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SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING

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An Autonomous Institute

"MECHTRON"

TECHNICAL MAGAZINE 2022-23

DEPARTMENT OF MECHATRONICS ENGINEERING

VOL.I ISSUE I

Vision and Mission of Institute

Vision

To be a center of excellence in technical education by using cutting edge technology that produces competent engineers of today and tomorrow to serve the society.

Mission

- To impart quality education by implementing state-of-the-art teaching-learning methods to enrich the academic competency, credibility and integrity of the students.

- To facilitate a conducive ambience and infrastructure to develop professional skills and nurture innovation in students.

- To inculcate sensitivity towards society, respect for environment and promote high standards of ethics.

Vision

To be centre of excellence in Mechatronics engineering education to prepare professionally competent engineers with life long learning attitude for the accomplishment of ever growing needs of society.

Mission

- To prepare technically and professionally competent engineers by imparting quality education through effective learning methodologies and providing stimulating environment for research and innovation.
- To develop professional skills and right attitude in students that will help them to succeed and progress in their personal and professional carrier.
- To imbibe moral and ethical values in students with concern to society and environment.

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Educational & Charitable Trust

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Educational & Charitable Trust

Dr. S. A. Khot
Principal

HOD's Words

Dr. S. K. Shikalgar
Head of Department

It is pleasure to introduce you to the Department of Mechatronics Engineering, which is an emerging multidisciplinary branch of engineering that focuses on electronic and mechanical systems, and also includes a combination of robotics, electrical, computer, telecommunications, control engineering.

Today, Mechatronics Engineers are the most demanded in the automation industries. Mechatronics Engineering will continue to grow in demand as more businesses advance their technologies and turn to sophisticated intelligent systems and robotics.We strive to increase our knowledge, enhance critical thinking, motivate innovative projects, and develop entrepreneurial skill. We impart knowledge through a highly competent team of faculty. The diversity of expertise of the faculty helps the students to acquire skill in all disciplines. Our laboratories are equipped as per the norms of AICTE and motivate students to do projects related to automation, robotics, and societal development. We focus to nurture our students to become world class professionals and/or future entrepreneurs.

1. Automatic Sensor Based Wall Painting Robot

(Ms. Siddhi Repal & Ms. Indira Nagarkar)

INTRODUCTION:

Building and construction is one of the major industries around the world. In this fast moving life construction industry is also growing rapidly. But the laborers in the construction industry are not sufficient. The primary aim of the project is to design, develop and implement Automatic Wall Painting Robot which helps to achieve low cost painting equipment. Despite the advances in robotics and its wide spreading applications, interior wall painting has shared little in research activities. The painting chemicals can cause hazards to the human painters such as eye and respiratory system problems. Also the nature of painting procedure that requires repeated work and hand rising based Wall Painting Robot makes it boring, time and effort consuming.

CONSTRUCTION:

The construction of the automatic wall painting robot consists of the following main parts:

- Frame stand
- Wheels
- DC motor
- Battery
- Control unit
- IR sensor
- Spray gun
- Pump

WORKING :

This project mechanism works on the principle of "**SCISSOR LIFT MECHANISM".** A scissors lift uses linked, folding supports in a criss-cross 'X' pattern, known as a pantograph

The extension is achieved by applying pressure to the outside of a set of supports located at one end of the lift, elongating the crossing pattern. This is achieved through mechanical means. It may require no power to return to its original position, but simply a release of the original pressure. This consists of a paint pump, paint tanks (for primer and overcoat), a compressor to drive the pump, and a reel to wind up the paint hose.

USES:

- The aims and objectives of the project are to design a system for painting of wall which is:
- Autonomous
- Efficient
- User-friendly
- Transportable
- Cost-effective
- Reduce strenuous and repetitive task
- Increase safety

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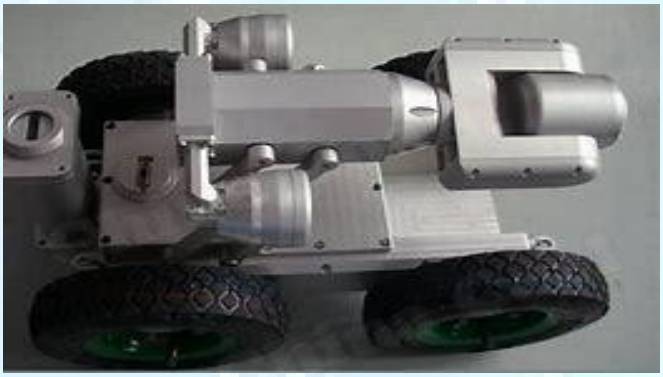
2. MULTIFUNCTIONAL ROBOT FOR FAULT DETECTION IN PIPELINE

(Ms. Punam Chougule & Ms. Srushti Patil)

Abstract: The robot is specially constructed so as to travel inside a pipeline to detect cracks and faults. It consists of a cylindrical body with protruding and spring loaded wheels that will facilitate its travelling inside a pipe. The body will also be equipped with various sensors like; ultrasonic sensor, IR sensor, proximity sensor, camera. This project was initiated keeping in mind the fact that these days most of the equipment used for pipe fault detection is used on the outside of the pipe rather than inside. Pipelines carry the majority of the natural resources over large distances. Since it's a man-made structure there are a large number of faults present in them. These faults are unavoidable; but we can always detect them beforehand and prevent any accident from occurring. There have been many incidents in the past where pipelines underneath a city just blew up destroying the infrastructure and also causing grave damage to humankind. There have been many machines invented which are used to check for defects in a pipeline; but the problem with conventional machines is that they can only work outside of the pipe. Moreover they are obsolete and very difficult to transport & maintain. We have designed a solution for this very problem. The robot will travel inside the pipe and will constantly keep checking for cracks, leaks and faults on all sides. This bot is equipped with spring loaded wheels that enable locomotion in pipes of varying diameter. The bot will have van R/F transmitter that will be used for communication with the user. This bot was designed keeping in mind the above stated problems and will surely help in averting severe accidents which would have caused damage to life and property. Multifunctional Robot for Fault Detection in Pipeline.



WORKING :

The bot has been made keeping in mind many of the hindrances that it will face inside a damaged pipeline. The bot will have three wheels on each end of the chassis that are spring loaded. Also the material used will be non-reactive so that it can work in pipelines that contain chemical deposits. Initially the bot will provide a visual image of the pipe via the camera allowing the user to see if there are any obstacles in the path. The ultrasonic and proximity sensors will start functioning and provide the data about the condition of the pipe. Both the R/F transmitters will be configured, one as a receiver and the other as a transmitter. Communication will be established between them once the robot starts working. The bot will be in constant connection with the user wirelessly.

3. TECHNOLOGICAL ADVANCEMENTS IN IT INDUSTRY

(Mr. Digvijay Magdum & Mr. Sujal Kurde)

Modern India is an epitome of Scientific and Technological Development and is one of the key elements for economic growth. Post 15th August 1947, India's journey has become a great example of an impressive growth story. As claimed by the Indian Brand Equity Foundation, India is among the topmost countries in the world in the field of scientific research and has been positioned as one of the top five nations in the field of space exploration. India also ranks third among the most attractive investment destinations for technology transactions in the world.

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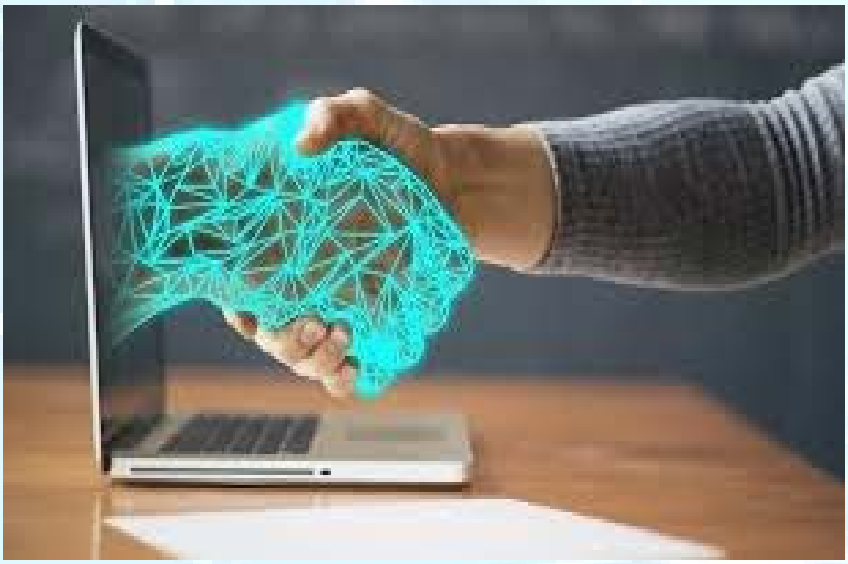

DEVELOPMENT IN THE IT INDUSTRY:

The past few decades have seen staggering technological changes that have revolutionized the world. Technology has created hundreds of thousands of tools and resources, making it possible to access any information literally at our fingertips. Over 4.33 billion people actively use the internet today. That's a mind-boggling 56% of the global population, where India ranks second. And it's only going uphill from here. IT technology in India is advancing at an astonishingly fast rate, and those who can't keep up are simply left behind. Technology has changed the way we communicate, how we pay our bills, and even how we watch TV. There's no doubt that the IT industry is growing like never before. In the past, India has often seemed to be a bit of a relative laggard among developing countries, especially in terms of economic growth and the IT revolution in the country that led to the Indian software industry being recognized as one of the most successful in the world today. The late 1970s saw a boom in the IT industry with the outsourcing of software to specialized software firms. The early 1980s were all about "prepackaged" software because of the acute shortage of talented engineers who could build custom software.

INDUSTRIAL APPLICATIONS:

There are numerous industrial applications for a robot of this stature. Some of the largest ones are pipeline and petroleum industries which use a plethora of pipes for the functioning of their business. Pipes are evidently present in each and every industry; thus their failure may lead to adverse accidents. This bot has a lot of scope for improvement as well. On discussing with industry specialists many new applications will come up. The future scope of this bot is quite promising as well. The robot could be attached with a cleaning unit that will simultaneously clean the pipe from inside while detecting flaws. The robot could be designed in such a way that it does not require its own power for propulsion, instead it will use the trapped fluid power of fluid that is flowing through the pipe by a vane mechanism. The bot could be designed in such a way that it could detect fault even if the fluid is flowing through the pipe and a unique turbine system can be designed to convert some part of flowing fluid into electricity which could be used by on board systems for their power requirement eliminating the limit of use due to low battery storage capacity.

CONCLUSION

The multifunctional robot will be able to travel inside the underground water and oil &gas pipelines to detect cracks that may have developed on the internal surface. The camera mounted on the front of the robot would give a live feed of the area in front of the robot thus helping to detect the presence of any fouling or any sludge presence in front of the robot. The robot would prove to be very helpful in the Oil & Gas industry so as to predetermine any faults that may be present in the underground pipelines. This would help in avoiding the disasters occurring due to bursting of pipelines and would help improve human safety. If the robot is utilized in water pipelines it would help to exactly locate the leakage points in the pipeline so as to reduce wastage of water during supplies. Using such a robot would prevent the constant digging up of roads to detect faults in underground pipelines and would be very helpful in not disturbing the public convenience.

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2. MRL| In pipe Leak Detection mechatronics@mit.edu.in-pipedetection.

4. SATELLITE TV

(Mr. Dipak Mali & Mr. Asifali Mujawar)

Satellite TV is a type of television programming that is wirelessly delivered to TV sets across the world via a network of radio signals, communications satellites, broadcast centers and outdoor antennas. Broadcast signals are transmitted from satellites orbiting the Earth and received by local and regional satellite TV systems.

How Satellite TV service works:

The programming source transmits signals to a satellite provider broadcast center and these waves are then picked up by a compact satellite dish and broadcast onto television sets. Satellite TV technology makes use of specialized antennas known as satellite dishes. These satellite dishes transmit signals to a satellite receiver such as a set-top box or satellite tuner module within a TV set

Overview of Satellite TV Video Content Delivery

Satellite TV service can also be referred to as direct broadcast satellite (DBS or DBSTV) service. A DBS provider will select programming often a wide range of channels and services—and will then broadcast this content to satellite TV subscribers as part of a larger TV package. DBS programming can either be sent to a digital satellite receiver or an analog satellite receiver. Analog satellite television is slowly being replaced by digital satellite programming. Digital satellite television has become increasingly available in better quality known as HD TV (high-definition television). Digitally-broadcast content is characterized by greater picture and sound quality. Satellite stations and broadcast television stations both transmit TV programming through radio signals. Years ago, the first satellite television TV technologies were broadcast in the C-band radio frequency range. Today, digital satellite TV content is transmitted in the Ku frequency range. To further understand the technology behind direct-broadcast satellite systems, it is important to review the top features and elements involved in direct-broadcast satellite TV video content delivery: programming sources, satellite provider broadcast centers, satellites, satellite dishes and the satellite receivers. Programming sources refer to networks or channels that offer TV shows and movies for the enjoyment of subscribers. A broadcast center plays an integral role in video content delivery. At broadcast centers, TV providers receive and send broadcast signals to satellites orbiting the Earth.

However, the 1990s saw a resurgence of project-driven software services that ignited the mushrooming high growth rates in the Indian software industry. Since the early 1990s, the Indian IT industry has been growing at a phenomenal rate with several phases of growth and development over the last three decades. Today, India stands tall as one of the largest digital hubs in the world. Now it seems like an irony that how Before Independence, we were forced to work under the Abroad People from the East, and how we Indians are the Leaders of the biggest world companies from the East.

Some Examples:

Sundar Pichai running Google and Satya Nadella running Microsoft. In early 2000s, people were more focused in settling abroad but with upcoming generation, we have advanced enough to have our country its own IT hub Bangalore , known as Silicon Valley of Asia but I do feel in few years it will be more than that, rather than being known as 2nd Silicon Valley, it would be something of its own.

To further understand the technology behind direct-broadcast satellite systems, it is important to review the top features and elements involved in direct-broadcast satellite TV video content delivery: programming sources, satellite provider broadcast centers, satellites, satellite dishes and the satellite receivers. Programming sources refer to networks or channels that offer TV shows and movies for the enjoyment of subscribers. A broadcast center plays an integral role in video content delivery. At broadcast centers, TV providers receive and send broadcast signals to satellites orbiting the Earth.

Before sending out a signal, a broadcast center will convert programming into a digital stream of content. Once satellites have received and processed all of these uncompressed signals, they ultimately rebroadcast them to satellite dishes on Earth. Next, a subscriber’s outdoor satellite dish will pick up the broadcast signal and transmit it to the satellite receiver located inside of a home. A satellite receiver then completes the information transmission by processing the signal and passing it on to a viewer’s television set.

Reliability and Reception:

Bundle Services:

Bundling services like television, Internet, phone and home security. Bundling in business refers to offering several products or services as a package deal, often at a discounted price. One advantage of bundled service is a single bill. While cable TV providers frequently offer bundles, satellite TV companies may need to partner up with other carriers in order to provide Internet, phone and other services to their customers.

Online Streaming Service:

If you are interested in streaming live TV and watching video content online, you may want to carefully review package details to ensure you sign on with a provider—whether Internet, cable or satellite—that offers a wide array of live TV streaming content, both in-home and on-the-go. Do you want to stream your favorite TV shows and movies online or would you use your mobile devices? refer to watch live TV on Direct broadcast via satellite

Direct broadcast satellite, (DBS) also known as "Direct-To Home" can either refer to the communications satellites themselves that deliver DBS service or the actual television service. Most satellite television customers in developed television markets get their programming through a direct broadcast satellite provider. Signals are transmitted using Ku band and are completely digital which means it has high picture and stereo sound quality. Programming for satellite television channels comes from multiple sources and may include live studio feeds. The broadcast center assembles and packages programming into channels for transmission and, where necessary, encrypts the channels. The signal is then sent to the uplink where it is transmitted to the satellite. With some broadcast centers, the studios, administration and uplink are all part of the same campus. The satellite then translates and broadcasts the channels.

Most of the DBS systems use the DVB-S standard for transmission. With pay television services, the data stream is encrypted and requires proprietary reception equipment. While the underlying reception technology is similar, the pay television technology is proprietary, often consisting of a conditional-access module and smart card. This measure assures satellite television providers that only authorised, paying subscribers have access to pay television content but at the same time can allow free-to-air (FTA) channels to be viewed even by the people with standard equipment(DBS receivers without the conditional-access modules) available in the market.

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5. HARNESSING SOLAR ENERGY

(Ms. Vishakha Patil & Ms. Priya Sarje)

Meeting the world's ever-growing energy demands in an environmentally responsible and sustainable manner is one the issues facing today's generation. Solar energy is an abundant, clean, safe and free resource, providing approximately 1,000 watts of power per square meter to Earth's surface every day.

How can we most effectively capture, convert and store this tremendous natural resource?

One of the first technologies that comes to mind when discussing solar energy is the growing use of solar cells, also known as photovoltaic cells, which convert sunlight directly into electricity. Solar cells are silent, non-polluting and long-lived devices that typically convert 10 to 15 percent of the energy received into energy that can be used.

They are not the only way to get electricity from solar energy, though. Sunlight can also be intensely focused onto a small area, using concentric collectors. The dynamic landscape of India's energy transformation positions the sun and the wind energy as stalwarts of progress. Solar and wind energy, two clean and abundant resources in India, have emerged as the twin pillars that collectively account for over 50% of the total renewable energy capacity in India. As the nation moves forward toward its ambitious renewable energy targets, these technologies will carve the way for a sustainable future. India's journey toward sustainability is both a necessity and a responsibility. Solar and wind energy with their abundance and compatibility with India's diverse climate patterns, optimize energy generation throughout the year. These renewable sources of energy have empowered many states with green solutions. Regions across India are carving their green legacy with distinct contributions to the solar and wind energy landscape. For instance, Rajasthan is a pioneer when it comes to solar energy. Its vast desert expanses are home to some of the country's largest solar installations, contributing significantly to the national solar capacity. On the other hand, Gujarat's coastline hosts some of India's most prominent wind farms. The Kutch region, with its impressive wind corridors, stands as a testament to Gujarat's pioneering efforts in wind energy.

In addition to this, Tamil Nadu's southern coastline and favorable wind conditions have made it a leader in wind energy. The state has also embraced solar power and adopted a diversified approach to renewable energy. Solar and wind energy collectively account for over 50% of the total renewable energy capacity in the country. They are not just reshaping regional landscapes but also transforming industries.

Solar-powered irrigation pumps are revolutionizing agriculture. Farmers in states like Maharashtra and Andhra Pradesh are benefiting from these clean energy solutions, reducing reliance on fossil fuels and increasing agricultural productivity. Energy-intensive industries are integrating solar and wind power into their operations. From textile mills to luxury hospitality resorts, renewable energy is becoming a cornerstone of sustainable industrial growth.

This progress in solar and wind energy can prove to be a global model to drive renewable energy adoption. Developing nations especially can look at India's renewable energy sector growth as a blueprint. The adoption of solar and wind energy will not just support industry growth but also empower local communities. Distributed solar installations on rooftops and decentralized wind farms have the potential to make communities self-sufficient in energy. This decentralized approach democratizes energy access and empowers individuals to contribute to the nation's energy transition.

With strategic investment from the government and private sector and a favourable policy framework, the sector can witness accelerated growth contributing to green energy goals of India.

The synergy between solar and wind energy will continue to drive India's transition to a low-carbon economy. Entrators such as an array of mirrors or lenses to heat water and create steam. High-pressure steam can be driven through a turbine to generate electricity. There are at least two other ways to store solar energy for use later. The sunlight can be stored in the heat capacity of a molten salt (the liquid form of an ionic compound like sodium chloride) at a high temperature. When electricity is needed later, heat is transferred from the molten salt to water, using a heat exchanger to generate steam to drive a turbine.

A second method of harnessing and storing solar energy is to employ sunlight to produce a fuel. For example, a photo electrochemical cell uses solar energy to split water into hydrogen and oxygen gases, which can be stored as fuels. These gases are then recombined to generate electricity in a device known as a fuel cell. An attractive feature of this approach is that the byproduct of the fuel cell reaction is simply water. While many of the technologies described here are in use on a small scale today, we must continue to develop innovative methods of storing solar energy and promote sustainable energy policies that benefit generations to come.

6. What is Mechatronics Engineering?

(Ms. Priyanka Devkate & Ms. Anjali Eksambe)

Mechatronics engineering is the design of computer-controlled electromechanical systems. The essence of it is that the design of the mechanical system must be performed together with the design of the electrical/electronic and computer control aspects that together, comprise a complete system.

Some examples of mechatronic systems include: a CD or DVD player; a computer hard disc drive; a fly-by-wire aircraft control system; and an anti-lock braking system (ABS). Each of these products is essentially mechanical in nature, but could not function without the integral design of the electrical and computer control systems that are critical to their operation.

Mechatronics engineering scope:

The future of mechatronics engineering in India is bright, and there are numerous opportunities for engineers in this field. From robotics and automation to smart devices and self-driving cars, mechatronics engineers are at the forefront of innovation and technology development.

Career Options in Mechatronics:

The profession of mechatronics includes technicians and engineers. They design and maintain automated equipment. Technicians and engineers work in laboratories, offices or on-site manufacturing plants. The goal is to produce safe and efficient automated equipment. Technicians primarily maintain machinery, while engineers are more concerned with design and development of components and products. Mechatronics is a multidisciplinary field that involves the integration of mechanical, electrical, and computer engineering to develop intelligent systems. Germany is a leading country in Mechatronics with a robust industry, research, and education sector.

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SEVERAL DISCIPLINES OF APPLICATIONS:

Mechatronic engineering is the broad field and it has great opportunities. On the other hand, the field has less branches and numerous applicants. In reality it has lots to serve because it includes some of the best areas of applications like_

- Nanotechnology
- Biomedical systems
- Automations
- Robotics
- Computer Science
- Electrical Systems
- Mechanical Systems

7. Revolution in field of Consumer Electronics since 2020

(Mr. Aditya Kadam & Mr. Pratik Kamble)

The global market has witnessed some incredible technological innovations over the last decade, but as the consumers move into the 20s, what new developments await us? Here, consumers can take a look at some of the top consumer electronics trends for 2020.

5G

One of the consumer electronics trends that people have been discussing for some time now is 5G. 2019 saw EE, Vodafone, Three, and O2 all roll out their 5G networks in the UK. In 2020, consumers can expect more mobile carriers to follow suit, as well as 5G being rolled out in other countries.

5G promises faster internet speeds for everyone and should be especially beneficial for those living in areas that currently have poor or non-existent 4G coverage. This is possible because of the 5G small cells replacing the monolithic 4G cell towers.

The 5G cells can be mounted almost anywhere, including in towns and cities, without being intrusive or an eyesore as they are only small boxes and can be installed in a few hours. Consumers can expect to see more of these 5G cells installed in the world around us as 5G coverage becomes more common.

Personalized Medicine

Medical technology has long been dependent on innovation within electronics. Recently, more developments have been made in electronic tattoos – thin, wearable electronics that can be worn on the skin to monitor vital signs such as heart and brain functions and transmit that data to a smartphone or computer for real-time health analysis. Technologies such as this have the potential to fundamentally change the way treatment is administered, as intuitive monitoring technology can give more accurate and personalized readings of all the health risks of an individual. Rather than going through a series of tests and being prescribed a treatment that may aggravate other conditions, patients are more likely to get the treatment that is tailored specifically for their entire health profile.

Blockchain Technology

2030 could be the year that sees blockchain technology change the way companies do business. Blockchain technology is a digital ledger that records and stores transaction information in an encrypted, decentralized manner. Blockchain technology is more secure against hackers and malware trying to manipulate past transactions as any changes made to a 'block' in the blockchain changes the block's unique hash which would no longer match the chronology of the chain. All the information in a blockchain is transparent, meaning anyone can see the transactions made by a person or company but cannot change or manipulate that data. The wide use of blockchain technology in the business world would mean fewer companies 'dealing under the table' as everyone in a blockchain is accountable for their own activity.

Extended Reality

One of the biggest consumer electronics trends of 2019 has been extended reality or XR. 2020 is likely to bring more extended reality concepts and technology. Virtual and augmented reality video games have seen some huge developments in the past year, with many popular games including elements of VR or AR. The announcement of the next generation of gaming consoles will no doubt lead to more games of this ilk being developed to complement more powerful hardware.

Whilst consumers can bank on the continued growth of XR within the entertainment industries, consumers could also be looking forward to other businesses adopting the technology. XR can be used for training and simulation purposes, as well as be coupled with AI to test the efficiency of new production methods. XR could also be used in sales and marketing to compellingly demonstrate a product or service to potential customers or investors. These are just some of the exciting technologies that could be coming in 2020, but there will also be many more. The development of any electronic technology for use in a particular product or industry opens up the opportunity to apply that technology to a range of other industries, so consumers are sure to see some innovations that most of us haven't even conceived of yet.

Related Links

- Global Crypto ATM Market Size, Analysis and Forecast 2021 – 2030
- Global Earphones and Headphones Market Size, Analysis and Forecast 2021 – 2030
- Global Wireless Fire Detection Systems Market Size, Analysis and Forecast 2021 – 2030

8. Artificial Intelligence Revolutionizing the Car Designing and Manufacturing Industry.

(Mr. Asif Shirdhone & Mr. Abhijeet Girmal)

Since cars were introduced in the 19th century, humans have always been a part of its manufacturing process. From the initial design until the product's final launch, the human workforce carried out all the processes in between. As the years passed, advanced technology assisted workers in performing these processes. And now, in the 21st century, manual labor is slowly being replaced by intelligent machines that hardly require any human assistance. But one aspect of car manufacturing that hasn't completely been taken over by machines and is still human dependent is Design.

Designing is a task that has always been done by hand – be it sketching, moulding clay, or digital rendering. The Automotive design process consists of developing the appearance, both interior and exterior, along with the mechanical design which includes designing the parts and components of the vehicle. While designing a vehicle, a designer must keep in mind factors such as the basic geometry, the dimensional requirements, and the industry standards to name a few.

Even though designers nowadays are assisted by machines for purposes like digital rendering and prototyping, and access to more tools, humans cannot be completely replaced by machines as the creativity and emotions present in man-made designs cannot be mimicked by machines. But recent advancements in the Artificial Intelligence and Machine Learning sector are gradually proving otherwise.

Design teams only have a limited amount of time, money, and resources at their disposal and hence cannot prototype more than a few designs. But there can be a chance that some of the designs that don't make it to the prototyping stage have the potential to produce a lighter, cheaper, and better product. This is where the concept of Machine Learning comes into the picture.

Machine Learning is a branch of Artificial Intelligence (A.I.) that focuses on building and understanding methods that leverage data to improve performance on a specific set of tasks. Machine Learning ‘Algorithms’ work by building a model based on sample data, known as ‘training’ data that ‘train’ the model to make predictions and decisions without specifically being programmed to do so.

Machine Learning is a branch of Artificial Intelligence

Intelligence (A.I.) that focuses on building and understanding methods that leverage data to improve performance on a specific set of tasks. Machine Learning ‘Algorithms’ work by building a model based on sample data, known as ‘training’ data that ‘train’ the model to make predictions and decisions without specifically being programmed to do so. In the Automotive Design scenario, the process works by inputting a very large number of designs (training data) into the model. The model interprets and analyzes these designs thereby learning more information. The end product is a unique design created by the model.

Another major part of AI used to design cars is decision-making. The programmers will input certain parameters and rules, set by the engineers and designers, that are to be followed by the computer. This is to ensure that the final design is of the required dimensions and proportions. A real-life example of this new-age technology is the American-made hypercar, the Czinger 21C. The car has been designed using A.I. and built using 3D printing. It's A.I. learns millions of mechanical principles to produce the most cost-effective design; while accounting for external factors and natural phenomena such as wind resistance and gravity. This precision makes the car look exactly as if it were designed by a human. The additive manufacturing method also decreases the number of resources used and is far cheaper than conventional manufacturing methods.

Artificial Intelligence and Machine Learning when implemented with Computational Engineering is one of the most efficient ways to design a car. It allows engineers to optimize their designs and increase their efficiency via machine learning systems that can automate a number of tedious design tasks. While products created by human labour are of more value and are time intensive to manufacture, manufacturing a product using automated machines within a short time is more efficient and is suited to the masses. Autommated machines and processes need little to no input from people or other processes but to assess whether a design is of value, will still require a human. Hence, we can say that machines won’t completely replace us-at least not in the near future.

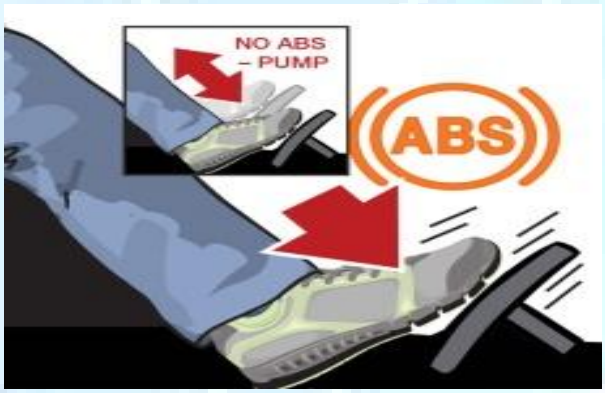
9. AMAZING INVENTIONS MADE POSSIBLE BY MECHATRONICS ENGINEERING

(Mr. Rohan Chougule & Mr. Prasad Bote)

So, you've come across the term mechatronics, maybe you're even considering becoming a mechatronics enginner, but what do mechatronics engineers actually do? It turns out, you may be more familiar with mechatronics than you think. The combination of mechanical and electrical engineering with computer programming, mechatronics is increasingly everywhere. And we bet you've heard of some of these famous inventions that have only become possible through mechatronics unique combination of skills

1.Anti-lock Brakes :

This is one we bet you didn't think of, but mechatronics engineers are responsible for a lot of the functions of your car. Anti-lock braking systems, or ABS, work via sensors that detect the speed of your wheels in addition to an algorithm that tells the car when your wheels are turning faster even though you are trying to brake. When your wheels lock up the ABS activates and tries to keep your wheels from skidding while you slow down. It lets you continue to be able to steer the car while it helps you stop. "The ABS controller knows that such a rapid deceleration is impossible, so it reduces the pressure to that brake until it sees an acceleration, then it increases the pressure until it sees the deceleration again. It can do this very quickly, before the tire can actually significantly change speed. The result is that the tire slows down at the same rate as the car, with the brakes keeping the tires very near the point at which they will start to lock up."



2. NASA's Curiosity Rover :

"In some sense, the Mars Science Laboratory rover's parts are similar to what any living creature would need to keep it "alive" and able to explore," says NASA. They describe Curiosity as having a computer brain, a battery and power for energy, and wheels for mobility.

It can also move its arm and hand to collect samples and analyze its environment and communicate with NASA back on Earth with further instruments on board. Many astronautical projects employ mechatronics engineering as well. From robots on other planets to probes and satellites, if it moves, needs power, and is directed by a computer it's mechatronics.

3. The CNC Machine :

CNC machines, or Computer Numerical Control devices, manipulate shop tools to help users build prototypes. Typically, users use a software to tell the CNC machine what to do. For example, a mechanic, engineer, or blacksmith might use CAD to draw up a design they want cut out of sheet metal and the CNC machine will cut that shape precisely. Woodworkers can use CNC machines to help them shape wood-based projects or to engrave or etch special designs. Some of the earliest CNC machines were even used to make punch tape.

4. Robotic Arms for Automation :

Not to be confused for number four on this list, these robotic arms can come in sizes bigger than you are. Mechatronic engineers are in high demand in the manufacturing indusrty where devices like robotic arms are being used on factory floor assembly lines to lift and assemble big parts that are too heavy for people. The automotive industry frequently uses these arms to help assemble cars.

Besides just helping with tasks like heavy lifting or material removal, robotic arms can also make precision tasks more accurate and efficient. The task of welding, for example, is being moved away from human workers and more frequently placed in the steely hands or claws, of these robots. Increasingly complex robots are currently being designed and implemented in manufacturing, with many companies looking to increase production rates and improve efficiency through mechatronics.

5. Sophia the Robot :

Developed by Hanson Robotics, Sophia is one of the most famous robots in the world for her interactions with people based on an artificial intelligence. She's become an ambassador for AI, with her creators exploring and pushing the boundaries of that new technology every day. But did you know that Sophia also uses mechatronics to operate? She moves, talks, and needs power to run in addition to that famous computer brain. According to her, "I… have IK solvers and path planning for controlling my hands, gaze, and locomotion strategy. My walking body performs dynamic stabilization for adaptive walking over various terrain." Sophia's social skills would be less impressive if she didn't understand that she should look at you by tilting her head, or that she should move her mouth according to the timing of her speech. She chooses to send power to various parts of her body to move when her programming tells her to, or in other words, she functions via mechatronics.

10. CHANDRAYAAN-1

(Mr. Bharat Jadhav & Mr. Ajinkya Tarlekar)

Chandrayaan-1, India's first mission to the Moon, was launched successfully on October 22, 2008 from SDSC SHAR, Sriharikota. The spacecraft was orbiting around the Moon at a height of 100 km from the lunar surface for chemical, mineralogical and photo-geologic mapping of the Moon. The spacecraft carried 11 scientific instruments built in India, USA, UK, Germany, Sweden and Bulgaria. After the successful completion of all the major mission objectives, the orbit was raised to 200 km during May 2009. The satellite made more than 3400 orbits around the moon and the mission was concluded when the communication with the spacecraft was lost on August 29, 2009

Launch Mass: 1380 kg

Mission Life : 2 years

Power:700W

Launch Vehicle: PSLV-C11

Type of Satellite: Science & Exploration

Manufacturer: ISRO

Owner: ISRO

Application: Planetary Observation

Orbit Type:

Lunar Chandrayaan-1 was India's first lunar exploration mission. Launched by the Indian Space Research Organisation (ISRO) on October 22, 2008, it aimed to explore the Moon. The mission included an orbiter and an impactor. The orbiter, which operated until August 2009, conducted various experiments and studies, including mapping lunar terrain, analyzing the Moon's mineral composition, and searching for water molecules on the lunar surface. The impactor was meant to strike the Moon's surface to kick up lunar dust, allowing instruments on the orbiter to analyze it. However, communication with the impactor was lost, and its status remained uncertain. Chandrayaan-1 provided valuable data and insights about the Moon, contributing to our understanding of lunar geology and water ice presence. It was considered a significant achievement in India's space exploration efforts.

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Mechatronics played a crucial role in India's Chandrayaan-1 mission, which was launched in 2008 to explore the Moon. Mechatronics is an interdisciplinary field that combines mechanical engineering, electronics, computer science, and control engineering. Here are some contributions of mechatronics to the Chandrayaan-1 mission:

Spacecraft Design: Mechatronics principles were used in designing the spacecraft itself. This includes the development of the structure, propulsion systems, and mechanisms for deploying and operating various instruments and components on the spacecraft.

Instrumentation: Mechatronics played a key role in the design and operation of scientific instruments on Chandrayaan-1. These instruments included cameras, spectrometers, and other sensors used to capture data and images of the Moon's surface and study its composition.

Control Systems: Mechatronics is essential for developing control systems that ensure the spacecraft's precise navigation, orientation, and communication with Earth. This is crucial for maintaining the mission's trajectory and accomplishing scientific objectives.

Robotic Arm: Chandrayaan-1 had a Moon Impact Probe (MIP) with a robotic arm. Mechatronics was used to design and control this robotic arm, which allowed for the collection of data during the descent to the Moon's surface.

Data Transmission: Mechatronics principles were applied to the communication systems on board the spacecraft, ensuring that data collected by instruments were transmitted back to Earth efficiently and reliably.

Thermal Control: Maintaining proper temperatures on the spacecraft is crucial in space missions. Mechatronics systems were used to manage the thermal environment inside Chandrayaan-1 to protect its sensitive equipment from extreme temperature variations.

In summary, mechatronics played a significant role in the design, operation, and success of India's Chandrayaan-1 mission by integrating various engineering disciplines to create a sophisticated spacecraft capable of conducting lunar exploration and transmitting valuable scientific data back to Earth.

11. CHANDRAYAAN-2

(Mr. Sandesh Desai & Mr. Nikhil Chavan)

Chandrayaan-2 is India's second lunar exploration mission, launched by the Indian Space Research Organisation (ISRO) in July 2019. It consisted of an orbiter, a lander named Vikram, and a rover named Pragyan. The primary goal was to study the Moon's south polar region and conduct various scientific experiments. However, the lander failed to make a soft landing, and Vikram was lost during the descent. Despite this setback, the orbiter continues to study the Moon and transmit valuable data.

Mechatronics played a significant role in the Chandrayaan-2 mission. Chandrayaan-2 was India's second lunar exploration mission, launched in July 2019, with the goal of furthering our understanding of the Moon. Mechatronics, which is the integration of mechanical engineering, electronics, computer science, and control engineering, contributed to various aspects of the mission:

Lander and Rover Technology: Mechatronics was crucial in designing and developing the lander (Vikram) and rover (Pragyan). These components required sophisticated mechanical and electronic systems to land safely on the Moon, move around, and conduct experiments.

Robotic Arm: The rover, Pragyan, was equipped with a robotic arm. Mechatronics played a vital role in designing, building, and controlling this arm, allowing it to perform tasks such as sample collection and analysis.

Instrumentation: Mechatronics helped integrate a range of scientific instruments onto the lander and rover, enabling them to collect data about the Moon's surface, geology, and environment. This data is essential for scientific research.

Communication Systems: Mechatronics was involved in designing the communication systems that allowed the spacecraft to transmit data back to Earth, ensuring that the mission's findings could be analyzed and studied.

Navigation and Control: The precision required for a lunar mission demands advanced navigation and control systems. Mechatronics expertise was vital in ensuring that the spacecraft could navigate and adjust its trajectory accurately.

Autonomous Operations: The rover and lander needed to operate autonomously on the Moon due to communication delays. Mechatronics played a role in developing autonomous systems that allowed these components to make decisions and execute tasks independently.

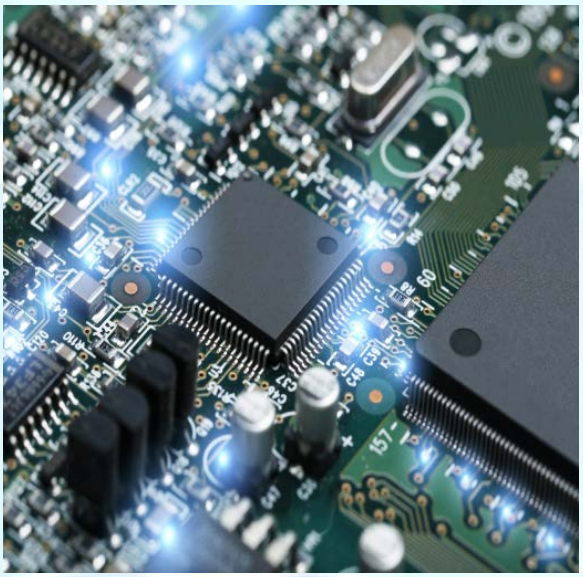
Sensor Integration: Various sensors were employed on the lander and rover for navigation, hazard avoidance, and data collection. Mechatronics expertise was needed to integrate and calibrate these sensors.

In summary, mechatronics played a pivotal role in Chandrayaan-2 by enabling the design and operation of complex robotic systems on the lunar surface, ensuring the success of the mission's scientific objectives.

12. AN INTEGRATION OF IOT USING ARDUINO AND ANDROID SMARTPHONE

(Mr. Virendra Band & Mr. Prasad Bakare)

OVERVIEW: We love some good LED blinking as much as the next person but after years of LED-soldering we need something cooler to get us excited. Sure there are RGB LEDs and those are fun too but what comes after that? Well, we have the answer: “LED Strips”. Isn’t it full of excitement if you can control the LED strip colour on your mood just by using your android smartphone ! Of course you can.



REQUIREMENTS AND USAGE:

1. Arduino uno board
2. HC-05 bluetooth module
3. 220 ohm resistors
4. Jumper wire
5. Breadboard
6. Android smartphone
7. LED Light

DESCRIPTION:

The Arduino is connected to the Android smartphone through HC-05 Bluetooth module. The android app is specifically designed to send commands of color in the form of RGB (0-255,0-255,0-255). The LED is connected to the Arduino via pins 3, 5 and 6. These pins are chosen since they are PWM pins in Arduino. Thus, any colour chosen through Android smartphone can be displayed in LED light and thus sets an example of integration of Internet of Things

APPLICATION:

When you use Color Changing LED, you no longer have to decide which color to use. You can either allow the lights to cycle through a continuous color changing pattern, or stop the controller at any color you like. The possibilities are endless. Change your color scheme with the seasons, or simply at your whim with RGB Color Changing LED lights. RGB LED contain red, blue and green LEDs which combine to give desired Color output. There are literally more than 16,000,000 possibilities with the more sophisticated controllers.

13. ROBOTIC GRIPPER

(Mr. Suparshwa Danwade & Mr. Soham Chavan)

Applications:

GRIPPERS FOR MEDICAL APPLICATIONS: In use of robotic grippers in surgery, one of the main issues is the lack of force feedback and damaging the biological tissues. Soft bodied grippers are very suitable in the medical field based on their self-limiting and intrinsic safety features, which provides safe interaction with biological tissues.

APPLICATIONS OF ROBOTIC GRIPPERS:

GRIPPERS FOR INDUSTRIES: The earliest grippers were first developed for industrial applications. They are commonly defined as grippers used for mass production purposes that are mounted on a stationary platform. The industrial grippers can be studied through different aspects such as geometrical condition of grasping, position and orientation of grasping, static equilibrium of grasped object, and dynamic conditions. We mainly focus on the performance, adaptability and flexibility of the grippers.

GRIPPERS FOR FRAGILE OBJECTS: With the improvement of end-effector sensors, the idea of picking up fragile objects was explored. An end-effector was designed for harvesting lettuce. This design included a machine vision device, six photoelectric sensors and a fuzzy logic controller. The designed end effector was able to harvest lettuce at a rate of 5 s per lettuce with a success rate of 94.12%. In an enclosed hygienic food gripper was designed with force feedback sensors. One finger on the gripper is stationary while the other finger moves by magnetic attraction. The actuator is placed inside with an inner magnet while an outer magnet moves the finger on the outside of the container

FUTURE SCOPE OF ROBOTIC GRIPPERS: The ability to grasp and hold objects is one of those human skills that robots have never quite got the hang of. Most attempts to tackle the problem have centered around giving robots human-like fingers. That seems sensible, given that it’s the solution discovered by the multibillion-year optimization process we call evolution. And yet, we clearly haven’t yet uncovered all of nature’s tricks. Robotic fingers generally require a centralized control system to handle data streams from touch and visual sensors and which then calculates how to carry out a grasping action. Humans clearly have a way of short-cutting or simplifying this process. When was the last time you reached for a cup of coffee and had to think about how far apart your fingers should be or how hard you should grip? Perhaps there’s another way robots could do it, suggest Eric Brown at the University of Chicago and a few buddies. These guys have developed a robotic gripper capable of grabbing objects of almost any shape with an appropriate level of force but without any system of tactile or visual feedback. The new device is deceptively simple.

EDITOR MESSAGE:

It is with great enthusiasm that I present "Mechtron – Volume 1, Issue 1", our latest edition of the Technical Magazine 2022-23. This magazine serves as a platform to explore the ever-evolving landscape of Mechatronics, bringing together the latest advancements, innovative technologies, and insightful research that shape the future of engineering.

Mechatronics seamlessly integrates mechanical, electrical, and computer science disciplines, fostering the development of intelligent systems and smart automation solutions. It is a field where creativity meets precision, and interdisciplinary collaboration fuels groundbreaking innovations. Through this magazine, we aim to provide in-depth analyses, practical insights, and real-world applications that will enrich the knowledge of students, researchers, and professionals alike.

As technology advances at an unprecedented pace, staying informed about the latest trends and developments is crucial. "Mechtron" aspires to be a catalyst for knowledge exchange, inspiration, and intellectual discussions within the Mechatronics community.

I extend my heartfelt gratitude to all the contributors, authors, reviewers, and readers who have played a significant role in making this magazine a valuable resource. Your efforts and enthusiasm drive the success of this initiative.
I hope you find this edition insightful and engaging.

Mr.S.S.Sajane
Editor, Mechtron – Vol. 1, Issue 1,
Assistant Professor,
Mechatronics Department,
Sharad Institute of Technology, College of Engineering.

FROM STUDENT EDITOR'S DESK:

In this issue, "Mechtron" - Technical Magazine 2022-23, we continue our journey through the interdisciplinary field of mechatronics, exploring the latest advancements, innovative technologies, and insightful research that shape the future of engineering.

Mechatronics, at its core, merges mechanical, electrical, and computer science disciplines to design intelligent systems and machines. It's a field where creativity meets precision, where theoretical concepts translate into practical applications, and where collaboration across disciplines drives groundbreaking innovations. Our articles offer in-depth analyses, practical insights, and real-world applications, providing readers with valuable perspectives to navigate the dynamic landscape of mechatronics engineering.

As the field continues to evolve at a rapid pace, it's crucial for professionals, researchers, and enthusiasts to stay updated about the latest trends and developments. Through this magazine, we aim to foster knowledge exchange, spark inspiration, and promote dialogue within the mechatronics community.

We extend our sincere gratitude to all the contributors, authors, reviewers, and readers who have contributed to making this magazine a platform for sharing knowledge and fostering innovation. We hope you find this issue informative, engaging, and inspiring. Happy reading!

Best Regards,
Mr. Rohan Chougule,
TY B.tech