

**Lakireddy Bali Reddy College of Engineering, Online workshop on
"Introduction to Robotics and Automation"**

	<p>LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS) Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME) Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India</p>	
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ROBOTICS CLUB, DEPARTMENT OF MECHANICAL ENGINEERING
Online Workshop on "Introduction to Robotics and Automation"
(In association with European Centre for Mechatronics, Germany)
18th to 20th June 2020 @ 2.00PM to 3.00PM

Objective: At the end of the workshop, the students will be able
To understand the basics of Robotics and Automation
To have a close look into Anatomy, Kinematics of Robot
To programme and control the robot



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<p>THREE DAY ONLINE STUDENT WORKSHOP ON INTRODUCTION TO ROBOTICS AND AUTOMATION</p>		
<p>From 18th to 20th June 2020 @ 2.00PM to 3.00PM E-certificate will be provided for all participants who participate on all the days Resource persons from renowned institutions Registration link: https://docs.google.com/forms/d/e/1FAIpQLSf4K_K7iaF3PyQw3Wc7-z5N_RsF4Cc5nuTu_PQWlslbYZUROQ/viewform?usp=sf_link</p>		
<p>Coordinators Mr. J.Subba Reddy Dr.K.Murahari Mr. R. Praveen Kumar</p>	<p>Convener Dr.S.Pichi Reddy</p>	
<p>ORGANIZED BY THE ROBOTIC CLUB, DEPARTMENT OF MECHANICAL ENGINEERING</p>		

Student Coordinator(S)
Mr. K. Siddha Nagarjuna
Mr. Pendem Sai Kumar

Faculty Coordinator(S)
Mr. J. Subba Reddy
Dr. K. Murahari
Mr. A. Nageswara Rao
Mr. R. Praveen Kumar

Convener(S)
Dr. S.Pichi Reddy, H.O.D
Dr. P. Ravindra Kumar

Details of the Workshop:

Registration Details:

Robotics Club Student Coordinator(s):

Mr. K. Siddha Nagarjuna +918639008666

Mr. Pendem Sai Kumar +918897312319

Faculty Coordinator(s):

Mr. J. Subba Reddy +919985100936

Dr. K. Murahari +918074139826

Mr. R. Praveen Kumar +918985923633

Mr. A. Nageswara Rao +918985621662

Convener(s):

Dr. S.Pichi Reddy, H.O.D., Mechanical Engineering

Dr. P. Ravindra Kumar, Prof., Mechanical Engineering

Principal:

Dr.K.Appa Rao, LBRCE.

The Robotics Club, Department of Mechanical Engineering, Lakireddy Bali Reddy College of Engineering (A), Mylavaram organized an online three days students workshop on *"Introduction to Robotics and Automation"* from 18 to 20 June 2020 from 2 PM to 3 PM through **Google Teams app**. The workshop is focused towards the students who are interested in learning and brushing up their basic concepts in the fundamentals of Robotics and Automation. The faculty and Alumni shared their experiences during the workshop. Successful projects were demonstrated in the workshop by Alumni and basic concepts of Robotics and Automation will be covered in the workshop.

The students are joined in the whatsapp group with the following link to share the information about the workshop from time to time.

<https://chat.whatsapp.com/HWGI3dbEWFrdUwojRWWcFO>

Participants are issued an E-certificate on successful attempt of the quiz (released on the 20th June 2020) and submission of their feed back at the end of the workshop.

Registration Details of the workshop: **Free**

Registration Link for 'Fundamentals of Robotics and Automation':

https://docs.google.com/forms/d/e/1FAIpQLSf4K_K7iaF3PyQw3Wc7-z5N_RsF4Cc5nuTu_PQWlslbYZUROQ/viewform?usp=sf_link

To attempt the Previous Quiz, organized by the Robotics Club, Dept of Mechanical Engineering, LBRCE, on "Basics of Robotics" (open up to 20th June 2020) go to the following link:

<https://tinyurl.com/RobocQuiz-LBRCE>

Email: jonnalasu@lbrce.ac.in, Website: www.lbrce.ac.in

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Schedule of the Programme:

S.No	Date	Topics	Resource Person / Faculty / Alumni
1	18-06-2020 (2.00PM to 3.00PM)	Fundamentals of Industrial Robotics: Introduction, Applications, Future Scope	Mr. J. Subba Reddy, Associate Professor, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram
2	19-06-2020 (2.00PM to 3.00PM)	Industrial Robotics: Drive Systems, Power Transmission Systems	Mr. J. Subba Reddy, Associate Professor, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram
3	20-06-2020 (2.00PM to 2.45PM)	Fundamentals of Industrial Robotics: Sensoring System and Programming of Robots	Mr. J. Subba Reddy, Associate Professor, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram
4	20-06-2020 (2.45PM to 3.30PM)	Inform Robotic Programming – Installation, Demonstration and Case Studies	Mr. P. Sai Kumar, IV yr B. Tech, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram

First Day of the Workshop (18-06-2020):

On the first of the workshop, Mr. J. Subba Reddy, Associate Professor, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram delivered a talk on "Fundamentals of Industrial Robotics: Introduction, Applications, Future Scope".

The screenshot shows a Microsoft Teams chat window for a group named "Robotics & Automation Workshop" which is active from June 18th to 20th, 2020. The interface includes a left-hand navigation pane with icons for Activity, Chat, Teams, Assignments, Calendar, Files, and Apps. The main area is divided into a "Feed" on the left and a "Members" list on the right. The "Feed" shows several messages, including a request to join, a connection issue report, a meeting scheduling notification, and a "Thank u sir" message. The "Members" list is divided into "Owners (4)" and "Members and guests (108)". The owners listed are: SUBBA REDDY, J. (TEACHING, 222933), MURAHARI KOLLI (TEACHING, 222933), SEELAM PICHU REDDY (HOD, 222933), and PRAVEEN KUMAR R... (TEACHING, 222933). The members and guests listed include two students: 19761A0313 (Student, 222933) and 17761A0369 (Student, 222933).

Industrial Robots

1921

The term "**robot**" (robota) was used the first time by the Czechian writer **Karel Capek** in his play "Rossum`s Universal Robot".

→ "Man creates a robot as a forced labour to serve him. But in the end the robot kills man!"



Karel Capek, 1936

1941

The science fiction writer **Isaac Asimov** first used the word "**robotics**" to describe the technology of robots.

He proposed also the "**Laws of Robotics**" :

- Law 1: *Robots may not injure a human!*
- Law 2: *Robots must obey orders given by human beings!*



Isaac Asimov



4G 59.5K/s

2:08 PM

Vol 4G LTE 46%

Fundamentals in Industrial Robotics_1.pdf - Adobe Acrobat Reader DC

File Edit View Window Help

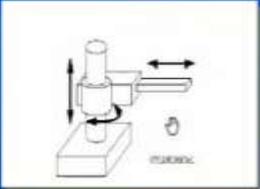
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25 / 45 32.8%

Share

Kinematic Structures

Cylindrical Coordinate Robots



Source: Pesto Industrial

Spherical Coordinate Robots



Source: Urimation

SUBBA REDDY, J



First industrial robots

This invention of G. Devol made available for the first time a **general purpose machine for manipulation** that was able to offer universal application.

In **1956** the first robot company **UNIMATION** was founded by George **Devol** and Joseph **Engelberger** to produce and market this manipulator. The product name was „**Unimate**“.



First industrial robots

Victor Scheinman continued to improve his "robot arm" concept.

In **1977** he started **in cooperation with UNIMATION** and with support from **GM** the production of a very famous, electrically driven 6-axis robot :

PUMA

**Programmable
Universal
Manipulator Arm**

Or:

**Programmable
Universal
Machine for Assembly**



Source: YouTube-First Test of PUMA 500



Major Industrial Robot Manufacturers



Sweden



Germany



Italy



Japan



Japan



Japan



Swiss



Japan



USA



Japan

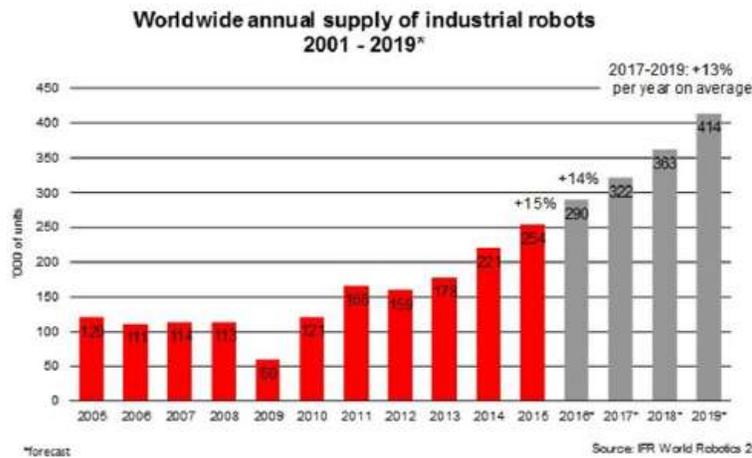


Austria



Industrial Robots worldwide

1.4 million industrial robots between 2016 and 2019



Source: UNECE

4 •

~1.828 Mio robots are operating worldwide in 2016



Second Day of the workshop (19-06-2020): On the Second of the workshop, Mr. J. Subba Reddy, Associate Professor, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram delivered a talk on "Industrial Robotics: Drive Systems, Power Transmission Systems".

Industrial Robots

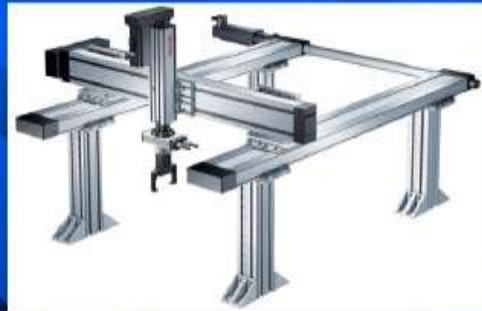
Robot in suspended position

Linear gantry axis



1D workspace extension

Gantry system

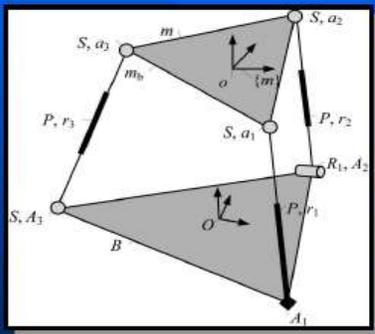


2D workspace extension



Kinematic Structures

Parallel or DELTA Robots



Source: RobotWorx



Industrial Robots

Mechanical design of Industrial Robots:

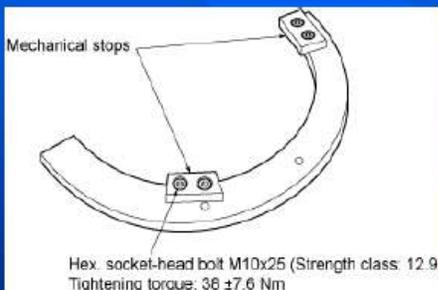
Robots are built from numerous parts:

- **Arm elements** → material= aluminum alloy, carbon steel or cast iron,
- **Actuators** → AC servo motors,
- **Reduction gears** → to reduce motor rotation and to multiply motor torque
- **Transmission devices** → to transmit the mechanical power generated by the motors (for instance by means of belts, spindels, or gears)
- **Sensors** → to measure arm positions and speed of axis motion
- **Cabling** → transmission of electrical power and electrical signals.

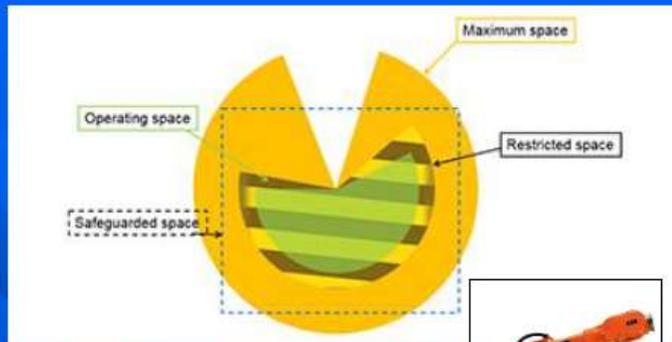
Source: Kawasaki



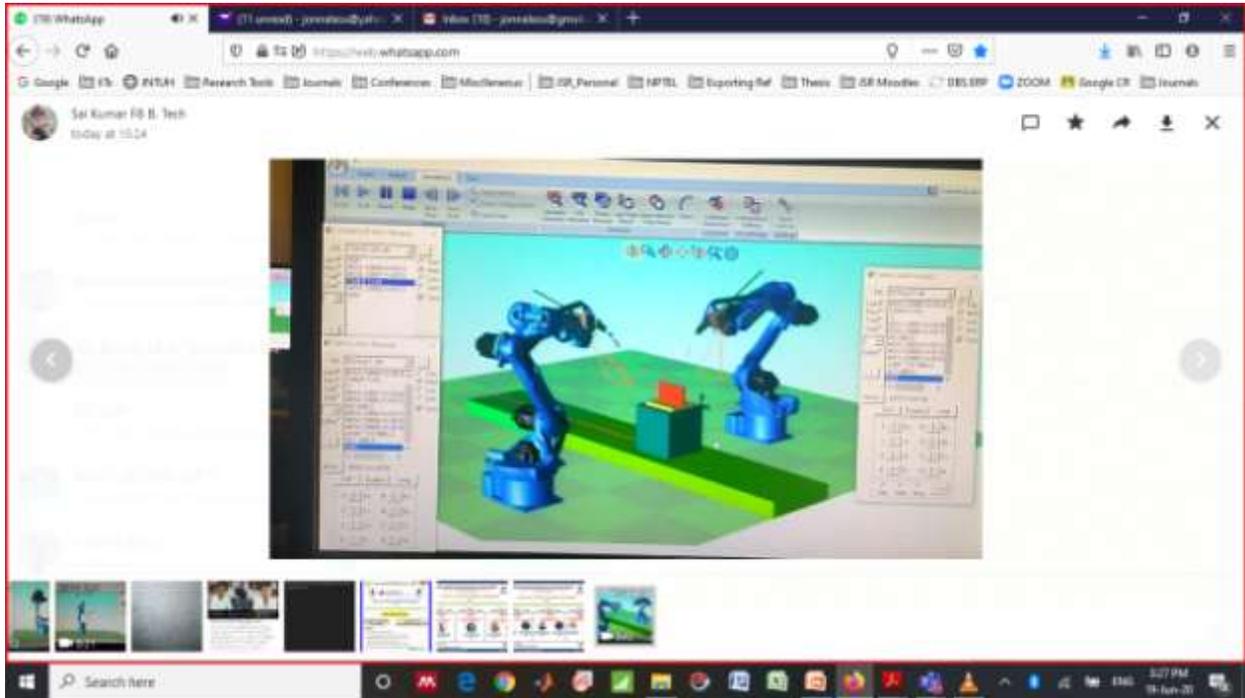
Limitation of Operating Space



- Electrical end-stops
- Mechanical end-stops
- Restricted areas



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Industrial Robots

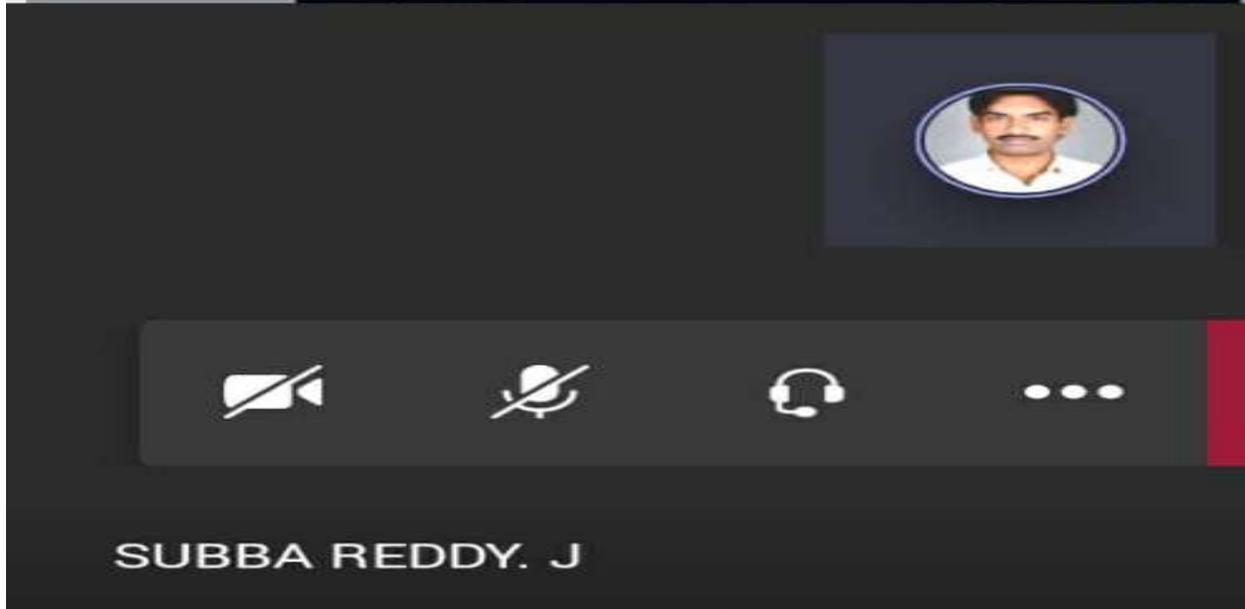
Mechanical structure of Industrial Robots:

- Robots and Humans share the same underlying structure of links and joints;
- The principle of moving joints and transmitting power through the links is common in both humans and robots;

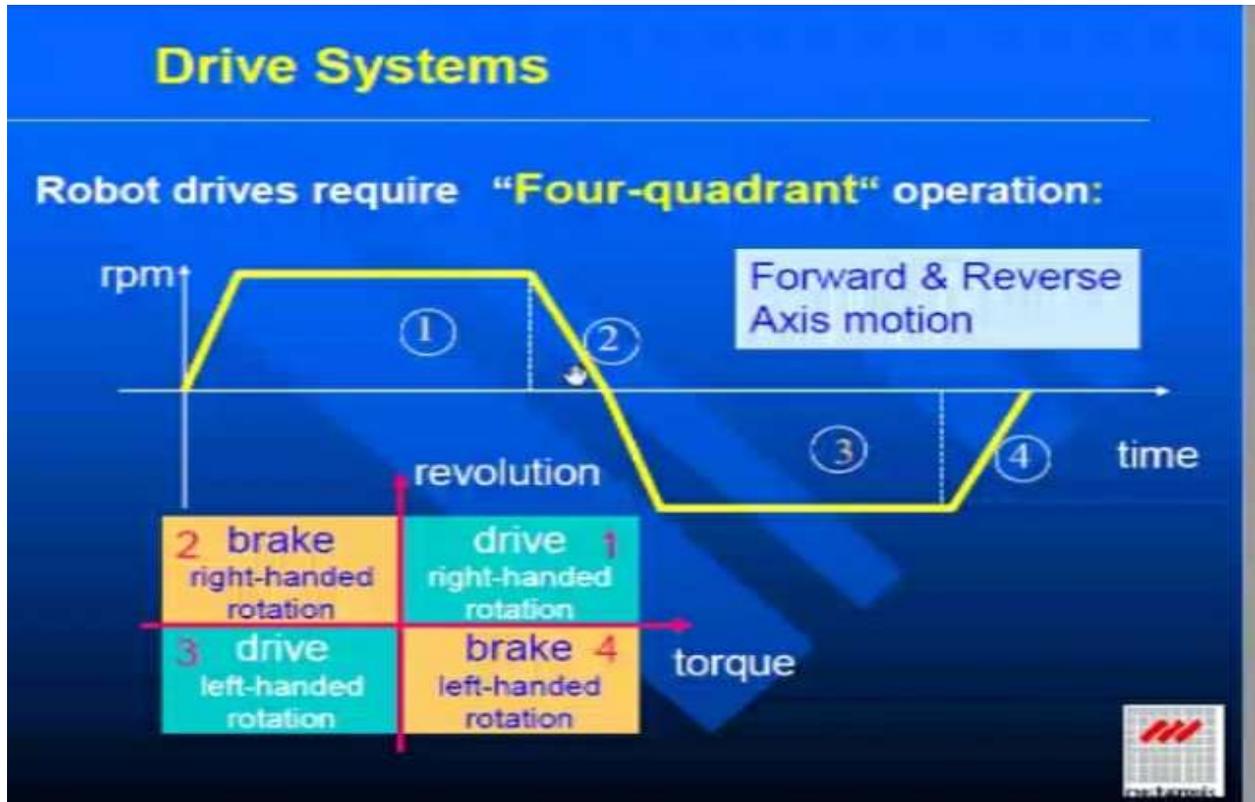


Robots are roughly categorized in two types: „serial link“ and „parallel link“ arrangements. The human arm is arranged as a „serial link“ since its joints (shoulder, arm, and wrist) are aligned in series.

Source: Kawasaki



A Zoom meeting interface showing a video thumbnail of a participant (Subba Reddy. J) and control icons for video, audio, and chat. The name "SUBBA REDDY. J" is displayed below the video thumbnail.

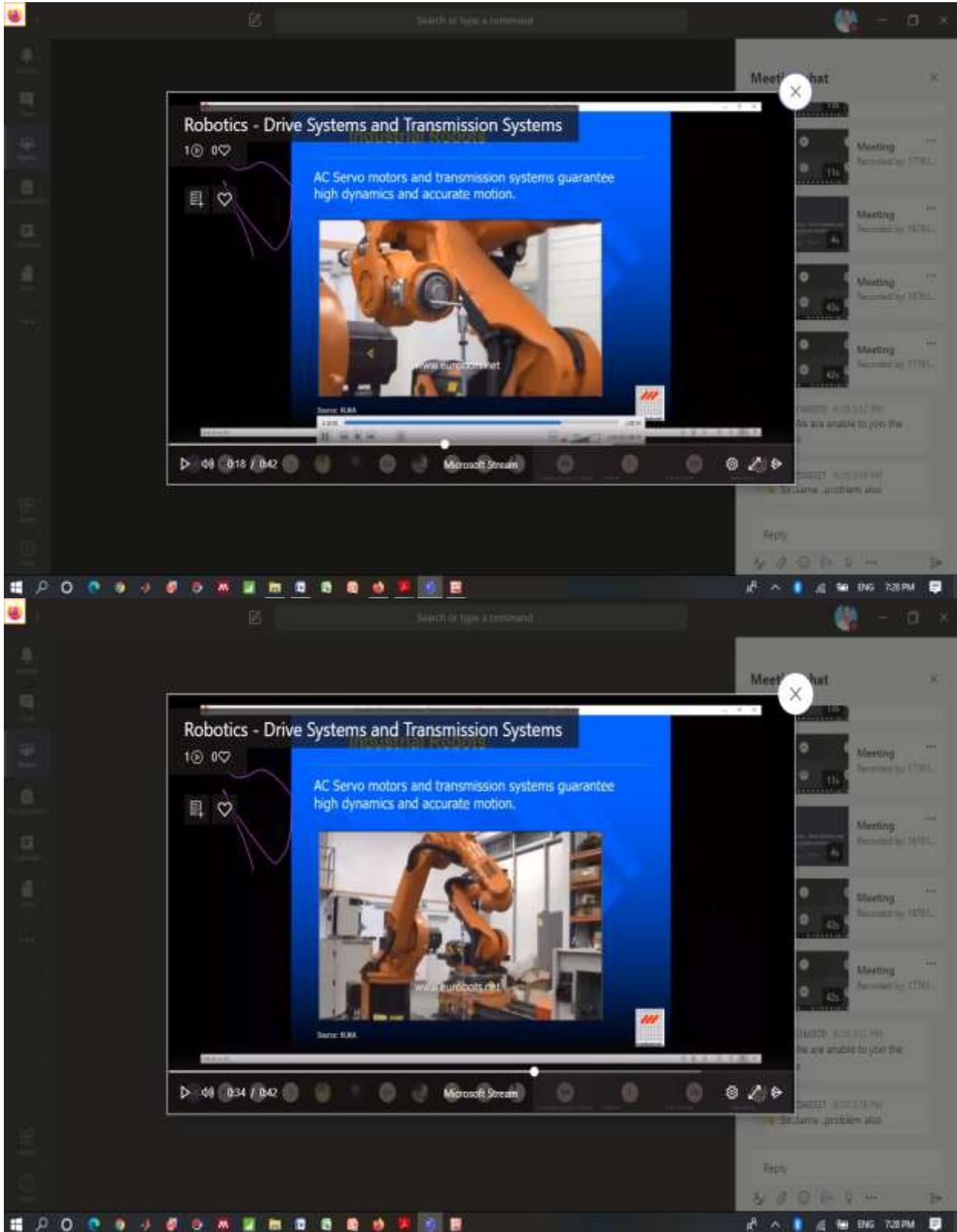


Harmonic Drive Principle

Gear unit:

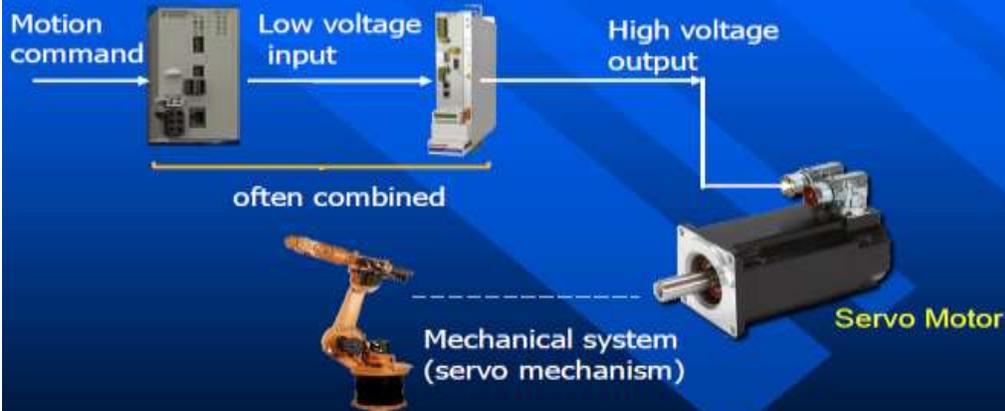
During rotation the wave generator is pressing about 30 teeth into the inner ring of teeth of the circular flexspline → Flexspline rotates at reduced speed.

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AC Servo Drive

The basic Design of a Servo System for Motion Control:



Source: Kollmorgen, Kistler



Power Transmission System

Robot axis



Source: KUKA

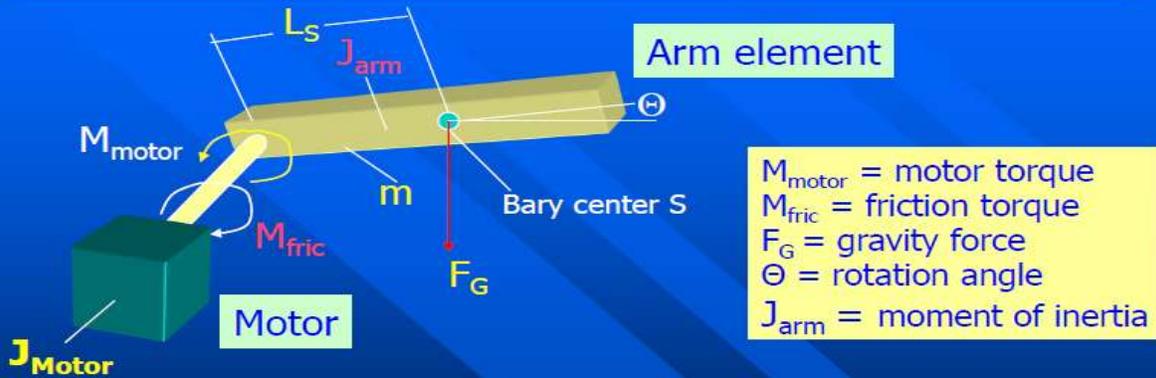


Source: REIS



Drive System:

Manipulator arm



$$M_{motor} = J_{Motor} \ddot{\Theta} + J_{arm} \ddot{\Theta} + m L_S^2 \ddot{\Theta} + M_{fric} + F_G L_S \cos \Theta$$

$$M_{motor} = [J_{Motor} + J_{arm} + m L_S^2] \ddot{\Theta} + k_{fric} \dot{\Theta} + m g L_S \cos \Theta$$

→ $M_{motor} = [H] \ddot{\Theta} + [D] \dot{\Theta} + G(\Theta)$ Dynamic model of a one-axis manipulator arm

Drive System:

Manipulator

To select for this example application is a:

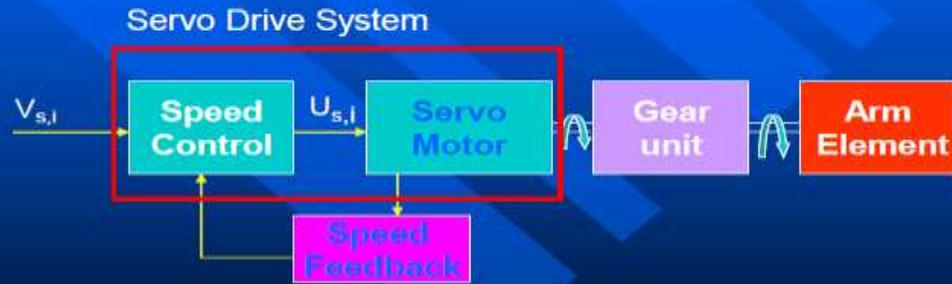
Servo disc motor



Torque: 5,1 Nm
 Max Rot. Speed: 3000 min⁻¹
 Max rotor current: 22 A
 $U_A = 90$ V
 $R_A = 0,47 \Omega$
 $c_M = 0,258$ Nm/A
 $c_E = 27V / 1000$ min⁻¹
 $= 0,258$ Vs/rad
 $VR = 0.00143$ Nms/rad (viscous friction)
 $HR = 0.08$ Nm (dry friction)
 $J_{motor} = 0.0012$ Nms²
 $L_A = 0.000705$ Vs/A

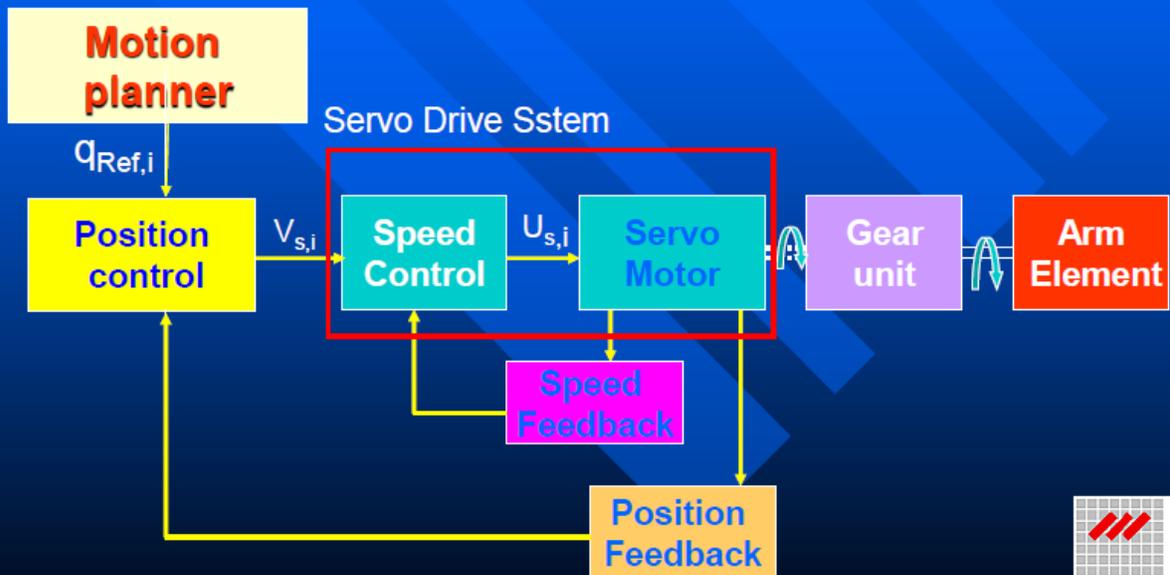
Robot Motion Control

From Servo Drive to Motion Control



Robot Motion Control

From Servo Drive to Motion Control



Third and Final Day of the Workshop (20-06-2020):

On the third of the workshop, Mr. J. Subba Reddy, Associate Professor, Mechanical Engineering, Lakireddy Bali Reddy College of Engineering, Mylavaram delivered a talk on "Fundamentals of Industrial Robotics: Sensing System and Programming of Robots".

Mr. P. Sai Kumar, IV yr B. Tech Student of Mechanical Engineering, LBRCE, Mylavaram has delivered a talk on "Inform Robotic Programming – Installation, Demonstration and Case Studies". Sai Kumar has discussed about installation and demonstration of certain commands of Inform Robotic Programming and Discussed about his project done during his final year.

Motion Control:

Sensor Measurement

Position measurement

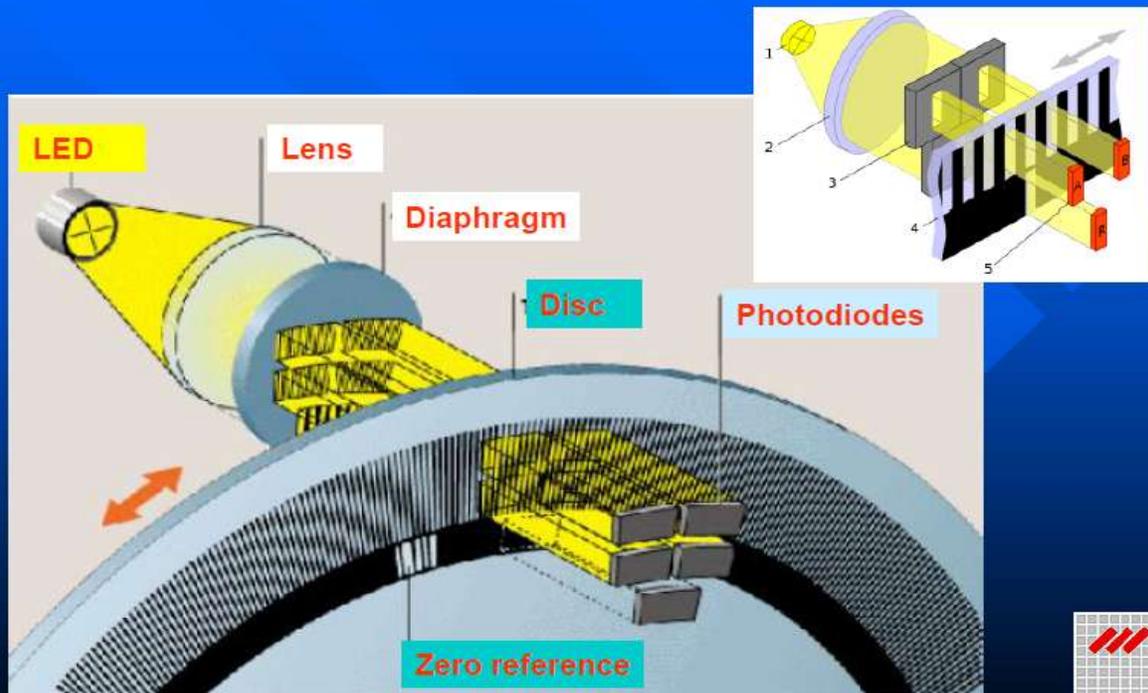
Encoder

- incremental
- absolute

Resolver

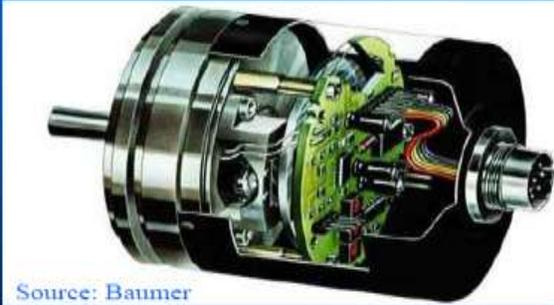
Incremental Encoder:

Principle



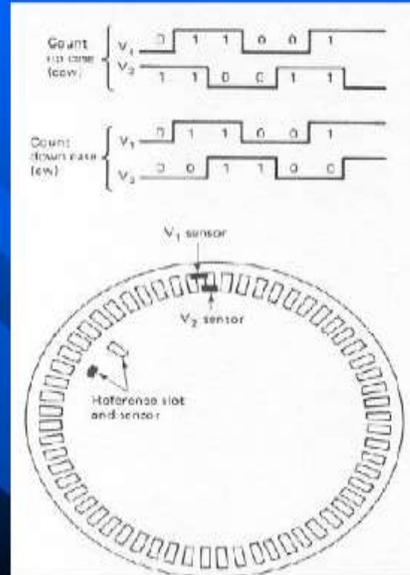
Incremental Encoder: Principle

Incremental encoder:

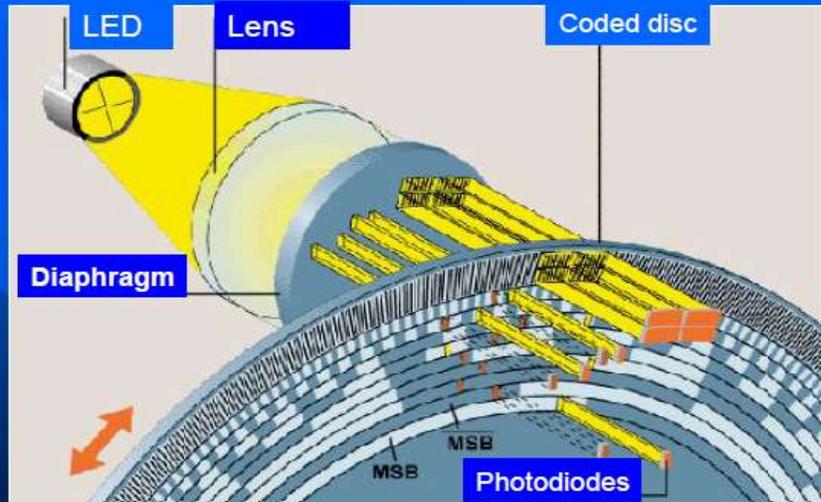
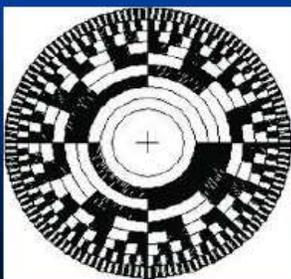
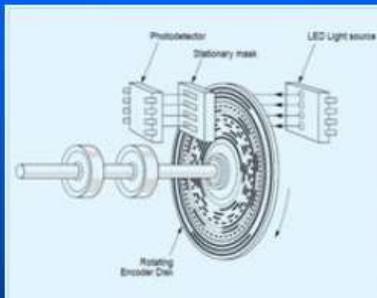


Source: Baumer

- Two sensors positioned with 90° displacement
- Pulses represent the output signals.
- Frequency of pulses is directly proportional to speed of encoder rotation
- Resolution = number of pulses per revolution.



Absolute Encoder: Principle

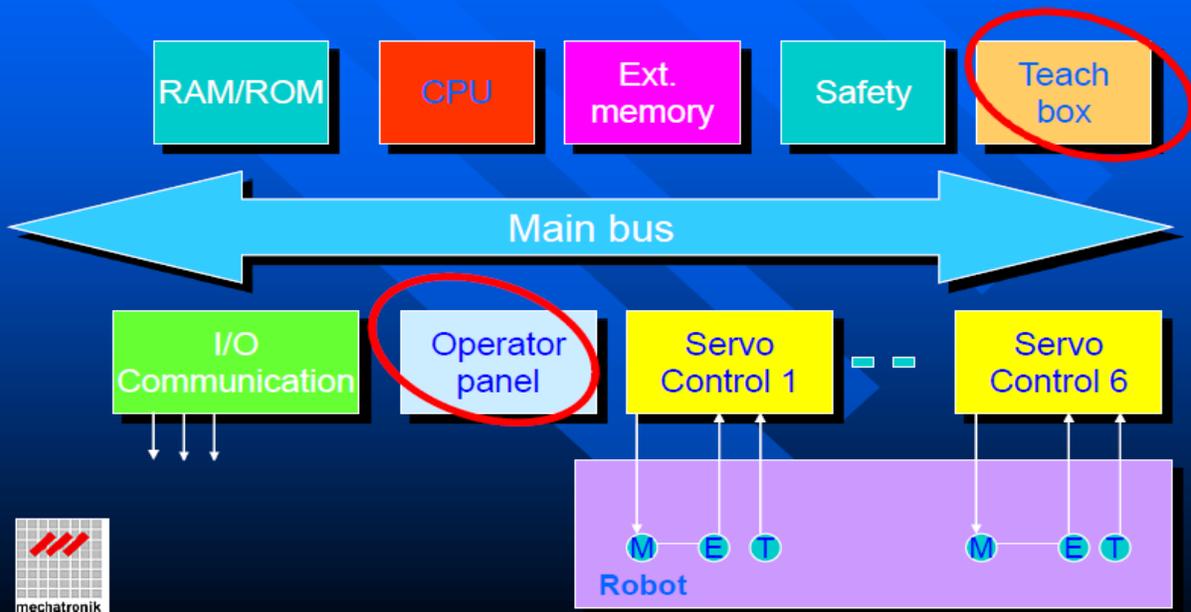


- Absolute position measurement by use of a coded disc

Source: researchgate, anaheim automation



Robot Control: User Input



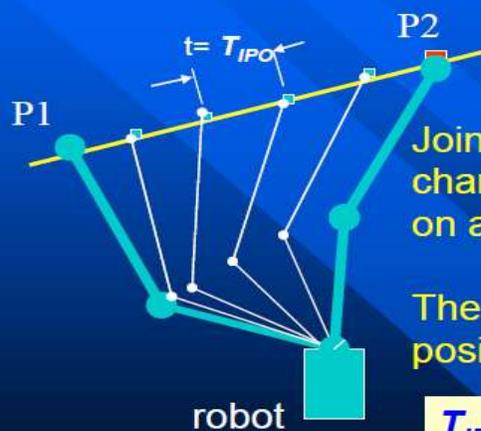
Robot Control: HMI (Operator Panel)





Robot Control: Motion Planning

- CP mode: Linear interpolated movement



Approach:

Joint angles of the robot are changing while the TCP moves on a straight line!

The calculation of intermediate positions will be performed within:

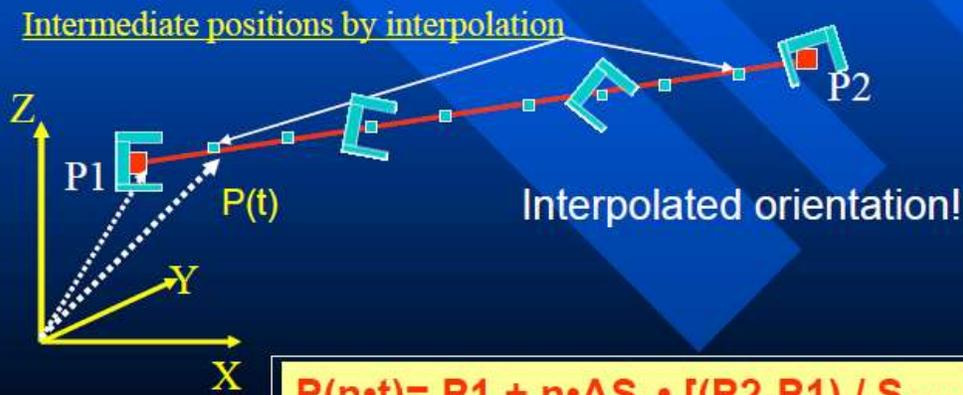
$$T_{IPO} = \text{interpolation cycle time}$$



Robot Control: Motion

•CP mode - Motion with linear interpolation

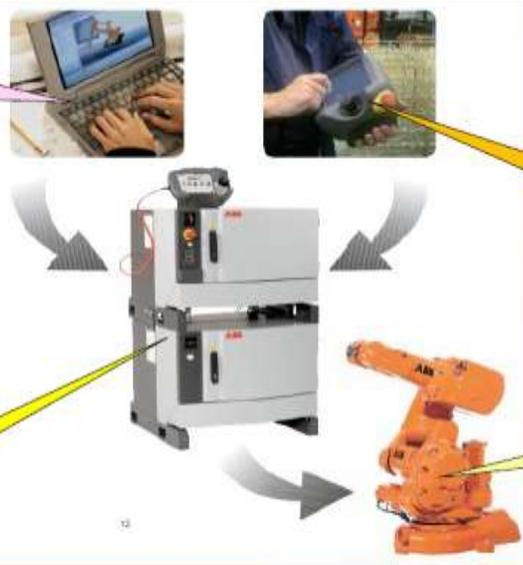
→ Interpolation of positions and orientations



$$P(n \cdot t) = P1 + n \cdot \Delta S_p \cdot [(P2 - P1) / S_{P1P2}]$$



PC-based
Programming &
Simulation



Main Components of an Industrial Robot System



Source: ABB

Robot Control: Programming

Programming units



ABB Robot (IRC5)



Yaskawa Robot (H10DT)



COMAU Robot (C5G)



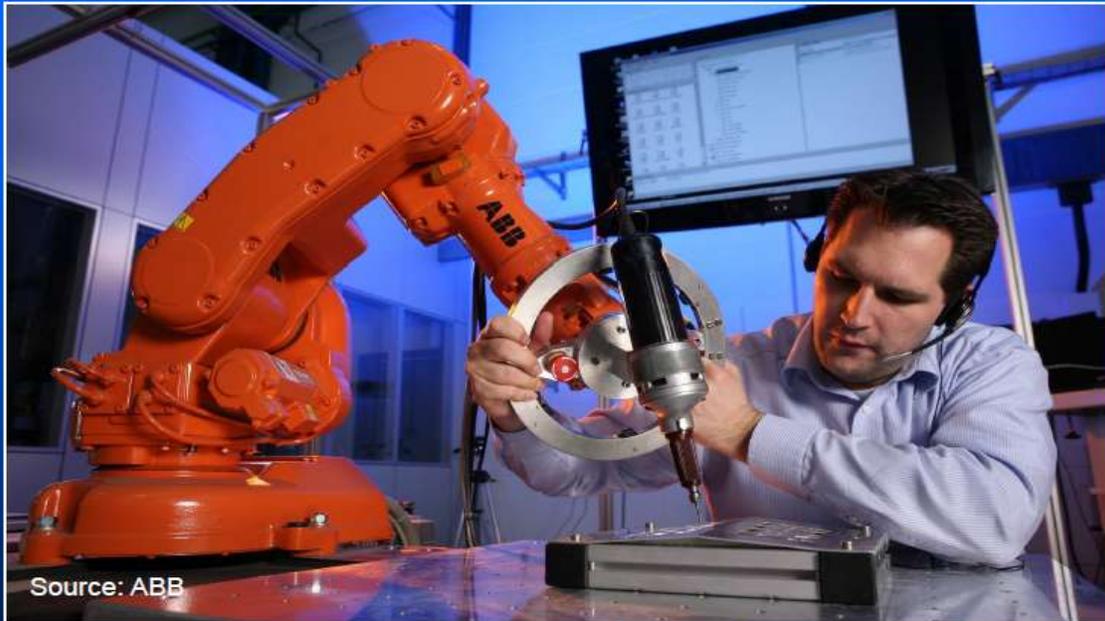
Robot Programming with Teach-in Mode

Online-Mode



.....programming close to the work piece





Example: Lead-through (Play-back) Programming



Position accuracy and Repeatability

The work of many robots is repeatable but not accurate!!

Reasons: Thermal drift when robot is cold; inaccuracies of individual components (from concrete base plate up to tooling at the endeffector)



Not repeatable; not accurate



Not repeatable; accurate

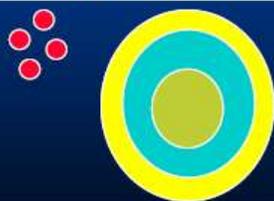
Repeatability:

~ 0,05mm – 0,1mm

Absolute accuracy:

0,25mm – 0,55mm

(see: ISO 9283)



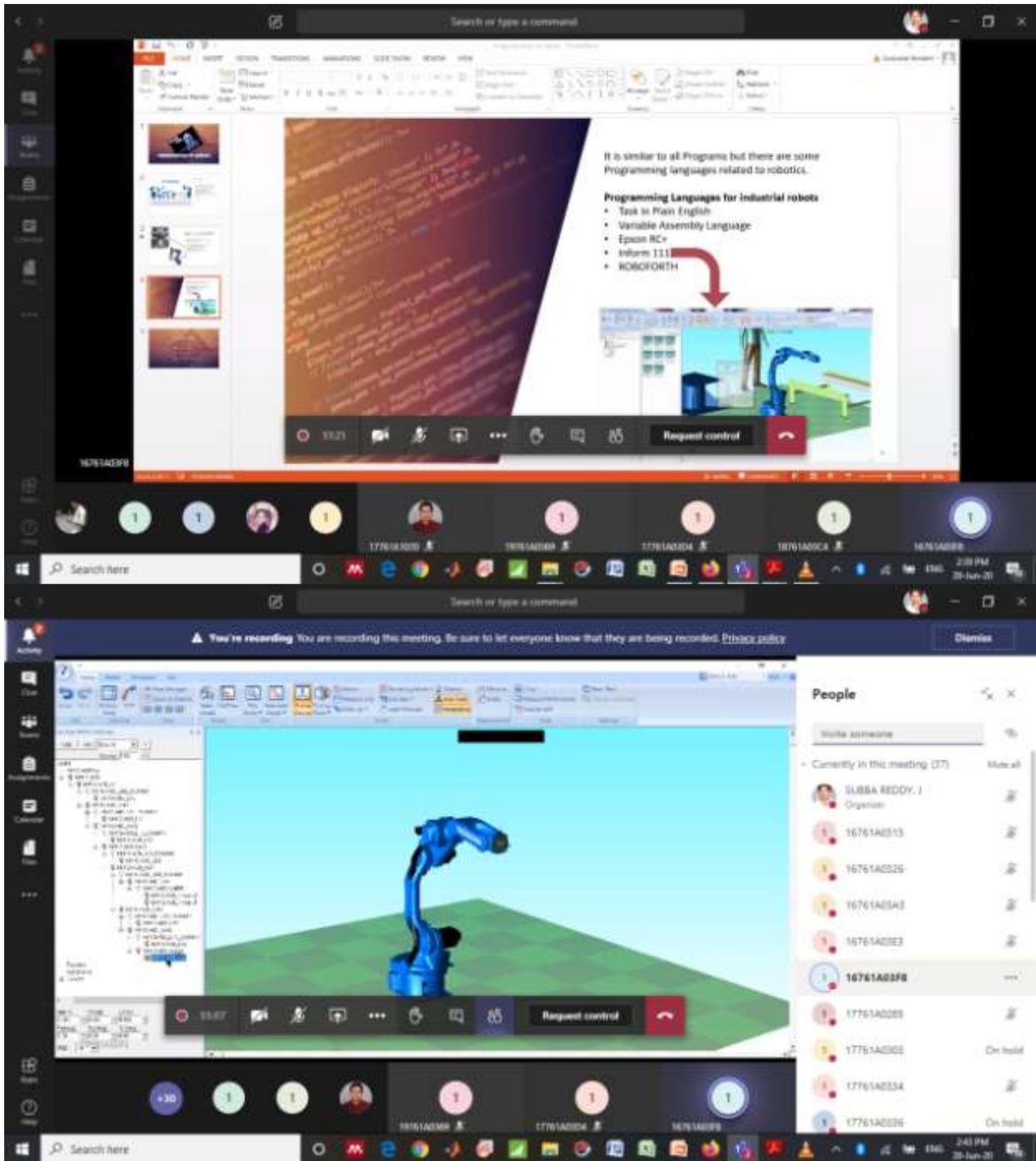
Repeatable; not accurate



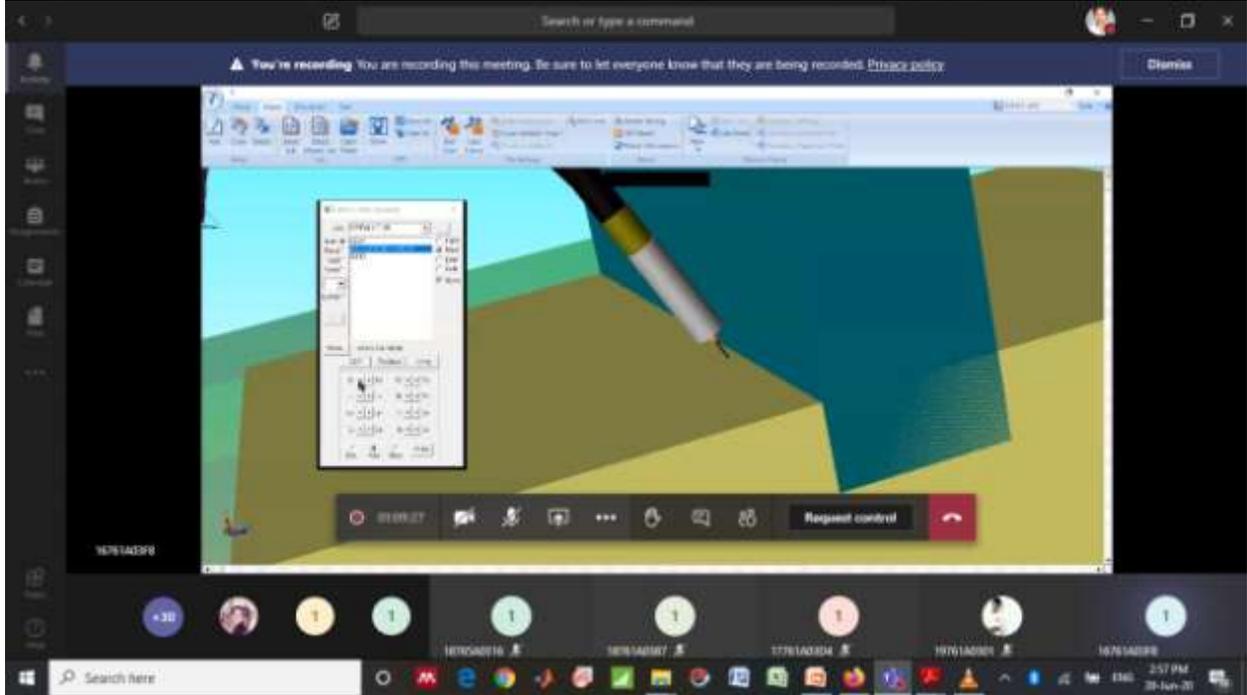
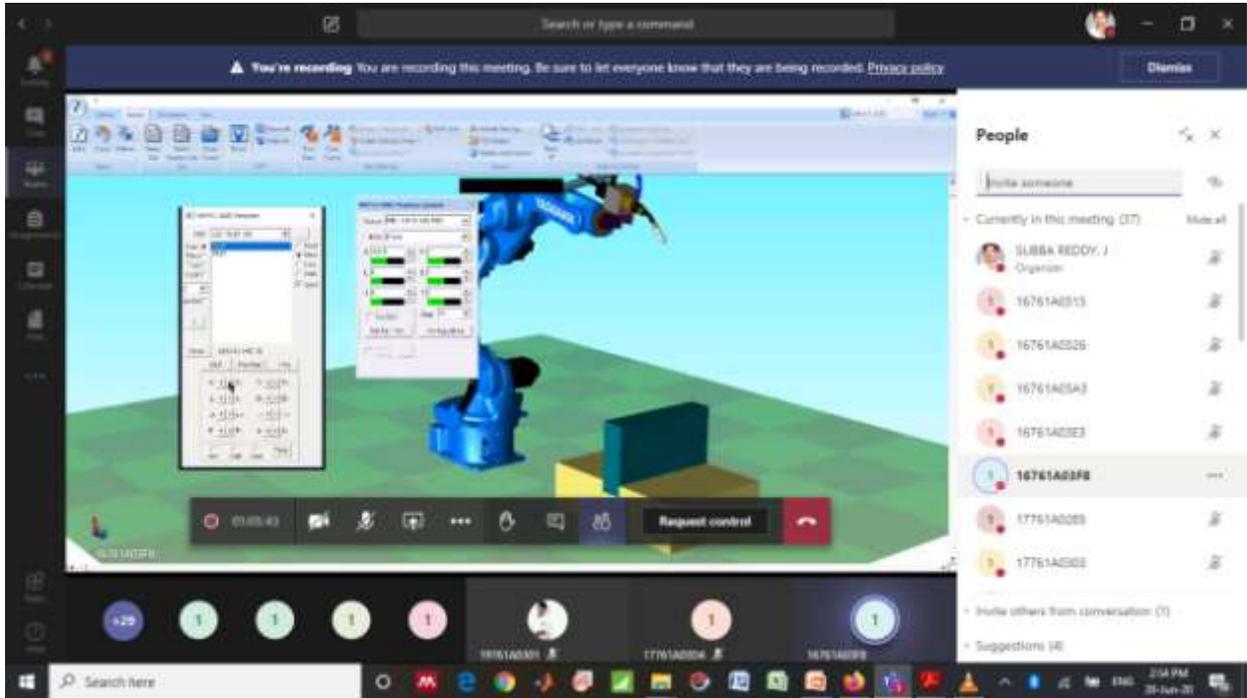
Repeatable; accurate



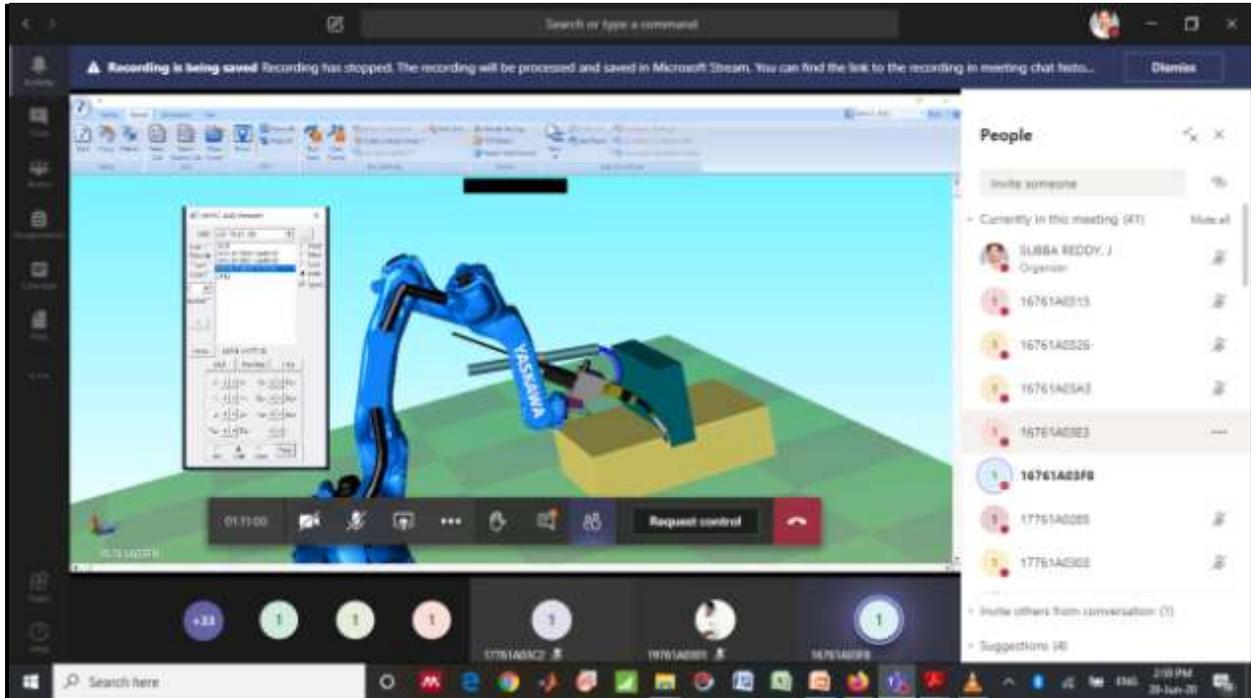
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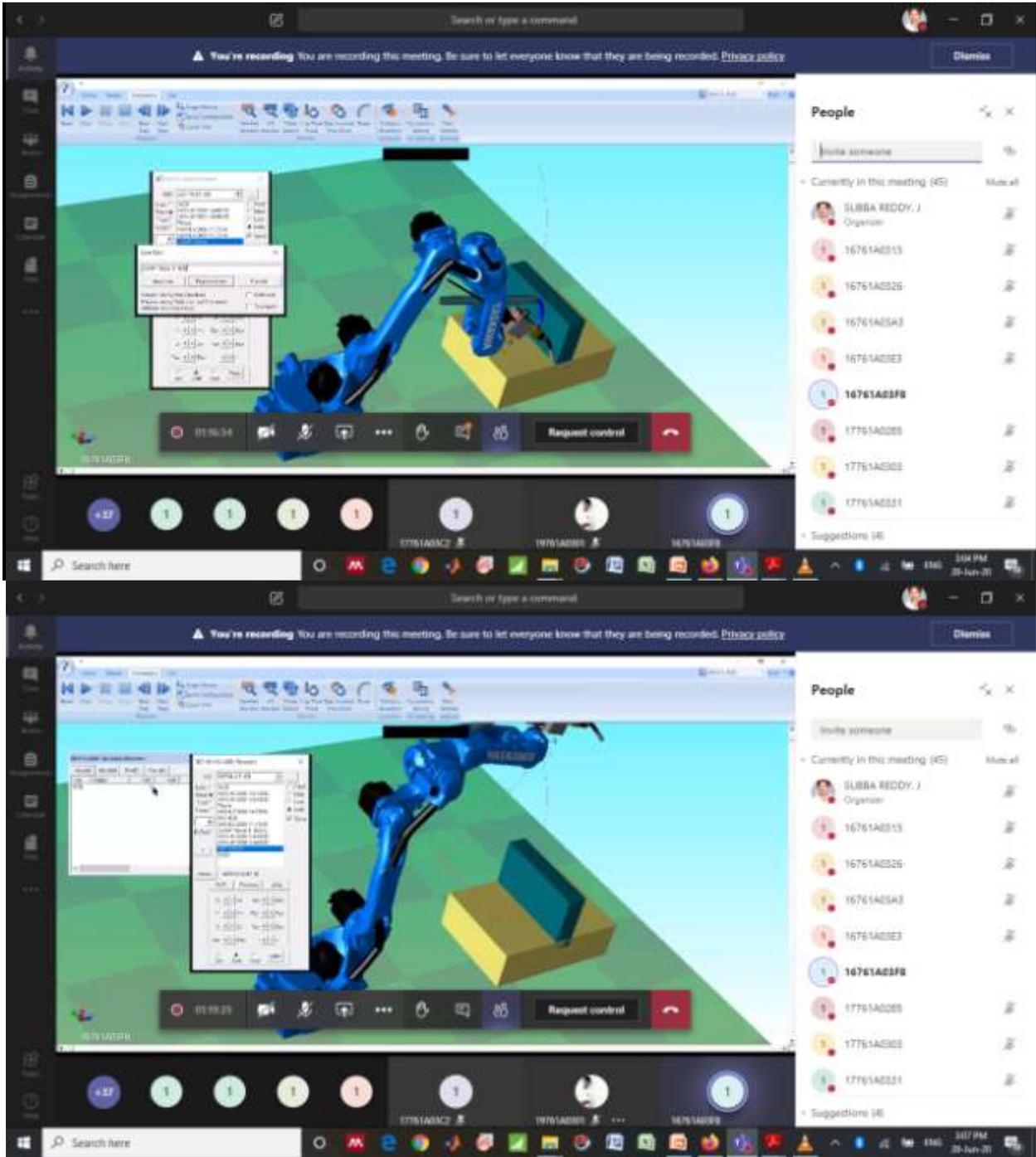
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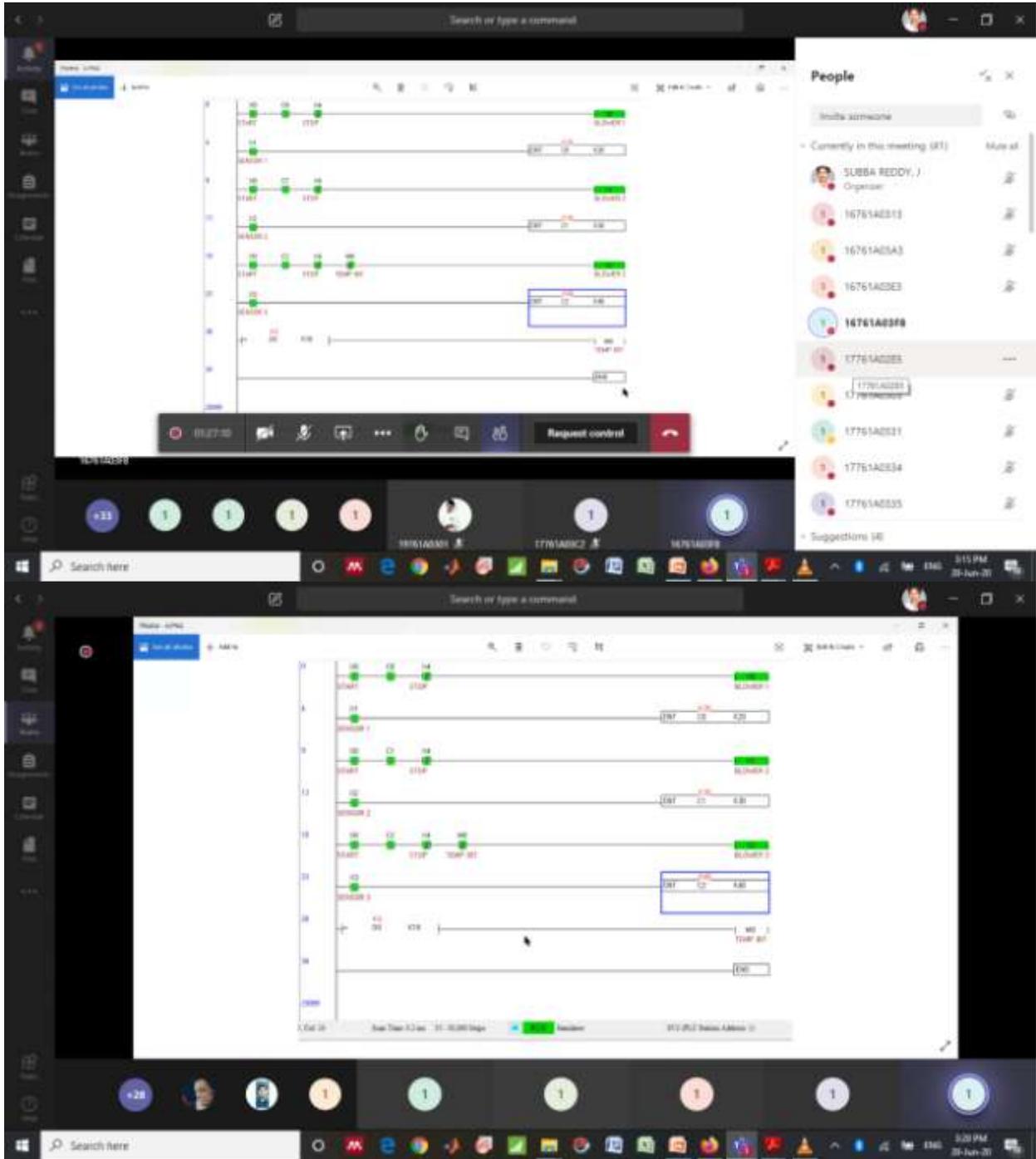
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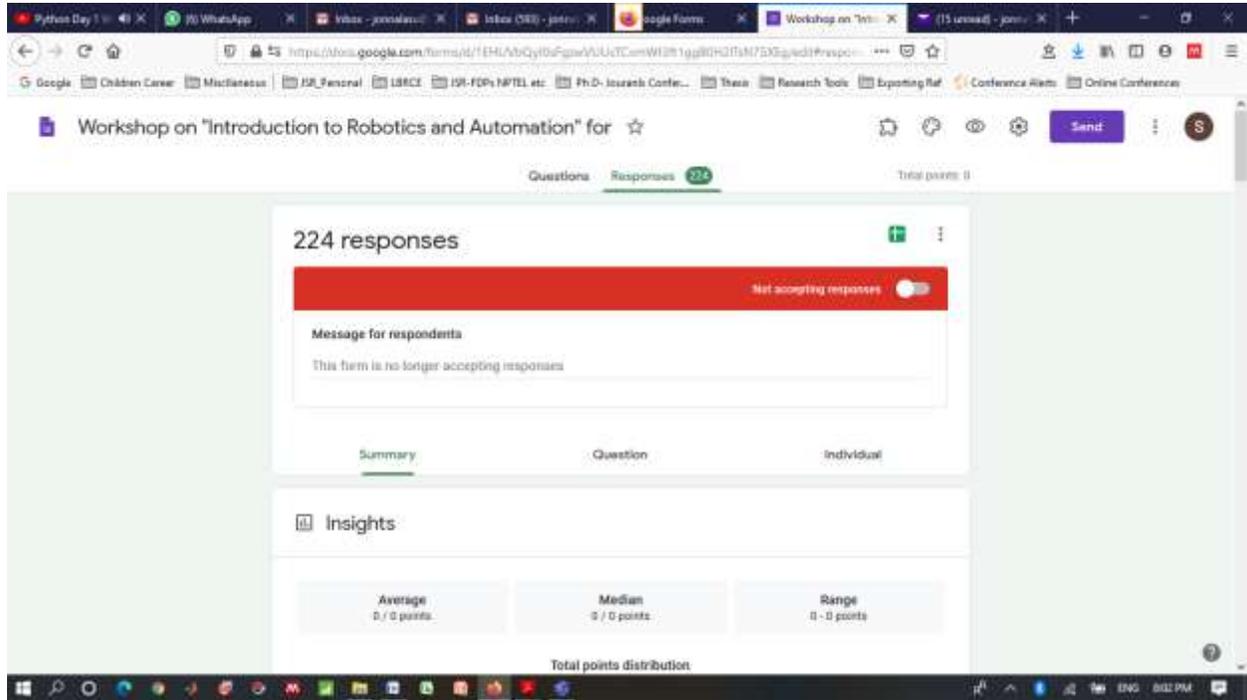
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M. Mahesh Reddy	17761A03E4	Lakireddy Bali reddy college of engineering
Shaik Faraz Hussain	18761A03F7	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
BADETI VENKATESWARA RAO	17761A0303	LAKI REDDY BALI REDDY COLLEGE OF ENGINEERING
RAJANI PRATHIPATI	18765A0312	lbrce
Harshavardhan Guntupalli	18761A03C4	LAKI REDDY BALI REDDY COLLEGE OF ENGINEERING
BADUGU SANDEEP	18765A0302	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
MOREMPUDI CHARAN KUMAR	18761A03D9	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
Ramanji reddy vennapusa	17761A0353	Laki reddy bali reddy college of engineering
SUDHARSHAN REDDY INDURI	19023501	University of Hertfordshire
HEMANTH KADALI	18765A0322	Lakireddy Balireddy College of Engineering
MOHAMMED SAIF ALI KHAN	17761A0334	Lakireddy Balireddy College Of Engineering
VENKATAKRISHNA REMALA	18765A0326	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
ROOP KIRAN KANULLA	17761A0380	LAKKIREDDY BALIREDDY COLLEGE OF ENGINEERING
Sai Divakar Boddetti	163J1A0306	Raghu institute of technology
GANAPATHIRAJU VIKAS VARMA	9917009027	Kalasalingam Academy Of Research And Education

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CHEEKATI SRAVAN KUMAR	183J5A0313	Raghu institute of technology
JALLEPALLI SAI SANDEEP	183J5A0323	RAGHU INSTITUTE OF TECHNOLOGY
KUNAPAREDDY SYAMPAUL	19761A03C1	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
YERRA SIVA KRISHNA	183J5A0364	Raghu Institute of technology
Borra visweswara rao	173J1A0308	Raghu institute of technology
KAPPAMMAVULLATHIL ASWIN VASU	163J1A0320	Raghu institute of technology
P.KOTESWARARAO	18765A0310	LBRCE
MAKALA CHIRANJEEVI	3237	RAGHU INSTITUTE OF TECHNOLOGY323
AMALAKANTI AJAY	16P31A0363	Aditya college of engineering and technology
Kolluru Sumanth	173J1A0328	Raghu institute of technology
CH.ESWARA VARA PRASAD	183J5A0314	RAGHU INSTITUTE OF TECHNOLOGY
KETAVATU BRAHMA TEJA	18765A0337	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
KOMARAVOLU PAVANI DURGA DEVI	19NM5A0312	Vignan's institute of engineering for women's
METTU RAKESH	18761A0387	Lakireddy Balireddy College Of Engineering
ETTE TEJANADH	17761A0370	Lakireddy Balireddy College of Engineering
GONTINI KARTHIK KUMAR	17761A03D0	Lakireddy balireddy college of engineering
SWETHA A	18AG031	SNS college of Technology
Sandeep S	16761A03A3	Lakireddy Balireddy college of engineering
MALLAMPALLI VENKATA CHAKRADHAR	173J1A0332	RAGHU INSTITUTE OF TECHNOLOGY
SK Mohammad Nayab Rasool	18761A03A2	Lakireddy Balireddy collage of engineering
HARIKESH PEDDI	173J1A0344	Raghu Institute Of Technology
Gunde Prudhvi Raj	17765A0305	LBRCE
SHANMUGA MUGESH R	1710092	National Engineering College
Allaka veerababu	318	WISTM ENGG COLLEGE
KAVITHA DAS	17NM1A0313	VIGNAN'S INSTITUTE OF ENGINEERING FOR WOMEN'S
NATCHATRA.K	18AG018	SNS COLLEGE OF TECHNOLOGY,COIMBATORE.
SELVARAJ K	1710090	National Engineering College
GARIKIMUKKALA RAKESH ROSHAN	18765A0321	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
POLUPARTHI JAGAN	ACET	Aditya college of engeenering and technology

**Lakireddy Bali Reddy College of Engineering, Online workshop on
"Introduction to Robotics and Automation"**

GUNDA SANTHOSH KUMAR	P3	Aditya college of engineering and technology
MEGHAVATH VIJAY KUMAR NAIK	19761A03C8	LAKIREDDY BALIREDDY COLLEGE of ENGINEERING
SAKTHIVEL M	1710086	NATIONAL ENGINEERING COLLEGE
SEELABOYINA PAVAN KUMAR	173J5A0334	RAGHU INSTITUTE OF TECHNOLOGY
UDHAYAKUMAR.B	1710107	NATIONAL ENGINEERING COLLEGE-KOVILPATTI
P.JASWANTH	173J1A0347	Raghu institute of technology
AMIREDDY SIVA REDDY	17761A03B2	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING MYLAVARAM
SIMHADRI VAMSI KRISHNA	183J5A0354	Raghu institute of technology
B. Bhavana	17761A03B3	Lakireddy balireddy college of engineering
NIVESH SWARGAM	17765A0312	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
Block 3	17761A03F0	Laki reddy bala reddy collage of engineering
REDDY SAISAMPATH	173J1A0355	RAGHU INSTITUTE OF TECHNOLOGY
K ASHOK KUMAR	183J1A0338	RAGHU INSTITUTE OF TECHNOLOGY
SHAIK AHAMAD ALISHA	173J1A0363	Raghu institute of technology
BASWANI SHYAM SRINIVAS	183J1A0308	RAGHU INSTITUTE OF TECHNOLOGY
VIGNESH.D	1706108	PSR ENGINEERING COLLEGE
KARI.NOOKARATNAM	19NM5A0310	VIGNAN'S INSTITUTE OF ENGINEERING FOR WOMEN
GOWTHAM.M.S	1710032	NATIONAL ENGINEERING COLLEGE KOVILPATTI
GOWTHAMAN.S	18AG007	SNS COLLEGE OF TECHNOLOGY
Gaddam balachandrudu	17765A0330	Lakkireddy balireddy college of Engineering
KISHOR H	1MS18ME417	M S RAMAIAH INSTITUTE OF TECHNOLOGY
KONA PTUDHVI	19765A0326	Lakireddy Balireddy College of Engineering
R.HEMALATHA	-	Adhiyamaan college of Engineering (Autonomous)
ARRABIRI PAVAN REDDY	18E15A0314	BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY
Bhavesh Kumar Dhande	112017245	Sandip Institute of Technology and Research Centre
P.SATHIYA MOORTHY	18AG025	SNS College of Technology
SIVA PRAKASH T	1710095	NATIONAL ENGINEERING COLLEGE-KOVILPATTI
GARIKAPATI HARSHITHA MADHURI	3123	St.joseph's college of engineering

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Kunthuru Siva Sankar	No	Andhra University
RAVI KONDA	16761A03E0	LAKKIREDDY BALIREDDY COLLEGE OF ENGINEERING
YASHWANTH. K	1MS19ME417	M. S. Ramaiah Institute of Technology
FARAZ JAVED	161391034025	BUNDELKHAND UNIVERSITY JHANSI
RENGANATHAPANDIAN.M	1710081	NATIONAL ENGINEERING COLLEGE,KOVILPATTI
BONDA SRI GANESH SAI PAVAN	17P31A0339	Aditya College Of Engineering And Technology
GAVVALARAJU SAI PRASANTH	19765A0323	Lakki redsy bali reddy college
KAREDLA VENKATA SRINIVAS RAO	18761A03D2	Lakireddy balireddy college of engineering
GESWANTH KOPPARTHI	17761A0384	Laki Reddy Balireddy College of Engineering
JAMBAVI TEJA	18761A03C5	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
PANDULA JAGADEESH GOPI	18761A03E4	Lakkireddy balireddy college of engineering
APARNA N	822716105045	Government College of Engineering, Thanjavur
JILLEPALLI MAHESH BABU	18761A03C7	Lakkireddy balireddy college of engineering
GAMPALA NAGA PRANAI	17761A0472	Laki reddy Bali reddy college of engineering
DEVI ARJA	17761A0205	Laki reddy bali reddy college of engineering
SHIKHAR VIJAY	603203	SRM IST
PARVEZ ALI	6387	SREE DATTHA INSTITUTE
Mr.S.MOHAMMED MUSTAFA	821918114014	St.JOSEPH'S COLLEGE OF ENGINEERING AND TECHNOLOGY
Akula ravichandra	18765A0331	Lakki reddy bali reddy college of engineering
NELSKUDITI NARESH BABU	16761D2110	DVR & Dr.HS MIC COLLEGE OF TECHNOLOGY
MAKIREDDY SAI KUMAR	317129520010	WELFARE INSTITUTE OF SCEINCE TECHNOLOGY AND MANAGEMENT
RAJULAPATI GANESH	177W1A0315	Malineni Perumallu Educational Society's
LANKA JAYA KRISHNA	18505A0213	PvP Siddharth
NAVEEN RAMISETTI	19765A0329	LAKKIREDDY BALIREDDY COLLEGE OF ENGINEERING
VANAPALLI SAITEJA	163J1A0397	Raghu Institute of Technology
SHAIK SHAIIDDIN	177W1A0317	malineni perumallu educatuonal society and group of institutions guntur
G.ESWAR SAI KANTH	319506402029	Andhra University
G.JAVID HUSSAIN	17G21A0312	Audisankara college of engineering and technology

**Lakireddy Bali Reddy College of Engineering, Online workshop on
"Introduction to Robotics and Automation"**

SIVAREDDY UPPUTURI	19761A0342	Laki Reddy Bali Reddy
Mr.S.MOHAMMED MUSTAFA	821918114014	ST.JOSEPH'S COLLEGE OF ENGINEERING AND TECHNOLOGY
SHAIK MAHAMMAD SAJID	19G21A0335	Audisankara college of engineering and technology
Parasa siva	18761A03E6	LakiReddy BaliReddy college of engineering
NALAM KRUPAKAR	18P31A0357	Aditya college of engineering and technology
ATMURI NAGA SAMPATH KUMAR	17761A0464	Lakireddy Bali Reddy college of engineering
CHAKALA NAVYA	17001F0038	JNTUA COLLEGE OF ENGINEERING ANANTAPURAMU, ANDHRA PRADESH
FATHE MOHAMMAD	156	MIET
DANDUBOYINA SRI KRISHNA MURALI	17761A0368	LAKI REDDY BALI REDDY COLLEGE OF ENGINEERING
TIRUMALASETTY VAMSI KRISHNA	17761A04B4	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
PILLI YAMINI	17761A0499	Lakireddy Balireddy college of engineering, mylavaram
GANDIBOYINA BHARATI	173J5A0328	RAGHU INSTITUTE OF TECHNOLOGY
SHIVA PRANAV PILLAGOLLA	17761A0398	Lakireddy balireddy college of engineering
S.J.DHANUSU PRIYA	18AG003	SNS COLLEGE OF TECHNOLOGY
MADDI TEJA	173J5A0318	RAGHU INSTITUTE OF TECHNOLOGY
CATHERINE CHRISTINA GANDURI	17761A0468	Lakireddy Balireddy college of engineering
DODDA SAI GANESH	17761A0471	Lakireddy Balireddy College of Engineering
Sharaj Hegde S	1MS17ME161	Ramaiah Institute of Technology
SOMISETTI VENKATESH	18P31A0368	ADITYA COLLEGE OF ENGINEERING AND TECHNOLOGY
Mulampaka Ajay	18P31A0355	Aditya college of engineering and technology
RAM	521230	lbrc
CHALLA NEERAJ KUMAR	17761A0469	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
DIVYA NARAMSETTY	115	VIGNAN'S INSTITUTE OF ENGINEERING FOR WOMENS
Manda Devakaruna	LBCE1	Lakki reddy bali reddy college of engineering
KAKARLA SIVARAMA KISHORE	17P35A0309	Aditya college of engineering and technology
LALAM.HEMANTH KUMAR	19L61A0310	CHAITANYA ENGINEERING COLLEGE
J SAI TEJA	18501A0233	Prasad V Potluri Siddhartha Institute of Technology
JUPALLI VENKATA SAI	17761A0473	Lakireddy Bali Reddy College of Engineering

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"Introduction to Robotics and Automation"**

KUNDURU LEELA PRASAD	17765A0307	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
MOHAMMAD SHAFI	173J5A0341	RAGHU INSTITUTE OF TECHNOLOGY
Naveen Pallepogu	16761A0341	Lbrce
PUTTUPU VENKATA MADHUSUDHAN	173J5A0320	RAGHU INSTITUTE OF TECHNOLOGY
RAMAKRISHNA	177W1A0304	Malineni perumallu educational society
KARANAM TEJASWI	173J5A0343	Raghu institute of technology
BANDARU.DHANALAKSHMI	18501A0207	Prasad.V.Potluri Siddhartha Institute Of Technology
RUKMINI MANDAL	173J5A0337	Raghu institute of technology
KASI MAITHRI CHERUKULA	17471A0409	Narasaraopeta engineering College
YERUVA SUDHEER KUMAR REDDY	17471A0405	NEC
RAVI P BAROT	18PGME001	CSPIT, CHARUSAT UNIVERSITY
KARTHICK P	1710410	National engineering college
SHIJOMON L J	1710093	National Engineering college
Evuri. Keerthi Reddy	18761A0366	Lakki Reddy Balli Reddy
KOMMINEN HARSHA VARDHAN	177W1A0305	Malineni Perumallu Educational Society's Group Of Institutions
Hemadharshini K	1	Nandha engineering college
NIDDAPU CHAKRI SAI SRI	173J5A0335	RAGHU INSTITUTE OF TECHNOLOGY
Sathiskumar N	2	Nandha Arts&Science college
NIDAMANURI NAGA VENKATA SAI KRISHNA	19FE1A04B0	VIGNAN'S LARA INSTITUTE OF TECHNOLOGY AND SCIENCE
KOTHAPALLI GOPI KRISHNA	19FE1A0476	Vignan Lara Institute of Technology and Science
KANCHARLA SAI KUMAR	19FE1A0461	VIGNAN'S LARA INSTITUTE OF TECHONOLOGY AND SCIENCE
MUPPARAJU PRIYANKA	19G21A0320	Audisankara College of Engineering & Technology, Gudur, Nellore.
GURRAM NAGA VENKATA SAI GANESH	190305117019	Parul
D.LAKSHMI PRASANNA	18ME1A0260	Ramachndra college of engineering in eluru
MUNNANGI VIJITHA GLORY	18765A0422	Lakireddy Bali Reddy College of Engineering
BONAM VENKATAKARTHIK	18ME1A0256	Ramachandra collage of engineering
RAMYA S	I don't no	Kumaraguru College of Liberal Arts and Science
PRAKASH V	731119114025	Institute of road and transport technology

**Lakireddy Bali Reddy College of Engineering, Online workshop on
"Introduction to Robotics and Automation"**

VALLABHAJOSYULA HARI PRASAD	16131A03M7	GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING (Autonomous)
GADDAM SASI VARDHAN	17761A0371	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
BORRA MANOJ KUMAR	17761A0264	Lakireddy Balireddy college of engineering
PALLAVI TADIKONDA	URK19EC1119	Karunya institution of technology and sciences
MANIKANTHA BALUGURI	17761A0260	Lakireddy Balireddy college of engineering
KAKARLA.HEMA HARIKA	URK19EC1111	Karunya Institute of technology and sciences
Ragavi M	18AG021	Sns College of Technology
DHARUNIKA C	1922A0160	Kumaraguru college of liberal arts and science
MAHENDRA.GUNUPURU	17761A0274	Lakireddy balreddy college of engineering
AASHIK SHAIK	17761A02A5	Laki Reddy Bali Reddy College Of Engineering
KETHU GOVARDHAN REDDY	18005A0305	JNTUA COLLEGE OF ENGINEERING AUTONOMOUS,ANANTAPURAM.
VINAY MAMIDISETTI	17761A0330	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
Terli Nani	17761A02A9	Laki reddy bali reddy college of engineering
Swapna Boyapati	17761A0265	Lakkireddy balireddy college of engineering
PENDEM ROOPA VENKATA SAI RAM	17761A02A0	Lakkireddy balireddy college of engineering
Boddeda Chandu	173J5A0312	Raghu Institute of Technology, Visakhapatnam
MIDDE SRINIVAS	16761A0393	Lakireddy Balireddy College Of engineering
G.SUBHASH	16761A0367	LBRCE / JNTUK
MUKUL SAI J	17761A03D4	Lakkireddy ballireddy college
KAVURI GURU NAGA VENKATA BHARADWAJ SHARMA	19FE1A0564	Vignan Lara
ALLA SRIKANTH REDDY	17761A0461	LAKI REDDY BALI REDDY COLLEGE OF ENGINEERING
MALLELA SRIHARSHA VARDHAN	17761A0486	Laki reddy balireddy college of engineering
KAVURI KOMALA NAGA SAI SRI MOUNIKA	17BQ1A0245	VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY
Bindu Madhav Ashok Sai Pavan.Narayana	17761A0336	Laki Reddy Balireddy college of engineering
Sarvani . Ramineni	17761A0339	Lakireddy balireddy college of engineering
SHAIK VASEEMUDDIN	16G21A04H2	audisankara college of engineering and technology
GOWTHAM.S	18AG005	SNS COLLEGE OF TECHNOLOGY
RASIKAPRIYA M	19BMA012	Kumaraguru college of liberal arts and science

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"Introduction to Robotics and Automation"**

BOLLIPALLI NAVEEN	17761A03B7	Laki Reddy bali Reddy college of engineering
PONNAGANTI SRI SUKESH	Y17AME476	BAPATLA ENGINEERING COLLEGE
BODDU GANESH	17761A0466	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
Yendluri Kowsik	16761A03B4	Lakireddy Balireddy College of engineering
M.Hema	18AG008	SNS College Of Technology
A.Pradeepa Mary	18AG019	SNS College of Technology, Coimbatore.
KAVIYA .R	18AG010	SNS COLLEGE OF TECHNOLOGY
KAKARLA VENKATA VJAYA KRISHNA SHANMUKHA REVANTH	17761A1020	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
MOHANA JANARDHAN SAI KUMAR PANUTHULA	17B21A0350	Kakinada Institute of engineering and technology
SHAIK MANSOOR	18505A0219	PVP SIDHARTHA INSTITUTION OF ENGINEERING AND TECHNOLOGY
Bokam Siva Prasad	318129520004	Andhra university
SHANTANU SONI	18EEAEIO38	ENGINEERING COLLEGE, AJMER
KORADA SRIKANTH	16761A03E3	LBRCE
PRASANNA KUMAR PENUMUCHU	18761A03F0	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
SRINU KUNCHAPU	17765A0306	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
M. DHANUSHKUMAR	951518106005	Kalasalingam Institute of Technology
TADEPU VEENA NAGA MADHURI	18761A03A3	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
KANNURU PRAVEEN	18761A03D1	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
CHINTADA RAKESH	19765A0321	Lakireddy balireddy college of engineering
SIVA CHENNA KESAVA TALLADA	17761A0348	Lakireddy Balireddy College Of Engineering
KOTA VENKATA SAI PAVAN KUMAR	16761A0329	LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DIVYA.M	04	SNS College of technology
DHARMASANAM RAGHU VAMSI KRISHNA	17761A0369	LAKKIREDDY BALIREDDY COLLEGE OF ENGINEERING
GOVADA GERATARAJU	17761A0373	Lakkireddy Balireddy college of engineering
KANCHARLA PRAVALLIKA	18765A0429	Lakireddy balireddy college of engineering
CHINTA SRUJANA	17761A0314	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
CHELLU THARUN KUMAR	17761A0363	Lakkireddy Balireddy collage of Engineering
Sai satya prakash chittimoju	17761A0366	Lakkireddy Balireddy College of engineering

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MOVVA VENKATA SWAMY	19761A0365	Lakireddy balireddy college of engineering
Galam krupasagar	19761A0312	LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING
SRIGIRI SRI HARSHA	17761A03F10	Lakireddy bali reddy collage of engineering
M. Mahesh Reddy	17761A03E5	VIGNAN INSTITUTE OF ENGINEERING FOR WOMEN
Shaik Faraz Hussain	18761A03F8	KUMARAGURU COLLEGE OF LIBERAL ARTS AND SCIENCE
BADETI VENKATESWARA RAO	17761A0304	NARASARAOPETA ENGINEERING COLLEGE
RAJANI PRATHIPATI	18765A0313	wellfare institute of science technology and management
Harshavardhan Guntupalli	18761A03C5	Lakireddy balireddy college of
BADUGU SANDEEP	18765A0303	Vignans institute of engineering for women

Feed Back on the Workshop:

NAME OF THE PARTICIPANT	Year of study	Branch	RATE THE DELIVERY CONTENT OF THE SPEAKER
TIRUMALASETTY VAMSI KRISHNA	III	ECE	Excellent
BADETI VENKATESWARA RAO	III	MECH	Excellent
MOREMPUDI CHARAN KUMAR	II	MECH	Excellent
METTU RAKESH	II	MECH	Excellent
NIVESH SWARGAM	IV	MECH	Excellent
NAVEEN RAMISETTI	II	MECH	Very Good
SIRISETTI NAGARAJU	III	MECH	Excellent
Madala.Tejasri	III	EEE	Excellent
JOSHUA PAUL	III	MECH	Excellent
GOLUSU LAKSHMI VIMALA	II	MECH	Good
Mahadasu chetan satya manikanta	III	MECH	Very Good
BODDU GANESH	III	ECE	Very Good
KUNAPAREDDY SYAMPAUL	I	MECH	Excellent
BANDARU GOPI	III	MECH	Excellent
GONTINI KARTHIK KUMAR	III	MECH	Very Good
Mukul Sai J	III	MECH	Very Good
Avinash Mukunda	II	MECH	Very Good

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KANNURU PRAVEEN	II	MECH	Very Good
Nanda Sai Palanki	III	ECE	Very Good
Rangiseti Naveen	I	MECH	Excellent
SRIGIRI SRI HARSHA	III	MECH	Excellent
MENTE JAGADEESH BABU	III	MECH	Excellent
Sandeep S	IV	MECH	Very Good
CHALLA NEERAJ KUMAR	III	ECE	Excellent
Duduku vamsi kumar	I	MECH	Excellent
KETAVATU BRAHMA TEJA	III	MECH	Excellent
ROOP KIRAN KANULLA	III	MECH	Excellent
Hemanth Kadali	III	MECH	Excellent
K.sunil	I	MECH	Very Good
Atragadda Dhana Venkata Vinay Sandeep	I	MECH	Excellent
SATHYAMOORTHY G	I	MECH	Excellent
Chodiseti Anantababu	III	MECH	Very Good
JUPALLI VENKATASAI	III	ECE	Excellent
LANKE JYOTHI VENKATA NAGABABU	III	MECH	Excellent
SIVA CHENNA KESAVA TALLADA	III	MECH	Excellent
METLA KOTA AKHIL	III	MECH	Very Good
Jillepalli Mahesh Babu	II	MECH	Excellent
SHAIK FARAZ HUSSAIN	II	MECH	Excellent
LAKHIMSETTI HARIKA	III	ECE	Excellent
Mohammed Saif Ali Khan	III	MECH	Very Good
KUNDURU LEELA PRASAD	IV	MECH	Excellent
Mukku jagan sankar rao	II	MECH	Good
KASIREDDY YATHEESHA	II	MECH	Excellent
Ganna Siva Krishna	III	MECH	Good
SRINU KUNCHAPU	IV	MECH	Very Good
M.jeswant	I	MECH	Excellent

**Lakireddy Bali Reddy College of Engineering, Online workshop on
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BORAVANCHA SURENDRA	III	MECH	Very Good
Golle Mahantesh	III	ECE	Very Good
CH.LAKSHMI POORNIMA	IV	MECH	Excellent
Eswara Sai Naveen Sriranganilayam	IV	MECH	Good
Challa Hema Sundar Yadav	III	MECH	Excellent
KORADA SRIKANTH	IV	MECH	Excellent
PANDULA JAGADEESH GOPI	II	MECH	Very Good
MEGHAVATH VIJAY KUMAR NAIK	I	MECH	Excellent
Catherine Christina Ganduri	III	ECE	Very Good
Dodda Sai Ganesh	III	ECE	Very Good
C TRISHIT	II	MECH	Excellent
GALANKI VAMSI	II	MECH	Good
Jitender Kumar Goyal	IV	MECH	Excellent
GAMPALA NAGA PRANAI	III	ECE	Excellent
Nallanagula Jagadeesh	I	MECH	Excellent
Kunapareddy Phani Kumar Likhith	II	MECH	Excellent
VINAY MAMIDISETTI	III	MECH	Excellent
Harshavardhan Guntupalli	II	MECH	Excellent
Bindu Madhav Ashok Sai Pavan.Narayana	III	MECH	Excellent
P.Sathiya Moorthy	II	MECH	Very Good
KANCHARLA PRAVALLIKA	III	ECE	Very Good
Gonthupalli Pavan Kumar	III	MECH	Excellent
CHELLU THARUN KUMAR	III	MECH	Excellent
Jambavi teja	II	MECH	Very Good
GARIKIMUKKALA RAKESH ROSHAN	III	MECH	Good
SINGULURI NAGA MANIKANTA	III	MECH	Good
SHAIK CHAN BASHA	II	MECH	Very Good
M.GOPIKRISHNA	I	MECH	Excellent
Bhavani kanakam	III	ECE	Excellent

**Lakireddy Bali Reddy College of Engineering, Online workshop on
"Introduction to Robotics and Automation"**

J.venkata Ganesh	II	MECH	Excellent
Kona Prudhvi	II	MECH	Excellent
Ette Tejanadh	III	MECH	Very Good
Jaya venkata saibabu	III	MECH	Very Good
ATTA PAVANI	III	ECE	Good
K. Surya Sai Kumar	III	MECH	Good
Movva venkata swamy	I	MECH	Very Good
SOLA JAMALIAH	III	MECH	Very Good
SODAGUDI ENOSH	III	MECH	Excellent
Pallepogu Naveen	IV	MECH	Excellent
Surasani.Hemanth kumar	III	MECH	Very Good
SEELAM VENKATA ARAVIND REDDY	I	MECH	Excellent
SEELABOYINA PAVAN KUMAR	IV	MECH	Excellent
Kokkiligadda Ramanjaneyulu	IV	MECH	Very Good
MADDIRALA RISHI	IV	MECH	Excellent
Shiva Pranav Pillagolla	III	MECH	Excellent
Swetha A	II	ASE	Very Good
PAVAN KUMAR TOKALA	I	MECH	Excellent
Thammineni Sowjanya	III	ECE	Very Good
VARIKALLU NAVEEN BABU	III	ECE	Excellent
Battagiri venkata Radha Krishna Reddy	I	MECH	Very Good
DHARAVATHU SAI PAVAN NAYAK	I	MECH	Excellent
KUNDURU LEELA PRASAD	IV	MECH	Very Good

**Lakireddy Bali Reddy College of Engineering, Online workshop on
"Introduction to Robotics and Automation"**

Certificate Format:



Sample certificate issued:



Student Coordinator(S)

Mr. K. Siddha Nagarjuna

Mr. Pendem Sai Kumar

Faculty Coordinator(S)

Mr. J. Subba Reddy

Dr. K. Murahari

Mr. A. Nageswara Rao

Mr. R. Praveen Kumar

Convener(S)

Dr. S.Pichi Reddy, H.O.D

Dr. P. Ravindra Kumar