Agnel Charities'
Fr. C. Rodrigues Institute of Technology, Vashi
Department of Mechanical Engineering and

MECHANICAL ENGINEERING STUDENTS' ASSOCIATION

AUTOMATION ROBOTICS

Presents

URJA

2020-2021

ROBOMATION

Agnel Charities'
Fr. C. Rodrigues Institute of Technology, Vashi

Department of Mechanical Engineering

Mechanical Engineering Students' Association

Presents

URJA

(2020-2021)

Robomation

(Robotics & Automation)

INSTITUTE PROFILE

F.C.R.I.T. was established in 1994 and is a part of the Agnel Technical Education Complex at Vashi, which itself was established in 1984. The institute is named after late Rev. Fr. Conceicao Rodrigues. F.C.R.I.T. persistently seeks and adopts innovative methods to improve the quality of education on a consistent basis. The campus has a cosmopolitan atmosphere with students from all corners of the country. Experienced and learned teachers are strongly encouraged to nurture the students. The global standards set at F.C.R.I.T. in the field of teaching spurs the students in relentless pursuit of excellence. In fact, it has become a way of life for all at the institute. The highly motivated youngsters on the campus are a constant source of pride.

F.C.R.I.T. has, within a short span of time, established itself as a leading engineering college in Mumbai University. Though its reputation rests mainly on the high quality, value-based technical education that it imparts, it has to its credit a verdant, well-maintained Campus and extensive facilities. Its location in the vicinity of the holy places of various religious denominations underscores its secular credentials and its philosophy of **"Vasudhaiva Kuttumbakam"**.

Institute Vision

To evolve and flourish as a progressive centre for modern technical education, stirring creativity in every student leading to self-sustainable professionals, through holistic development; nurtured by strength and legitimate pride of Indian values and ethics.

Institute Mission

I. To provide industry-oriented quality education.

II. To provide a holistic environment for overall personal development.

III. To foster relationships with other institutes of repute, alumni and industry.

Vision of Department

To provide a vibrant academic, research and industrial environment for creating self-sustainable professionals and responsible citizens.

Mission of Department

- To provide state-of-the-art infrastructure and quality education.
- To generate opportunities for students to provide Industrial Exposure.
- To imbibe team spirit and entrepreneurial skills.

Program Educational Objectives (PEO)

Graduates will...

- Be able to use effectively engineering knowledge and modern tools in the field of core Mechanical Engineering.
- Have interdisciplinary competence in areas like Mechatronics and CAD/CAM/CAE.
- Be able to demonstrate adequate competency and creativity to take up corporate challenges.
- Be able to pursue higher studies and entrepreneurship.

Program Specific Outcomes (PSO)

Graduates will be able to...

- Apply knowledge in the domain of Design, Thermal and Manufacturing sciences to solve Engineering Problems.
- Use appropriate tools and techniques to solve problems in the field of Mechanical Vibration and CAD/CAM/CAE.

PRINCIPAL'S MESSAGE

I intently believe that you should have an all-round development of your personality, having ambitions and aims untrammelled and hard work, enthusiasm, resilience laced with knowledge and intellect which will take you to any extent you desire. Make it a habit to read newspapers daily and ensure the optimum use of the library. In today's world, a professional approach towards things is necessary. Understanding the basics, relating them to real-world situations, and then building them into bigger things will help you to become a better engineer. Time management is another asset in the fervent strive for success. Endeavour to be a better human being while foraying in the competitive life, realizing your dreams, honesty and integrity should be your second name. College life provides the opportunity to develop one's personality to the fullest extent. The college magazine not only harnesses the skill of writing in the students but also inculcates the pleasure of reading among them.

- **Dr. S.M. Khot**

HOD'S MESSAGE

Mechanical Engineering is one of the broadest engineering disciplines, offering students a wide range of career options and always remains at the center of all technological advancements. Due to the technological advancement in the engineering field in general, the role of a mechanical engineer is changing rapidly. To meet the ever-changing requirements of the industry and sustain in today's scenario, Mechanical Engineers must have knowledge and skills in multiple domains and multidisciplinary areas to cater to the needs of allied industries. There is a need for Mechanical Engineering students to cultivate ideas that allow them to be absorbed in these emerging fields. At present, we all are going through a pandemic situation and the next two years will be very challenging. Each individual can identify the right field for their career and try to develop required skills sets expected by the industry.

I am glad that the Mechanical Engineering Students Association (MESA) is doing excellent work. Every year MESA organizes events such as Synergy, MESH, Industrial Visit, Poster Presentation, URJA (annual magazine) and CALIBRE (National Level Project Competition). These events help students to get acquainted with the latest trends in industries and research. I would like to congratulate the magazine committee for selecting the right theme for URJA Magazine and publishing it.

- Dr. Nilaj N. Deshmukh

COORDINATORS' MESSAGE

MESA is a collegiate organization that stands for Mechanical Engineering Students Association. The objective of MESA is to create opportunities for students to enhance their knowledge about the latest developments in the technological world, by organizing various events. The MESA council of F.C.R.I.T., Vashi has ensured a continuous flow of ideas and knowledge by conducting seminars every year. These seminars give the students a sneak peek into the outside world. SYNERGY and MESH are the two events conducted every year under the aegis of MESA. In SYNERGY, one industry is identified during the year and is invited to the campus for interaction. The aim is to bridge the gap between industry and institute and provide an opportunity for staff and students to directly interact with them. During MESH, a seminar lecture series is organized in which expert speakers from industry and academia such as BARC, IIT, etc. are invited to deliver a lecture in their area of expertise. A project poster presentation is also organized wherein the final year students display their projects and present posters of their respective projects. Students of lower semesters get an opportunity to have a glimpse of the type of project being carried by final year students. In spite of the pandemic, MESA successfully also organized CALIBRE 2k21 a National Level Project Competition and a National Level Poster Presentation Competition. Apart from these activities, MESA also publishes an annual magazine on various technological topics. The published articles are related to research and inventions that many are unaware of and might be interested in.

MESA continuously works for the overall development of the personality of the student other than their academic responsibilities. MESA provides wings to the mind and sky is the limit for the minds which are planning to fly high. It is rightly said, "*Intelligence without ambition is a bird without wings" and "Until you spread your wings, you'll have no idea how far you can fly"*.

- MESA Coordinators

TABLE OF CONTENTS

ABOUT MESA

MECHANICAL ENGINEERING STUDENTS' ASSOCIATION popularly called MESA is a collegiate organization that relates the activities under the Mechanical Engineering Department. MESA is among the most active student bodies in the institute. Mentored by experienced and proficient faculty members of the Mechanical Engineering department, students take upon many initiatives that prepare them to face the challenges of the future. MESA aims to create opportunities for the students to enhance their knowledge about the latest developments in the ever-evolving technological world by organizing various events. SYNERGY is one of the many esteemed events conducted every year as a part of activities under MESA. SYNERGY is conducted in the odd semester every year; these events provide a broader vision to the students regarding various technologies and developments happening in the professional field outside the college classrooms.

"World Engineering Day" was organized on 4th March 2021, under the aegis of MESA. The Institution of Engineers (India), Belapur had taken the initiative to inculcate creative thinking and an innovative mindset amongst the students. It was an enlightening experience.

MESA has organized a technical fest called CALIBRE in March 2018 and 2019 and in April 2021. CALIBRE 2K21 was organized in association with "The Institution of Engineers (India), Belapur Local Centre" with huge success

Functions of MESA:

- Promoting the interests of students in various technical areas pertaining to mechanical engineering.
- To promote interaction between academia and industry by organizing industrial visits, special lectures and intellectual talks.
- Interacting with other technical societies, within and outside the institute to promote flow of knowledge and interest.

To allow students to learn and focus on cutting-edge technology by presenting it to the students in an interesting manner through seminars and workshops.

MESA COUNCIL 2020 -21

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(Secretary)

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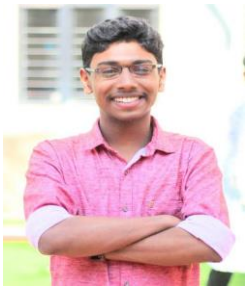

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Automated mobile logistic swarm

J. Om Prasaad (ME V - A), Pranav Ghanvat (ME V - A), Pratham Kumbhar (ME V - A)

I.INTRODUCTION

Swarm robot systems are widely applied in warehouse logistics, which effectively improve the logistics efficiency. Task allocation strategy is the core problem for swarm robot systems. Therefore, testifying the approach has a practical significance. The current study confirms the strategy using general robotics tools is AMLS. However, for warehousing logistics, a few special factors need to be considered: man robot coexistence in working environment, energy consumption of robots and collision avoidance among robots. The article is based on a novel swarm robot transportation platform, called Automated Mobile Logistics Swarm Bots (AMLS), based on a multi-agent Single-Line Pathfinder (MASPF) method and the Master-Slave Algorithm, which can accurately verify the effectiveness of task allocation. Besides, the charging process is designed to supplement the energy consumption of robots. The experimental results show

Figure 1: Swarm Bots [1]

that the AMLS satisfies the requirements of the warehouse logistics scenarios. The AMLS can be applied in testifying the efficiency of task allocation strategy for logistics systems. that the AMLS satisfies the requirements of the warehouse logistics scenarios. The AMLS can be applied in testifying the efficiency of task allocation strategy for logistics systems. AMLS is comprised of autonomous mobile robots called Master and Slave Bots. The article discusses the self-assembling capabilities of the AMLS. This concept lies at the intersection between collective and IoT-Enabled configurable robotics. For interaction of multiple robots, as shown in

Figure 1, communication between the robots is vital to carry out a specific task where one robot (master) delivers orders to other robots (slaves). With advancements in wireless communication technology, it is possible to interface one bot to another bot. In the swarm-bot formation, bots are attached to each other, and the robotic system is integrated under one umbrella, that can move and reconfigure as required. For instance, the swarm-bot might change its shape to traverse a narrow passage or climb an obstacle. Due to many mobile robots involved in the accomplishment of a single task, the communication module becomes complex and a challenging task. Proper sharing of information and instruction between each robot in the system is necessary for the successful accomplishment of the task. Hence selection of a proper communication technology for swarm robots in accordance with the application, cost, and environment is very important. Generally, short-range-wireless-communication techniques are best suited and match the characteristics of swarm robotics. In AMLS, collectively inter-bot communication is through relays via a sophisticated wireless hardware and software module.

II.INTERNET OF THINGS (IoT)

The Internet of Things (IoT) system operates autonomous micro-machines that need to communicate with each other and with the cloud when necessary. This evolution that brings together cloud computing with swarm robotics is called swarm computing, and currently it is in its infancy. Swarm computing brings together cloud principles with network principles, to give rise to a higher functionality and flexibility of swarms or IoT ecosystems. It focuses on increasing data sharing and mobility, while also allowing temporary control of devices connected to the cloud. The most visible advantage of investing in cloud robotics is the ability to delegate more difficult tasks to higher-intelligence agents in the cloud. Cloud cooperation should enable swarm robots to, for instance, connect to more intelligent bots in the cloud when faced with a difficult challenge. There should be a real-time data processing, support, and response, whether by humans or robots, to inform the autonomous robots' actions/responses. The swarm robots in the current project are controlled by a centralized system where all the bots connect to a common IOT cloud, through which they communicate and store all the accumulated data. The BoT-IoT dataset was created by designing a realistic network environment. The network environment incorporated a combination of normal and botnet traffic.

In AMLS, IoT plays a major role in providing a system of Cloud-Computing database and connects the bots with assembly lines of major factories with hands on applications to Monitor, Access and provide Feedback for the tasks carried out by AMLS. IoT is paired with the sensory components to give faster and better results, which improves the overall production rates.

III.ROBOTICS

In warehouse systems, robots are assigned a specific task by the server. These tasks include receiving the list of tasks to be performed in a specific time frame, identifying the location

of the goods to be transferred, picking up the goods, transporting the goods to the desired location, unloading these, and returning to the assigned position. For completing the mentioned tasks, robots need to be designed in an industry-specific way. Warehouses have a different functional system, and the size of the goods varies according to the type of material involved. To tackle such issues, swarm robots must be built in accordance with the work in the warehouse. Each warehouse may have different designs of swarm robots based on their functions. The algorithm determining the movement and functionality of the robots may remain the same or vary slightly, but the objective of Swarm robots remains as mentioned irrespective of the nature of the products going to be transported using the system.

An advantage of soft materials is that they are often economical, readily available, and easy to handle; the most common example being the large range of elastomers used in much of the current research by using 4D printing technology.

The Master bot can be designed using various concepts. Two widely used concepts are- Stationary Master Bot and Mobile Master Bot.

Figure 2: Swarm Bots in action [2]

The Stationary Master bot controls all the Slave Bots by staying at one designed place. In designing the stationary bot, various parameters must be considered. As the Bot controls and monitor numerous slave bots, as shown in *Fig.2*, the most important aspect is the designated location of the Master. Positioning of the master bot must be within the central range of the slave robots. Once the range of the slave robots is determined with respect to the size of the warehouse, the positioning of the master bot is determined. If the warehouse dimensions do not satisfy the range of the bots, various methods like use of powerful sensors, modifications in the algorithm, and change in the placement of the storage units must be utilized.

Mobile Master Robots are the widely used type of systems. In this type of bots, complex algorithms involving monitoring of bots, quality checks, obstacle avoidance and tasks related to smooth functioning of slave bots are involved. Warehouses which hoard variety of goods and has high traffic of objects usually focus on mobile master bots for its versatile working abilities. Such bots require high maintenance as it performs complex tasks and can encounter various issues while managing several bots.

A. Designing of Algorithm

• Wandering and Object detection.

• Aligning the slave bots, in accordance with the master's order, while relaying the tasks.

• Gathering at the object location.

• Synchronized motion towards the destination.

• Dropping the object.

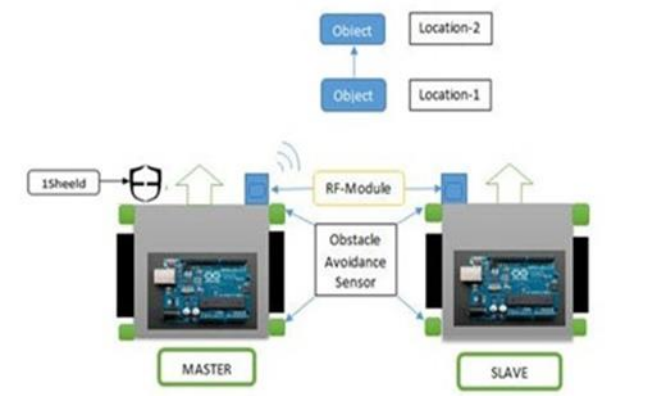

Figure 3: Block Diagram of the System [3]

The simulation is done by assessing the environment of the workshop. The simulator is used to create 2 robots, running on a similar algorithm. Since it is not possible to create a movable stage, the AMLS Master Bot is designed to be mobile and is monitored and detected. The robots run an algorithm to undergo a random motion as per the coding. The AMLS moves forward in a synchronized line- following trajectory by mimicking the master bot, as shown in *Fig.3*, which is sensory to the constant task data flow. After reaching the fed destination the object carried, is off-loaded and the master bot relays back the following instructions. The package is dropped, and the IoT enabled application receives the notification from the master bot, specifying to either repeat the task again or give new instructions. This shows the scalability and the successful two-way communication between AMLS and the control panel.

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Automation frenzy

Ritwik Saraf (Mechanical V- B)

IV. INTRODUCTION

Information once invaluable has become mere paltry with the influx of a global information pathway- the internet. Since its first debut in sci-fi literature, IoT has gained an exponentially realistic pathway to becoming the future of the human kind. The amalgamation of the availability of internet, the development of internet enabled electronics, and most importantly the ever-accumulating demand for tranquility in human life has led to the development of the next generation of human evolution- Industry 4.0.

V. INTERNET OF THINGS (IOT)

In its nascent stage as perceived currently the Internet of Things is a mere tool in the hands of its developers trying to make things that are relatively easy to manually operate work over more complex protocols. Like all evolution though, this added effort in adaptation may seem unnecessary is fundamental to the future of human life. The sci-fi version of this IoT implementation may seem unrealistic but remains only a fragment of imagination compared to the actual impact Industry 4.0 could cause in this world of manipulated silica. Home-Automation, industrial machinery automation, automated locomotion, automation in logistics, inventory, education, experimentation, etc. seem like a dream hundreds of years away only plausible in movies and script right out of the human imagination. Like the New York Times predicted- "Man won't fly for a million years" [1] in 1903 only to be proven wrong in less than 2 months of their prediction; the concept of IoT is right around the corner and the benefits it wields are severely underplayed and underestimated. Like every other technology, Industry 4.0 is limited not by imagination, but by the available technology around it.

VI. STATISTICS

To put things into perspective, for the real growth in the belief of the internet of things and automation, there were 7 billion IoT devices in 2018. In 2019—the number of active IoT devices reached 26.66 billion. Every second—127 new IoT devices are connected to the web.[2] By the projected growth in number of IoT devices connected over the internet protocol There Will be 41 billion IoT Devices by 2027[2] The difference between a few million IoT devices and a few billion, then, is quite staggering. Other estimates that push IoT projections farther into the future provide even more striking numbers, forecasting as many as 125 billion IoT devices by 2030. Last but not the least, the automotive industry, largely changing its face since the end of the last decade- By 2023, 70% of Automobiles Will Be Connected to the Internet [2]

VII. AUTOMATION

Industry 4.0 is a warehouse of planned as well as incidental automation carried out over the internet protocol to make production easier as well as more efficient taking into consideration the predictable nature of computers functioning within their bounds of 1s and 0s. This predictability allows us to function withing the set rules of mathematics bringing harmony to a mess of seemingly randomized variables. Statistics prove that production and productivity increased by manifolds in magnitude with the pungent rise of the British oppressive colonial industrialization. The essence of this crafted aggrandization coupled with the notion of free will in society will boost every possible scenario to its maximum competency along with its acknowledged ratification. Automation, along with the production industry will affect multiple sectors such as medicine, logistics, agriculture, fishing, power generation, power storage, health-care, governance, etc. making changes in the very concept of the working class in the modern society. The impact of IoT can be all but imagined, as it progresses rapidly thorough the bounds of traditional technology.

VIII. CONCLUSION

The clairvoyance of augmented reality, 3D printing, Virtual reality and the Internet of Things in conformity to blockchain, bigdata and the entire concept of industry 4.0 are the major boosters in the progress of automation. Adaptation of real-life sci-fi scenarios may not be as far away in the future as one may have imagined and credits to the real-life Tony Starks and Bruce Banners of our time have protracted legacies to them, yet to unveil their full potential and thus on the brink of leaving a mark forever. Like windows, Macintosh, the lightbulb, Aero planes, etc., the internet of things will be another feat engineer achieve making their mark on the free world as we know it

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Affordable automated carts for efficient transportation

Adithya Basker (Mech V-A)

I. INTRODUCTION

In this era, where upgrades and advancements in technology every day is considered as normal as brushing, automation, and robotics have proved to be a dominant field. Any field considered, there will be some or the other part which makes use of automation technologies. Out of which are the Automated Guided Vehicles, popularly knowns as AGVs, working as transporters in industries and warehouses as shown in Figure 1. The AGVs make use of magnetic coin shaped chips which are embedded into the ground and are tracked by the magnetic reader fitted under the AGV. These transporters make use of complex codes and due to their complexities, thus turning out to be quite costly and hence unaffordable for medium and small-scale industries and unfit for household & general usage. Keeping this problem in mind, this article mainly focuses automated carts made using development boards like Arduino boards which can work as efficiently as the existing AGVs and would be affordable for all the classes of people and business.

Fig.1 Automated Guided Vehicle (AGV) [1]

II. AUTOMATED LINE FOLLOWING CART

As the name suggests, Automated Line Following Carts are carts which follow a line (maybe a black or white strip) laid on the floor which guide the cart to different sections within a floor. One such cart used in industries is shown in Figure 2. The floor can be a shop floor, an office floor, a college floor etc. It is an efficient means of transport within a particular part/floor of a multi-section plant/office. Though line following mechanism seems to be quite simple, the RFID scanner and chips brings in the automation part of this cart. The track/line which the robot follows by means of infrared sensors consists of small coin shaped RFID chips laid over the track. Each chip has a Unique Identification Number (UID) which would be assigned to a particular area on the floor and also to a particular key on the matrix keypad. The chips would be read by the RFID reader present at the bottom of the cart. Once a particular chip is read, it is compared with the entered UID i.e., the one associated with the key pressed by the sender and if it matches, the robot comes to a halt thus indicating it has reached the desired destination. All the processing can be done in the Arduino board thus reducing the making cost to a great extent. Other modifications may include Obstacle Avoidance mechanism using ultrasonic sensors which would avoid any kind of accidents when the cart is being run in dynamic environments like college/office floor. Also, the use of encoders will allow the robot to take appropriate routes and turns which would help in saving energy and reduce battery consumption. In this way, the automated line follower can be used as an intra-floor transporter without the requirement of human intervention.

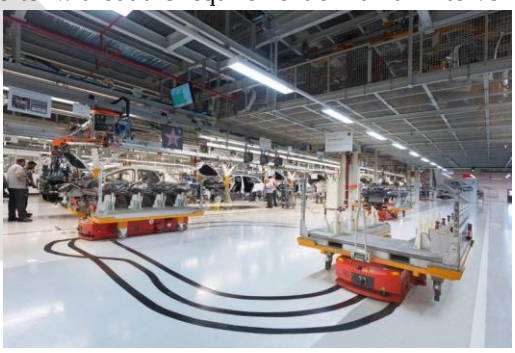

Fig.2 Line follower carts in Industries [2]

III. AUTOMATED HUMAN FOLLOWING CARTS

Moving a step further into the advancement in automation technologies and sensors, one can now have a cart which would follow the user/master by means of his/her mobile's GPS location. And that's what the Automated Human Following cart shown in Figure 3 does. It simply follows its master by sensing the GPS co-ordinates of the user's smartphone by means of GPS reading module. Again, this cart can be made simply by using development boards like Arduino. The major advantage of this kind of cart is that, its motion is not restricted to a particular line/track. It is free to move and follow wherever the user goes. Also, these kinds of carts can be effectively used in areas like restaurants, hotels, old age homes, garages, industries, offices etc. the working can also be further enhanced by using obstacle avoidance, increasing the weight capacity and also making it possible to

run the cart over rough terrains. This cart would act as a load carrying companion for the user which can carry the loads/goods of the user and keep following as per the received co-ordinates. Piaggio has already come up with such kind of carts but with quite a lot of complexity, be it in terms of the mechanism, coding or the price thus making it unaffordable to certain classes of people.

But such simple, yet sleek carriers would enable people from all levels to use them to the fullest since the coding and the mechanism part is quite simple, hence making the error identification pretty much easy. In this way, people would be able to carry their goods wherever they go in a more effective, efficient and contactless manner.

Fig.3 Piaggio Cargo bot (GITA) [3]

IV. CONCLUSION

In this way, we can introduce automated carts which can come into use not only in big warehouses but also in areas like garages, household, old age homes etc. thus making load carrying easier. Also, such automated carts available at lower prices of around 5k to 7k INR would prove to be helpful to many people, especially the ones who might be differently abled or maybe suffering from back problems. Also, it would make the transportation process free of human intervention thus avoiding or maybe minimizing the errors caused. In all these ways, automated carts can be made available for everyone for use and fulfil the daily carrying needs in a more efficient and effective manner.

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Future humans: the humanoids

Yash Vaidya (Mech V-B)

I. INTRODUCTION

Looking at the research and developments in the field of artificial intelligence, it is safe to assume that we are not far away from experiencing a complete autonomous world. Robots have become our co-workers, with accuracy and capacity beyond that of humans. From bringing coffee to your desk to manufacturing a complete car, nearly any given task is possible with the help of robots when given the right set of commands. It was 1495, when Leonardo da Vinci, the first one to dream of combining artificial intelligence and hardware and bring into the world what we call, a Humanoid. The codes were written, scrap was brought to life, and the era of humanoids began.

II. ARTIFICIAL INTELLIGENCE (AI)

Humanoids, as the name suggests are human form of robots. Hence, they are expected to work in the same way as that of humans. This is possible by imparting them with artificial intelligence. Artificial intelligence can be considered as the backbone of a humanoid robot. The commands given by humans in the form of codes, must be analyzed and appropriate decisions must be made without causing any harm to the humans and environment. These decisions should be most logical and optimum to perform the given task as humanly as possible. This is where the AI plays an important role. Not only making them (humanoids) understand us, but also letting them express themselves, AI is proven to be a vital contribution to the robotics and automation industry.

III. HUMANOID

A humanoid robot is a product made by combining hardware and software, which is developed by humans. To invent such a machine is itself a difficult task. Here, we are not only talking about the applicability, but also the emotional intelligence incorporated in a machine. Humanoid robots are expected to work hand in hand with human beings in the everyday world. These robots are supposed to make the tasks easier. A Social Humanoid robot Sophia can be seen in Fig 3.1. which is specifically designed to satisfy human's social needs.

Fig 3.1: Sophia Robot

AI takeover is a hypothetical scenario where robots will dominate over humans.[1] Looking at the fast developments and the advancements in the automation field, we can already see the robots in almost every industry. They are of fixed type performing a well-defined task, and of mobile type which can perform varieties of tasks.[2] Humanoids are used in the field of healthcare, education, and entertainment.[3] In the future, humanoids can be used to perform safety tests and research that are dangerous to human being. Are these tests capable of making robots more human? The possibility is that we will refine the existing 'very advanced' artificial intelligence. The robots are gaining enough knowledge to work on their own without having to give commands. There is evidence to prove this intelligence, one of which is the Facebook Programs developed and started chatting in their own language back in 2017.[4] If we ever consider the possibility of robots acting on their own, the suggested hypothesis is not far away to be true.

As interesting the automated robots sound, a time may come when we will go jobless as every job will be being performed by the robots. In 2017, Sophia, a humanoid was given Saudi Arabian citizenship.[5] This shows that robots have become so intelligent that they can be considered as citizens. The autonomous freedom and capability of expressing feelings, the humanoids are soon to be a part of our life.

IV. CONCLUSION

The advancements in Artificial Intelligence and Humanoids have proven that the robots are slowly getting consciousness. They are starting to think like humans. They are starting to generate their own thoughts and commence their own actions. They not only can communicate with humans autonomously, but they are also capable of communicating with other robots on their own in ways that we can see and perhaps, in the ways we can't see yet. Will the time come where the robots are counted in the population count? Will we ever see a day when we will have to wake up

and report to our ‘robot’ boss? Will they take over the world? We are soon to find out.

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The Future of Robotics: Soft Robots

Aditi Shinde (Mech V – B)

I. INTRODUCTION

Robotic systems have been designed to emphasize speed and precision which translates it into a very specific architecture. But when the environments are not perfectly known and measured, there's a higher chance of a robot damaging its surroundings or itself. Because what makes a robot precise and strong also makes them ridiculously dangerous and ineffective in the real world, since their body cannot deform or better adjust to the interaction with the real world. In contrast, soft robotics systems are inherently safe, adaptive and tolerant while operated in an unknown environment, especially for human-machine interaction. It focuses on using soft, compliant materials to construct robotic devices, that can undergo very large deformation without causing any damage to its surrounding [1]. Soft robotics differs from the traditional robot design approach of using rigid materials for both robot links and joints. It uses a compliant body with distributed actuation. The compliant body is made up of soft materials i.e., large range of elastomers and smart materials. The distributed actuation continuously controls the shape of this very deformable body.[3]

II. SOFT ROBOTICS: ARCHITECTURE

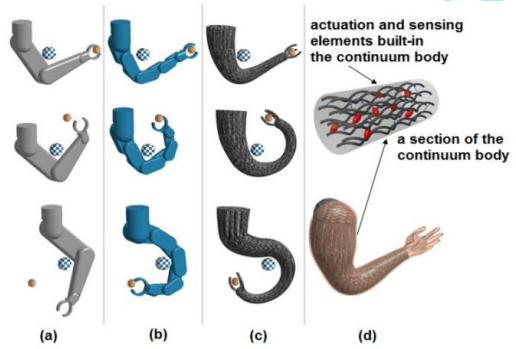

Figure 1: Comparison of (a) a conventional rigid robotic manipulator, (b) a corresponding hyper-redundant robotic manipulator, (c) a corresponding soft robotic manipulator, and (d) a soft robotic arm with a continuum topology seamlessly housing the actuation and sensing elements in the same continuum body [7]

Soft robots are primarily composed of easily deformable matter such as fluids, gels, and elastomers that can match certain materials, in a process called compliance matching. Compliance matching is a principle that states, materials that come into contact with each other should share similar mechanical rigidity in order to evenly distribute internal load and minimize interfacial stress concentrations. However, this principle does not apply to rigid robots ($E=10^9$Pa) interacting with soft materials ($E=10^2$-10^6Pa), which can cause damage or mechanical immobilization (where E is the Young's Modulus, which gives a measure of the stiffness of a solid material). But, in case of soft robots, these stresses are widely spread out which reduces the likelihood of damage. [7]

III. MANUFACTURING OF SOFT ROBOTS

Soft robotic systems built from materials known as soft materials with mechanical properties similar to those of living tissues, designed and manufactured in a very innovative way rather than artificially assembled by serial or parallel arrangements of elementary blocks, as it was in the case of rigid-body robots.

Figure 2: 4D Printed Structure

An advantage of soft materials is that they are often economical, readily available, and easy to handle; the most common example being the large range of elastomers used in much of the current research by using 4D printing technology.

IV. TYPES OF SOFT ROBOTS

Several types of soft robots have been developed to perform tasks like gripping, manipulation, locomotion, and exploration. Their capabilities are significantly enhanced by enabling both proprioception and tactile sensing, including strain, pressure, bending, twisting, etc. As

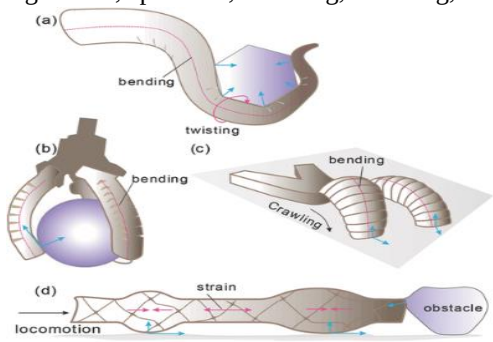

Figure 3: Illustration of various types Soft

illustrated in Figure 3, using a worm robot as an example, compressive and tensile strain distribution can be used for closed-loop control of locomotion, contact pressure and shear force with the ground can help the robot to adjust its shape over rough terrain while tactile sensing at its head provides useful feedback to detect and avoid obstacles. [8]

V.MEDICAL SURGERY

Soft robots are very well suited to medical applications, where eliminating patient trauma and pain are highly

important. As illustrated in Figure 4, the challenges faced in invasive surgery make compliance, variable stiffness, and safety some of the most important design criteria, and the field of soft robotics is well placed to meet these demands. The soft materials achieve high patient acceptability in comparison with robotic devices made from metallic or other rigid materials. [2]

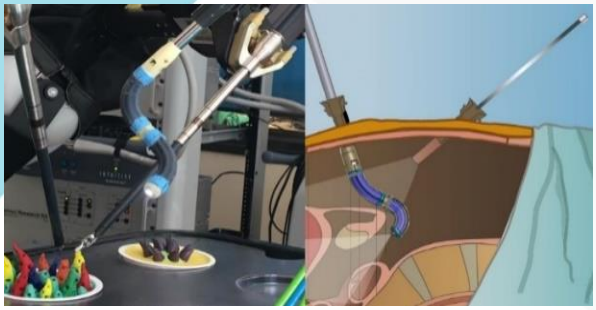

Figure 4: Soft Robot performing invasive surgery

For invasive surgery, soft robots can be made to assist surgeries due to their shape changing properties. Shape change is important as a soft robot could navigate around different structures in the human body by adjusting its form. This could be accomplished through the use of fluidic actuation.

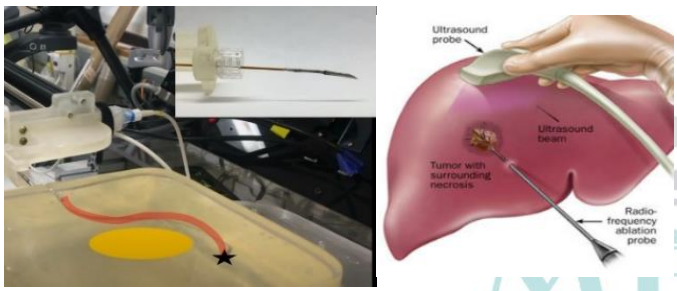

Figure 5: Highly Articulated Robotic Needle performing Liver RFA (RFA is use to destroy inoperable primary or metastatic tumors in the liver)

As illustrated in Figure 5, By using soft robot in the form of Robotic needle, percutaneous Radio Frequency Ablation (RFA) can be performed without requiring multiple punctures in the liver to carry out ablations, thus making the treatment of large or multifocal tumors better while also reducing time taken for postoperative care.[6]

X. INDUSTRIAL APPLICATION

Soft robots are flexible and hence can change their form making them the most suitable as universal grippers. Here, tactile sensing is used for controlling soft robots on production line, which makes them extremely adaptable with the body they interact with. Highly desirable in industries which make delicate shape and fragile products which can be easily deformed by conventional grippers as shown in Figure 6.

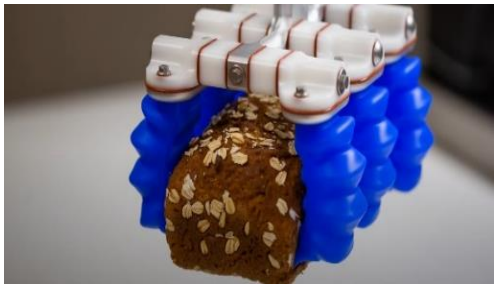

Figure 6: Soft Robotic Gripper

Additionally, soft robots will also make the assembly line safer. Traditionally, manufacturing robots have been isolated from human workers due to safety concerns, as a rigid robot colliding with a human could easily lead to injury due to the fast-paced motion of the robot. However, soft robots could work alongside humans safely, as in a collision, the compliant nature of the robot would prevent or minimize any potential injury when used as collaborative robots. [3]

XI. SOFT ROBOTICS IN SPACE

For space applications in the absence of gravity, neither wheeled systems nor legged robots are likely to be useful (they both require gravitational force). To move efficiently under microgravity any mobile robot (not mounted on a structure) will need to fly or crawl. For example, the NASA SPHERES robot uses a collection of small CO_2 thrusters to push itself around in the International Space Station as shown in Figure 7. [4]

Soft robots that can climb or crawl provide convenient means to transport equipment or perform examinations. One can imagine a team of soft robots traveling between space station modules to perform inspections. They can also be deployed outside to check on solar arrays or antenna structures to evaluate if a spacewalk is necessary. As a portable device, a soft robot can fit between structures whenever the astronaut needs a third hand for some specific procedures. When not in use, soft robots can be easily folded-up and stored in some odd space which would otherwise be considered a dead space (hence would save very expensive space and weight). The morphing capability not only benefits storage, but also provides alternative method of gripping.[5]

XII. CONSTRAINS TO OVERCOME IN THE FUTURE

Proprioception for soft robots is much more difficult than their rigid counterparts, because they have almost infinite degrees of freedom (DOFs) and can be deformed by both internal and external driving loads. Sometimes it is difficult to accurately predict the response of a soft robot due to certain driving condition based on modeling because of the complex behaviors (nonlinearity, hysteresis, viscoelastic effect, large strain, or deformation) of these hyper-elastic materials used.[3] Highly deformable machines are difficult to control using traditional approaches. The complex material properties themselves become an important design consideration. [8]

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Farmer to Robot – The Symbolic Handover?

Ritka Sonkusare (Mech V-B), Pratiksha Pawar (Mech V-B)

I. INTRODUCTION

Agriculture is often regarded as backbone of Indian economy and is one of the most critical occupation all over the world. Hence farmers aspire to produce higher quality crops in greater quantity but the number of available hands necessary to do it is permanently shifting with minute odds that it will be otherwise anytime soon. To overcome this, automation is necessary where the only alternative lies is employing more efficient tools and technology.

II. ESCALATING TRENDS IN AGRICULTURE

Today the most challenging task for agricultural sciences is to ensure for continuous and ample supply of food to growing human civility. Farm automation habitually linked with "Smart Farming", is technology makes farms more efficient and automates the crop or life stock production cycles. In these day and age, an increasing number of companies are working on robotics innovation to develop drones, autonomous tractors, robotic harvesters, automatic watering and seeding robots. There are many more trends on going and ever increasing. For example, Harvesting and picking is one of the most popular robotic application in agriculture due to the accuracy and speed that robots can achieve to improve the size of yields and to decrease waste from crops being left in $field$ [1]. Autonomous precision seeding combines robotics with geomapping. Monitoring huge fields of crop, ground robots and drones are provided to collect data autonomously. Ground based robot like 'BoniRob' provide even more detailed monitoring as they are able to get closer to the crop. In figure 2.1 Bosch deep field robot (BoniRob), is billed to eliminate some of the most tedious tasks in modern farming. Robot also have an advantage as they are able to access areas where other conventional machines failed to perform.

Fig. 2.1 BOSCH deep field $BoniRob$[2]

III. IMPACT OF AUTOMATION IN AGRICULTURE

While farming may seem like a simple process. Many farmers still find themselves spending more time within their fields, rather than with their families at home. Fortunately, modern technology is making it possible for farmers to spend less time on the farm and more time with the people they love. One of the most important benefits of farming automation is the significant cost reduction. When farmers undertake the task of farming manually, they need to pay several employees to do the work for them. With automation the entire production process can be computerized and this is done automatically. Agricultural robots automate slow, repetitive and dull tasks for farmers, allowing them to focus more on improving overall production yields. Farm automation practices can make agriculture more profitable while also reducing the ecological footprint at the same time. But as we all know every coin has two sides. Similarly, there are some unsatisfactory impacts of automation in agriculture as well. It costs a lot of money to make or buy robots also maintenance is required to keep them running. Due to automation, there are the chances that farmers can lose their jobs. Automation costs high, lack of access to poor $farmers$[3]. Somewhere in the future the moral of traditional farming will dissipate.

IV. CONCLUSION

Behold, there are many prerequisites of automation and these will likely proliferate hereafter. Although, there are several buckets of good things in automation, the complexity of what can be motorized, however, is still up to humans, and is limited only by the imagination. Well, your imagination and your ability and standardize formatting your inputs, integrate into various systems, and create rules. Misuse of automation for lack of a better word, is bad. Specially for country like India, where the population is so high, off-limit automation will lead to unemployment and poverty where "the rich get richer and the poor get poorer". Hence the absolute handover of farms is paradoxical. Instead, operating farms together by both robot and farmer, will touch the sky.

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Automation and Robotization of Underground Mining

Reuben Godfrey Pereira (Mech VII)

I. INTRODUCTION

Underground mining exploits various useful minerals. The exploitation and transport of minerals are mostly mechanized. Some machines are automated and, to varying degrees, autonomous. The largest market for underground mining machinery is the mining of hard coal. This is followed by mining for copper ores and other raw materials, such as rock salt or zinc and lead ores. The share of mining for these other raw materials is small. Difficult conditions of machine operation have resulted in noticeable changes in the approach to safety and comfort at work. This is the reason for seeking a method to eliminate or reduce human participation in mining operations. The progress in mobile control and navigation techniques has led to an interest in automation and robotization. Measurable economic benefits have been obtained by using such solutions. Another important consideration is increasing the safety and comfort of underground workers. Robotization can contribute to enhanced safety when withdrawing people from the most threatened zones. These zones are where mining usually take place. A separate and increasing need is using robots in underground rescue operations. Coal mines are difficult workplaces, not only for humans, but also for machines. Natural hazards, limited space, a lack of natural light, dustiness, humidity, high temperature and mine atmosphere hinder mechanization. [1]

II. MIKRUS

Raw materials found in coal seams are exploited by means of mechanized longwall systems. Longwall systems are systems of compatible and cooperating machines that simultaneously carry out the process of mining (loading and hauling of mined rock) as well as securing the roof. The American company Caterpillar Inc. is the leader in the field of automatic ploughing systems. The competitive longwall technique is the shearer technology, which has been fully automated for use in thin seams. MIKRUS ("midget" in Polish), is equipped with a GUŁ-500 cutting and loading head with two cutting drums. GUL-500 is moved by a longwall conveyor along the coal side wall by means of a cable system under the powered roof support units (Figure1. MIKRUS system).

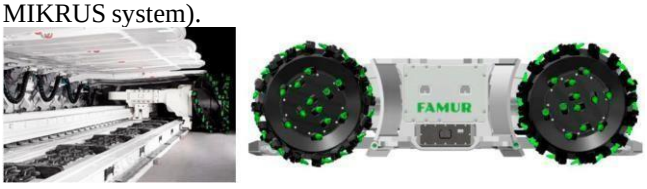

Figure 1. MIKRUS system

The whole complex is powered and controlled by an integrated system located on the surface (Figure 2. Cabin for monitoring the automatic operation of the MIKRUS system from the surface). Information on the work of all longwall face machines is supplied to the automation system. Based on this information, the system generates signals to the control systems of machines (shearer, conveyors, support units, pumps). In the event that information about hazards appears in individual devices, the system signals it at the operator's workstation. If the permissible operating parameters are exceeded the system will turn off individual devices. For security reasons, the operator can start up individual devices even if there is a risk of failure. In the automatic work cycle, the operator only controls the speed of the loading cutterhead feed, while the work of other devices is controlled by the master system of the longwall automation complex. The operator can switch over to manual control and change the operating parameters of the devices at any time. The combination of the features of plow and longwall shearer systems in the MIKRUS complex translates into increased operational efficiency in low faces. The MIKRUS longwall system allows for profitable and safe extraction in thin coal seams. Innovative solutions based on automation contribute to operations comfort. [2&3]

Figure 2. Cabin for monitoring the automatic operation of the MIKRUS system from the surface

III. ROAD HEADER

Making drifts in underground mines is one of the most important processes. In most cases, headings are made with road headers controlled locally by the operator. This work is dangerous due to falling rocks, dust, noise and temperature. EH-Remote Head Control v2 is a system enabling the remote control of road headers designed for operation in particularly dangerous zones due to the risk of gas and rock outburst as well as rock burst hazards. The system allows the service staff to work in safe work conditions, as during the shearer operation, they stay in a non-hazardous area. The safety of underground miners is the most important issue of all matters related to the operation of underground mining plants. The system consists of a few elements (Figure 3). Up to ca 50 m–100 m behind the shearer, a box with a laser shining parallel to the axis of the excavation is mounted on the roof. The laser position is corrected using a wireless remote control. The shearer has a set of devices for automatic positioning of the shearer in the heading. The devices include a set of cameras, sensors and a signal processing controller. A radar is used to communicate with the laser. In the safe zone outside the directly threatened area is an operator's workstation in the form of a cage with monitors with a remote-control panel. The operator's workstation is in the form of a cage with

monitors and a remote-control panel located in a safe zone outside the directly threatened area.

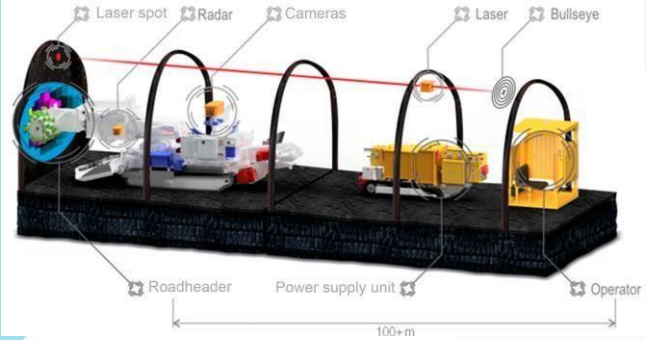

Figure 3. Structure of the EH-Remote Head Control.

The data recorded by the laser sensor, radar sensor and cameras allow the visualization station to determine the position of the shearer and the head. It also checks the possibility of their movement on an ongoing basis and determining a possible collision. The 3D application additionally maps the state of cutting in the face. It uses various indicators and lights and provides information on the shearer's condition, including the signaling of warnings and emergencies (Figure 4. 3D application of the EH-Remote Head Control). [1&2]


Figure 4. 3D application of the EH-Remote Head Control

IV. JULIUS

A mining robot, 'Julius', (figure 5. Julius) developed by ARIDuA's (Autonomous robots and the Internet of Things in underground mining). This robot benefits from the synergetic effects of IoT and robotics. A mobile autonomous robot, in combination with a wireless sensor network (WSN), can help to explore unknown or inaccessible areas in an underground environment. These could be both, either active mines in case of a current hazardous situation or abandoned mines in which unpredictable risks are too severe for human activity. The application of an automated technology, which can be operated from a distant position and most important, a safe area, will increase the safety of the miners. Julius was retrofitted to withstand the mine's environment and meet ARIDuA's objectives. In particular, its robotic arm and hand are protected by a rubber covering. Furthermore, it comprises LED spotlights, 2D laser scanners, a 3D laser scanner and color and depth cameras.

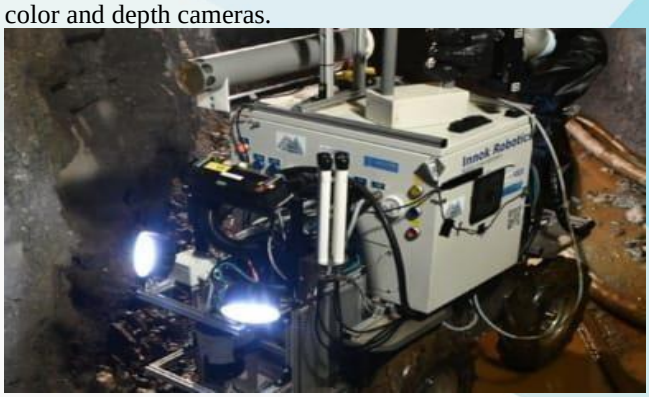
Figure 5. Julius

With its sensors and computational power, the robot is able to drive autonomously, i.e., it is able to steer and accelerate automatically and detect obstacles. Julius was tested two types of navigation strategies: absolute and relative navigation. The former requires mapping an area beforehand and placing points on the map. With these preconditions, the robot is able to localize itself in the map and drive autonomously from one point to another. The mapping algorithm uses the front camera and therefore depends on light. The latter navigation strategy does not require a map and uses the robot's environment for orientation and navigation. The implemented algorithm uses the 3D laser scanner and thus does not depend on light. [4]

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Cooperating robots for manufacturing and Assembly

Malcolm Dias (Mech V-A), Melissa David (Mech VII)

I. INTRODUCTION

For quite a long time, industrial assembly has relied on fixed sequences of operations where manual and automated tasks are repeated in the same, optimal way during each cycle. When the production is set to the maximum throughput, this paradigm is very efficient, but it can have technical problems and malfunctions in some cases. In addition, flexibility is key to adapting to market and global economic changes [1]. As a result of a different paradigm, this paper discusses the introduction of autonomous production/handling units capable of switching tasks and positions on the shop floor. In addition, they can be automatically reconfigured so that the tools and the production line can respond quickly to potential production changes.

II. FRAMEWORK

Following are some of the main components of the framework

- Autonomous, flexible assembly equipment with reconfigurable tools and advanced sensing capabilities that can easily adapt production processes to process disturbances Configurability is further enhanced by the use of mobile robotic units that can be efficiently moved around the shop floor and automatically take over tasks, in conjunction with the robots already installed in the assembly line.
- Using distributed and open controls linked to sensor data, intelligent control and monitoring systems enable enhanced performance and high-level reconfigurability of production processes [2].
- Service-oriented and ontology-based integration and communication architecture to enable transparent integration and networking of the control systems [5].

III. MOBILE ROBOTS

Despite extensive scientific research on mobile production resources in previous years, industrial applications were limited to cases that operated under restricted circumstances, such as the AGV stands for Automated Guided Vehicle. Some recent examples of robots that contribute to increased flexibility include the use of a robot cell from BMW called a "mobicell," as well as the use of redundant robots. PSA- manufactured robots the “mobicell” concept a robot cell can physically be moved from one plant to another and begin production in a new location within 2-3 weekdays Nonetheless, the adaptability of this approach is commendable and limited due to the bulkiness of the entire cell. The goal for the development of mobile robotic units is to use existing robot platforms and focus research on how this base will be supplemented in order to provide a fully operational mobile robot at both the hardware and software levels. At the hardware level, this means that the various sensors and robotic arm that have been designed will be integrated into the mobile platform. Novel localization and mapping techniques, which have been successfully used by the robotic scientific community, must be implemented and made robust for industrial requirements at the software level. In an architecture specification, software modules for perception, navigation, obstacle avoidance, and path planning will be developed in an architecture specified for the task [3] [4].

IV. COOPERATING ROBOTS

The use of cooperating robots is the key to achieving reconfiguration on a unit-wide basis.

It is possible to use cooperating robots, i.e., robots that communicate with each other to perform common tasks, in order to reduce the number of fixtures required and minimize the process cycle time, while addressing the accessibility issues presented by the usage of fixtures. Single controllers can multitask and handle many robots, or specific frameworks can allow regular controllers to work together by exchanging motion data, synchronization signals, and safety signals. The applications of cooperative robots include: Workspace sharing, multi-machine motion synchronization, which allows numerous machines in a cell to start and finish the same motion instruction simultaneously. With respect to Figure 1, a typical example would include the following workflow:

- The mobile robot service retrieves information from an overall cell sensor, which is implemented by an ontology, in order to determine the task's status and location get the remaining operations
- The mobile robot service decides what actions to take.
  a) The manner in which the gripper is grasped (movement) from a broken robot and b) trajectory points in space, and so on
- The mobile robot service exchanges information with the faulty robot to coordinate the gripper exchange.
- The robot service is adjusted following the gripper exchange.in order to derive and

evaluate results automatically new paths, and eventually achieve the desired results positions in welding.

- The unit will then execute the next one or move to the next assigned area once the task has been completed.

V. LINE LEVEL RECONFIGURATION

The traditional manufacturing control systems are not designed to exhibit the capabilities of responsiveness, flexibility, robustness, and reconfigurability, since they are built upon a weak response to changes, due to the rigidity and centralization of their control structures. In, agent-based control algorithms and multi-agent systems are presented as a solution, characterized by application feasibility, robustness, flexibility, reconfigurability, and deploy ability. Examples of industrial applications of the agent-based control have been reported within the cylinder head manufacturing facilities of DaimlerChrysler and in the case of an automotive engine assembly system. The inability of the existing platforms to handle the great number of agents/services. required for the operation of real-life assembly plants, and the interoperability issues, which to be solved require the use of standard platforms that support the transparent communication between distributed control components or application.

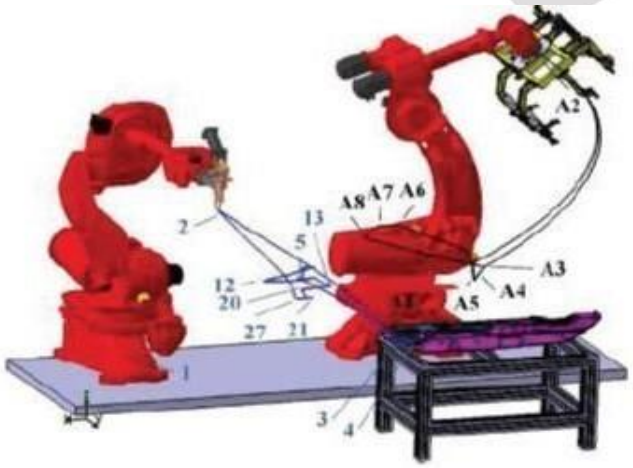

Fig. 1 Robot motion

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Comparison between siemens control and Fanuc control

Baniz Antony (Mech V-A)

I. INTRODUCTION

The Automation industries completely revolutionized the entire production world by their wieldy ideas and use of less workforce. Since decades a never-ending deliberation in the automation industry has been wobbling that, 'Is Siemens controllers better than Fanuc controllers or the other way round'. Since 1945 from the stage of development of Computer Numerical Control (CNC) machines many companies have been developing different types of controllers for CNC's, but till date only these two automation companies could hold themselves up in manufacturing CNC controllers. The contention between these two companies has been increasing over the years in this industry. Let's first check with the history of these two Electronic Giants.

II. HISTORY

In 1955, Fanuc, a Japanese based company began their work in Automation and started developing coding systems in the machines. Initially the coding system was developed in a low-grade format which was used to control only Fanuc based machines.

In the early 70's the coding was in a development stage and they came up with a coding system in early 80's and implemented an International Organization for Standardization (ISO) standard which can be used universally. In 1982, almost 50% of the machine was controlled by Fanuc, as it was easy to understand for the programmers and operators. By 2000, 90% of CNC's in the world was controlled by Fanuc controllers.

In Siemens Control System, a German based company which started its development phase in the early 80's. Due to some demerits in the Fanuc Control system a new system had to be developed as the use of Canned Cycles wasn't popular.

The German Engineers worked on a system which reduced the manual calculation by just feeding the data and the cycles will automatically get generated. They made many changes and tried to make various control systems. They entered this market as a popular control system and became a competitor of Fanuc Controls.

III. DIVULGE OF FANUC

The coding system used in the Fanuc system is the ISO standard coding system which does not change machine to machine.

Programming in Fanuc is done in 3 different ways: Manual programming, Canned Cycle programming and Custom Macros Programming. Manual programming is normal programming by using G and M codes. Canned cycle is a way of conveniently performing repetitive CNC machine operations. Custom Macros programming can be used to make programming on their own by using mathematics and creating their own formula, as shown in fig(a) where we have to feed in the data and automatically the program will get generated. The next phase of Fanuc system is Software based programming, they have collaborated with all the software manufacturing companies such as Delcam, Mastercam, NXcam and Solidcam and are supported by Fanuc as the coding is generated for their machines after a particular design is given as an input.

Fig(a): Fanuc Control Panel [3]

IV. DIVULGE OF SIEMENS

When it comes to Siemens control systems there is no standardization, different code should be programmed for different control systems for the same machining process of the same product like a code programmed in a control system cannot be used in another control system. There is no coordination between their controllers.

The method of programming is simple in this system which is quite similar to macro programming, as the machinist has to feed in the data, enter the size of the workpiece and the programming will get generated automatically as shown in fig(b). There is a lot of confusion with its symbols and manual programming in programmers, which have to be tested and a lot of time is being wasted.

Fig(b): Siemens Control Panel [4]

V.CONCLUSION

In Siemens controller software and simulations are used before manual programming as there is a high chance of error. Even after all these, it is hard to comment on which one is better, as they are good in their own aspect or domain. Siemens control is easy to program whereas Fanuc control has a Universal standardization. Siemens control has many different variations and innovations but Fanuc is leading global just with their stock product.

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Automation in agriculture

Yash Chaudhary (Mech V - B)

I.INTRODUCTION

Farming is a very cut-throat profession. The profit margins are slim, the yield is seasonal and susceptible to tarnish by weather and soil conditions and the government support is marginal. Yield is all important in farming. Farmers are paid per quintal (100 kg) of crop grown in their fields. Hence, the more yield they have, the more they can earn. One way to increase the yield could be the use of latest engineering innovations. By introducing the concepts of Automation and IoT to the field of agriculture, the yield can be maximized while also making the farmers work easier. In this research paper, the steps in the process of farming will be analyzed and automation solutions will be provided for the same.

II.SOIL PREPARATION

Soil preparation is one of the most important steps in agriculture. After continuous use, the soil starts to lose its nutrients. Hence to prepare the soil contents, prior to sowing, ploughing is performed. In this process, the top soil loosens up and the nutrients deep in the soil come to the top. It also aerates the soil which helps in better breathability of the roots. It also removes weeds, kills pathogens and insects, etc. [1]

In this process, the critical aspect is knowing when the soil needs ploughing. Because ploughing is a very time and energy consuming process, it should only be done when required. Therefore, to understand if the soil requires ploughing, soil sampling can be performed. A small sample of soil is retrieved, as depicted in Fig 2.1, from different parts of the field and tested in a soil sampling lab. These tests will determine the nutrient levels (Nitrogen, Phosphorous and Potassium), soil acidity, organic matter, etc. which will help the farmer better understand the soil composition and determine the need for ploughing. [2]

This data is then fed and recorded on a central computer which can be used for determining the crop which will have the highest yield on that particular soil.

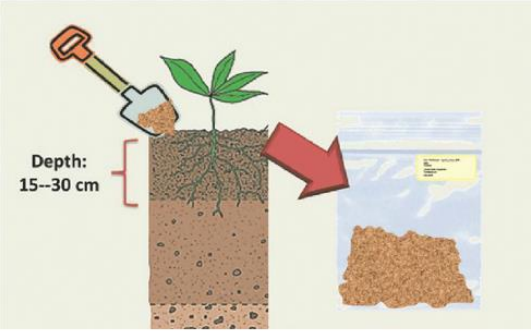

Fig. 2.1: Soil Sampling Process

III.SOWING

Sowing is the process of planting the seeds in the soil. Planters and seeders are used to sow the seeds at a larger scale, as shown in Fig 3.1. These implements have to be driven by the farmer and in perfect straight lines. By using IoT, the seeder will select the right type of seed to be sown by using the data gathered after soil analysis. This in addition to GPS positioning data and predetermined field boundaries, would mean that the seeder can be self-driven.

The farmer would only need to align the tractor with the field and by using cruise control and automatic steering, the implement will be self-driven. It will have an onboard computer which will calculate the amount of seed to be sown and where. Because it will be operated by a robot, it can be driven at a much higher speed with the same precision when compared to human driven, this would drastically reduce the time required for sowing. This high-speed precision planting will also ensure uniform emergence of the crop and hence maximize the yield per plant. [3]

Fig. 3.1: Seeder

IV.FERTILISATION

Fertilization is the next most important process of farming. After the seeds are sown, fertilizers (organic or chemical) are sprayed over the soil which provide additional nutrients to the soil. This is carried out by attaching the sprayer behind the tractor and circling the field, as shown in Fig. 4.1. Farmers usually leave tram lines after 8 rows to accommodate the tractor when it is driven for spraying. But it still becomes very difficult to know which part of the field has been fertilized and how much. By using data from the central computer, the maximum fertilizer required can be calculated so as to reduce wastage and over-fertilization. Also, by using GPS positioning data, the parts of the field which have been fertilized can be updated in real time and it would be easier to spot the unfertilized parts.

Fig. 4.1: Fertilizer Sprayer

V.HARVESTING

Harvesting is the process of gathering a ripe crop from a field. On a small scale, this is done mostly by hand, but on a larger scale, combine harvesters are used which can carry out reaping, threshing, winnowing and gathering.

Reaping is the process of cutting the crop from the field and collecting it. The combine uses a header to achieve this. Threshing is the process of loosening the edible part of the crop from the straw to which it is attached. Winnowing is a process by which chaff is separated from grain. It can also be

used to remove pests from stored grain. Finally, gathering is done which stores all the crop in the combine while straw or other materials are expelled out. [4]

The combine harvester (Fig. 5.1) is already an automated machine and by combining all these tasks, saves a lot of time and manpower for the farmer. This results in a higher yield.

But this has a major drawback i.e., weather. If it rains, snows or hails, harvesting cannot be carried out. Hence to minimize the impact of weather, the central computer will use a predictive model to chart out the best days and the number of hours required to harvest the maximum crop in the least amount of time. It would take data from the weather station and analyze it for the best days for harvesting and chart them on a calendar. Data like irrigation events schedule, pest alarm models, right time for the specific crop to be harvested will also be fed so as to get a result which is specific to that field and hence the most efficient. [5]

Fig. 5.1: Combine Harvester

VI.STORAGE OF CROPS

This is the most important non-farming process for a farmer. Once the farm produce is harvested, it needs to be stored somewhere where it will await transportation to distributors while still retaining freshness. There are usually two places to store crops – silos present on or near the farm (grain crops) and cold storage facilities (perishable crops), as shown in Fig. 6.1. Cold storage facilities are a part of cold chains which comprise of a network of food producers as well as storage, transportation and distribution providers which ensure that fresh & frozen food reaches consumers. As the demand increases, it has become really difficult to secure space in a cold storage facility and managing the crops until they reach the distributor and finally the customer. [6]

Hence, to tackle this, the central computer will first analyze the available cold storages in a particular radius. Then it will tally the space they have with the quantity of the harvested crop from the field. The computer will use data from the past to predict the total harvest sometime before it is completed. As a result, the farmer will have a cold storage space and location secured even before the harvesting is completed. This way, maximum freshness of the crop can be ensured and hence the yield would be increased.

Fig. 6.1: Cold Storage Facility

VII.COST OF COST OF AUTOMATION IN INDIA

Having seen the different automation solutions in various processes of farming, the most important factor has been omitted i.e., Cost. Even though, farming produce is the largest contributor to India's GDP, farmers struggle to make ends meet. Indian farmers have to go through several problems like lack of infrastructure, lowering productivity, seasonal irrigation, etc. Saving the money for expensive upgrades is very difficult, if not impossible. These systems, although will be very effective at a larger scale, in India, implementation is still a huge challenge. [7]

VIII.CONCLUSION

In this research papers, several automation solutions for the farming sector were discussed. Automation in soil preparation, sowing, fertilization, harvesting and storage of the crops have been highlighted and proved cost effective and feasible. These, if applied, will help in increasing the yield of farmers while keeping the cost of consumables like seeds, fertilizers and fuel as well as maintenance costs as low as possible. The major requirement for these is a central computer, GPS positioning systems in the equipment and access to soil testing labs and cold storages. In conclusion, farming is a sector with a lot of scope for atomization and IoT based applications. These innovations when applied, will give us a glimpse into the farms of the future.

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Creative Corner

Greetings Readers,

This time we have decided to introduce a Creative Corner Section in our magazine URJA as a token of appreciation for the creativity of our classmates. We all are well aware about the pandemic and its aftermath on all our lives, but even in such trying times creativity and activity did not stop. Our fellow classmates created a tonne of creative contents. As scholars say, "Creativity is just intelligence having a bit of fun. " In that spirit here are a few works by our fellow classmates...

Wanna have a cup of coffee? 😉

FCRIT MESA

-Kshitij Chorge
Mech V-A

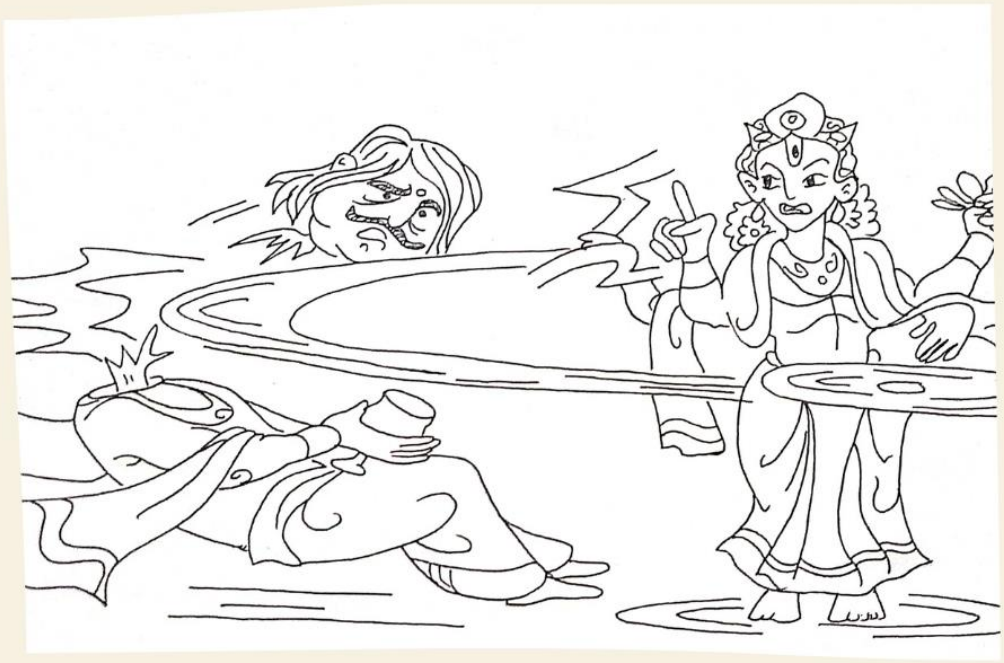
Music

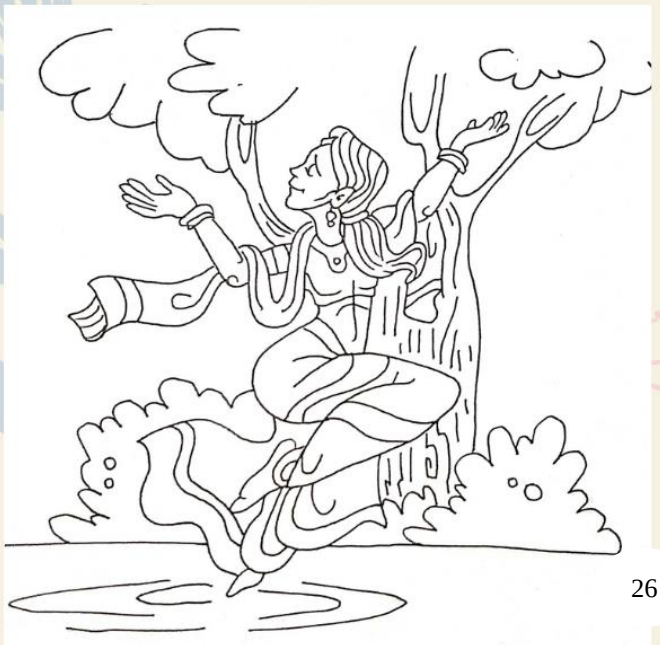
Music....celebrates your birth into its own worlds everytime u get lost in it...
It feels like you are reborn
Into a world unknown to you
Yet so beautiful
So divergent
Yet so peaceful.
Dont you feel, walking through it.. that you are losing yourself into this world with every step you take...
Suddenly walking straight into the this ocean of melody...
Right when u feel the water glaze your feet ... u want to dip yourself in it... give into its waves...into its world....submerge yourself completely....
And as you open your eyes..deep in this ocean...far from the lands of chaos....
U find yourself in your own atlantis....
Where there's no king...no rule...
Just peace.... and harmony in these rhytms ..
U look around
.. and u feel gifted....
U feel this world giving its hand to you..and you take it... and u let it lead you into itself....
U feel comforted...like you're not alone...
Like there's someone alongside you.... its not music honey....its you yourself...your peaceful self.... thats the power of music... it makes you connect to that part of yourself where no living creature can reach but you....
Thn u realise...its not a destination...its a path.
Maybe thats why music has no limits

-Prathamesh Rajesh Vaity
Mech V-B

PRANAV GHANVAT

MECH V-A





Ruchita Patil
Mech VII

Any sketches up here?

Aditi Shinde
Mech V-B

STUDENTS' ACHIEVEMENTS

PRIZES WON IN VARIOUS COMPETITIONS

Sr. No	Name of the Student	Name of the Event	Prize/Position/Rank	Date
1	Akshata Patil	Ai-a-thon	First	21/11/2020-22/11/2020
3	Akshata Patil	IdEEaVolt-Idea Pitching Competition	Third	19/07/2020
4	Akshata Patil Yash Kale	Ideathon'20	First	22/11/2020
6	Jebastin Durai Nadar	Aakash 2020	Second	27/07/2020

FACULTY ACHIEVEMENTS

Sr. No.	Name of the Faculty	Particulars	Year
1	Dr. Sanjay Rukhande	Completed Ph.D. from University of Mumbai	2020-21
2	Dr. Aqleem Siddiqui, Mr. Kamlesh Sasane, Mr. Girish Dalvi	Received grant of Rs. 93000/- from AICTE for Organising ATAL FDP on "Electric Vehicles"	2020-21
3	Dr. S.M. Khot	Best Principal Award, IEI BLC-FCRIT Excellence Awards	2020-21

PLACEMENT DATA

Sr. No.	Name of the Student	Company Name
1	Hemant Rajendra Agrawal	Godrej
2	Tejas Chougule	Cognizant
3	Ashay Ghadi	Burns MCD
4	Tanay Iyer	TCS Ninja
5	Kedar Ketkar	TCS Ninja
6	Harsh Khot	TCS Ninja
7	Chris Koli	TCS Ninja
8	Shalom Monteiro	TCS Ninja
9	Abhishek Pandey	Godrej
10	Ganesh Patil	Multidimensions
11	Tajir Asim Parvez	TCS Ninja
12	Emmanuel Vaz	Burns MCD
13	Vineet Abraham	LTI

LIST OF TOPPERS

Toppers in Semester VIII		
Rank	**Name of the Student**	**CGPI**
1	Toraskar Tushar Maruti	9.95
2	Kalamkar Vishwas Shivaji	9.92
3	Devadiga Nitesh Shankar	9.88

Toppers in Semester VI		
Rank	**Name of the Student**	**CGPI**
1	Dixit Shubham Vishnu	9.78
	Shelar Rahul Vasanth	9.78
2	Patil Monali	9.77
3	Patil Akshata	9.69

Toppers in Semester IV		
Rank	**Name of the Student**	**CGPI**
1	Gupta Shreyansh	9.98
2	Chaudhary Harsh	9.91
	Shinde Aditi	9.91
3	Chaudhary Yash	9.87
	Kottian Sahil	9.87

SYNERGY 2020

SYNERGY is organized with the aim of bridging the gap between the industry and the institute by facilitating an effective interaction between them. This event provides an opportunity to the students as well as the faculty members to know more about the emerging technologies and methodologies adopted by the industry. Also, the industry in turn, gets to know the institute closely, thereby providing an opportunity to identify the value addition required to create high class professionals from the institute.

Synergy 2020 was the latest edition of our vibrant and vigorous industry-academia interaction. It was held on **5th December 2020** via the online medium. We were fortunate enough to have the guest speakers from Mahindra & Mahindra Limited, from their Nashik Plant. Mr. Sunil Bhatkhande Senior manager in Manufacturing quality assurance department, Mr. Shreyas Gokhale manager in Industrial & Process engineering department and the chief guest Mr. Dhananjay Joshi Deputy manager in the central maintenance department were the keynote speakers who graced us with their presence and shared their valuable knowledge and experience with the students. The speakers dealt with technical aspects of the manufacturing process of their Automobiles and opportunities in their field. This was followed by an open interaction where we observed a wholehearted involvement from the students.

WORLD ENGINEERING DAY

On the account of world engineering day, The Institution of Engineers (India), Belapur had taken the initiative to inculcate creative thinking and innovative mindset amongst the students of F.C.R.I.T, Vashi.

"World Engineering Day" was organized on 4th March 2021, under the aegis of MESA. Speakers were invited to deliver lectures for Mechanical Engineering Students of Semester II, Semester IV, Semester VI and Semester VIII. The speaker was Mr. V. Ravinath, Assistant Vice President, Petrochemical Division, Reliance Industry Limited, Navi Mumbai.

The guests who graced the occasion with their esteemed presence are:

1. **DR. M.B. DAGAONKAR**
   Council Member, IEI, Kolkata

2. **DR. SAMIR C. NIMKAR**

   HON. SECRETARY IEI (BLC)

3. **MR. KESHAV K. VARKHEDKAR**

   CHAIRMAN & COUNCIL MEMBER IEI (BLC)

Also present were:

1. **Fr. SATURNINO ALMEIDA**
   MANAGING DIRECTOR, FCRIT, VASHI

2. **DR. S. M. KHOT**
   PRINCIPAL FCRIT, VASHI

3. **DR. NILAJ DESHMUKH**
   DEAN (FACULTY) and HOD (MECH) FCRIT, VASHI

MESH 2021

Mesh is an event conducted in the odd semester which intends to bridge the gap between the industry and the institute. Mesh is named so as the metaphor for two gears in mesh. It meshes the industry with an institute aiming for favorable output. It integrates academic technical knowledge with latest industry trends. During Mesh seminars are conducted on various emerging technologies and methodologies adopted by the industry. Specialized guests' speakers in the respective domains are called to give a deep and knowledgeable insight about the ongoing industry trends. This event facilitates a vigorous industry-academia interaction, thereby benefiting the students as well as the faculty members. The industry in turn gets the opportunity to identify the value addition required for the institute in order to turn the future endeavors into high class professionals.

This year despite the ongoing pandemic, Mesh 2021 was successfully organized and conducted virtually. The webinar was held on March 20, 2021 via the online platform Microsoft Teams. The event began at 9 am with vibrant participation. We were pleased to have our guest speakers Dr. G.C Nandi and Dr. Kavi Arya from IIIT Allahabad, and IIT Bombay respectively.

The insightful sessions had the following area of interests:

1. Robotics: Kinetics and Control- ML Modelling, Kinetic movement equations, and future of Robots delivered by Dr. G.C Nandi (Professor, Head of Centre of Intelligent Robotics, IIIT Allahabad).

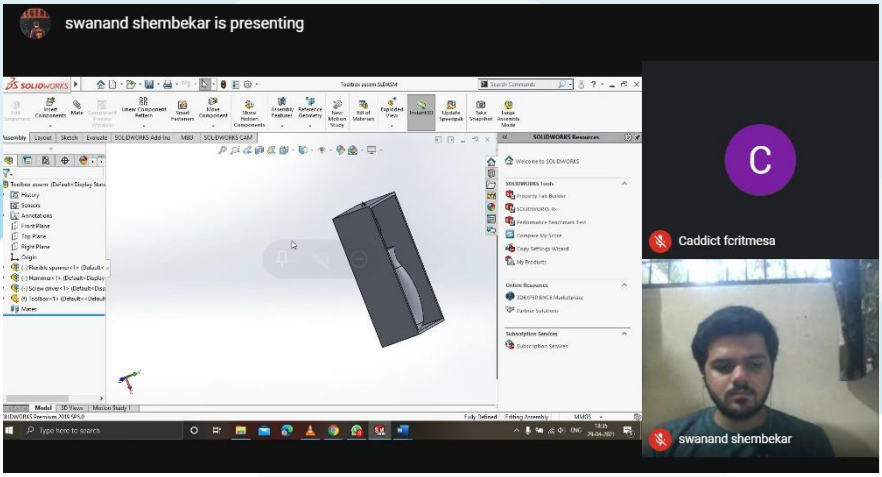
2. Student Innovators for Local Disruption: Turning problems into Opportunities - Exordium to e-yantra and presentation of e-yantra projects delivered by Dr. Kavi Arya (Professor, Computer Science and Engineering Department, Principal Investigator: e-Yantra Project, IIT Bombay).

The event was successful with vibrant participation. The hosts gave us an interesting comprehension about the possible developments and challenges in the respective fields. The session was concluded with a vote of thanks from the committee members.

CALIBRE 2K21

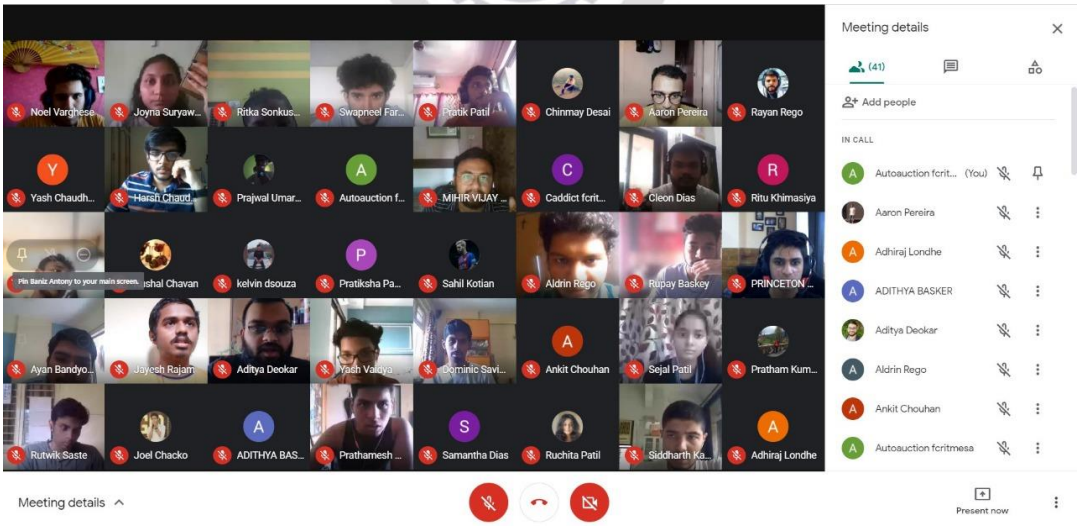
FCRIT Mechanical Engineering Students' Association with the Mechanical Department, conducted 'CALIBRE 2K21', a technical fest in association with "Institution of Engineers India (IEI)" Belapur local Centre, on 29 April,2021. It was conducted with a prime objective of allowing students from our own institute and various other engineering institutes to showcase their innovative ideas and collaborate with other engineering students, and to enable students to test and enhance their skills and knowledge in the field of mechanical engineering. CALIBRE also provides them a platform to test and develop their projects and compete in this highly competitive engineering field. Even in the trying times of the COVID-19 pandemic, learning couldn't stop, and hence CALIBRE 2K21 was conducted via online medium using Microsoft Teams.

On the 29th of April, various exciting technical events were held which allowed undergraduate and diploma students from various engineering institutes to actively and enthusiastically participate from the comfort of their home. CALIBRE 2K21 includes a variety of interesting and fun events like "National level Project Poster Presentation", "National Level Paper Presentation", "Quizophile", "Caddict" and a unique event that was introduced for the first time "Auto Auction". All the participants entered the events with great enthusiasm and competitiveness for the National Level Project Poster Presentation Competition and the National Level Technical Paper Presentation Competition. The students got a chance to showcase their unique ideas and preparations. The teams presented their projects and technical papers and were judged on the basis of their efficiency and innovativeness.



The fest ended with a prize distribution ceremony. All the winners were felicitated with certificates and prizes and all the participants were encouraged with a participation certificate. This too was performed via the online medium.

This was a wholesome and complete event bringing together people of all different thoughts, perspectives and backgrounds under the banner of science. The MESA team, under the guidance of the MESA coordinators and the Teaching and Non-Teaching staff of the mechanical department made this event a huge success. Their unparalleled efforts will certainly prove worth in making events like CALIBRE 2K21 possible and even better year after year.



PRESIDENT'S NOTE

We began our journey as a family, learning about MESA from our senior members. They aided us in acquiring new skills, learning new software, and most importantly, in trusting each other while working as a team.

Working under the senior council's direction, we successfully completed Synergy 2019 and Mesh 2020, but due to the pandemic, we were unable to conduct our technical fest, Calibre 2k20. But, with their guidance and understanding, we marched forward with confidence and determination for the next year.

New members joined our team, became a part of the Mesa family, and together we planned and conducted Synergy 2020 and Mesh 2021, which helped the team members improve their coordination and understanding, bridged the gap between our ideas and perspectives, refined our skills, and prepared us for our technical fest, Calibre 2k21.

We started planning with the help of our lecturers, while also coordinating with the HOD. We attempted to come up with new ideas for events that would take place throughout the fest while keeping in mind the perspectives and learning experiences of previous events. On the other hand, we kept the digital functioning of the fest in mind and worked hard with our promotion activities. The team pushed their limits to think creatively by becoming socially engaged on various social media platforms and addressing other colleges across the country. Simultaneously, sponsorship was a time-consuming activity because online contact was the only option available to all of us, but thanks to the team's sincere efforts, we were able to collect a substantial amount that helped us go through with

all our plans. Because of our hard work and dedication, the fest was extended to a two-day event. With all activities running concurrently, everything went as planned, and when the event date arrived, we were all extremely excited. The first day of Calibre 2k21 began, and all of the scheduled events received overwhelming support and positive feedback. It was a genuinely happy moment for all of us at the end of the second day; everyone was overjoyed; it felt like a dream. But MESA's journey was also coming to an end. Being a part of MESA for two years was one of the best experiences we could have had. But at the end, we must keep moving forward and pass on our heritage to the junior members, wishing them the best of luck on their journey.

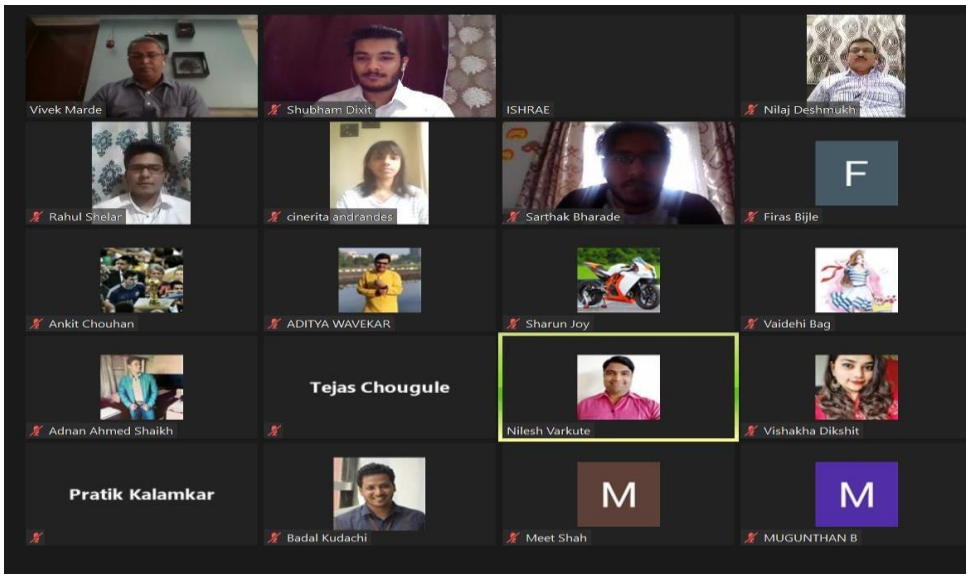
Finally, I'd like to express my gratitude to all of my colleagues for their constant support, as well as the faculty coordinators for their belief in me and my team and all of MESA's well-wishers.

- Desai Chinmay
President
MESA 2020-2021

ISHRAE COLLEGIATE CHAPTER

The Indian Society of Heating Refrigeration and Air Conditioning Engineers (ISHRAE) was founded to promote the HVAC industry in India. The student chapter aims to provide the student members with industry exposure and get them more involved in HVAC. The ISHRAE student chapter of FCRIT was started with the goal of getting new opportunities for students in the field of HVAC specifically and provide a stable career in the same. The FCRIT chapter was initiated on 22nd September 2007. Mr. Nilesh Varkute and Mr. Badal Kudachi are the faculty advisors of FCRIT chapter. ISHRAE organizes various events like Exhibitions, Quizzes, Technical Paper Presentations, Industrial visits, Job Junctions, etc.

The ISHRAE FCRIT chapter for the year 2020-21 was installed on 7th September 2020. This year the ceremony was conducted on the Zoom platform due to the pandemic. The dignitaries Mr. Mihir Sanghvi, Mr. Vivek Marde, and Mr. Parth Thakkar were the chief members from the ISHRAE Mumbai Chapter that attended the ceremony. This event was attended by the appointed council of the FCRIT Chapter (President, Secretary, Treasurer, Committee Members) along with the Faculty Advisor and other ISHRAE Student Members.

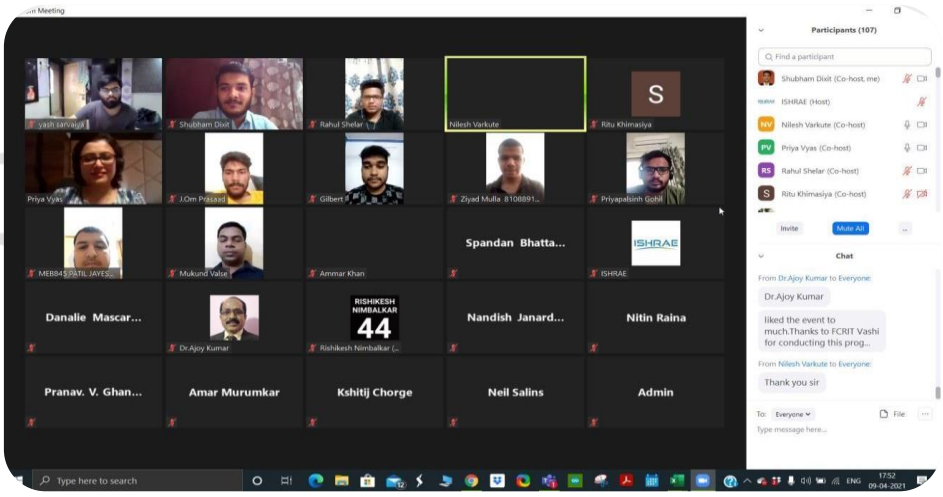


Installation Ceremony 2020-21

ISHRAE conducted webinars on “Renewable and Sustainable Future in India and Research opportunities & Green Buildings” and “Writing of Scientific Journals”. Both the webinars were conducted on an online platform with a huge number of student participation. The Webinar topics were covered in Case Study format for better understanding of the subject.

Webinar on “Renewable and Sustainable Future in India and Research opportunities” & “Green Buildings”

Webinar on “Writing of Scientific Journals”



Apart from this, a one-day industrial visit to Equinox business park was organized. There was active participation from students in all these activities which only enriched their experiences.

SAEINDIA COLLEGIATE CHAPTER

SAEINDIA is an affiliate society of SAE International registered in India as an Indian non-profit engineering and scientific society dedicated to the advancement of mobility industry in India. The founding principle of the SAE International is to unite scientific and technical staff to perform free academic discussions, to dedicate themselves to the cause of prospering the science and technology for automotive vehicles and to make contributions to speed up the modernization of automotive industry. The Club actively organizes various events such as TORQUE- Intercollege event of Nitro Racing and SPARK- Seminar by speakers from the automobile sector. Prof. Girish Dalvi and Dr. Aqleem Siddiqui are the faculty advisors for SAEINDIA COLLEGIATE CHAPTER. The Mechanical Department has a SAE Collegiate Club, having more than 50 members.

The Club had organized a webinar on “Basic Insights: Motorsport Technicalities” which was mainly focused on providing basic insights of technicalities of Motorsport Events to give brief insights about the Automotive Industry. Apart from this the seminar gave a brief idea about the hands-on career opportunities in today’s industries and helped in bridging the gap between theoretical knowledge and practical application. The webinar on “Finding Your Niche” was also held by the SAEINDIA COLLEGIATE CHAPTER. It discussed about the importance of soft skills in the corporate world. These are the necessary qualities that the budding Engineer of India should possess.

SAEINDIA BAJA

Our SAEINDIA collegiate team “Team Kaiser Racing” consists of 25 automobile enthusiasts who take part in events which include design and fabrication of an ATV as well as the actual event which includes an endurance race. The team is led by Captain Ruturaj Chavan and Vice-captain Melvin Joseph and guided by faculty advisors Dr. Aqleem Siddiqui, Prof. Girish Dalvi, and Mr. Sandeep Arote. The competition is a measure of how well a vehicle is designed, modelled and constructed in all respects. The overall participation and innovation by students are a proof that mechanically and aerodynamically sound buggies are just the beginning of FCRIT’s contribution to the automobile sector.

The team made a stunning debut two years ago, the team made sure the alterations with respect to design improvement were implemented and the car stood tall and roared well before the event. This marked the beginning of, what would prove to be, a very successful journey.

The journey from the inauguration to the event is never a cakewalk, the team faced challenges befalling it with sleepless nights and tiring days. The path was narrow and curvy but the team drifted through each turn with a firm mind-set.

In 2019, Team Kaiser Racing was Ranked 129th of 295 teams, ranked 14th in the final endurance test, ranked 1st among new teams in the final race and ranked 13th in the Design Evaluation report. Unfortunately, due to the COVID-19 pandemic, it was not possible to conduct BAJA this year. The team, in this time, has been hard at work making alterations to the design and fabrication of the ATV so as to give themselves a competitive edge over their competitors.

SAEINDIA AERO CLUB

A team of 7 members aspiring to fly high, set a spark for the foundation of Aero Club in 2019. Later, additional members joined the club as support team members. The team registered for their first event SAE Aero Design Challenge in August, 2019 and started with the journey.

Being the pioneering team of the club, it was a tough journey for the team as they had to start from scratch for each and every design parameter. With the help of online courses, reference books on aerodynamics and through multiple iterations of their plan, the team gave birth to its prototype, the White Lady, and consequently their final RC plane, Garuda.

The event is all about designing and fabricating a highly stable heavy lifting RC aircraft falling under the given constraints. All the efforts put in by each and every member of the team paid off, as they secured an impressive 5th place in the technical presentation round and 16th for the report submission, a feat commendable for their first competing year.

With a successful run for the year 2019-20, This year AeroFCRIT club has participated in micro and regular class the efforts of both teams are being appreciated and the regular team was the 2nd Runner-up All over India in Design Report.

The team now aims to keep the legacy up and running with new members added to the team and continue participating in SAE ADC and other similar events. Plans for the next

round are already set in motion and they are working hard to secure better rankings, even amid the current situation. The college has constantly supported the team by clearing their doubts and providing all the necessary facilities.

FACULTY PROFILE

Dr. S. M. Khot **(Principal)**	**Ph.D. (IIT Bombay)** – Aerospace Engineering **M. E. (Shivaji University) -** Mechanical Design Engineering Professor (Exp. - 32 years) Area of Research - Mechanical Vibration Dynamics and Control, Active Vibration Control, Smart Structures
Dr. Nilaj Deshmukh **HOD and Dean (Faculty)**	**Ph.D. (IIT Bombay)** – Aerospace Engineering **M. Tech. (VJTI, Mumbai) -** Automobile Engineering Associate Professor (Exp. - Industrial 2 years, Teaching - 21 years) Area of Research - Virtual instrumentation, Combustion, Combustion Instabilities, Measurement Techniques, Noise Analysis, Aerodynamics
Prof. T. Mathewlal	**M. S. (BITS, Pilani)** **B. Tech. (Mechanical) -** Systems Associate Professor (Exp. - 32 years) Area of Research - Engineering Mechanics and Thermal Engineering

Dr. Nitesh P. Yelve **Dean (PG Studies)**	**Postdoctoral Fellowship (City University of Hong Kong)** **Ph.D. (IIT Bombay)** - Aerospace structures **M. Tech. (VJTI Mumbai) -** Machine Design Associate Professor (Exp. - 19 years) Area of Research – Structural Health Monitoring, Active vibration control, Structural Dynamics, Design of Experiments Using Statistical Methods, Composite Materials
Prof. N. G. Kshirsagar	**M. Tech. (VJTI Mumbai)** - Machine Design Assistant Professor (Exp. - 23 years) Area of Research – Design, MEMS, Synthesis of Mechanism
Dr. Aqleem Siddiqui	**Ph.D. (Mumbai University)** **M. E. (Mumbai University)** - Machine Design Assistant Professor (Exp. - 22 years) Area of Research - Active Vibration Control, Automobile Engineering, Design
Prof. Prasad Bari	**Ph.D. Pursuing (VJTI, Mumbai)** **M. Tech. (VJTI, Mumbai)** - Production Engineering Assistant Professor (Exp. – Industrial - 5 years, Teaching - 14 years) Area of Research - Micromachining

Dr. Sanjay Rukhande	**Ph.D. (VJTI, Mumbai)** **M. E. (SPCE Mumbai)** - Machine Design Assistant Professor (Exp. – 20 years) Area of Research - Design, Analysis, Finite Element Method, Surface and Coating
Prof. Shamim Pathan	**Ph.D. Pursuing (IIT, Bombay)** **M. E. (Mumbai University)** - Machine Design Assistant Professor (Exp. - 13 years) Area of Research - Vibration Measurement, Condition Monitoring and Fault Diagnosis
Prof. Bipin Mashilkar	**M. E. (Mumbai University) -** CAD/CAM and Robotics Assistant Professor (Exp. - 14.5 years) Area of Research – CFD
Prof. Pallavi Khaire	**Ph.D. Pursuing (VJTI, Mumbai)** **M. E. (Mumbai University)** - Machine Design Assistant Professor (Exp. – 12.5 years) Area of Research - Mechanical Vibration, Machine Design and Condition Monitoring
Prof. Praseed Kumar	**M. E. (Mumbai University)** - Machine Design Assistant Professor (Exp. – Industrial - 8 years, Teaching - 13 years) Area of Research - Active Vibration and Control, Control Systems, Smart Materials and Measurement

Prof. Kamlesh Sasane	**M. E. (Mumbai University)** - Machine Design Assistant Professor (Exp. - 13.5 years) Area of Research - Design Analysis, Mechanical Vibrations, Automobile and Mechanical Materials
Prof. Deepak Devasagayam	**M. E. (Old Dominion University, US**) - Mechanical Engineering Assistant Professor (Exp. – Industrial - 5 years, Teaching – 10 years) Area of Research - Manufacturing, Production, Solar
Prof. Nilesh Varkute	**M. E. (Mumbai University) -** Thermal Engineering Assistant Professor (Exp. - 12 years) Area of Research - Computational Fluid Dynamics, Heat Transfer, Renewable Energy and Energy Management
Prof. Girish Dalvi	**M. S. (Politecnico Di Milano, Italy)** - Mechanical Systems Design Assistant Professor (Exp. - 11 years) Area of Research - Vibration Measurement and Analysis, Virtual Instrumentation and Mechatronics
Prof. Suvarna Rode	**M.E. (Mumbai University)** - Machine Design Assistant Professor (Exp. – Industrial - 3.5 years, Teaching - 12.5 years) Area of Research - CAD/CAM, Smart Material and Structures

Prof. Badal Kudachi	**M. Tech. (VTU, RC, Mysore) -** Thermal Power Engineering Assistant Professor (Exp. – Industrial - 6 months, Teaching – 7 years) Area of Research – Renewable, Thermal Barrier Coating, CFD and Energy Storage
Prof. Mohammad Afzal Alam Ansari	**M. Tech. (IIT Bombay) -** Aerospace Propulsion Assistant Professor (Exp. – Industrial - 6 months, Teaching – 7 years) Area of Research – Propulsion, CFD, FEA, Combustion, Thermoacoustic
Prof. Shoumik P. Kulkarni	**M. Tech. (WCE) –** Mechanical Design Engineering Assistant Professor (Exp. – Teaching – 4 years) Area of Research – Mechanical Vibrations, Vibro- Acoustics
Prof. Sunny Sarraf	**M. Tech. (VNIT) -** Mechanical Engineering / CAD CAM Assistant Professor (Exp. – Industrial - 1 Years, Teaching – 5 years) Area of Research –FEA, CAD CAM, 3D Printing and Bio-modelling
Prof. Amar Murumkar	**M. E. (Mumbai University) -** Manufacturing Systems Engineering Assistant Professor (Exp. – Industrial - 8 Years, Teaching – 6 Years) Area of Research – Quality, TQM, Six Sigma and Cost of Quality

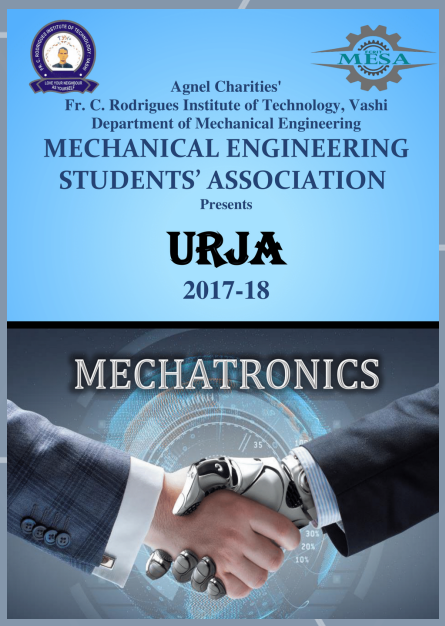
Prof. Shoaib Shaik	**M. E. (Mumbai University) -** Machine Design (Exp. – Teaching – 9 years) Area of Research –Machine Design and Operation Research

Non-teaching Staff	
Mr. Sayaji Atole	Lab Assistant
Mr. Sandeep Arote	Lab Assistant
Mr. Pankaj Wavhal	Lab Assistant
Mr. Pravin Patil	Lab Assistant
Mr. Narayan G.	Lab Assistant
Mr. Sanjay Junonikar	Lab Assistant
Mr. Rego Menezes	Lab Attendant

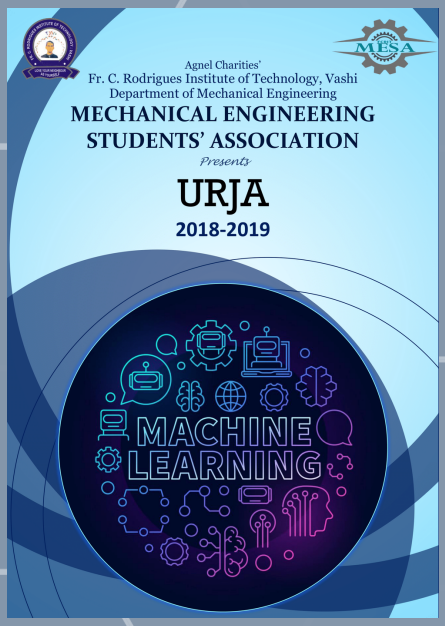
ABOUT URJA

URJA is the annual magazine published by MESA which is based on various technological topics, where articles are published related to research papers and inventions that provide a glimpse into new and upcoming engineering advances. URJA also gives an insight into the annual activities performed by MESA in association with Mechanical Department. Here is a glimpse of URJA 2018-19 which was based on a very trending and evolving theme of MACHINE LEARNING.

URJA 2016-17



URJA 2017-18



URJA 2018-19

URJA 2019-20