagram and tag the Currents page along with unique hashtags. The first round of the event was conducted on 22nd February. The theme was based on "Forgotten Electronics". The participants were selected to the final round based on the post's views and likes and based on specific other judging criteria. The theme for the final round was decided as "Wildlife". For this round, we had the opportunity to invite Mr Jayaprakash Bojan, a famous wildlife photographer. After a detailed inspection, the Judge announced the top three winners.

WORKSHOP 2: PCB DESIGNING

PCB designing workshop was conducted on 27th February. The entire workshop was divided into two sessions. The first session involved familiarizing the participants with the basic PCB concepts, different steps involved in designing and fabrication of the PCBs. The second session involved familiarizing the Autodesk EAGLE Software, which is generally used for PCB designing. The participants were given live tasks to simulate various designs during the workshop.

(DAY 3)

VALEDICTION :

During the third and final day of the symposium, the Valediction ceremony took place on 28th February afternoon, graced by honourable chief guest Dr Ganapathy Subramaniam, CEO of Cosmic Circuits. Dr Subramaniam enlightened the young minds with the various opportunity available to them in the future. Then the evening was sweeter and melodious by the famous fluteboxer, Mr Sudhir with his exceptional talents in musical Instruments. Mr Sudhir was India's first-ever Fluteboxer, and one of the semi-finalists in Asia Got Talent and India Got Talent.

WORKSHOP 3: IMAGE PROCESSING WITH GAME DEVELOPMENT

The Image processing workshop was conducted on the last day of the symposium. In the first session of the workshop, the basics of Image Processing in Python3+ using OpenCV library was introduced with hands-on. Followed by this, a basic introduction to the turtle library was given to the participants. In the second half of the workshop, a basic ping pong game was constructed using the concepts learnt during the initial part of the workshop. The Pongs were controlled by masking two real-life objects in real-time.

EVENT 4 - COLLOQUIUM :

Colloquium is the Paper presentation event conducted by the events team of EEEA on 22nd February. During the first round of the event, participants were asked to submit their papers in IEEE standard format, which was later checked for plagiarism. The Top ten finalists were asked to provide a PPT presentation in front of honourable judges Dr Raja and Dr Naveen Yalla on the symposium's final day. The top three presentations were announced as winners by the judges.

Currents 2021, which was organized and managed solely by the students of the EEE Association, was spread over three days with 3 Workshops, 4 Events and 3 Guest Lectures and was a grand success.

Electric Pathways

1.) Introduction

"As the demand for fossil fuel is enormously increasing over time, the future of generating power using non-renewable energy will come to a halt. This overconsumption and the associated risks are pressuring the environment and economy. Therefore, looking for sustainable sources to produce energy is simply a shortcut to long-term profit earnings and an incentive towards developing "innovative ways to generate energy" to expand and produce clean-energy products."

We all have heard/read the above very often, which is why we would like to introduce to you below an exciting and relatively new field of research that could potentially serve as one of the smaller-scale solutions to our ever-growing energy crisis.

In big cities, walking and vehicular activity is very high. This is especially true at the centre of community activities such as trade centres, offices, and education. Therefore, adequate innovation is needed to make transportation paths a source of electrical energy by applying Piezoelectric Sensor Technology as a conversion medium energy.

2.) Piezoelectric technology

Redirecting routes to integrate the principle of piezoelectric devices to urban roads is significant at this stage. Focusing on the transition of energy to piezoelectric integrated roads will lead to a viable and more reliable source of energy.

The term Energy Harvesting refers to producing electrical energy by utilizing the energy present in our surroundings. However, energy formed from various vibration machines, objects in motion, or any other source of mechanical energy is often left untapped and left to waste. As an effective method to utilize this loss, piezoelectric materials absorb the wasted mechanical energy and convert it to electrical energy.

3.) What is piezoelectricity? What are piezoelectric materials? What are some common piezoelectric materials?

Piezoelectricity is defined as the capability of some crystals and other materials to generate an electrical voltage when subjected to pressure or strain treatment. This happens when some parts of the crystal develop a positive and negative charge at two different regions to form electrodes. These electrodes then cause the accumulation of electrical charge on the item. The more pressure given or received on the piezo element, the more the resulting output voltage.

4.) Different type of piezoelectric materials:

There are many kinds of piezoelectric materials that can harvest energy from the movement of vehicles on highways. The main classes are made of crystals that have a natural piezoelectric effect, such as piezoceramics (lead zirconate titanate [PZT]), polymer (polyvinylidene fluoride [PVDF]), macro fibre composite [MFC], piezoelectric semiconductors [ZnO₂] and glass-ceramics [Ba₂TiSiO₆, Li₂Si₂O₅]. However, each piezoelectric material has different mechanical and piezoelectric properties.

The most commonly used are piezoceramics and polymer. The piezoceramics are rigid, while the polymers are flexible and soft. The polymers generate less energy than the piezoceramics, and this is due to the different piezoelectric and dielectric properties.

5.) Application of piezoelectric materials in roadways/sidewalks/pavements– how do they work?

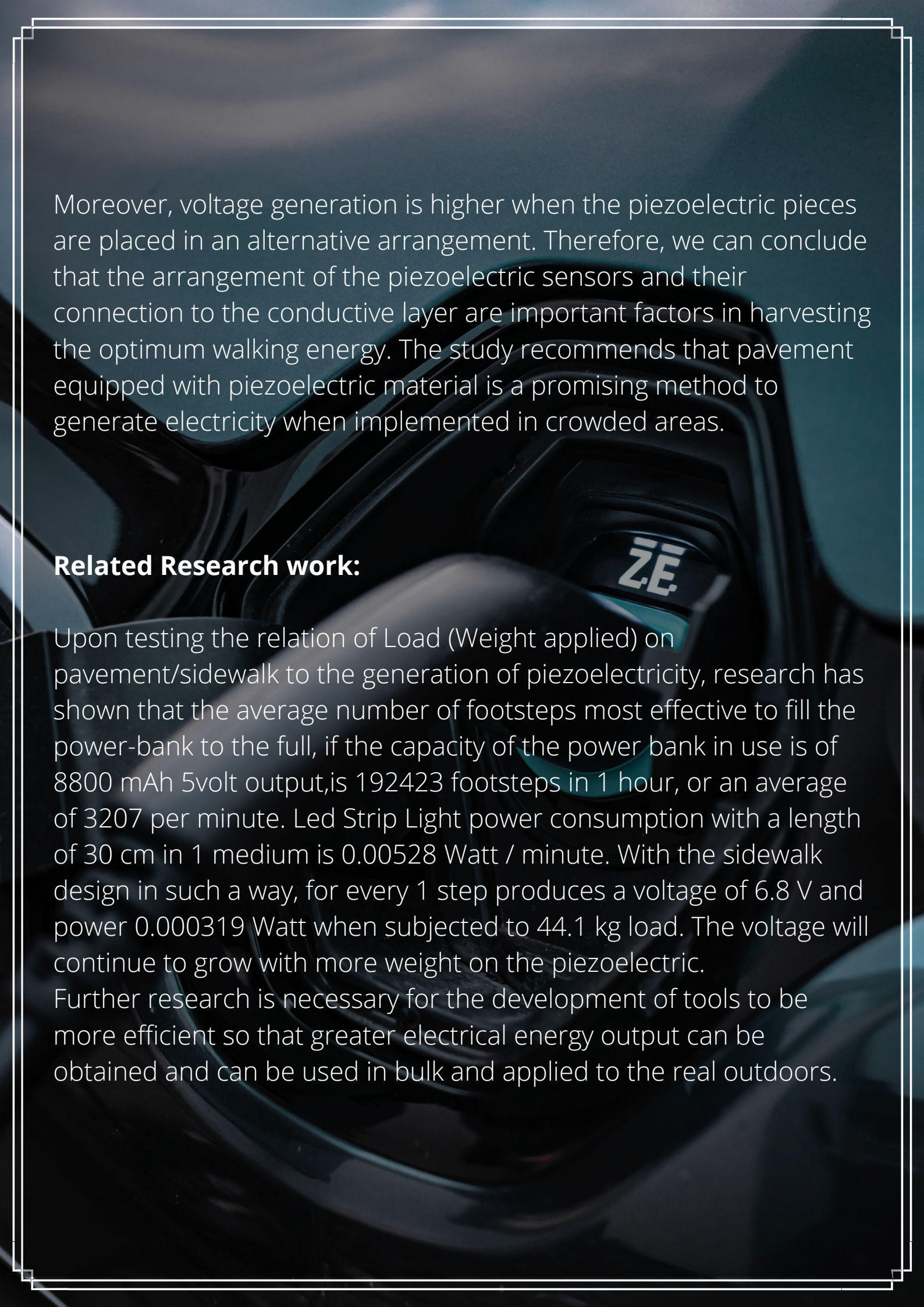
Powering Traffic Lights/Signs and Street lighting:

1. Using piezoelectric roads:

Piezoelectric crystals can be embedded about 5 cm underneath the asphalt layer to utilize the energy generated due to the vehicle motion, as illustrated below. As the vehicles move over the asphalt layer, the wheels exert a force or pressure into the crystals, and it will deform. This deformation in the crystal will absorb the force and undergo the process of power generation, to be stored in batteries. The use of storage is essential at this stage, since street lights are operated for 12 h per day. Therefore, the energy can be dispersed when required.

2. Using piezoelectric sidewalks/pavements:

Pavement material is an essential factor to consider when creating a pedestrian and environmentally friendly walkway. Generally, the kinetic energy of our footsteps when we walk is mostly wasted. This energy can be harvested and converted to electrical power. Using piezoelectric materials within pavements in the form of tiles, the kinetic energy of walking is gathered through a piezoelectric mechanism. Research studies propose a pavement consisting of piezoelectric sensors. Flexible and green materials are selected as the top layer of the pavement. The scaled prototype is fabricated according to the mechanism of walking. The pavement is tested in terms of voltage generation in different arrangements. The results show that in order to harvest the optimum energy of walking, the piezoelectric sensors need to be covered with a conductive layer such as a steel sheet. Also, it is found that covering the piezoelectric materials with a hard surface results in effective load distribution over the sensors when stepping on it, generating more voltage.



Moreover, voltage generation is higher when the piezoelectric pieces are placed in an alternative arrangement. Therefore, we can conclude that the arrangement of the piezoelectric sensors and their connection to the conductive layer are important factors in harvesting the optimum walking energy. The study recommends that pavement equipped with piezoelectric material is a promising method to generate electricity when implemented in crowded areas.

Related Research work:

Upon testing the relation of Load (Weight applied) on pavement/sidewalk to the generation of piezoelectricity, research has shown that the average number of footsteps most effective to fill the power-bank to the full, if the capacity of the power bank in use is of 8800 mAh 5volt output, is 192423 footsteps in 1 hour, or an average of 3207 per minute. Led Strip Light power consumption with a length of 30 cm in 1 medium is 0.00528 Watt / minute. With the sidewalk design in such a way, for every 1 step produces a voltage of 6.8 V and power 0.000319 Watt when subjected to 44.1 kg load. The voltage will continue to grow with more weight on the piezoelectric. Further research is necessary for the development of tools to be more efficient so that greater electrical energy output can be obtained and can be used in bulk and applied to the real outdoors.

6.) Suitable places to adopt this idea?

With regards to implementation of this technology in roadways: Since traffic flow rate (vehicles/h) affects piezoelectric power density, piezoelectric technology performs best in areas with high traffic flow rates.

Even average traffic speed (km/h) affects piezoelectric power density. Therefore, highways, flyovers and high-speed motorways are most practical for implementation of such piezoelectric technology.

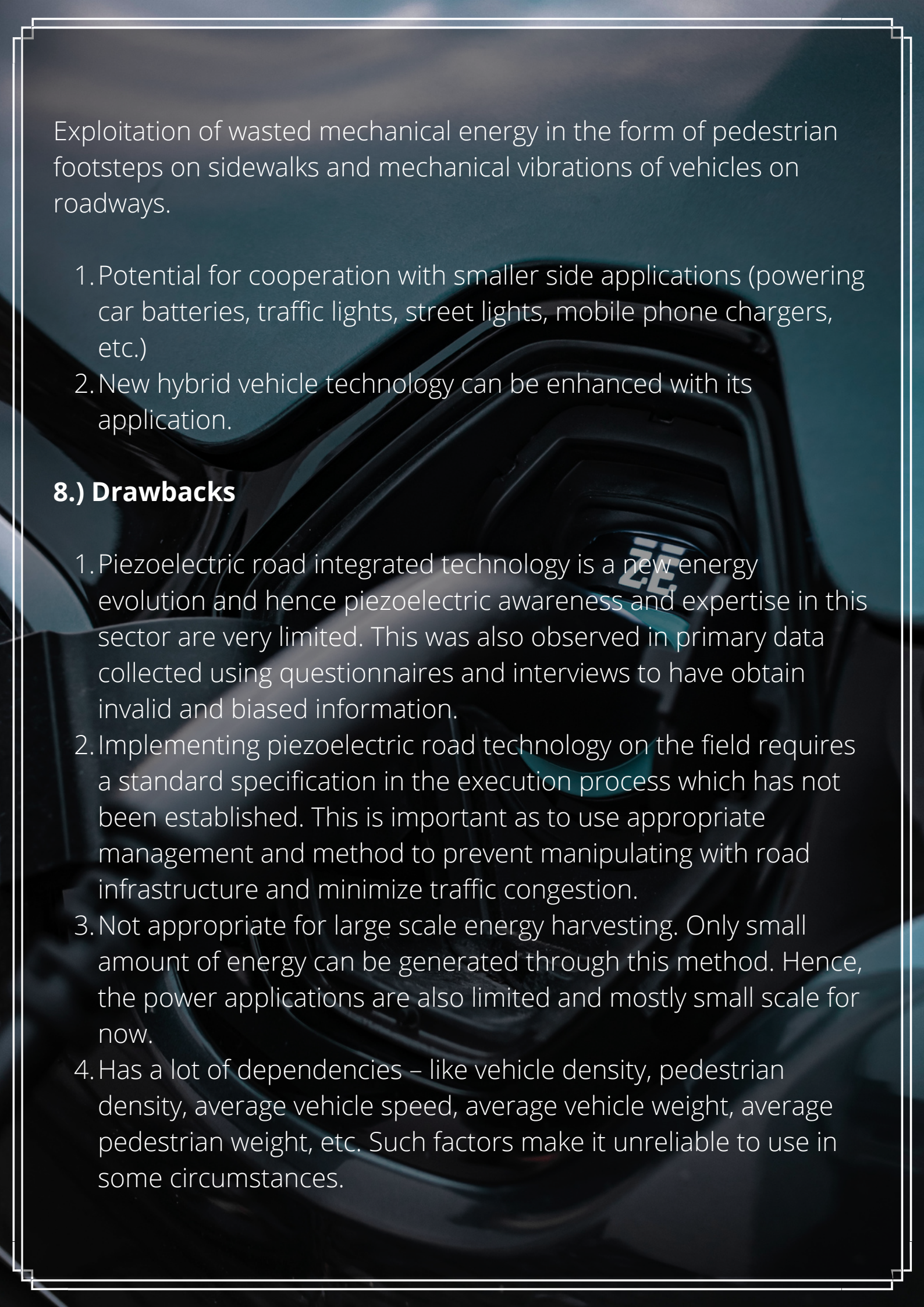
With regards to implementation of this technology in sidewalks/pavements:

In big cities, where pedestrian activity is very high, especially in the centre of community activities such as trade centres, offices, and education. Such places are most suitable for implementation.

Public jogging tracks and parks where jogging/walking is the primary activity are also some places where the technology can be applied effectively.

7.) Advantages

1. Renewable source of energy
2. Save the cost of laying long-distance transmission line for powering of street and traffic lights; traffic facilities can power themselves, adjust its working time according to the vehicle density on the roads, and achieve energy-efficiency.
3. Piezoelectric devices can also be used to get traffic information, such as vehicles' load and driving speed and deliver real-time data to the traffic control system database, which can provide reliable information for road transportation research studies.
4. Piezoelectric power generation involves using components that have a simple structure, flexibility of the design and geometry, the small size of the sensors, the ability to mesh into hybrid materials easily, and does not need an external power supply-driven.



Exploitation of wasted mechanical energy in the form of pedestrian footsteps on sidewalks and mechanical vibrations of vehicles on roadways.

1. Potential for cooperation with smaller side applications (powering car batteries, traffic lights, street lights, mobile phone chargers, etc.)
2. New hybrid vehicle technology can be enhanced with its application.

8.) Drawbacks

1. Piezoelectric road integrated technology is a new energy evolution and hence piezoelectric awareness and expertise in this sector are very limited. This was also observed in primary data collected using questionnaires and interviews to have obtained invalid and biased information.
2. Implementing piezoelectric road technology on the field requires a standard specification in the execution process which has not been established. This is important as to use appropriate management and method to prevent manipulating with road infrastructure and minimize traffic congestion.
3. Not appropriate for large scale energy harvesting. Only small amount of energy can be generated through this method. Hence, the power applications are also limited and mostly small scale for now.
4. Has a lot of dependencies – like vehicle density, pedestrian density, average vehicle speed, average vehicle weight, average pedestrian weight, etc. Such factors make it unreliable to use in some circumstances.

9.) Previously demonstrated applications of piezoelectric technology:

Some examples of already demonstrated applications of piezoelectric technology around the world:

1. In 2008, the East Japan Railway Company installed a footstep-sensing floor at Tokyo Station- Marunouchi North Exit; harvesting the crowd's kinetic energy to operate ticket gates and display systems. Production of electricity reached 10 K Watt-second per day. The electricity generated is used to power all electronic displays at the station as well.
2. In 2009, the Ayalon, Coastal, and Trans-Israel Highway were embedded with piezoelectric devices 5 cm below road level to test its efficiency in terms of electrical energy supplied by the moving vehicles. This test was proposed by an Israeli company named Innowattech that specializes in improving green methods to harness waste energy using piezoelectricity. The project was set to test a one km stretch of a single and four-lane road integrated with piezoelectricity. The results meet the required amount of energy in which 200 KWh for a single lane and one MWh on four lanes were generated at that time.
3. In the U.K. - Lancaster University research programme planned on generating power from passing road traffic, with the goal of generating 1–2 MW/km at traffic volume of 3000 cars/hour.

Location -Bird's Street, Central London; piezoelectric roads installed to power street lights.

10.) Conclusion

Having met the power metrics will make such invention a starting point to a self-sustaining environment by being dependent on vehicle elements to curb down input energy and cost. This will be a revolution in the production of energy by meeting innovations and technologies to shape future energy. However, further concentration is required to quantify and result in a greater power outcome to become a reliable source of electricity.

Hence, we can conclude that implementing piezoelectric technology in road energy harvesting is feasible and has a bright future.

- Yash Chaturani and Fahmida Hiba Fathima

Li-Fi Tech

LiFi Technology

LiFi (Light Fidelity) is a mobile wireless system that transmits data using light rather than radio frequencies. It offers a unique roadmap toward solving the challenges faced by 5G. It is more reliable, virtually interference-free, and uniquely more secure than existing radio technology, including Wi-Fi and cellular.

The Evolution of Lifi Technology

Professor Harald Haas is a Professor of Mobile Communications at the University of Edinburgh, who also co-founded the company PureLiFi along with Dr. Mostafa Afgani. At his 2011 TED Global Talk, he coined the term "Li-Fi," introducing the concept of "wireless data from every light."

From January 2010 through January 2012, the D-Light project at Edinburgh's Institute for Digital Communications was funded. Under his guidance, this group published the first proof-of-concept results demonstrating that it is possible to turn commercially available light-emitting diode (LED) light bulbs into broadband wireless transmission systems.

In a 2011 TED Global lecture, Haas promoted this technology and assisted in forming a company, PureLiFi, in marketing it. PureLiFi, formerly PureVLC, is a Li-Fi original equipment manufacturer that mainly focuses on integrating Li-Fi technology into current LED lighting systems.

How does LiFi work?

A LiFi system consists of 2 main components:

- A transmitter containing a MODEM, LED driver, and LED
- A receiver has a photodetector and demodulator.

The Li-Fi transmitter is connected to the internet. A MODEM converts data from the internet into a modulated data stream. A LED driver decodes the modulated data stream and calculates the current supplied to the LED.

The intensity of the light from the LED lamps varies billions of times per second, quicker than the human eye can see. This variation in intensity transforms light into a digital signal conveying data. The optical data stream is received by a light detector and demodulated into electrical form for user access via signal conditioning.

Why LiFi outcompetes Wi-Fi

- **Internet speed**: according to recent data, LiFi has a download rate of 42.8 Gbit/s with infrared light with a radius of 2.5 meters when the best Wi-Fi would barely reach 300 Mbit/s. Therefore, LiFi provides high-speed data transmission compared to Wi-Fi.
- **More bandwidth**: the light spectrum is 10,000 times wider than the radio spectrum. Therefore, LiFi, which uses the visible light and infrared spectrum, increases the volume of data that can be transmitted per second.

Li-Fi Tech

- **Cost-effectiveness and sustainability:** LiFi is up to 10 times cheaper than Wi-Fi, requires fewer components, and uses less energy. The use of simple elements makes this system more sustainable.
- **Accessibility:** any light fitting can easily be converted into an internet connection point, as only a simple LiFi emitter needs to be connected to it for data transmission.
- **Advanced security:** light does not pass through walls as radio waves do, preventing intruders from intercepting LiFi communications through a wireless network. This makes it more secure as it is easier to control access to a network.
- **Reliability:** LiFi transmits its signal without interruptions, making communication more stable than with Wi-Fi. In areas susceptible to electromagnetic interference, Wi-Fi cannot be used. Li-Fi has the advantage of being useful in electromagnetic sensitive areas such as in aircraft cabins, hospitals, and nuclear power plants without causing electromagnetic interference.
- **Wireless and invisible:** LiFi takes advantage of lights and dispenses with the router, so it works without the need for cables. In addition, it can operate with infrared light, which is invisible to the human eye, or with visible LED light at very low intensity to avoid disturbance. The LED lights used to transmit LiFi signals are modulated fast that the naked eye cannot perceive the modulation or "flicker".
- **No saturation:** Wi-Fi has a limited capacity and becomes saturated when the number of users surfing the internet increases, causing them to crash, reducing speeds, and even interrupting the connection. However, internet connection via light could prevent the collapse due to saturation of the radio spectrum as the visible light spectrum does not get saturated.

Applications of LiFi:

- **Home and building automation:-** Many experts believe that Li-Fi will become more prevalent in homes because of its potential for quicker speeds and security benefits due to how this technology works. Because data is transmitted using light, the network can be restricted to a single physical room or building, limiting the risk of a remote network attack. Though this has more implications in the enterprise and other sectors, the advent of home automation may surge residential usage of this technology.
- **Underwater application:-** Wired connections are used to control most remotely operated underwater vehicles. Factors such as the length of the cables used, the cable's weight, and fragility may limit the operational range of these vehicles. Li-Fi-based communications could provide significantly higher mobility because light can pass through the water down to a certain distance.
- **Aviation:-** Data transfer in commercial passenger airplanes may be done efficiently using LiFi. Light-based data transfer will not interfere with radio-based equipment on the aircraft, such as the radar.
- **Hospital and Medicine:-** Medical establishments regularly conduct remote exams and treatments. Li-Fi systems may be preferable for transferring high-volume, low-latency data across networks. Light waves do not cause much damage to medical devices, and they also

Li-Fi Tech

help get work done faster.

- **Vehicles**:- To improve road safety, vehicles might communicate with one another using front and rear lights. Traffic signals and streetlights may also offer information about current road conditions.
- **Industrial Automation**:- In industrial areas where data needs to be transmitted, Li-Fi can replace slip rings, sliding contacts, and small cables, such as Industrial Ethernet. Li-Fi is also an option to conventional industrial Wireless LAN protocols due to its real-time capabilities. Fraunhofer IPMS, a German research institute, claims to have created a ideal component for industrial applications involving time-sensitive data transfer.
- **Advertising**:- Streetlights may be used to show ads for local companies or attractions on cellular devices. On a customer's smartphone, current sales and promotions can be advertised when they enter a shop or pass past the store's front that uses this technology.

Looking into the Future

LiFi has a simple architecture and uses direct modulation methods similar to those used in low-cost infrared communications devices such as remote-control units. In contrast, radio frequency communication, like Wi-Fi, requires radio circuits, antennas, and complex receivers. It can transmit data at high speeds over visible light and infrared spectrums using LEDs. Due to its construction's simplicity and its applications in various fields, it will undoubtedly replace Wi-Fi technology in the near future.

Kanagabujam Venkatramani, Year II

Haptic Tech

Haptics – the touch of technology

In Steven Spielberg's 2018 film Ready Player One, based on the 2011 book by Ernest Cline, people enter an immersive world of virtual reality called the OASIS. What was most gripping about the futuristic tech in this sci-fi movie was not the VR goggles but the engagement of a sense beyond sight and sound: touch.

Characters wore gloves with feedback that let them feel the imaginary objects in their hands. They could upgrade to full body suits that reproduced the force of a punch to the chest or the stroking of a caress. And yet these capabilities, too, might not be as far off as we imagine.

Engaging touch in human-computer interactions would enhance robotic control, physical rehabilitation, education, navigation, communication, and online shopping. The future is not just bright but textured.

Etymology

The etymology of "haptics" is derived from the Greek word for touch that refers to anything relating to the sense of touch. Haptics is the science and technology of transmitting and understanding information through the sense of touch using tactile sensations in interfaces.

The most well-known examples of haptics are probably the vibration in a mobile phone or the rumble in a game controller. Still, there are many applications: wearables, AR/VR experiences (also known as spatial computing), digital out-of-home advertising, automotive infotainment, and high-end military and industrial simulation equipment.

The significance of touch

We consistently underestimate the importance of touch. After the vision, it's the second most crucial way we understand, explore, and interact with the world.

Touch is like our extra set of eyes. It provides a rich 360° field of perception that complements our high-definition but limited visual field. It is also fundamentally associated with our sense of body ownership and presence and intimately linked to how we communicate emotion.

Types of haptics

Haptic devices are grouped into three main types: graspable, wearable, and touchable. They range from the joystick, gloves, and even your mobile device.

Graspable haptics :

Graspable devices often take advantage of kinesthetic sensations: feelings of movement, position,

Haptic Tech

and force mediated by nerves in our skin and in our muscles, tendons, and joints.

Wearable haptics :

On the other hand, Wearable devices usually rely on tactile sensations — pressure, friction or temperature — mediated by nerves in the skin. Some VR and AR systems act on vibrations created by electric motors on the skin. However, they need bulky wires and battery packs attached to the body, limiting their "reality" and applications.

Touchable haptics :

The final device category is touchable interfaces, such as smartphone screens that give a little bump when you click on an app. They mimic the texture of an object without it being there. This category of haptics is known as haptography.

Conclusion :

Haptics is a fast-evolving area. With virtual reality technologies maturing, the demand for consumer-grade haptics will intensify, and force feedback gloves will revolutionize the VR industry. Imagine being able to "feel" the texture of dresses sold online to monitor health using wearable wellness devices; the possibilities are endless. Hence, haptic technology can be a game-changer in the entertainment and gaming industry and become mainstream in medical and online shopping. Maybe, haptics is the way the future "feels" like.

Soundarya ,Year II
Srikrishna,Year II

PAPER BATTERY

Introduction :

BATTERIES COME IN VARIOUS SIZES AND FORMS, FROM TINY WEARABLE DEVICES TO INDUSTRIAL POWER BACKUPS. CONVENTIONAL BATTERIES HAVE LIMITED LIFECYCLES, CONSUME LARGE AMOUNTS OF SPACE, RELEASE TOXINS, AND OFTEN FAIL OVER TIME. IN A LONG QUEST TO OVERCOME THESE DIFFICULTIES, THE PAPER BATTERY IS AN INITIATIVE HIDDEN IN NANOELECTRONICS. THE SOUL OF THIS BATTERY IS CELLULOSE, WHICH SERVES AS A SEPARATOR BY PROVIDING A LOWER IMPEDANCE AND A HIGH CYCLABILITY.

Concept & Design :

THE DESIGN INVOLVES SPREADING THE INK OF CARBON NANOTUBES (CNT) ON A PIECE OF PAPER. THE PAPER ACTS AS A CATHODE, WHILE A LITHIUM METAL ION ACTS AS THE ANODE AND CELLULOSE, A PLANT PRODUCT USED AS A SEPARATOR. THE SEPARATOR ENABLES THE FLOW OF ELECTRONS, HINDERING THE ELECTRICAL CONTACT BETWEEN THE CATHODE AND ANODE TERMINALS. THE FORMULATED CNT PAPER IS PLACED IN IONIC (NaCl, NaOH) OR BIO (SWEAT, BLOOD, URINE) ELECTROLYTES. IN ADDITION, IT IS USED AS A CAPACITOR BY FOLDING IT IN HALF SO THAT THE ELECTRODES ARE AT THE EDGES WITH PAPER IN THE MIDDLE. AS A RESULT, IT PROVIDES A VOLTAGE COMPARABLE TO OTHER CAPACITORS THAT ARE MUCH LARGER.

RECENTLY...

YI CUI, ASSISTANT PROFESSOR AT STANFORD UNIVERSITY, HAS DESIGNED THE PAPER BATTERY USING THE CHEMICAL VAPOR DEPOSITION TECHNIQUE THROUGH WHICH SILICON NANOWIRES ARE SYNTHESIZED. REPLACING THE CARBON NANOTUBES WITH SILICON NANOWIRES AS ANODE WOULD RESULT IN TEN TIMES BETTER STORAGE COMPARED TO A TRADITIONAL ANODE BATTERY. FURTHERMORE, HIS QUEST TO SUBSTITUTE LITHIUM METAL OXIDE AT CATHODE EITHER WITH SILICON OR LITHIUM SULFIDE IS STILL UNDER RESEARCH, RESULTING IN IMPROVING THE EFFICIENCY AND POWER OF THE BATTERY.

THE PAPER BATTERY HAS A WIDE RANGE OF APPLICATIONS IN THE FOLLOWING DOMAINS:

1) Medical :

ITS BIOCOMPATIBILITY, LIGHTWEIGHT, AND FLEXIBILITY MAKE IT SUITABLE FOR FORMING PACEMAKERS, DRUG DELIVERY, AND BLOOD BAG TEMPERATURE MONITORING. IT WORKS AS AN IDEAL POWER SOURCE FOR ARTIFICIAL ORGANS. VICTOR PUSHPA RAJ, SENIOR RESEARCHER AT RENSSELAER POLYTECHNIC INSTITUTE, CERTIFIED THAT IT IS SAFE TO USE EVEN IN THE BODY DUE TO LOW TOXIC CHEMICALS AND HIGH PAPER CONTENT.

2) Media & Advertising :

ACCORDING TO THE RESEARCHERS FROM RENSSELAER POLYTECHNIC INSTITUTE, A PAPER BATTERY CAN POWER LIGHT-EMITTING DIODES OR ANY AUDIO DEVICE THAT WOULD PLAY A SONG ON THE OPENING OF GREETING CARDS. THE LIGHTWEIGHT AND COMPACTNESS OF A PAPER BATTERY WOULD ALLOW THE DEVICE TO BE EASILY FIT INTO THE CARDBOARD DESIGN AND DISPLAY VIDEOS AND PLAY MUSIC, ATTRACTING MORE ATTENTION AND THUS PROVIDING BETTER ADVERTISING.

3) Electronics:

INCORPORATING THE PAPER BATTERY IN THE TRADITIONAL ONE DECREASES THE BATTERY WEIGHT BY TWENTY PERCENT, IMPROVING ITS EFFICIENCY. IT IS ALSO A POTENTIAL RECHARGER ESPECIALLY RELEVANT FOR HYBRID CARS, THE FUTURE TRANSPORTATION. ADDITIONALLY, IT IS IDEAL TO USE IN AUTOMOBILES, AIRCRAFT, AND BOATS. THE PAPER BATTERIES' PILING MAKES IT SUITABLE FOR STORING SOLAR AND WIND ENERGY SINCE IT CAN ENDURE MANY RECHARGE CYCLES. THERE ARE NUMEROUS POTENTIAL APPLICATIONS FOR PAPER BATTERIES, INCLUDING SMART CARDS AND WEARABLE ELECTRONIC DEVICES, WHICH ARE STILL IN THE RESEARCH PHASE.

DESPITE THE ADVANTAGES OF PAPER BATTERIES, NANOPARTICLES CAN ALSO BE HARMFUL TO THE LUNGS. DIRECT EXPOSURE IS UNLIKELY BECAUSE IT IS STORED IN ELECTRONIC DEVICES BUT ENSURES NO LEAKAGE OCCURS WHEN THE OUTER CASING CRACKS.

IN NO TIME, PAPER BATTERIES WOULD BE CAPABLE OF POWERING ELECTRIC VEHICLES. THUS, ACCELERATING WORLD TRANSPORTATION WITH E-VEHICLES VIA PAPER BATTERY CHARGERS BRINGS A NOTABLE CHANGE IN THE CONTEMPORARY WORLD.

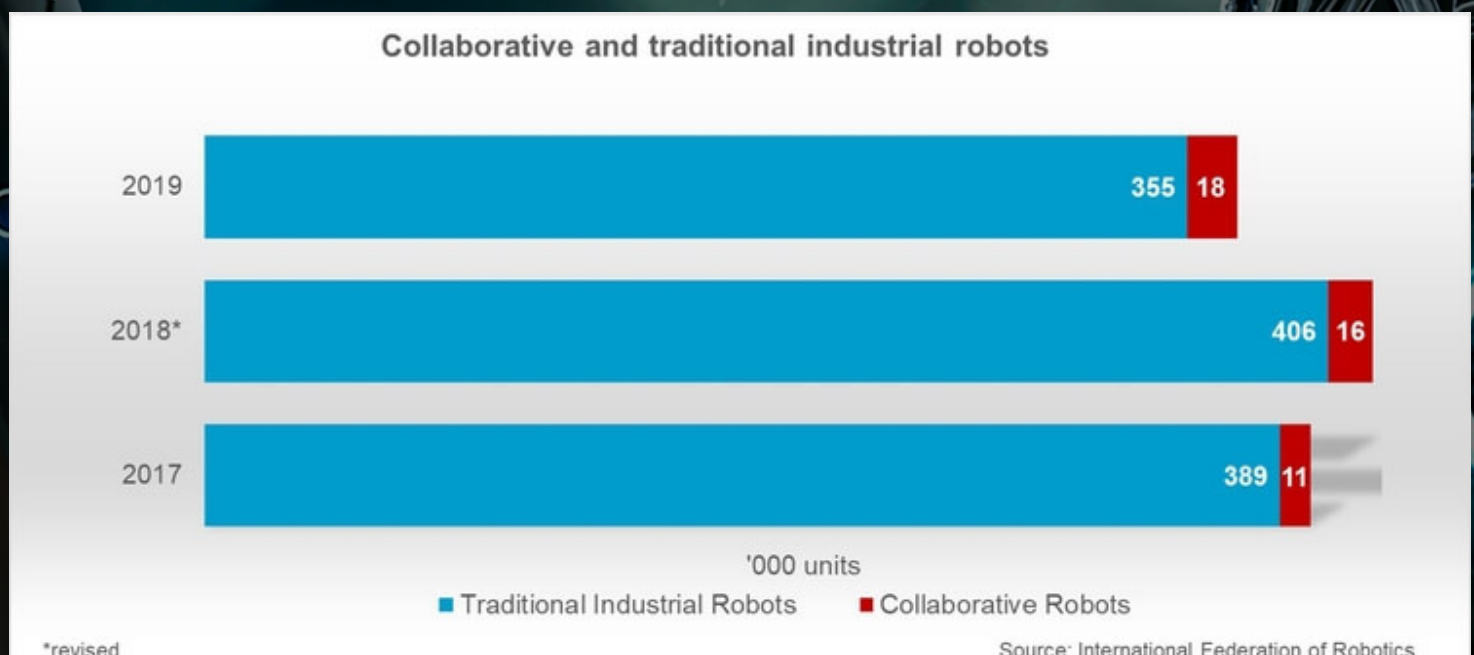
**- SIRIPURAM JYOSNA
YEAR II**

EE Application in Robotics

How far are we from truly personal robots?

The closest we have come to personal robots is Asimo. Asimo is a bipedal robot — that can walk like humans- which was unveiled to the world in November 2000 by Honda. 2 decades ago it showed the advancement of robotics and engineering to that date. How far have we come since Asimo? And are we close to reaching a point where we see home robotics? Or personal robots? These are the questions that this article will try to answer.

Robots available in the market today can be broadly classified into industrial and service robots. Industrial robots used in industries are usually employed in production lines. Whereas service robots can be seen in medical operations, entertainment, handling logistics, and a lot more. When personalized robots become a reality they will fall under the service category. Although the robotics service category has a small share in the robotics market. it is growing. Shown in the graph below.



Why are Industrial robots dominating?

Industrial robots have become a lot more advanced than they were a few decades ago. Now we see robots like Atlas (Boston Dynamics) perform gymnastics and perform actions similar to that of humans. Atlas is a bipedal robot that is being developed with a vision to perform search and rescue tasks. Although these types are more service-based. Currently, there are Industrial robots that are collaborating with humans in production lines to make the production process more efficient.

“The stock of industrial robots operating in factories around the world today marks the highest level in history” says Milton Guerry, President of the International Federation of Robotics

Why do organizations plan on integrating robots in manufacturing lines? There are 2 main reasons

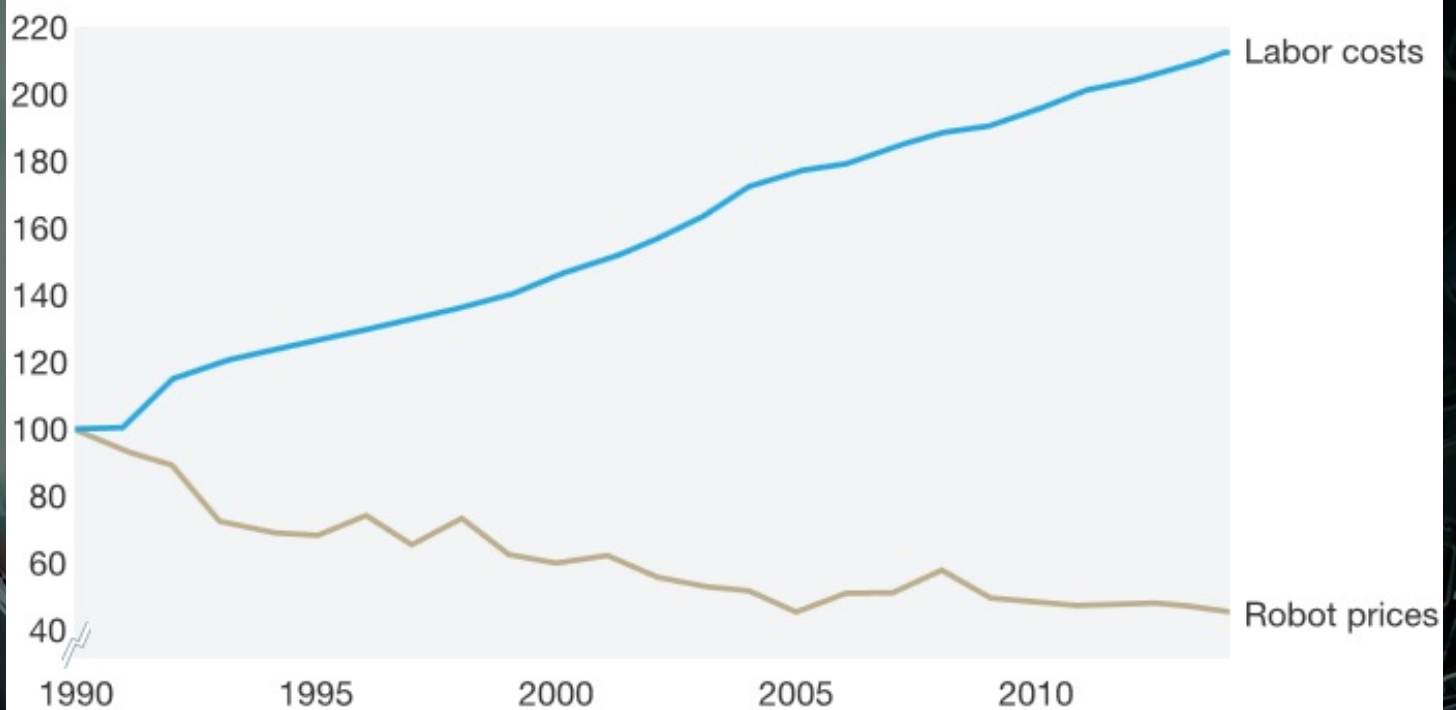
- 1) The reduction in cost for the business
- 2) Ease of use.

Industrial robots are the primary area that is being researched upon in academia. The results of which we see now. In the graph below we see that costs for robots have been on the decline. This is primarily due to the advancement of sensor and machine vision algorithms. Such software advancements reduce the need for additional mechanical components in robots for functioning. The smarter the robot gets the simpler the mechanical design and lower the cost. Added to this are Industries worldwide on the vision to reach Industry 4.0. The vision is of an industry where most of the tasks are automated and data is used for making smart decisions. Hence reduced cost, ease of implementation, and advancements in robotics has led to the domination of industrial robots in the robotics market.

In addition to this Labor costs is on the constant rise. For companies to maintain profit margin they will have to search for alternatives. And robotics seem to be a viable option.

Cost of automation

Index of average robot prices and labor compensation in manufacturing in United States, 1990 = 100%



Source: Economist Intelligence Unit; IMB; Institut für Arbeitsmarkt- und Berufsforschung; International Robot Federation; US Social Security data; McKinsey analysis

McKinsey&Company

Image credits: McKinsey&Company

Personal robots fall in the category of service. Although it shares a smaller percentage of the market we need to analyze its performance for the coming years.

How will service robots perform in the coming years?

Service robotics Startups are constantly expanding the market share of service robots. Nuro, a valley startup started by 2 robotics ex-employees of Google, works on providing autonomous delivery of goods from distributors to customers automatically. Currently, their startup is valued at 2.7 billion dollars. They are driving the way for autonomous delivery systems. Another well-known start-up: Boston Dynamics which makes agile mobile robots for various applications is now valued at around 1.1 billion dollars. Definitely, these companies are increasing the envelope of robotics technologies and paving the way for a new market called robots-as-a-service.

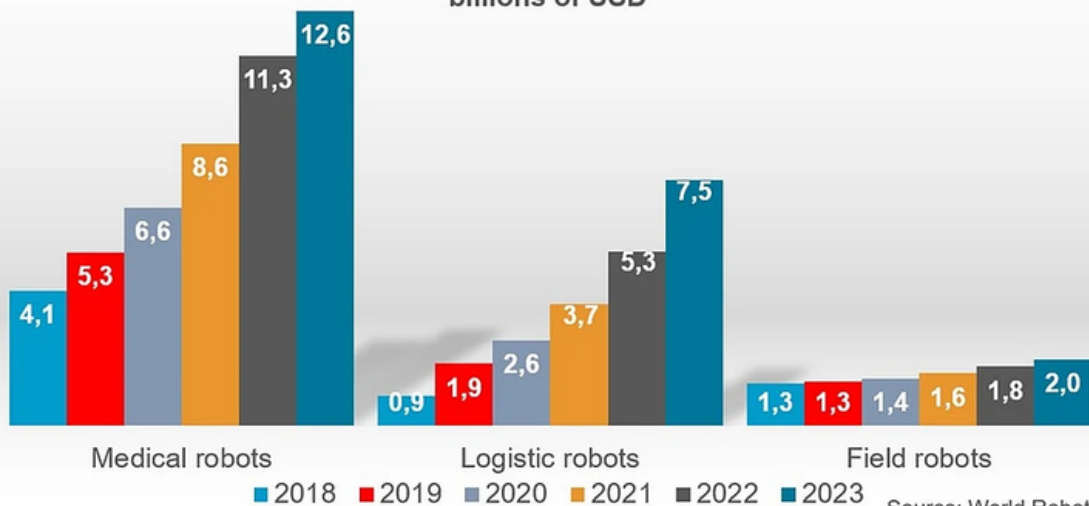
“Every 5th service robot supplier is a start-up” — International federation of robotics (IFR)

Service robots for professional use - major applications



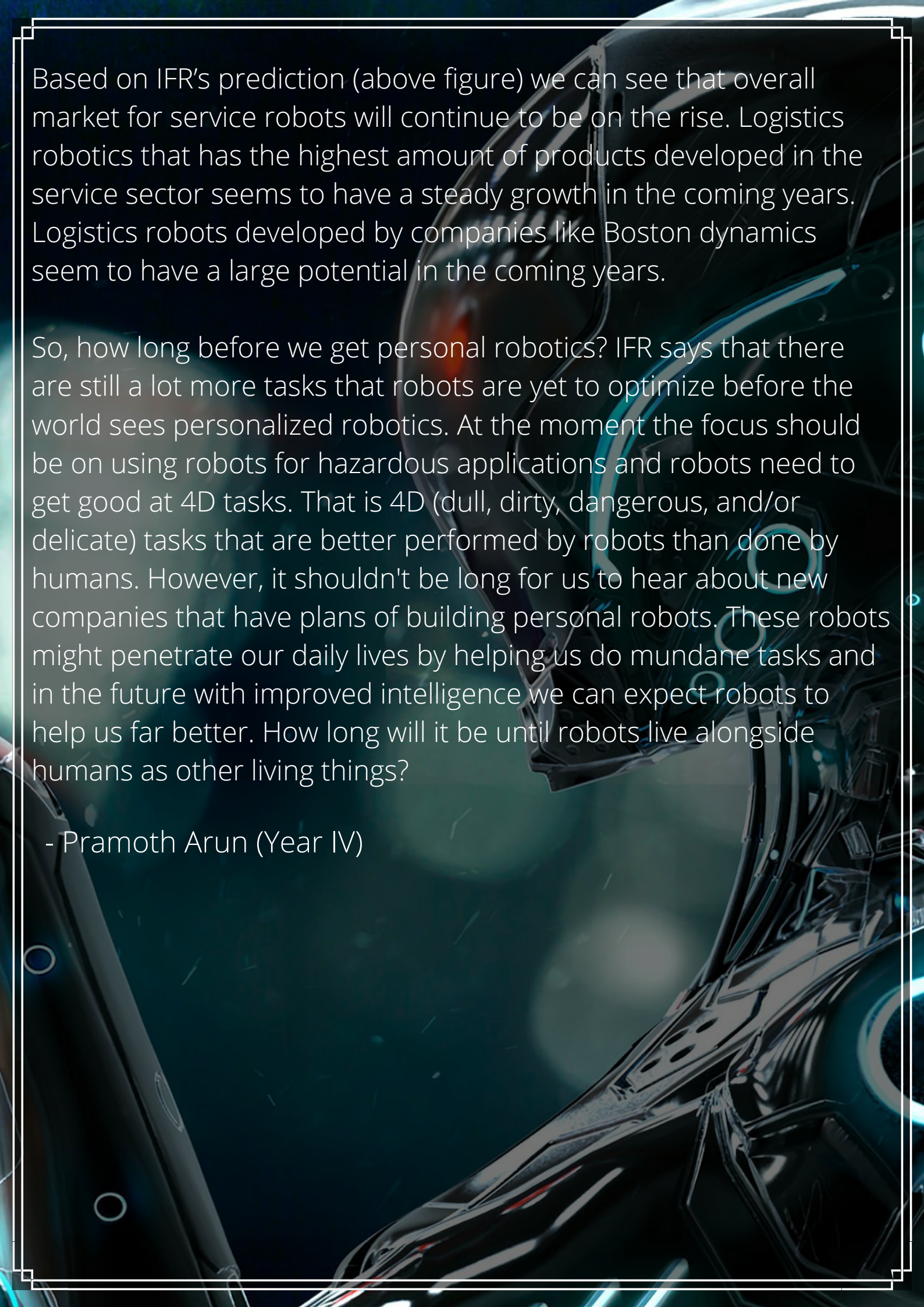
Turnover 2018 and 2019, potential development 2020-2023

billions of USD



Source: World Robotics 2020


IFR's prediction on sales of service robots



Based on IFR's prediction (above figure) we can see that overall market for service robots will continue to be on the rise. Logistics robotics that has the highest amount of products developed in the service sector seems to have a steady growth in the coming years. Logistics robots developed by companies like Boston dynamics seem to have a large potential in the coming years.

So, how long before we get personal robotics? IFR says that there are still a lot more tasks that robots are yet to optimize before the world sees personalized robotics. At the moment the focus should be on using robots for hazardous applications and robots need to get good at 4D tasks. That is 4D (dull, dirty, dangerous, and/or delicate) tasks that are better performed by robots than done by humans. However, it shouldn't be long for us to hear about new companies that have plans of building personal robots. These robots might penetrate our daily lives by helping us do mundane tasks and in the future with improved intelligence we can expect robots to help us far better. How long will it be until robots live alongside humans as other living things?

- Pramoth Arun (Year IV)



COMPANY INTERNSHIPS



ESWARA PRASAD

GOLDMAN SACHS

UPCOMING SDE AT GOOGLE INDIA

SELECTION PROCESS

The selection process consisted of one OT and three rounds of technical interviews. OT consisted mainly of coding and aptitude sections. Probability and Permutations, and Combinations were given importance in the aptitude section of the OT. In technical interviews, puzzles, C++ internals like #defines, linker, loader, compiled file, etc., were asked apart from coding questions.

INTERN EXPERIENCE

The internship provided a solid understanding of a real-time process monitor running on a highly scalable and distributed platform like Kubernetes. Developing efficient automated fixes to intermittent issues and effective ways of notifying them using advanced incident reporting platforms like the Pagerduty was an exciting aspect. Designing an efficient and comprehensive dataset helped enhance my existing knowledge about core computer science concepts like database management systems by creating a production-level dataset.

The mentors, team members, and people at GS, in general, were very supportive. Everyone's ideas are valued, and the work culture was fantastic.

LEARNINGS

The key is to show interest and interact well with the mentor.

It is an excellent opportunity to network with the team members. People at GS are very approachable, and one can contact anyone in GS regardless of the seniority. The evaluation of performance for getting a PPO is mainly based on how one interacts with the mentor and manager.

One will most likely get a PPO if they show sincerity and interacts well with the mentor



ARAVINTH R

WELLS FARGO

SDE INTERN AT WELLS FARGO

SELECTION PROCESS

The internship process involved an OT and 2 rounds of PIs. The OT consisted of 3 sections - Verbal Reasoning, Business Analytics and Coding. While the Business section had questions on data interpretation and stocks, the coding section had 2 medium level questions to be solved in an hour. The 1st PI was technical and focused on concepts from DSA, OS and Networks. They also asked a couple of puzzles and a coding question. The 2nd PI was technical+HR and they focused mainly on my resume

PROJECT DESCRIPTION

My project was based on a problem statement involving AI/ML to implement personalized and intelligent banking services. I worked mainly on ML, cloud microservices and API development. The project was very interesting and exciting as it focused more on research unlike traditional internship projects and allowed me to explore and analyze different technologies.

INTERN EXPERIENCE

My internship experience at Wells Fargo was great. My mentor was really supportive and gave me a lot of insights on tech industry, academics and also life in general. The work culture in Wells Fargo is really positive as it focuses on not just work but also on people and at no point did I find the work to be either hectic nor unenjoyable. We had interaction sessions with top C level executives of the company and were also given opportunities to work and collaborate with fellow interns from around the world.

LEARNINGS

In internships, getting your work across to your manager is as important as the work itself. Unless you make your managers understand your work completely, they won't appreciate the hours you would've spent perfecting nitty-gritty details. While it is natural to think about PPO, focusing too much on it might shift your attention from the ongoing work and might end up being counterproductive. It is important to focus on work at present and performing well in those will automatically guarantee you a PPO.



CHARMIE RAJAN

BAJAJ AUTO LTD

UPCOMING PROGRAM ASSOCIATE AT WELLS FARGO

SELECTION PROCESS

The entire process happened online on CoCubes platform. The test consisted of 4 sections (English, Analytical, Quantitative, Technical). It was for a total of 90 minutes with 90 questions, 1 mark for every right answer and -0.25 for every wrong answer. Technical round focused on machines, networks and linear systems and mathematics.

Interview process: Technical round (knockout round) + HR round. In the technical round, they asked what my favorite subject was. I was more inclined to a software domain, so the software head was called upon. They explained the type of projects they do and asked if I would be interested in them.

PROJECT DESCRIPTION

To sum it up, it was aimed at developing a software solution for electrical applications. The department and project allotted to each intern were based on their performance during their interview and what they would fit best in to.

INTERN EXPERIENCE

The internship was for 8 weeks (June till August). We had a seamless onboarding process with an orientation period for a week, post which I was allotted Research and Development as the department. The work was extremely flexible with great mentorship! No working hours as such, just goals to be met (which weren't huge either :P). A weekly review session was scheduled to review if our weekly targets were met. We could experiment a lot, try out new techniques and work with supportive industry experts!

LEARNINGS

It is best to be quite vocal about the domain of work you prefer in your interviews. PPO offers were based on how well you present your end product during your final review and also based on if you met your targets on time. We could be really frank about our choices and opinions with respect to PPO, it wasn't forced upon.



VENKAT SUBRAMANIAN

NVIDIA

INCOMING ASIC ENGINEER, NVIDIA

SELECTION PROCESS

The selection process involved an online test (which mainly focussed on aptitude, digital electronics and static-timing analysis based questions) and a resume shortlist round, after which there was a techno-HR round where we were tested on our fundamental understanding of concepts, past projects, knowledge of engineering software, puzzles and Verilog fundamentals.

PROJECT DESCRIPTION

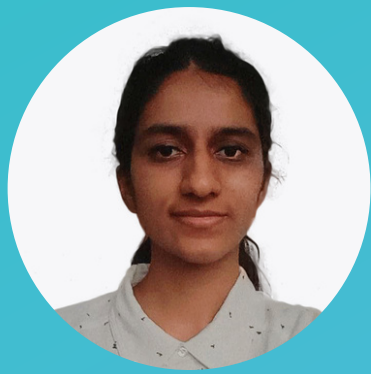
I was part of the DRAM-memory team. The goal of the 9-week project was to design a utility script from scratch that verifies the specifications of each protocol that talks to the DRAM cell. Most of the internship duration was spent on learning the microarchitecture and native software. After the utility was built fully, it was deployed to be used by the members of the team

INTERN EXPERIENCE

The people at NVIDIA were extremely helpful and supportive throughout the internship duration. Everyone knows that you are a college undergrad intern, so they do not burden you, and at the same time ensure that you ramp up to keep up with the steep learning curve. The working hours were completely flexible, and the mentors ensure that you feel a part of the team, by involving you in team meetings and chats.

LEARNINGS

The learning curve can be scary in the beginning, and the shift from college to corporate can be very intimidating at start. But trust the process and ramp up slowly, do not panic and communicate to your mentor/manager efficiently.



KRUTI HINDOCHA

CHANDHAR RESEARCH LABS

UPCOMING DIGITAL ENGINEER AT NXP
SEMICONDUCTORS

SELECTION PROCESS

It was an off-campus internship, so I had to mail the owner of Chandhar Labs requesting for an intern opportunity. I mentioned my area of interests, and my previous projects relevant to it in the mail.

INTERN EXPERIENCE

Made an ML-based testbed for IoT security to detect Slow DoS attacks. The testbed used the analysis of the difference in the time delay between messages sent and messages received over an MQTT broker with and without attack. It wasn't very hectic, and our mentor was quite supportive.



ELECTRICAL

ADITYA MODEKURTI

TATA STEEL LIMITED

INCOMING MANAGEMENT TRAINEE (TECHNICAL)
AT TATA STEEL

SELECTION PROCESS

1. Online Test: General Aptitude (Quantitative Reasoning, Verbal Reasoning, Logical Reasoning, Data Interpretation); Core (Control Systems, AC & DC Machines, Power Systems, Power Electronics, Transmission & Distribution)
2. Personal Interview: Questions based on my project mentioned in the introduction, questions on power systems (basics), reason to join the company and what I would contribute

INTERN EXPERIENCE

The 8-week long project was done virtually and individually. There were no specific work hours, I had the freedom to finish the assigned tasks whenever I wanted to. There were 3-4 check-in conversations with my guides. The internship was a no-nonsense experience focusing only on our projects. My guides were very helpful, right from helping me get an understanding of the project to correcting the smallest of mistakes in my final presentation. They put aside their own work and helped me out at times.

LEARNINGS

- Communicate a lot with your mentors/managers, keep them in the loop and give the smallest of updates on the work done via a mail at the end of each day
- Follow-up till you get your job done.
- Try to do a little extra than what is expected of you (Eg. a simulation, a financial analysis of the solution you are providing).
- Understand why you are doing the given project and what change it can bring about for the company.
- Try to provide actionable outcomes at the end of your internship.
- Never take anything for granted, questions can come from any angle in the final presentation.
- If there is an exit interview, show that you are in this for the long run, give honest feedback and opinions.



A MONISH PRABHU

AXIS BANK

SUMMER INTERN AT AXIS BANK

SELECTION PROCESS

The online test consisted of machine learning and statistics basics along with a coding Question. After online test, there was one Techno-HR Interview. In the interview, the questions were based on Logical reasoning, situation-based questions, and some questions based on CV. The HR questions were based on my motivation, my strengths and weaknesses, and some situational questions. It was around half hour interview. The results were declared on the same day in the evening.

PROJECT DESCRIPTION

I worked on the project 'Log Mining from SAS server logs' in the Business Intelligence Unit (BIU). The task was to build a Parser in Python to extract the SQL queries meta-data present in log files. It was a fairly challenging project to do over a period of two months.

INTERN EXPERIENCE

There wasn't much pressure involved in my project. Talking about the work-culture, I would say it was pretty good. The entire team was very supportive, and the work environment encourages collaboration.

LEARNINGS

Going through a standard set of HR questions and preparing them in advance helps a lot. Many Analytics companies tend to ask at least one medium to easy level coding question. So I would advise you to learn Coding & Basic Dsa concepts like Linked-Lists, Stack & Queues.



RESEARCH INTERNSHIPS



SIDDHARTH RAO A

MITACS GLOBALINK RESEARCH SCHOLAR,
MCGILL UNIVERSITY

SELECTION PROCESS:

One month after submitting my application, MITACS informed that I had cleared the initial filtering. I was told that host professors were reviewing my application and that I should be prepared to attend interviews. Eventually, I did get a few interview calls—these primarily focused on my research experience, technical skills, and soft skills. I was subsequently offered the project based on my interests and profile.

PROJECT DESCRIPTION:

The project aimed to provide autonomous navigational assistance to the blind using deep learning techniques. As part of this, we developed a novel approach to generate extended content descriptions for images. The model aimed to tackle complex multi-event images and provide robustness to scene variations. A CNN backbone was used to extract features from the image, which were then passed to an external attention based vision transformer for generating descriptions.

HOW WAS THE INTERN EXPERIENCE?

The internship provided a great learning experience and helped me gain a lot of exposure. I got to explore new areas, and experience a research environment first-hand. In spite of working remotely, there was constant support and guidance from the team. The overall work culture was very flexible and did not feel hectic at all. On an average, I had put in about 4-5 hours per day, with weekends being holidays.

ANY TIPS FOR SIMILAR UPCOMING INTERNS?

The right choice of projects can go a long way in your selection—make sure to choose those that match your research profile and interests. Selection is carried out in multiple rounds, and hence patience is key. Interviews carry a lot of weightage and are your best shot at making a good impression. So make sure to research more on the project and related concepts. Prepare for both technical and non-technical questions. All the best!



ANGAD RIPUDAMAN SINGH BAJWA

RESEARCH INTERN AT ISI KOLKATA

SELECTION PROCESS:

I was aware that ISI (Indian Statistical Institute) Kolkata had a few senior profs doing research in the field of machine learning and computer vision. They have a separate Computer Vision and Pattern Recognition unit as well. I emailed my intern professor and had a short call with him where he asked about my previous research experience and projects.

PROJECT DESCRIPTION:

The project dealt with explainability of AI in the medical community. The question of explainability of AI has hindered its acceptance as a stand-alone system in the medical community. We worked on melanoma classification and tried to compare the clinical features used by dermatologists in classifying melanoma to that used by deep learning models.

HOW WAS THE INTERN EXPERIENCE?

It was interesting and I got to learn a lot. Research interns go as you go, but then again if you want to get work done you need to be self-motivated. We had weekly meets on Sunday where I had to show the progress done that week. I had a lot of help and guidance from the professor's PhD students which I felt was crucial as I could clear my doubts or ask them for resources to learn stuff I didn't know.

ANY TIPS FOR SIMILAR UPCOMING INTERNS?

Any tips for similar upcoming interns? Start searching for profs and mail them during your 5th semester, especially international profs. Check out their research interests and papers to know if you would like to work under them. Don't be intimidated by a high profile prof, even they want interns. Try getting tangible results from your interns in the form of a paper or articles. Keep working on your profile and skills. Don't wait for the intern to start for you to learn something, rather do personal projects. Most importantly, believe in yourself!



K SHREYAS MAHESH

RESEARCH INTERN AT SSN

SELECTION PROCESS:

At a specific time every year, a portal opens up for many colleges for internship applications. In SSN, they had the list of available colleges and professors. You have to submit your resume and other relevant details to enter the shortlisting procedure. Depending on your personal performance and demand for projects, you will be allotted to your preferences.

PROJECT DESCRIPTION:

We built a power electronics system to support solar power supply for Oxygen concentrators. We implemented various algorithms to improve the efficiency of energy conversion, while also keeping other factors like feasibility and ergonomics in mind.

HOW WAS THE INTERN EXPERIENCE?

The internship experience was really good. Because of the COVID lockdown, the entire internship was held online. The 2 month internship had weekly goals and regular meetings to keep track of the progress being made in the project. At the end of the internship, we had to submit a comprehensive report of the project and submit it to receive a certificate. We also have the choice to proceed with the project and try to get a paper published on the same.

ANY TIPS FOR SIMILAR UPCOMING INTERNS?

It's a challenge to receive online internships for hands-on fields like Power Electronics. Moreover, try to familiarize yourself with simulations software like Matlab simulink, EAGLE, Sequel and LTSpice. This is because most of the research work in this domain will happen through these software during online internships.



PRATIK UTHAN

RESEARCH INTERN AT UIT,
TROMS, NORWAY

SELECTION PROCESS:

There is no official process to land an internship at UiT (The Arctic University of Norway). I have an interest in Electric Vehicles so I searched for projects in that field. So the next step was to mail the professor and wait for his reply. I was asked a few technical questions related to EV's in an interview conducted on Skype and then was later sent a confirmation email.

PROJECT DESCRIPTION:

My project can be best described as building a swappable hybrid electric battery infrastructure for a ferry. I am currently building a battery model in Simulink and trying to obtain the highest possible efficiency. The battery must support one full journey (two way) so the efficiency is very important. At the dock we are building a charging infrastructure where the used battery is swapped for the fully charged one. Also the size of the battery matters due to the size constraints on the ferry so that is another thing that I have to take care of.

HOW WAS THE INTERN EXPERIENCE?

I can't tell much about the work culture since it was an online internship due to covid constraints. But the professor and his assistant have been super helpful. I just have to inform my guide if I had a doubt and he clarifies it within a couple of hours. The pressure of work is also not much and you can do the project simultaneously with your normal semester schedule. I have learnt a lot so far and also had a lot of fun contacting companies for more information on Ferry batteries.

ANY TIPS FOR SIMILAR UPCOMING INTERNS?

Before applying for an internship in a college abroad I would advise you to do an internship or project in India. Your resume is very important and the technical questions I was asked were mostly based on what I had written in my resume. Also it is not necessary that you will receive a reply every time so you need to be patient and wait for a professor to reply.



PATHIKRIT SAHA

RESEARCH INTERN AT ICSR,
IIT PALAKKAD

PROJECT DESCRIPTION:

We performed a literature review on various matrix decomposition methods for matrix inversion purposes, with focus on the VLSI implementability of the processes. We studied some methods of QR decomposition like Gram-Schmidt Orthogonalization, Givens Rotations, Gaussian Elimination, etc. We finally studied the Gauss Jordan method of matrix inversion in depth and implemented the algorithm using MATLAB and Verilog and compared the method to the QR decomposition techniques studied previously.

HOW WAS THE INTERN EXPERIENCE?

Intern experience was very pleasant and the work was not very hectic. My supervising professor was very helpful and held regular doubt clearing sessions with me along with review sessions. The first 2-3 weeks were spent in familiarizing myself with Verilog. Even though the internship was virtual, the process was very smooth. I mostly had to work with a PhD scholar under my supervising professor who was already working on the project.

ANY TIPS FOR SIMILAR UPCOMING INTERNS?

Do some research on the professor's domain, research interest and projects before mailing. You need not do a lot of research, just enough to be sure what to expect in the coming 2-3 months. See it as a learning curve. You will learn a lot of new things and get a good insight into how academic research takes place.



G AKASH

RESEARCH INTERN AT SWIFAR,
YUNNAN UNIVERSITY

SELECTION PROCESS:

Alright, the approach I took majorly consisted of cold mailing various professors in the field of my interest. It is not a simple process, it involves reading various research papers, writing multiple cover letters, fairing out your resume and finally dealing with rejection mails. I followed all this, and I've gotten enough interns by this way.

PROJECT DESCRIPTION:

My project is related to Cosmology and Computational astrophysics. I was asked by my guide to study General theory of relativity and Tensor calculus which took me about a month to do so. My work was on sketching the Ergoregion of magnetized Kerr space-time. To do this, I had to compute & reproduce the sketches of ergoregion of a Kerr black hole & a Magnetized Charged black hole.

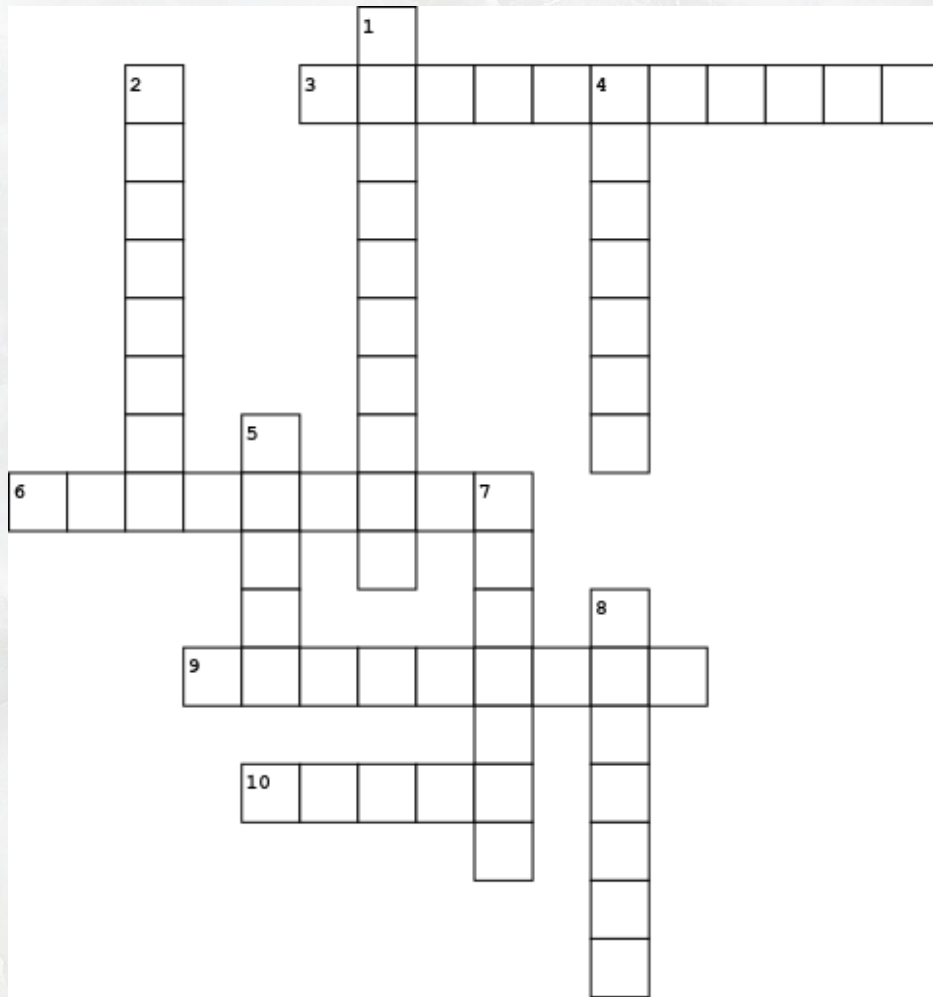
HOW WAS THE INTERN EXPERIENCE?

I learnt a great deal of research that is going on in the field of my interest. I gained a lot more knowledge about the research field and what happens in the research community. I had fun during the time of my intern. I never had a set working hours nor did I have any constraints like harsh deadlines and so. Just a weekly update to my guide on what I did or on what's to be done. Apart from that nothing was hectic and if you like reading research papers then you'd be fine.

ANY TIPS FOR SIMILAR UPCOMING INTERNS?

Don't give up after just few rejection mails. Keep mailing until you get an acceptance mail. Patience and perseverance is the key to survive in the research community. One tip I can give is, don't be choosy with the type of professor you expect. But before you do that, check their profile, and see if that's what you want. If yes, then do it and if it's a no, then move on start reading another paper.

Tronicals Crossword



Across

3. A device that either increases (steps up) or decreases (steps down) the voltage for transmission of electricity over long distances.
6. One of the pioneers in the realm of circuitry, this German physicist has two circuitry law's named after him.
9. A machine that converts mechanical energy to electricity for transmission and distribution over power lines to domestic, commercial, and industrial customers.
10. He was the main scientist supporting the ac in the war of currents.

Down

1. These Semiconductor devices have become a cornerstone of modern electronics, with their wide range of utility, from amplification to switch operation.
2. A component of a machine that is responsible for moving and controlling a mechanism or system, for example by opening a valve.
4. He was an English physicist who invented the first thermionuclear valve or vacuum tube, also established the right-hand rule.
5. An induction coil used to block alternating current and pass direct current, or to block high frequencies and pass lower frequencies.
7. He was an English physicist and chemist whose many experiments contributed greatly to the understanding of electromagnetism. He also has two electromagnetic induction laws named after him.
8. Postulated the electron theory of electrical charge in 1892 and the force that acts on a charged particle placed in a magnetic field.

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