DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPALLI

EEE ASSOCIATION

COVER STORY

WEARABLE ELECTRONICS

TRONICALS

VOLUME 6 | ISSUE 2

CONTENTS

MESSAGE FROM THE HOD

Dr. V. Sankaranarayanan

The Department of Electrical and Electronics Engineering is renowned for its highly experienced faculty and motivated students who consistently maintain high academic standards. The department fosters an environment of growth and innovation that molds students into exemplary engineers. The state-of-the-art infrastructure equips students with resources to pursue innovative research.

Since its inception, the Electrical and Electronics Engineering Association (EEEA) has performed exemplarily with its unique activities that cater to the student community as well as social responsibility ventures that give back to society. Despite the challenges involved in an online platform, the EEEA successfully conducted the department's annual technical symposium - Currents'21. This encompassed seminars by eminent personalities, workshops, technical contests and quizzes in the field of electrical and electronics engineering. The event was well received and appreciated by all, which is a testament to the great efforts of the association.

This issue of Tronicals has been carefully curated by the editorial team to shed light on the achievements of the department, as well as latest developments in core field areas. It brings out the creativity of the students. I appreciate the efforts of EEEA and wish them success in the years to come.

MESSAGE FROM THE FACULTY ADVISOR

Dr.Aneesa Farhan M A

It gives me immense pleasure to address the EEE community of NIT–Trichy in my role as the faculty advisor of the EEE Association. Guiding and being in constant touch with some of the most enthusiastic and determined student members has proved to be a truly memorable experience. In spite of facing new challenges and the year demanding more innovative ideas than ever, the association has continued to carry out all its technical and socially responsible endeavors successfully.

Starting with the EEEA inauguration for the academic year, the association went on to organize all its flagship annual events like Enigma, Wired, Volts to name a few, the yearly Object Model Analogy series and exciting technical workshops, including a game development workshop. Most importantly, EEEA managed to conduct Currents'21 in the best way possible through consistent efforts, tireless discussions and a dedication to strive for perfection at all times.

The Editorial team has come forward with the second issue of Tronicals for the year, wherein the above-mentioned feats of the EEEA and the accomplishments of our department are discussed in detail. The various academic and scientific essays definitely prove to be quite interesting reads for the readers. Having witnessed the office bearers and members take EEEA to new heights this year, I congratulate the team and hereby wish the succeeding team to put their best foot forward and keep up the good work!

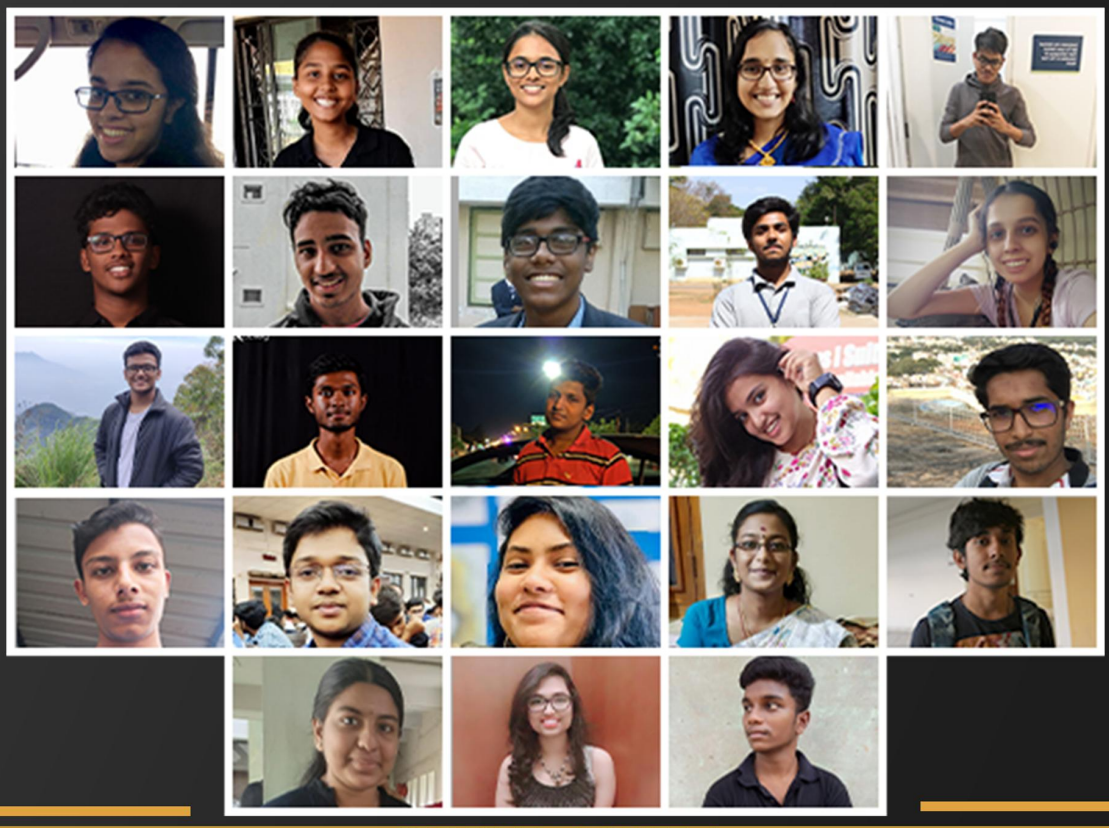
EDITORIAL

Warmest greetings from the Editorial team! The beginnings of this academic year are quite foggy in our minds and yet, the journey henceforth has proved to be memorable just as much as a quirky, off-beat one it was at that. While we missed out on the joy of having face-to-face compile meets and animated discussions, the year did teach us to be more versatile and stay on our toes at all times. Virtual meets and email correspondences did come to our rescue, even so it has been no match to the old-fashioned conversations and negotiations that used to be interspersed by some heart-warming banter.

On that note, one can't help but feel immense gratitude towards the team for keeping the traditions alive; for being on the move with the second Tronicals issue despite it all. This time, with our cover story, we address the all-pervasive wearable technologies that are slowly making their mark in all our lives - in both subtle and conspicuous ways. We then go on to acknowledge the vital role data analytics has come to play in the power systems of the future and the influx of electronics in the field of biomechanics so as to cater to a multitude of human needs.

Crafting the issue together has brought us all a sense of purpose and so much joy. And with this issue, we hope to pass on this excitement undiminished to you, our beloved readers. Thereby wishing you some happy reading, the Editorial team '21 signs off, with a full heart. Cheers !

- Nila & Anjula



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. programe, 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.

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

VISION

To be a centre of excellence in Electrical Energy Systems

B.TECH PROGRAMME

Programme Educational Objectives (PEOs):

The major objectives of the B.Tech. programme in Electrical and Electronics Engineering are to prepare students:

1. for graduate study in engineering
2. to work in research and development organizations
3. for employment in electrical power industries
4. to acquire job in electronic circuit design and fabrication industries
5. to work in IT and ITES industries

Programme Outcomes (POs):

The students who have undergone the B.Tech. programme in Electrical and Electronics Engineering (EEE)

1. will have an ability to apply knowledge of mathematics and science in EEE systems.
2. will have an ability to provide solutions for EEE problems by designing and conducting experiments, interpreting and analysing data, and reporting the results.
3. will have comprehensive understanding of the entire range of electronic devices, analog and digital circuits with added state-of art knowledge on advanced electronic systems.
4. will have knowledge and exposure on different power electronic circuits and drives for industrial applications.
5. will have in-depth knowledge in transmission and distribution systems, power system analysis and protection systems to pursue a career in the power sector.
6. will have a good knowledge in microprocessors/microcontrollers, data structures, computer programming and simulation software.
7. will be able to develop mathematical modelling, analysis and design of control systems and associated instrumentation for EEE.
8. will be able to systematically carry out projects related to EEE.
9. will have an ability to participate as members in various professional bodies as well as multidisciplinary design teams.
10. will demonstrate the ability to choose and apply appropriate resource management techniques so as to optimally utilize the available resources.
11. will be proficient in English language in both verbal and written forms which will enable them to compete globally.
12. will have confidence to apply engineering solutions with professional, ethical and social responsibilities.
13. will be able to excel in their professional endeavours through self-education.
14. will be able to design and build renewable energy systems for developing clean energy and sustainable technologies.

M.TECH POWER SYSTEMS

Programme Educational Objective (PEOs):

The major objectives of the M.Tech. programme in Power Systems are to equip the students with adequate knowledge and skills in Power Systems Engineering and to prepare them for the following career options:

1. research programmes in Power Systems Engineering
2. employment in power research and development organisations
3. to work in electric power industries and energy sectors
4. faculty positions in reputed institutions

Programme Outcomes (POs):

A student who has undergone M.Tech. programme in Power Systems (PS) will

1. have an ability to evaluate and analyse problems related to Power Systems and be able to synthesise the domain knowledge and incorporate the principles in the state of art systems for further enrichment.
2. be able to critically investigate the prevailing complex PS scenarios and arrive at possible solutions independently, by applying the acquired theoretical and practical knowledge.
3. be able to solve PS problems such as load flows, state estimation, fault analysis and stability studies.
4. be able to develop broad-based economically viable solutions for unit commitment and scheduling.
5. be able to identify optimal solutions for improvising power transfer capability, enhancing power quality and reliability.
6. be able to evolve new schemes based on literature survey, and propose solutions through appropriate research methodologies, techniques and tools, and also by designing and conducting experiments.
7. be able to interpret power system data and work on well-defined projects with well defined goals to provide real time solutions pertaining to PS.
8. be able to develop, choose, learn and apply appropriate techniques, various resources including hardware and IT tools for modern power engineering, including prediction and modelling with an understanding of the limitations.
9. be able to develop dedicated software for analysing and evaluating specific power system problems.
10. be able to participate in collaborative-multidisciplinary engineering / research tasks and work as a team member in such tasks related to PS domain, giving due consideration to economic and financial intricacies, and lead the team in specific spheres.
11. be able to confidently interact with the industrial experts for providing consultancy.
12. be able to pursue challenging professional endeavours based on acquired competence and knowledge.
13. be a responsible professional with intellectual integrity, code of conduct and ethics of research, being aware of the research outcomes and serve towards the sustainable development of the society.
14. be capable of examining critically the outcomes of research and development independently without any external drive.

M.TECH POWER ELECTRONICS

Programme Educational Objectives (PEOs):

The major objectives of the M.Tech. programme in Power Electronics are to equip the students with adequate knowledge and skills in Power Electronics and to prepare them for the following career options:

1. research programmes in Power Electronics and related areas
2. employment in R & D organisations related to sustainable technologies
3. to work in power electronic circuit design and fabrication industries
4. faculty positions in reputed institutions

Programme Outcomes (POs):

A student who has undergone M.Tech. programme in Power Electronics (PE) will

1. have an ability to evaluate and analyse problems related to Power Electronic Systems and incorporate the principles in the state of art systems for further improvement.
2. be able to investigate critical PE problems and to arrive at possible solutions independently, by applying theoretical and practical considerations.
3. be able to solve PE problems such as switching control, converter design, analysis and control of solid state drives and stability studies.
4. be able to develop appropriate power converters for sustainable energy technologies.
5. be able to identify optimal solutions for improvising power conversion and transfer capability, enhancing power quality and reliability through PE based solutions.
6. be able to evolve new power electronic topologies and control schemes based on literature survey and propose solutions through appropriate research methodologies, techniques and tools, and also by designing and conducting experiments.
7. be able to work on small, well-defined projects with particular goals to provide real time solutions pertaining to power electronics.
8. be able to develop, choose, learn and apply appropriate techniques, various resources including sophisticated digital controllers and IT tools for modern power electronic system simulation, including prediction and modelling with existing constraints.
9. be able to develop dedicated software for analysing and evaluating specific power electronics and control problems.
10. be able to participate in collaborative-multidisciplinary engineering / research tasks and work as a team member in such tasks related to PE domain, giving due consideration to ecological and economical intricacies, and lead the team in specific areas.
11. be able to confidently interact with the industrial experts for providing consultancy.
12. be able to pursue challenging professional endeavours based on acquired competence and knowledge.
13. be a responsible professional with intellectual integrity, code of conduct and ethics of research, being aware of the research outcomes and serve towards the sustainable development of the society.
14. be capable of examining critically the outcomes of research and development independently without any external drive.

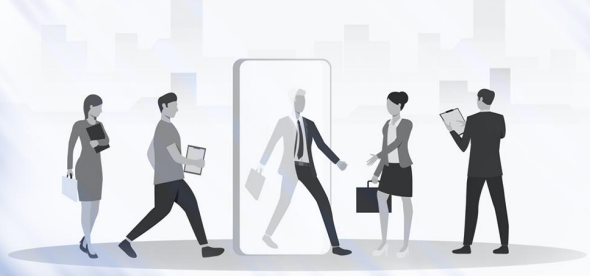
INTERNSHIPS & PLACEMENT STATISTICS

Internships

Microsoft:	Rakshaa Viswanathan, Shyam M
	S P Srinidhi
Qualcomm:	Abhinarayani V, Priya Meghana Karri
Goldman Sachs:	Siddharth Venu, Eswar Prasad P
	Shashank Kakarlapudi
Nvidia:	Venkat Subramanian P ,
	Muppana Mourrya,
	Kondepudi Hima Varsha
Texas Instruments:	Kalai Kaamesh,
	Sanaboyina Vijaya Ganesh
Cisco:	Harith Laxman
Wells Fargo:	Ayush Kumar Singh, Aravinth R
Bajaj:	Charmie Rajan
Citicorp:	Sai Karthik KA, Aviral Verma
American Express:	Shashank Srivastava
Axis Bank:	Monish Prabhu
Schlumberger:	Sangavi M
Visa:	Aditya Pethkar
Tata Steel:	Raghul M , MSR Aditya,
	Hari Narayanan R, Rasal Nazir
	Panthula Sampoorna

Placement Statistics

Total Placed - 64
Software - 31
Electrical - 14
Electronics - 11
Analytics /M - 8



DATA ANALYTICS IN POWER SYSTEMS

Big Data has been the rage for the past decade, seeing widespread application and creating new job types that nobody had imagined before. But what is Big Data? As the name gives it away, "Big- a huge amount" and "Data-quantities, characters, or symbols on which operations performed by a computer, which may be stored and transmitted." But from a technical standpoint, Big Data can be defined as high-volume, high-velocity and high-variety information asset that requires and demands cost-effective, innovative forms of information collection, storage, and processing for enhanced insight and decision making. Big Data is only growing exponentially with time. It is data with such a large size and complexity that none of the traditional data analysis tools can store it or process it efficiently. Big data is much more than a series of data sets in various types; it is an effective tool to achieve the system's multiple advantages. Out of all the potential applications, Big Data is proving to be an essential field for the electricity industry.

Big data analysis is all set to become the norm for the power system market. The electricity production system has faced numerous challenges and technological advancements. To operate, maintain, and regulate the generating sector's electric power system, we need to tackle these challenges and technical issues effectively. The focus on real-time power generation, transmission, distribution can

enhance the efficiency than was previously possible. The frontier of Electrical Engineering could lie in Big Data for a country as large and diverse as ours, requiring efficient computation to save manpower, energy and other resources.

Let's look at the way Big Data is currently implemented in Power Systems. A centralized unit collects the data by using the Advance Measuring Infrastructure such as a smart meter. Smart meters are used for calculating energy consumption. These intelligent meter readers can collect data almost every fifteen minutes and use this data for the computation of various parameters with respect to power generation and device protection. Other specific devices collect the vast data and send it back to the centralized unit vice versa. The data generated in different forms is collected in the centralized unit. To extract the critical data from this massive chunk of data, we need advanced computing techniques. As the data is in complex dimensions, we need to use an optimization algorithm. In some cases, there is a chance of data missing or data being uncertain, so data cleansing is required. After the process, we can go for the decision making by using advanced Machine learning & AI techniques for the policymaking, marketing, system, and device control for better operation and maintenance of the power system.

The primary applications for Big Data from its short stints in our Power Systems industry are:

- Fault Detection and Prevention through Data Analysis
- Predictive Maintenance/Condition based Maintenance
- Transient Stability Analysis for Superior Device Understanding

- Electrical Device State Estimation and Health Monitoring
- Power Quality Monitoring
- Renewable Energy Forecasting
- Load Profiling and Forecasting
- And many more

With this large variety in how we can implement this analytic breakthrough in the Electrical Industry, we have only scratched the surface in terms of its application. And it goes to show that an industry as old as Power Systems and Power Generation needs to challenge itself to innovate and push for improvements even if it needs us to step out of our comfort zones and explore new frontiers in Science.

-Anushka & Sabharinathan

WEARABLE TECHNOLOGY

What are wearables?

Wearable technology, also known as "wearables," is a category of electronic devices that can be worn as accessories, embedded in clothing, implanted in the user's body, or even tattooed onto the skin. Wearables are usually powered by microprocessors and enhanced to send and receive data via the Internet. After the invention of smartphones, wearable electronics are the next significant innovation in the world of technology.

Different types of wearables

There are different types of wearables, to name a few:

1) Smart Watches: A watch that does more than just telling time. It provides users notifications on their calls, messages, emails, social media updates, etc. It also eliminates the need for some specialized devices like calculators, schedule organizers, and dictation gadgets.

2) Fitness Tracker: Helps keep track of the number of steps the user walks each day, continuously monitors the heart rate and sleep patterns. Using this information, the device can calculate and report accurate data on the activity's effectiveness and quality of life.

3) Head-Mounted Display: Takes you to a different world of virtual reality. It provides virtual information directly to your eyes.

4) Smart Glasses: They are capable of adding information alongside what

the wearer sees. It is achieved through an optical head-mounted display (OHMD) or embedded wireless glasses that use a transparent heads-up display (HUD) or an augmented reality (AR) overlay.

5) Sports watches: The wearable device is specially built for sports personnel who love running, cycling, swimming, etc. These devices come with GPS trackers and record information on the user's pace, heart rate, etc.

6) Smart jewellery: The jewellery notifies the users of their text messages, calls, or emails when their phone is out of reach. Smart Rings perform various functions, from enabling contactless payments to changing colours for specially-abled patients (Mood Rings) that allow healthcare workers to help them better.

7) Smart Textiles: Smart electronic devices are incorporated into wearable clothing. Their functions range from aesthetic or performance-enhancing to protective clothing such as radiation-proof wearables, which are valid for space travel and research

8) Epidermal: These wearable electronics are surgically implanted under or on the layer of the skin. These are primarily used for medical reasons like tracking contraception, insulin levels, etc.

The need for wearables

Wearable technology has influenced many arenas and domains such as healthcare, fitness, ageing, accessibility, education, and transportation. The primary goal of wearables is to smoothly become a functional part of the individual users' lives. Before wearables, it was possible to obtain much of

the information listed above, but sometimes it proved to be a hassle and required devices weren't always convenient. Wearables are connected to our smart devices, transmitting this information to them and allowing us to view it at later times, as well as in the moment. This can help you with setting goals and tracking your progress towards them.

How do wearables work

The growth of mobile networks enabled the development of wearable technology. In the most basic sense, we have to understand that wearable technology is that technology that has devices attached to the clothes we wear. Sensors can also be attached around a wearable device to allow them to monitor various activities in the area. Most sensors can track motion, brain activity, heart activity, and muscle activity. We can mostly see them in health-oriented devices. Miniature computers are also inside some wearable devices, similar to how smartphones have miniature processors inside of them. These are found in smart-watches and other wearables that are supposed to help us interact with other objects in the vicinity.

Wearables in medicine

Wearables are extensively used to enable continuous monitoring of human physical activity and behaviours, and physiological and biochemical parameters during daily life. They are used to monitor heart rate, blood pressure, body temperature, blood oxygen saturation level, posture, sleep cycle, and activity schedule Wearable devices also may evolve to be skin-attachable devices. Sensors can be embedded into the environment, such as chairs, car seats and mattresses.

Wearable technologies could be innovative solutions for healthcare problems. Some wearable technology applications are designed to prevent diseases and maintainhealth, such as weight control and effective physical activity monitoring. Wearable devices are also used for patient management and disease management. Wearable applications can directly impact clinical decision-making. Some believe that wearable technologies could improve patient care quality while reducing care costs, such as patient rehabilitation outside of hospitals. The big data generated by wearable devices is both a challenge and opportunity for researchers who can apply more AI techniques to that data in the future.

Wearables in Sports

Head injuries and concussions are extremely common in team sports such as football, volleyball, and rugby. Hitting the ball with the head and passing can cause severe head trauma.

Technologists innovate new helmets with inbuilt sensors such as linear and angular accelerometers, gyroscopes, and piezoelectric displacement sensors. Data analysis can be performed over the sensor's information to check out possibilities of head trauma. Light wearable inertial sensors can pick up acceleration from any source: mouthguard chewing, throwing, insertion into helmet facemask, etc. A head impact detector was developed using a support vector machine classifier, trained on frequency-domain features of linear acceleration and rotational velocity. Since motion dynamics differ between head impacts and spurious non-impact events,

the system could detect head impacts using this method to achieve 99% accuracy.

Safety wearables

Safety wearables are devices that are designed to help you in situations where you feel threatened or endangered. They're sometimes disguised as jewelry so they can be used in a discreet way without letting a potential attacker know what the user is doing. Most are operated by a button that sends an alert to others, sounds a loud alarm, or both. The alerts they send can either be pre-programmed texts or recorded voice messages. A lot of them also have built-in GPS, allowing you to immediately share your location with friends, family, nearby people, or even the police.

Future of wearables

A number of industries are developing new and innovative types of wearable technology, especially in the healthcare industry where they're looking to take a step beyond fitness trackers to create health care trackers. These could be used to monitor things like blood pressure, vital signs, or blood sugar levels for diabetics. Even devices like smart hearing aids and glasses that measure vision performance are becoming available to both medical professionals and the general public.

Other devices like pet trackers, smart jewellery, and AR/VR headsets are continuing to grow, gaining momentum. There's a lot of potential for wearable technology at the moment. It'll be interesting to see where things go from here and how they continue to impact us both individually and as a society.

Some other predictions for the future include:

1) Exoskeleton: Some manufacturers use them to help human workers perform better at physically intense professions (for instance, lifting heavier weights without injury). Hyundai Motor Group has been testing its Hyundai Vest Exoskeleton, which reduces pressure on workers' necks and backs in the factory setting. Hyundai says the exoskeletons help to minimize injuries in the workplace and increase worker efficiency. Exoskeletons like this will become the norm in manufacturing and industrial environments around the world.

2) Intelligent Prosthetics: Wearable technology also encompasses the new wave of prosthetics and robotic limbs currently being developed. These are increasingly being kitted out with technology that enables the limb to become more intuitive – for example, by responding to the nervous system or brain signals. MIT's Media Lab is involved in a research project that combines special amputation surgery with intuitive prosthetic development. Special robot prosthetics are being designed for ten volunteers, and the hope is the volunteers will be able to operate their prosthetics via the nervous system. In the future, intelligent prosthetics like this, which respond to the individual's commands more intuitively, may become the norm.

3) 3D Printing of human tissues: If we can create replacement limbs, why shouldn't we create replacement organs? Researchers are already working towards this goal. In one example, a team at Rice University in Houston claims to have made a significant breakthrough in the bioprinting of viable

human tissue, giving hope that it will be possible to print fully working replacement organs in the future. This, combined with advances in robotics and prosthetics, could revolutionize the world of medicine.

4) AI for the brain: Companies like Facebook are racing to develop brain-computer interfaces that could, in theory, allow you to type your Facebook status update using only your mind (telepathic typing). Elsewhere, Elon Musk's Neuralink company is working on a brain-computer interface that would help people with severe brain injuries. Announcing the plans in 2019, Musk predicted a future in which humans could have the option of "merging with AI."

Market impact of wearables

The overall Wearable Electronics Market is forecast to reach USD 51.60 billion by 2022 at a CAGR of 15.51% between 2016 to 2022. Wearable Electronics is the future and constitutes a rapidly growing industry. They have a significant impact on the overall market and consumers apart from their direct functionalities. To understand these impacts, we need to look at some of the background activities in a typical wearable technology.

Owing to the constant human contact, wearables have access to an uninterrupted stream of data and commonly perform the following activities:

1) Data Acquisition
2) Computation (local or cloud-based)
3) Live Monitoring
4) Information Acess from the Internet
5) User Feedback

The most significant contribution to the wearables market comes from the product sales of the corresponding devices. The other part deals with services and lifetime functionalities on top of the gadgets like recommended health or fitness regimes offered by professionals.
The features like computation and user feedback require access to credible medical data alongside robust computation using massive Medical Machine Learning models with predictive analysis.This opens up a whole new scope for market expansion wherein the user agrees to share their data to get access to personalized feedback and corresponding services.
The sheer amount of data and the scope for personalization also lead to cybersecurity threats and privacy concerns. Inaccurate results or feedback constitute another problem from overreliance on wearables.

Drawbacks of wearables

Wearables tend to have a relatively short battery life. Some devices, like the simpler Fitbit trackers, can last for several days. But some of the more advanced wearables, like the Apple Watch, will only last for a day or so. For some, it can be a hassle to remember to remove the wearable to charge it regularly. Thus, many researchers are looking into the possibility of wireless charging options that would eliminate the need to remove the device.
Some wearables have been reported to mismeasure data on occasion. This can be especially dangerous when measuring particulars related to health. For individuals with heart conditions, this false reading could lead to overexertion and further health issues.
Ultimately, it's up to the user to decide whether a wearable device is

something from which one would benefit. With their increase in popularity, it's essential to weigh the pros and cons before committing to one.

Challenges for wearables in the future

The biggest challenge for the wearable industry is to get sustainable customer engagement. Many wearable electronics are short-lived because of their short-term customer engagement. Bad quality, pain to sync with smartphones, poor battery life, uncomfortable and awful design, UX problems are some of the functional reasons which put the user off the device. However, you might find wearable devices that are very strong functionally and physically and still bomb at the market simply because they failed to create any meaningful impact on the users, lives, habits, or behaviours.

Security of information

Many wearables tend to have little to no security measures keeping their data safe. The fact that much of the data is unencrypted and that most of these devices use Wi-Fi or Bluetooth connections to transmit data means cybercriminals can get their hands on it pretty easily.This means, whether you like it or not that your tracked information could be used for marketing or health purposes. There are positive ways this information could be used, but as with all big data, there's also a chance it could be misused.

Currently, most of the available data via wearables isn't valuable enough for hackers to pursue. But as wearables and their capabilities continue to evolve, they may become higher-priority targets.

Conclusion

There is no denying the looming role of Wearable Electronics in the immediate future. They possess the ability to improve our quality of life vastly. With the increase in production of various sensors and actuators and the possibilities it upholds in the future, wearables would no longer be an accessory but a necessity in daily life. With their plethora of benefits, wearables are sure to revolutionise the medical, transportation, fitness, fashion, and education fields and outgrow its fallbacks. Advancements in material technology can improve drawbacks like lower battery life, whereas a higher degree of collaboration in the design and development of the hardware and software will lead to a more optimised experience. Authentication features and secure networks can reduce data privacy issues, bring data security to the forefront while making the user more conscious. Wearable technologies with the integration of the internet of things and machine learning can pave the way for a fully automated future.

Ultimately, the future is looking exciting. And wearable electronics will be playing a noticeable role in it.

- Rakshaa & Mandar

BIOMECHANICS AND ELECTRONICS

Biomechanics is a two-word term referring to bios-life and mechanics-mechanical properties. It basically deals with the mechanical properties associated with the movement and structure of living organisms. Technological developments in this field are a blessing which make our life relatively simple and easy.

Skin is the largest organ in our human body. Our response to sense and the reaction forms the fundamental way we respond to our environment. Electronic skin is one such advancement in the field of biomechanics towards intelligent robotics and biomedical technologies. It combines three main technologies in its working- stretchable electronics, temperature reactive coatings and brain mimicking memory. The electronic skin is crucial for its applications as prosthetics, artificial intelligence, soft robotics, health monitoring, bio-compatibility, and communication devices. They consist of flexible, self-healing and stretchable electronics and mimic the properties of human or animal skin. Electronic skin can detect and sense pain and pressure just like the human brain senses it. It has electronic memory which helps it retain and recall information. Recently they have been made out of green materials and environment friendly products. The main challenge is the ability of the material to withstand mechanical strain and maintain sensing ability or electronic properties. Recyclability and self-healing properties are especially critical in the future design of new electronic skins.

A research initiative was taken up by the Pohang University of Science and Technology from South Korea by professors Unyong Jeong and Dr. Insang You from the Department of Materials Science and Engineering. The team also included Professor Zhenan Bao of the Stanford University. Their research mainly centered on the application of special properties of ion conductors to get a membrane which can detect and identify temperature changes and mechanical stress. The POSTECH sensors consist of various features, including pressure sensors, vibration sensors and stretchable skin to emulate real life skin as closely as possible.

Pressure sensors have been calibrated to ensure that the right sensitivity is reached. These pressures can reach up to 10 kPa which is similar to a light touch on the skin. However, to achieve such high sensitivity, the research team were able to minimize these issues by using a high-performance piezo-resistive pressure sensor with a distinct linear relationship between the pressure being applied and the output signal.

Furthermore, there has been significant development in linearly sensitive Bi-modal E-skin, which can detect and provide feedback on instantaneous pressure and temperature changes. As the material itself is temperature independent the stimulus discriminability is really accurate and spontaneous.

The flexibility of the membrane gives it additional applications, like vibrations sensors, which can be used to recognise human voice through vibrations. Unlike normal microphones, these devices can detect voices clearly as they directly pick up the voice off of the vibrations on our throat.

Another research initiative was taken up by researchers at RMIT University, Australia. They developed a prototype of human skin with the ability to feel pain. It does this by recreating pain at a speed comparable to the speed at which signals are transmitted to the brain. It might seem counterproductive to incorporate pain sensation into our skin membrane. However, research leader Madhu Bhaskaran asserts that pain sensation is really vital towards next-gen biomedical and intelligent robotics. Pain acts as a defensive mechanism to make sure that the parts don't get damaged when under too much pressure or temperature. This innovation in biomedical technology might change the way prosthetics are viewed.

The advances in biomechanics and electronics have been enormous over the past few years bringing prosthetics closer to human characteristics. Every day, we step closer and closer to cyberpunk fiction, and these technologies can help solve the physical barrier of numerous people around the world. With time, it is possible that these technologies can become affordable for the common man, and solve major crippling issues that humanity faces in the future beyond.

- Shreyas & Rajalakshmi

EEE ASSOCIATION
Inauguration

The EEE Association conducted its very first virtual inauguration in December 2020. The meeting had over 200 attendees, which is quite a remarkable achievement for an online college event. The inauguration was graced by several delegates including the chief guest, Mr Saji S, a renowned industry expert. The event commenced with the prayer song dedicated followed by the lamp's virtual lighting.

The inauguration then began with the welcome address, given by the chairperson of EEEA, Mr Kartikey, who highlighted the key features of the association and the events planned for upcoming year. The faculty advisor, Ms Aneesa Farhan, then gave an overview of the new members inducted into the association. Next was the HOD, Mr Sankaranarayanan, who was called upon to address the gathering. He expressed his appreciation to the association for making this event possible amidst an ongoing lockdown. His speech was highly motivating and greatly boosted the general morale.

A critical mark in the inauguration was the release of the biannual technical magazine, Tronicals. Tronicals is the technical magazine of the EEE association. The magazine's preview was showcased

through a short promo video, while the link to the virtual magazine was circulated within the chatbox. This was the 6th edition of Tronicals.

This was followed by the presidential address by the Dean of Student Welfare, Dr N.Kumaresan. He, too, expressed his surprise at the number of attendees and appreciated the smooth coordination that went into making this event a possibility. He expressed his best wishes to the association.

A short video was played highlighting the donations made by the EEE Association to Malarachi ashram. That goes hand in hand with the association's belief of sharing happiness with the society.

Finally, the chief guest was called upon to address the students. He gave a small presentation which showed his work experience within the electrical industry and his endeavours as an engineer in HVDC India.

The meeting then came to an end with the vote of thanks, delivered by the Overall Coordinator, Mr. Arun Prasanna, following which a virtual photoshoot took place, after which the attendees adjourned.

- Gokulan