INVICTUS - 2018
Inaugural address by SK Shirguppi, SVP – Rolta India Ltd
Industry 4.0 – Trends in Manufacturing Industry

Dr. Huggi, Principal, TechFest Organizers, Staff & Students Ladies and Gentlemen.

A very Good Morning to you all today. I feel honored and privileged to be amongst this august and distinguished gathering. It's really a nostalgic feeling to be back with my alma matter which has imbibed in me a great sense of quality education thus molding me as a responsible individual.

In the morning today I was interacting with some of the students of Mechanical Engineering Department alongwith the Faculty members and I must state on record that this Campus and the institution has come up really well in last 2 decades and buzzing with activities. I can clearly remember having spent my last 2 years in this new building which was still under construction when I passed out in 1987. I also feel proud to see such a large gathering of students from various Engineering Colleges from nearby sates and a large team from Mandya Engineering College attending this unique Techfest hosted by our own Engineering College here in Bijapur. When I heard that this TechFest has been termed as "Invictus" I was quite inquisitive to know what it stands for and its meaning which is a real tongue twister. I googled and realized that it is a title of a short Victorian poem by the English poet William Ernest Henley. "Invictus" is a Latin word meaning "unconquered" and let me start with the first few lines of the poem which are very relevant here for today's program.

Out of the night that covers me,

Black as the pit from pole to pole,

I thank whatever gods may be

For my unconquerable soul.

This is Very interesting and aptly named **to take an edge to conquer the unconquered** for this event and congratulations to all Students and faculty who have put in their efforts making this event happen that will benefit all to keep pace with the recent technological developments.

Now coming to the event today and how I landed here. I was in Bijapur recently for attending a marriage in the family when I was approached by the organizing committee Secretary of this TechFest Prof. Srikant Purohit who mentioned that the Engineering College Staff & Principal are very keen to have me as the Chief Guest for this Inaugural session. I was a bit surprised to also note that they had researched my profile and thought it fit for me to be the Chief Guest and to address the students and faculty on this occasion. Even though it was scheduled on a working Friday involving travel from Mumbai I readily accepted the invite as I am always excited to participate in such technical events and also considered a right occasion for me to come back to my alma matter. Thank you once again for considering me Sir Dr.Huggi and the entire Organizing Committee for giving me this honor.

Now having accepted the offer I then requested them to help me with the topic on which I need to speak so that I can be relevant to the students and faculty rather than me picking up a topic of my choice. So accordingly, I was informed to speak on the **"Latest Trends and Developments in the Industry specifically Industrial Automation"**. This made my job much more difficult as you all know that Automation is really a vast subject in today's world and given a choice, I could spend hours and days covering this subject while detailing Automation aspects being applied in various industries. Then I sat back quietly and thought for a while, and decided to introduce to all the students and faculty the concept of **Industry 4.0 – Trends in Manufacturing**, which is the current buzzword, and this way I would cover all relevant aspects of automation, trends and development in various industries.

Let me first familiarize you all with few simple examples of what **Industry 4.0** is all about and how it is changing the way we live, the way we look at things, the way we interact with each other etc etc.….

I am sure many of you order products using Amazon, Flipkart etc…..You search for a product, read the reviews, put it in cart or just ignore…Next the system automatically starts suggesting certain products based on your search trends and list similar products from other suppliers you have researched or reviewed…It also suggests that others who were looking for this product also purchased some other relevant items. For e.g you are searching for a Smasung Note8 and the system automatically starts recommending you to look for its screen guard, covers, Dash charger, discounts offered and associated items. This search results will also be reflected into your Facebook Account, Google Account, Instagram, Twitter whenever you login to them.

Similarly when you make online bookings for Hotels, Bus, Flights etc using various portals like Booking.com, Trivago, Agoda, Makemytrip etc…and based on your searches and selections you start receiving recommendations, options from other sites based on your trends and it will also suggest who your other friends have also visited this place in past or have liked this hotel etc..

There are devices or equipments which we use in our daily lives like Refrigerators, Washing Machines, Smart TVs, Cars etc which are now called as connected devices also known as Smart device. These Smart Devices are electronic devices, generally connected to other devices or networks via different wireless protocols such as Bluetooth, NFC, Wi-Fi, 3G, 4G, Cloud etc., that can operate to some extent interactively and autonomously. These are termed as Internet of Things (IoT), which describes the world in which objects that form part of our everyday lives can communicate through various networks.

Let me take an example of connected devices - Amazon Echo is a brand of smart speakers developed by Amazon. The devices connects to the voice-controlled intelligent personal assistant service Alexa, which responds to the name "Alexa". The device is capable of voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, playing audiobooks, and providing weather, traffic and other real-time information. It can also control several smart devices acting as a home automation hub.

Echo devices also have access to 'skills' built with the Alexa Skills Kit. These are third-party-developed voice experiences that add to the capabilities of any Alexa-enabled device. Examples of skills include the ability to play music, answer general questions, set an alarm, order a pizza, get an Uber, and more. Skills are continuously being added to increase the capabilities available to the user. The Alexa Skills Kit is a collection of self-service APIs, tools, documentation and code samples that make it fast and easy for any developer to add skills to Alexa. All of the code runs in the cloud – nothing is on any user device.

This is in nutshell **Industry 4.0** for an amateur or layman, which I will now elaborate further in more technical depth.

Today, we are at a Pivotal point in the history. If you haven't been paying much attention to the last century of industrial history, you might be forgiven for thinking that we have only had the one revolution: in the time period between 1760 and 1840. First came steam and the first machines that mechanized some of the work our ancestors did. This represents the transition from skilled artisans making goods by hand to (relatively) unskilled workers using machines powered by a water wheel or steam engine. The transition was most prevalent in the textile industry, but the effects of the first industrial revolution were eventually felt in almost every aspect of daily life.

That was **Industry 1.0**, and we're on our way to **Industry 4.0**, so what about **versions 2.0 and 3.0**?

The second industrial revolution took place over the end of the 19th century and beginning of the 20th from about 1870 to 1914 and the beginning of World War I. Unlike the first industrial revolution, which was characterized by the advent of new technologies, the second industrial revolution had more to do with improving existing technologies and the synergies between them. For example, electricity replaced water and steam as the primary power source in the factories. The second industrial revolution also marked the beginning of the assembly line, interchangeable parts and, with them, started mass production.

The third industrial revolution, like the first, saw the introduction of **disruptive new technologies** such as, automation and the computer. These advancements brought about monumental changes to manufacturing, enabling levels of precision (thanks to industrial robots) and accuracy (thanks to Computer Numerical Controled (CNCs) machines, never before seen on the shop floor. Pinpointing the time period for the third industrial revolution is tricky, because—at least on some accounts—we're still in it even today, but the beginning can be traced to the early 1960s, which saw the introduction of the first industrial robot and first commercial CNCs.

Let me give you one classic example of the impact of such disruptive technology. You all know how capturing photography has changed our lives. This is a digital world to capture images replacing physical photographs.

All of you must know that there was a large corporate known as Kodak who after decades of being an undisputed world leader in film photography, Kodak built the first digital camera way back in 1975. Kodak followed the razor and blades strategy of selling inexpensive cameras and making large margins from consumables like films, chemicals and paper. As late as 1976, Kodak commanded 90% of film sales and 85% of camera sales in world. But then, the story goes on, the company could not see the fundamental shift from analog to digital technology that was happening right under its nose. Kodak began to struggle financially in the late 1990s, as a result of the decline in sales of photographic film and its slowness in transitioning to digital photography. In 2012, Kodak filed for bankruptcy protection in the United States Court. Kodak announced that it would stop making digital cameras, pocket video cameras and digital picture frames and focus on the corporate digital imaging market. Kodak sold many of its patents to a group of companies. This is the impact of disruptive new technologies.

Today Manufacturing industry trends are in the limelight as the industry's greatest change is happening in the recent times. Over the last several years, there has been significant advances in and adoption of new automation technologies. Latest technology in manufacturing industry makes automation companies to reinstate more workers every day. On the other hand, the way we build and deliver the goods & products that fuel our economies, our lives will be different.

And now we enter **Industry 4.0**, in which computers and automation will come together in an entirely new way, with robotics connected remotely to computer systems equipped with machine learning algorithms that can learn and control the robotics with very little input from human operators.

Thus **Industry 4.0** is truly revolutionizing manufacturing industry. This helps accelerate the ongoing convergence of information technology (IT) and operational technology (OT) to support digital transformation. In 2018, there has been an a definite acceleration of this IT/OT convergence, particularly as this relates to the acceptance of and proliferation of **Industrial Internet of Things (IIoT)-enabled** solutions, **cybersecurity, edge computing, augmented reality (AR), robotics, smart manufacturing, artificial intelligence (AI), analytics, digital twins, and progress on the Open Process Automation (OPA) front**. Manufacturing facilities have been incorporating greater levels of automation, so the rise and demand for new technologies is growing rapidly.

You should closely observe that the odd-numbered revolutions were the apparent result of **disruptive new technologies**, for e.g., the steam engine or computer. In contrast, revolution 2.0 had less to do with the invention of new technologies than with enhancing the synergy between them. If the pattern holds good, we should thus expect **Industry 4.0** to involve more optimization than invention.

Industry 4.0 introduces what has been called the "smart factory," in which cyber-physical systems monitor the physical processes of the factory and make decentralized decisions. The physical systems become Internet of Things, communicating and cooperating both with each other and with humans in real time via the wireless web. The smart factory, also sometimes called "the factory of the future" is the keystone of the fourth industrial revolution. Indeed, it's often represented as the aggregate of all the **Industry 4.0** technologies: cyber-physical systems—physical assets connected to digital twins—the Industrial Internet of Things (IIoT), data analytics, additive manufacturing and artificial intelligence.

Lets take a look at the Intelligence at the Edge. As more data-intensive compute workloads are pushed to the network edge, real-time remote management and a simplified edge infrastructure are crucial for success. Operational issues, such as managing asset performance to improve production while reducing unplanned downtime will drive end users to deploy edge computing.

Companies that take advantage of self-managed, edge computing infrastructures will be able to unlock additional data that had previously been stranded inside machines and processes. They will also be able to more quickly identify production inefficiencies; compare product quality against manufacturing conditions; and better pinpoint potential safety, production, or environmental issues. Remote management will enable on-site operators to connect in real time with off-site experts to more quickly resolve, or even avoid, downtime events. This will help to free operations people and IT staff to perform their respective roles, making best advantage of their specific expertise.

Latest technologies and tools are allowing companies to create and test situations in the contemporary world. These latest trends help to stimulate the design process and the assembly line before an actual product is created.

Many companies have been using augmented reality solutions for remote assistance as they allow people in various locations across the globe to connect in a live view and trouble-shoot together. Technical issues can be resolved and receive feedback in real time through **wearable Augmented Reality (AR) glasses**, expediting problem solving and significantly reducing travel costs.

For example look at 3D Printing which plays a key role in manufacturing industry allowing for the seamless creation of tangible products using a single machine. 3D printing in manufacturing industry provides more possibilities for how you design a part. On the other hand, 3D printing can help you achieve the same thing in one piece without additional processes such as screwing, welding for a certain category of product where you would normally require six pieces. Waste can be reduced using three-dimensional printing, recycling of plastic and cuts down on the wait time for replacement parts and transportation.

Next, let me bring to you some of the advances in industrial cybersecurity management solutions, which are being deployed to address the unique requirements of industrial automation equipment, applications, and plants; particularly as these relate to the stringent constraints on system updates and network communications. These advances will incorporate commercial-type IT cybersecurity management solutions, but in a manner that limits any negative impacts on control system operation.

More importantly, these new industrial cybersecurity management solutions will extend this functionality to include unique, non-PC-based industrial assets and control system protocols. These solutions will also recognize and manage industry-specific cybersecurity regulations, such as Critical Infrastructure Protection CIP, and leverage new integrated strategies that combine IT, OT, and IIoT security efforts, maximizing the use of all corporate cybersecurity resources.

Challenges continue to grow for the industrial cybersecurity community. Broader deployment of operational technology is expanding the use cases requiring protection. Resource shortages are undermining the effectiveness of established

defenses. Blurring boundaries between IT, OT and IoT are increasing the need for more integrated, collaborative cybersecurity strategies.

Industrial plants and infrastructure systems need secure control systems to ensure safe, reliable operation. Widespread use of operational technologies in smart cities presents a similar challenge. Compromised systems jeopardize citizen safety, business continuity, and effective delivery of critical government services like water and sewage. To avoid such incidents, smart city planners need people who understand operational technology and the associated security challenges. Leveraging the experiences of the industrial cybersecurity community is essential.

Cybersecurity challenges are also increasing within the traditional plants and infrastructure systems. Many plants still lack the resources to sustain defenses or proper strategies to enable external support. Deployment of IIoT strategies is proceeding without real solutions for critical issues like secure-by-design-devices and secure supply or support chains. Growing use of cloud-based solutions are undermining the ability of in-house teams to govern security practices. Segregating cybersecurity efforts by technology is no longer a sustainable approach.

On top of that Cybersecurity technology is moving very fast. There are more choices than ever in technology, techniques, deployment architectures, and service providers.

Some of the key areas where we see increasing trends are

Anomaly and Breach Detection: *The market for industrial cybersecurity products and services continues to evolve, develop and expand. Increased awareness of cyber risks, governmental actions, and more comprehensive regulations have driven the development of new solutions and a new cadre of suppliers.*

Next is Endpoint protection*, which is a central focus of every industrial cybersecurity strategy. Despite the known limitations, most industrial*

companies still use anti-malware software wherever possible in their control systems. Some also use application whitelisting. Automation companies are like-wise applying these security products in their control systems.

The endpoint protection solutions used in control systems are generally the same as those used for corporate IT. However, the application of these products is more constrained. Industrial users also have unique challenges in maintaining malware signatures, etc. These differences impact the features industrial users want and the value they place on the new developments occurring in the endpoint protection market.

***Next comes the Industrial cybersecurity management solutions**, which includes a broad range of products for maintaining a facility's security posture. This is a distinct segment of the overall cybersecurity management solutions market, distinguished by the unique features of industrial automation equipment and the need to respect stringent constraints on system updates and network communications.*

***Finally Industrial network security solutions**, which include a broad range of products for protecting plants, networks, and endpoint assets. This is a distinct segment of the overall networking products, distinguished by the unique requirements of systems that control critical industrial assets and infrastructure. This market segment is also distinguished by its focus on operational safety and availability, as opposed to the conventional IT focus on information privacy and confidentiality.*

The next advancement in **Industry 4.0** is in the area of **open process automation (OPA)** vision which, is gaining additional traction, with the Open Process Automation Forum adding new end user and supplier members.

Initiated by ExxonMobil and managed by The Open Group, this initiative aims to build a proof-of-concept prototype, establish standards for, and ultimately build commercial open process automation systems that minimize vendor-specific technologies and increase overall return on system investment, while maintaining stringent safety and security. This would be achieved by specifying

highly distributed, modular, extensible systems based on standards-based architecture for interoperable components, with intrinsic cybersecurity.

The objective is to eventually replace large **CapEx automation** retrofit programs with smaller **OpEx programs** that require less analysis, engineering, and planning. Updates to these new open systems will be managed as a maintenance activity. These new systems will consist of smaller, more modular and more easily distributed components. These systems will better empower technical personnel, reducing the level of training required and facilitating additional benefits through collaboration.

Ladies and Gentleman New technologies are accelerating the merging of the virtual and physical worlds, enabling the creation of new business models. Manufacturers are introducing new business models under which they sell digital services along with products. Examples include digital twins, which are a virtual replication of an as-designed, as-built, and as-maintained physical product. Manufacturers augment the digital twin service with real-time condition monitoring and predictive analytics. Customers use the equipment and products along with maintenance and operational optimization services based on predictive and prescriptive analytics. The process licensors for large pieces of equipment at refineries and petrochemical plants that, in essence, run their processes for converting petroleum into other chemicals. The challenge is always that the technology is optimized when it is delivered but needs to be operated in a particular way to maintain that level of optimization over a period of time. It can be challenging for customers who do not have the skills to ensure that those pieces of equipments are constantly optimized.

By connecting that equipment up to DCS cloud environment, you're able to monitor its performance against its nameplate capacity and identify instances where it's starts to degrade. More than that, one can very clearly understand the reason why it's happening and provide an advisory service to the customer to make the change. This sort of predictive maintenance enabled via the cloud is exactly the sort of optimization that comes with the fourth industrial

revolution. By taking production data beyond the four walls of plant, manufacturers will be able to eliminate unplanned downtime across their facilities and gather insights for improving efficiencies beyond what has been previously possible.

Augmented reality (AR) technologies are used to connect virtual design to physical equipment for operator training and visualization, as well as for machine maintenance. Thanks to IIoT, Cloud, Big Data, and operational analytics; **artificial intelligence (AI)-based machine learning (ML)** solutions can be used to make operational changes without the need for programming.

Let's look at Building intelligent factories in the cloud technology which in addition to the virtual reality and robotics, factories environments are creating advancements in cloud computing and smart sensors. These sensors can carry out tasks such as converting data into different units of measurement, communicating with other machines, recording statistics and feedback and also closing off devices.

IoT functionality can track and evaluate production quotas, consolidate control rooms and create models of predictive maintenance. Internet of things helps to get the information at the right time to make the right decisions in such a way like your speedometer showcasing how fast you are driving today versus your speed from yesterday.

Next comes the Industrial IoT-enabled distributed analytics, which will further extend data processing and computing close to or at the data source, typically through intelligent, two-way communication devices, such as sensors, controllers, and gateways. In many instances, the data for distributed analytics comes from IIoT-connected devices located at the edge of the operational network.

These devices can be located near or embedded in a wide variety of edge machines and equipment, such as robots, fleet vehicles, and distributed microgrids. The analytics can be embedded within distributed devices or created in a cloud environment and then sent to the edge for execution. From an

operational perspective; security, privacy, data-related cost, and regulatory constraints are often the reasons cited for keeping the analytics local.

Distributed analytics can help support revenue generation from new methods of serving existing customers and ways to reaching new ones. These include asset optimization through improved, proactive, and highly-automated management of infrastructure and resources; higher satisfaction and retention by engaging customers with high-value products and services where and when they need them; and improved operational flexibility and responsiveness through better and faster data-driven decisions.

You all are seeing Robots on the rise i.e. managed by humans for building a better manufacturing sector with augmented, virtual reality, robotics and data analysis using smart equipments can raise to a question: what will the **Industry 4.0** workforce will look like?

This results in robots as a complement to, not a replacement for, human workers. We can enhance our output using these robots. Industrial automation is another important aspect of the industry's future. This enables to attain accuracy and productivity beyond human capability even in environments that would be considered hazardous for humans. However, newer generations robotics are easy to use, simple to program, with capabilities such as voice and image recognition to re-create complex human tasks.

Another benefit of robotics is that they do precisely what you order or ask them to do. Robots reduce most tedious manufacturing jobs and also create new jobs for a re-trained workforce.

A shift to manufacturing industry trends in industrial automation helps to have a bright future and make business into greater profits, healthier economies. As the automation industry is moving into more complexes, companies are making products symbiotically ushering in a new era of production.

Summary: In summary Successful digital transformation will be a prerequisite for industrial organizations to compete effectively and maximize business

performance. When looking for a place to start the digital transformation process, asset performance management (including avoiding unscheduled downtime) is a great place to focus on.

End users and OEMs alike are embracing, digital transformation. While the increasing convergence of operational technology (OT) and information technology (IT) serves an enabler, this digital transformation must still embrace legacy assets, as plants will not "rip and replace" old, but otherwise well-functioning, equipments without financial cause. Legacy assets must remain a part of, and be integrated into the solutions for digital transformation wherever possible.

Succeeding here will require both an open mind for emerging technologies, approaches, and business models; and close collaboration between OT and IT groups at the respective operations and enterprise levels, as well as with technology suppliers and industrial and governmental consortiums. While not all technologies, solutions, and approaches will be right for all companies, it's important to understand what's going on, what's available today, what's likely to be available tomorrow, and what peer organizations are doing to be able to determine where to best focus your limited human and financial resources.

Over the last several years, there has been significant advances in and adoption of new automation technologies. This rate of change and subsequent adoption will continue to ramp up in the coming year. Many of the recent advances include industrializing some popular consumer technology. This helps to accelerate the ongoing convergence of information technology (IT) and operational technology (OT) to support digital transformation.

Despite all the optimism that comes with the future of manufacturing, there are good reasons to be concerned, too. Chief among them is the so-called skills gap. According to analyses from Deloitte, there will be 3.5 million job openings in manufacturing over the next decade but only enough skilled labor to fill less than half of them.

With 2 million jobs potentially unfilled, there have been many proposals for upskilling the workforce in short order. Efforts to attract more millennials to take up careers in manufacturing—for example, by using social media—have met with some success, but what if the real solution to the skills gap is a technological one? To be clear: this isn't meant to imply the kind of "automation-run-amok" hyperbole that's often found in the outsider's perspective.

For a factory or system to be considered **Industry 4.0** compliant, it must include:

- Interoperability — i.e machines, devices, sensors and people that connect and communicate with one another.
- Information transparency — where the systems create a virtual copy of the physical world through sensor data in order to contextualize information.
- Technical assistance — needs both the ability of the systems to support humans in making decisions and solving problems and the ability to assist humans with tasks that are too difficult or unsafe for humans.
- Decentralized decision-making — requires the ability of cyber-physical systems to make simple decisions on their own and become as autonomous as possible.

But as with any major shift, there are challenges inherent in adopting an **Industry 4.0** model like:

- Data security issues are greatly increased by integrating new systems and more access to those systems. Additionally, proprietary production knowledge becomes an IT security problem as well.
- A high degree of reliability and stability are needed for successful cyber-physical communication that can be difficult to achieve and maintain.
- Maintaining the integrity of the production process with less human oversight could become a barrier.
- Loss of high-paying human jobs is always a concern when new automations are introduced.

- And avoiding technical problems that could cause expensive production outages is always a concern.
- Additionally, there is a systemic lack of experience and manpower to create and implement these systems — not to mention a general reluctance from stakeholders and investors to invest heavily in new technologies.

But the benefits of **Industry 4.0** model could outweigh the concerns for many production facilities. In very dangerous working environments, the health and safety of human workers could be improved dramatically. Supply chains could be more readily controlled when there is data at every level of the manufacturing and delivery process. Computer control could produce much more reliable and consistent productivity and output. And the results for many businesses could be increased revenues, market share, and profits.

Reports have even suggested that emerging markets like India could benefit tremendously from **Industry 4.0** practices. Today the city of Cincinnati, Ohio has declared itself an "**Industry 4.0** demonstration city" to encourage investment and innovation in the manufacturing sector there.

As I said earlier this is a vast subject and will need many days to explain its impact on each of our industries. Atleast with this introduction today I am sure this is a good food for thought for you all to start researching the web for various write-ups, applications and tools related to **Industry 4.0**. With this I urge all Students and Staff of this esteemed institution to take a closer looks at the advancements happening with **Industry 4.0** and to be relevant to the current market trends you all must align your courses and curriculum in that direction so that students who pass out from here remain relevant to the industry requirements. I am very sure that this technology event and conference will serve as a forum for all of us to network, share and explore emerging opportunities and technological innovations to explore various opportunities more efficiently.

As I said in the morning where I enlisted **10 Benefits of Engineering Career** of which I would like to repeat the **last 10th Benefit**, which is very critical for success for all Engineers today.

Creative Thinking, Thinking out of Box, which is also known as Smart Thinking. Because we are in a time of rapid social and technological changes, the need for engineers to think creatively, Out of the Box and Smartly is greater now than ever before.

So Ladies & Gentlemen, I would like to convey my sincere gratitude to all the organizers of this event, Faculty, Students and specially the Organizing Committee, Prof Srikant Purohit, Organizing Secretary and Dr. Huggi, Principal for specially inviting me to Chair this inaugural session of TechFest "Invictus" and giving me this opportunity to share my thoughts, experience and insights of various recent developments in the Industry known **Industry 4.0.** It is an honor to be part of my alma mater again. I wish you all a very happy and prosperous 2018.

Thank you all.