

Instrumentation Cell

Instrumentation involved in every aspect of day to day life. Instrumentation and sensors involved in traditional practices has shifted every field operations now days. With the integration of sensors, robotics, machine vision and (AI, ML and DL) algorithm each application has ben expedited in terms of accuracy and precision of application in farm field. Starting with this project of centre of excellence at NAHEP in which Instrumentation cell has separately formed. This Cell has done exemplary work by providing its services to all four portfolios and three divisions. As, the mandate of this centre is to provide digital farming solutions to farmer by enhancing knowledge base of PG/PHD students through technology of Instrumentation technology used in it. This INSTRUMENTATION CELL extended its association with three main divisions we call it Agridrone, Agribots and Agriagv's and four portfolios which are Smart Portable Machinery, Seed Seedling and Nursery Automation, Food Processing Automation and Climate based Digital Knowledge System. This cell is actively performing its role in terms of Automation in food processing and seed seedling and nursery. In Smart Portable Machinery sensors, automation, actuation, navigation and control system is present which can make very machine intelligent to perform any other field operation. Additionally Instrumentation involved in smart portable machineries now a days using provides an alternative solution to traditional approaches performed in field with the advent use of IOT application integrated with sensors and machine vision. Remote sensing and GIS application are performed using drones with the help of all imaging sensors such as RGB Sensor, Multispectral, Hyperspectral and Thermal camera. With the help of these imaging sensors all insights for insect detection, soil water management of field and vegetation will be provided remotely using IOT and internet based applications. Similarly, other advent use of spraying can be used for the precision spraying in the field. Likewise all other soil sensors such as NPK, Moisture, Humidity, Temperature, PH and Electrical Conductivity can be measured and given instant insights using data loggers to soil department. With the available agriculture meteorology sensors available at this centre insights will be provided to all students. Other Mechatronics, Pneumatic and Hydraulic Laboratories knowledge will be imparted to beneficiaries of the project through proper channel of Instrumentation Cell. Instrumentation Cell is also giving solution guidance and services to agriculture automated guided division through camera sensors and other navigation guidance and simulation system. Based on these AGV some field operation will be performed under the support and guidance of Instrumentation Cell. Furthermore, with the advent technology of agriculture robotics there is lots can be done with the integral association of Instrumentation Cell. In the end Human Labour successfully minimized and yield of field is optimized only because of use of sensor robotics based machine vision technology in the field of agriculture. This sudden shift in technology is need of world clock. Population is increasing day by day and if we wish to fulfil demand and supply gap of world's population there is no alternative rather to utilize technology in the field operations in agriculture. There are certain tasks like weeding and harvesting out of other applications which requires intensive labour. And here we are who can do this by involving instrumentation and automation in agriculture. Sensor based automation and vision based robotics creating making it possible to produce more and higher quality food with less manpower. Hail the Instrumentation Cell.

1. Objectives of Instrumentation Cell:

1. To develop advanced laboratories for Designing & developing Agri-Bots, Agri-Drones, Agri- AGVs and Instrumentation Cell.
2. To develop the capacity amongst the faculties/scientist/PG-Ph.D. students/ rural entrepreneurs for the development and adoption of the Instrumentation devices and digital farming.
3. To develop different mobile applications, software programs, Decision support systems etc. on digital farming for effective dissemination of advanced Instrumentation technologies among different stake holders.
4. To conduct high end capacity research and technologies for integration of advanced engineering & technologies into existing farming practices for increasing production efficiency.
5. To organize National/ International seminars, conferences/exhibitions/ stakeholder interface meetings for upscaling students and faculty research approaches.

2. Significance of Instrumentation Cell:

1. Instrumentation Cell and Automation has been very useful in the advent of. A lot of processes usually done by man such as ploughing, planting, harvesting, irrigation, weeding, soil maintenance and other many other processes such as fruit picking has been completely being replaced by these sensor robotics machine vision based robots.
2. Each applications of agriculture with the help of sensors and Instrumentation can be replaced by Agriculture Robots; Agriculture Automated guided Vehicles and Agriculture Drones. This is how sensor based machine vision robotics used to monitor, predict, cultivate, harvest plants without the interference of any human character.
3. These sensor based machine vision robotics machines can investigate, verify and provide information about areas of land as relating to the part which has a better soil and agro meteorology and the area which has high productivity as well as low productivity
4. Automation has been useful and is useful in being accurate and precise, thereby drastically reducing the rate of wastage and saving you the time of practising trial and error method of where and how in a particular plot.

IC Portfolio Diagram:

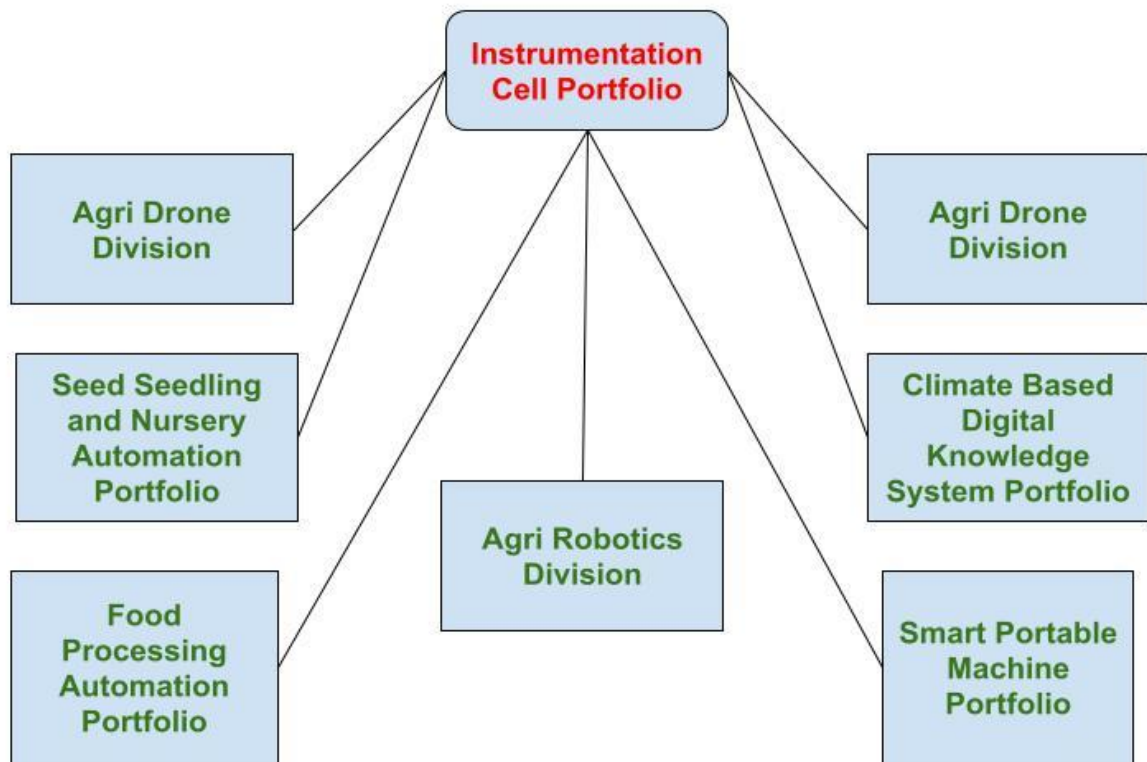


Figure: Instrumentation Cell Portfolio (IC)

Instrumentation Cell Portfolio (IC) pictorial representation is as shown above. You can see the association of this IC cell Portfolio is associated with three divisions and four other portfolios. These three divisions are Agri drones, Agri bots and Agri AGV's. These three divisions are in always requirement of sensors and instrumentation to gather information from field operations of farm on instrumentation Cell. To give Guidance Navigation and control to the agriculture robots, drones and automated guided vehicles are always relies on Instrumentation Cell. Instrumentation Cell is working as a torchbearer to these main three different divisions. The other four portfolios are application portfolios which this center of excellence at NAHEP tried in best way to classified into it. Instrumentation Cell is the heart of this three division and four other portfolios. Out of these four portfolios two portfolios are based on the total automation which is seed seedling and Nursery Automation and other one is Food Processing Automation. Third portfolio is associated with the actual field operation which also requires automation which is sensor vision based automation. These portfolios are called Smart portable machine portfolio. Last portfolio is associated with the meteorological and soil related data gathering with the help of drone which requires imaging camera sensors to give different insights related to remote sensing and GIS. Here in this process they utilize different application software to process images and data with help of QGIS software. That's how Multispectral, Hyperspectral camera, Thermal and RGB cameras can be used to give insights remotely for precision spraying and disease and insect detection remotely.

IC Portfolio Workflow:

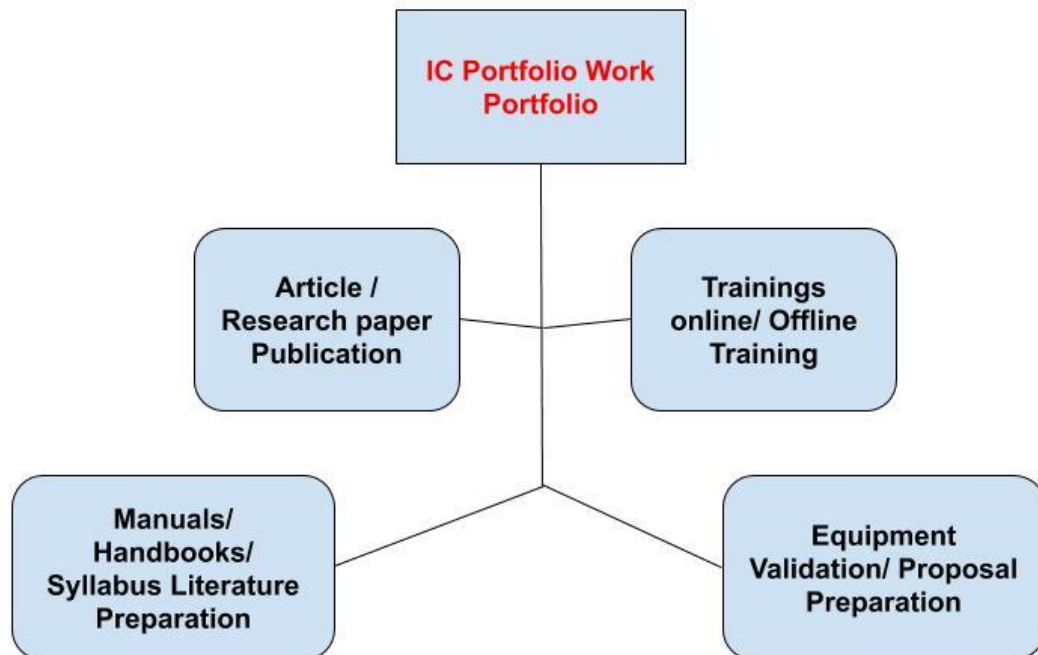


Figure: IC Portfolio Workfolio



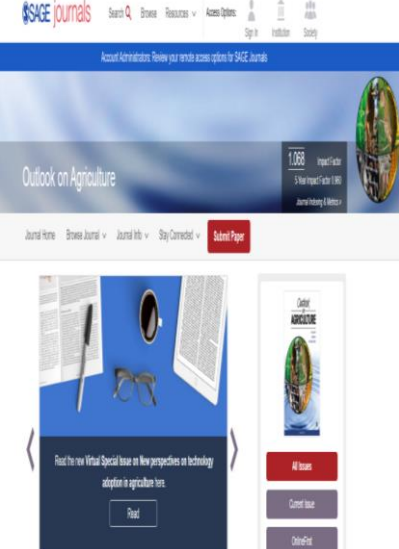
Before starting work everyone needs some planning and strategy to achieve outcome of mandate work. Keeping in this mind Instrumentation Cell (IC) portfolio here at NAHEP – CAAST, DFSRDA, VNMKV, Parbhani has took lots of imitative and these initiatives are mainly classified into four different segments. These segments classified are as follows:

1. Article/ Book/ Research Paper Publications :

Since 6 January 2020 to till date instrumentation Cell has been very efficiently carried out this publication at certain level to create impact of this IC cell at the national level on the heart of NAHEP CAAST, DFSRDA, VNMKV, and Parbhani. In the quest one book has been published on the topic of **Unmanned Aerial Vehicle: Design, Planning & Mission Using Agridrones**. Three articles out of which one is Marathi and other two articles in English are published in famous magazine newsletter and papers. Three research papers out of which two are accepted for publication and one is in review process. All these papers are based on sensors and Instrumentation for agriculture applications. These three papers are specifically overview and review papers details are shared below.


1. Book/ Article and Journal Publications :



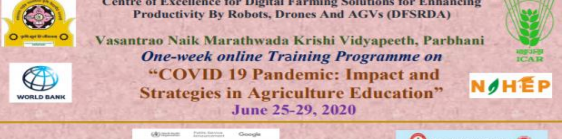
Sr. No.	Book/ Article and Journal	Photo
1	<p>Er. Sachin Karad, Dr. Swati Mundhe & Dr. G.U Shinde, “Unmanned Aerial Vehicle: Design, Planning & Mission Using Agridrones” Book Published in International Publication Lambert Academic ISBN-978-620-2-91776-6.</p> <p>Title: Unmanned Aerial Vehicle: Design, Planning & Mission Using Agridrones First Author and presenter: Sachin Karad Book Link: https://www.amazon.in/Unmanned-Aerial-Vehicle-Planning-Agridrones/dp/6202917768</p>	
2	<p>A Research paper in: AfCPA 2020, Abstract ID #7606, A review on Sensor based robotics agriculture: Improving traditional Agriculture Practices - Accepted for Oral Paper.</p> <p>Title: A Review on Sensor Based Robotics Agriculture: Improving Traditional Agriculture Practices First Author and presenter: Sachin Karad Paper link: https://paafrica.org/Presentation/?aid=7606 Link: https://paafrica.org/uploads/files/OnDemand_Sachin_Karad.mp4</p>	
3	<p>Sachin Karad, Senior Research Fellow NAHEP VNMKV Parbhani Published English Article on “Smart NPK Soil Sensor: Step towards Precision Agriculture” in AgriCos e-Newsletter Magazine.</p> <p>Title: Smart NPK Soil Sensor: Step towards Precision Agriculture First Author : Sachin Karad Link: https://3b3ad16b-16bf-4401-956b-39e03266b7cf.filesusr.com/ugd/93e822_927aa5b72fa144e6a8dde664b359f497.pdf?index=true</p>	

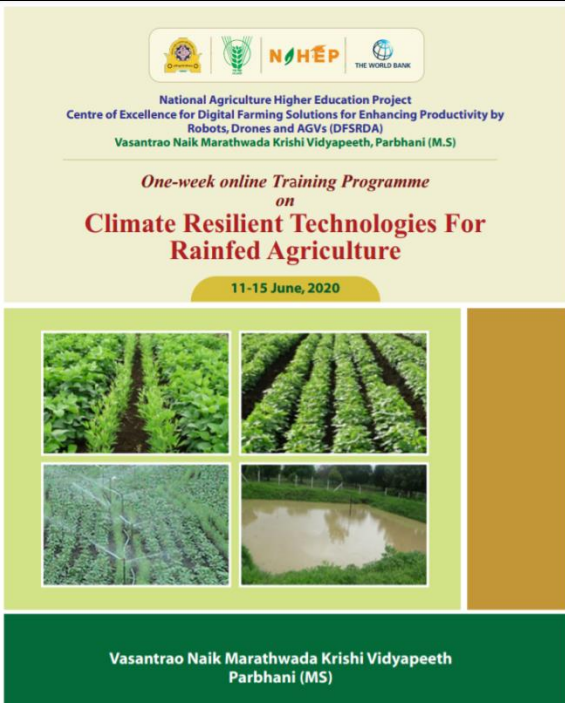
<p>4</p>	<p>Dr. Swati Mundhe Junior research Fellow & Er. Sachin Karad Senior Research Fellow Published A research Article on Soil Spectroscopy: Advance Soil Analysis Prediction Technology in Agricos e-newsletter Magazine with ISSN Number: 2582 - 7049.</p> <p>Title: Soil Spectroscopy: Advance Soil Analysis Prediction Technology First Author : Sachin Karad Link: https://3b3ad16b-16bf-4401-956b-39e03266b7cf.filesusr.com/ugd/93e822_d5042074ea7943838aa1876dae723c6e.pdf?index=true</p>	 <p>Soil Spectroscopy: Advance Soil Analysis Prediction Technology Mundhe S.S.¹ and Karad S.C.² ¹JRF, NAHEP, CAAS-DFSODA, VNMKV, Parbhani-431402, (M.S), India ²SRF (IC), NAHEP, CAAS-DFSODA, VNMKV, Parbhani-431402, (M.S), India</p> <p>SUMMARY Soil world database is essential need to monitor soil status. Soil Spectroscopy is analytical method by which soil properties can be measured and monitored for large area in big scale. This technique is very easy, less costly and environmental friendly. For soil property prediction visible spectroscopy and infrared explained in detail.</p> <p>INTRODUCTION Wavelength range between 0.4mm and 0.78mm is the Visible light (Vis) of EM Spectrum. Radiation involvement with soil generates power due to transfer of charge and effect of field concept. Some bands and colour of soil can be captured by human eye of EM spectrum. Vis and UV spectroscopy Owen (2000) are good to provide soil spectral quantitative information spectra (Viscerra Rossel et al., 2006). Wavelength range between 0.78 mm and 1mm is the Infrared (IR) radiation of EM Spectrum. Energy of frequency corresponds to molecular vibrational, rotational energy of EM Spectrum. The basis of IR spectroscopy is the absorption of</p>
<p>5</p>	<p>Second paper accepted in Indian Journal on Plant Protection and publication will be available in march first-week. Details of the paper are as follows. NAAS rating: 5.03</p> <p>Title: Advancement of SVR Technologies in Precision Farming: An Imperative Tool for Crop Productivity Assurance First Author: Sachin Karad Link:</p>	 <p>Authors Details S. C. Karad¹, A. K. Chaitanya², Sujayaree O. J³ ¹SRF (IC), NAHEP, CAAS- DFSODA, VNMKV, Parbhani, Maharashtra. ²Post Graduate Student, Department of Genetics and Plant Breeding, Lovely Professional University, Punjab ³Ph.D. Research Scholar, Department of Postharvest Technology & Agricultural Engineering, Indian Agricultural Research Institute, New Delhi *Author Correspondence Email: akamura.1204639@lpu.in</p> <p>Dear Researchers/Contributors, We are pleased to inform you that your paper entitled "Advancement of SVR technologies in precision farming: An imperative tool for crop productivity assurance" authored by "S. C. Karad, A. K. Chaitanya, Sujayaree O. J" has been accepted for publication in the Indian Journal (NAAS-507) as regarding reference in</p>
<p>6</p>	<p>Third paper is sent to Outlook on Agriculture Journal. Waiting for acceptance. Details of the paper are as follows</p> <p>Title: A Review on Unmanned Aerial Vehicle Integrated with different sensors for Precision Farming First Author: Sachin Karad Link: https://journals.sagepub.com/home/oag</p>	

2. Online / Offline Training Conducted: Of course now the world has shifted towards new normal in the very bad days of Covid -19. In this new normal period Instrumentation Cell portfolio of NAHEP – CAAST, DFSRDA, VNMKV Parbhani is not far behind to adapt this period. IC portfolio designed six new trainings to reach out students of this university as well as World and Indian other SAU students. In the quest of arranging six trainings IC portfolio reached to 10,000 students of India and world. We have seen NAHEP center created an impact on INDIA and World platform. Details of all trainings are as follows.

Training Online Offline conducted by Instrumentation Cell:

Sr. No.	Trainings Details	Photo
1	<p>One week online Trainings on “BASIC PRACTICES OF ANSYS 2020-R1 FOR AGRICULTURAL RESEARCHERS (CAD/CAM/CAE Series)” were organized by Er. D. V. Patil Core Team member, where 170 participants take advantage of this e-training course.</p> <p>Dates Conducted: 12/5/2020 - 29/5/2020</p> <p>Training Coordinator: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	 <p>The poster features the NAHEP logo at the top, followed by the text 'National Agriculture Higher Education Project' and 'CENTRE OF EXCELLENCE FOR DIGITAL FARMING SOLUTIONS FOR ENHANCING PRODUCTIVITY BY ROBOTS, DRONES AND AGVS'. Below this, it says 'e-Trainings' and 'BASIC PRACTICES OF ANSYS 2020R1 FOR AGRICULTURAL RESEARCHERS (CAD/CAM/CAE Series) 12-29 May, 2020'. The central part of the poster shows three images: a 3D model of a propeller, a 3D model of a cylindrical component, and a simulation of a propeller. Below these images are six blue boxes with white text: 'CAD', 'CAM', 'CAE', '3-D Printing', '3-D Scanning', and 'Simulation Modelling'. At the bottom, it reads 'Computational Software tools for scientific decision-making process in precision Agriculture'.</p>
2	<p>One Week Online training organized by Dr. K.K Dakhore Core Team member on “Recent Advances and Instrumentation in Agriculture Meteorology (CDKS Portfolio)” total 457 trainee were attend this online training program.</p> <p>Dates Conducted: 26/5/2020 - 02/06/2020</p> <p>Training Coordinator: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	 <p>The poster has a green and yellow background. At the top, there are five circular images showing various agricultural and meteorological scenes. Below these is the NAHEP logo. The text reads 'Centre of Excellence for Digital Farming Solutions for Enhancing Productivity By Robots, Drones And AGVs(DFSRDA)'. It then states 'One-week online training on Recent advances & instrumentation in Agricultural Meteorology' and '26 May – 02 June, 2020'. At the bottom, it says 'Vasantao Naik Marathwada Krishi Vidyapeeth Parbhani (MS)'.</p>


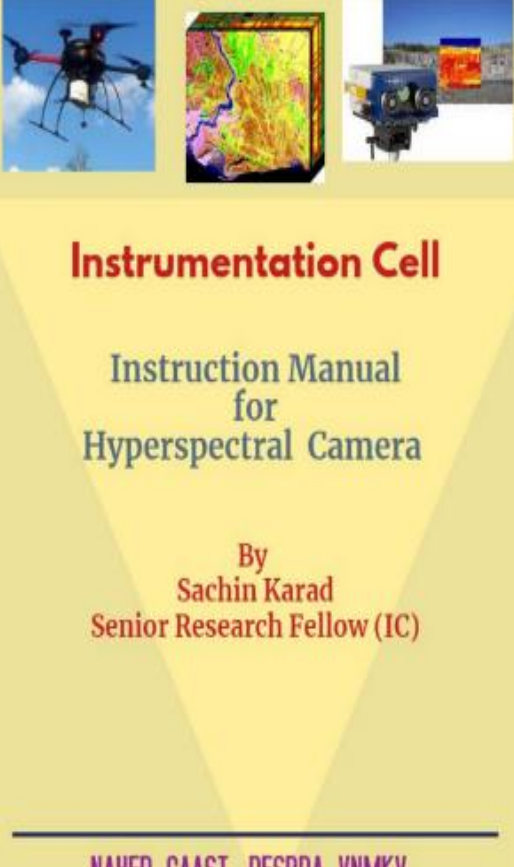
<p>3</p>	<p>One week International online training program is organized by Dr. Bharose Achyut on “Biotechnology: It’s Application in Modern Agriculture” where 480 trainee were participated.</p> <p>Dates Conducted: 04/06/2020 - 08/06/2020</p> <p>Training Coordinator: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	 <p>One-week International online Training Programme “Advance Digital and Biotechnological Tools in Modern Agriculture” 4 - 8 June, 2020</p> <p>ABOUT</p> <p>The Center for Advance Agricultural Science and Technology (CAAST) for Digital Farming Solutions For enhancing Productivity by Robots Drones and AGV's (DFSRDA), Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra & Vilsaoo Deshmah College of Agricultural Biotechnology, Latur is Organizing a one week online International Training programme on “Advance Digital and Biotechnological Tools in Modern Agriculture” from 04 to 08, June 2020. Due to ongoing COVID -19 crises, most of us are restricted to work remotely. So, our Center is taking initiative of organizing talks by established scientist experts in their respective areas through this virtual training.</p> <p>Talking about our CAAST-DFSRDA center, it is proposed on 50:50 cost sharing basis between the World Bank and the Government of India, implemented at VNMKV, Parbhani (M.S.) India (Agriculture University). One of the main objectives of CAAST-DFSRDA, VNMKV Center is developing a holistic model to raise the standard of current agricultural education system that provides career opportunities to PG, Ph.D. students. Additionally this shoulders a responsibility of promoting entrepreneurial attitude of students and professionals alike.</p> <p>BACKGROUND</p> <p>In the last few decades, agriculture entered into the modern world through varietal and hybrid development, nutrient management, advanced crop protection and post harvest management. Biotechnology paved the way to boost modern agriculture through transgenics for crop protection, expedited varietal developments through molecular breeding, rapid production of uniform tissue culture plants, increased understanding in precision nutrient management, and enhancing overall nutrition and produce quality. Furthermore, agriculture biotechnology aims to find sustainable solutions to withstand abiotic stresses such as drought and salinity and stabilize crop yields. Yet, several scientific challenges exist and we are just beginning to understand the power of modern tools and techniques in finding new relevant information that could be filled in for complete understanding of various biological processes. This online training would provide an outstanding opportunity to learn advances in crop research, various tools and techniques, scientists routinely use in their research along with technical or scientific challenges that are being addressed through biotechnological approaches. The online training also provides an opportunity to interact with scientists to learn and think about “out-of-the-box” career opportunities in agricultural biotechnology.</p> <p>AIM</p> <p>The online training aims to discuss leading-edge technologies and recent scientific developments in addition to the immediate challenges in agriculture and allied sectors. It will aim to familiarize students and professionals in biotechnology about current research trends, relevant cutting-edge technologies for high-throughput analysis and interdisciplinary areas that are embraced in leading laboratories.</p> <p>OBJECTIVE</p> <ul style="list-style-type: none"> • Update on basic understanding of the technical Skills involved in biotechnology relevant to agriculture. • Familiarize with high-throughput (NGS and omics) technologies in modern agriculture research. • Provide Technical Knowledge on Innovation glass and photovoltaic technologies in protected cropping • Impart Knowledge for “designer crops” using genome editing tools. • Familiarize with biotechnological approaches for integrated pest management. <p>TARGET AUDIENCE</p> <p>PG, Ph.D. Students, Faculty, Scientists and Staff of Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, other State Agricultural Universities and Non agriculture universities within country and abroad from the area of Biotechnology. The Research fellows working in various National/ International adhoc schemes are eligible to register and are requested to take advantage of the online training conducted during this COVID -19 lock down period.</p> <p>Organized by : Dr. A.A. Bharose, VDCOAB, Latur B, ICAR-NAHEP, CAAST-DFSRDA, VNMKV, Parbhani (M.S.), India Mob. :-919170728496</p>
<p>4</p>	<p>One-week online Training Programme organized by Dr. Vaidya P. H. on “Application of Remote Sensing & GIS In Digital Agriculture” where 450 participants were participated.</p> <p>Dates Conducted: 04/06/2020 to 08/06/2020</p> <p>Training Coordinator: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	 <p>Centre of Excellence for Digital Farming Solutions for Enhancing Productivity By Robots, Drones And AGV's (DFSRDA) Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani One-week online Training Programme on “Application of Remote Sensing & GIS In Digital Agriculture” 4 - 8 June, 2020</p> <p>REMOTE SENSING</p> <p>ABOUT</p> <p>Centre of excellence for Digital Farming solutions for Enhancing Productivity by Robots, Drones and AGV's (DFSRDA), VNMKV, Parbhani is organizing a “One Week online training on “Application of Remote Sensing and GIS in Digital Agriculture” during 04th to 08th June, 2020. “The Centre for Advanced Agricultural Science and Technology (CAAST) for Digital Farming solutions by Enhancing Productivity by Robots, Drones and AGV's (DFSRDA)” is being implemented in Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, and Maharashtra under World Bank Sponsored. National Agricultural Higher Education Project (NAHEP) of Indian Council of Agricultural Research (ICAR), New Delhi, Government of India, Since 2019. One of the main objectives of this center is the capacity building among the PG/PhD students and faculties of VNMKV and other Universities about recent advances in agricultural science and technology.</p> <p>AIM</p> <p>The aim of organizing this training is to expose the participants to basic principles of RS and GIS and their applications in agriculture. This training is designed for participants to acquaint with the various processes involved in acquiring, analysis and interpreting RS and GIS data used for various applications. This training will also help to give understanding on the application of RS and GIS in solving the research problems.</p>
<p>5</p>	<p>One-week online Training Programme on “COVID 19 Pandemic: Impact and Strategies in Agriculture Education” was organized by Dr. Veena Bhalerao Core Team member in which 401 participants were participated.</p> <p>Dates Conducted: 9/06/2020 to 13/06/2020</p> <p>Training Coordinator: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	 <p>Centre of Excellence for Digital Farming Solutions for Enhancing Productivity By Robots, Drones And AGV's (DFSRDA) Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani One-week online Training Programme on “COVID 19 Pandemic: Impact and Strategies in Agriculture Education” June 25-29, 2020</p> <p>COVID-19 (Novel Coronavirus)</p> <p>ABOUT</p> <p>Centre of excellence for Digital Farming solutions for Enhancing Productivity by Robots, Drones and AGV's (DFSRDA), VNMKV, Parbhani is organizing a Five days online training on “COVID 19 Pandemic: Impact and strategies in agriculture education”. The project Centre for Advanced Agricultural Science and Technology (CAAST) for Digital Farming solutions by Enhancing Productivity by Robots, Drones and AGV's (DFSRDA) is being implemented in Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani, and Maharashtra under World Bank Sponsored. National Agricultural Higher Education Project (NAHEP) of Indian Council of Agricultural Research (ICAR), New Delhi, Government of India, Since 2019. One of the main objectives of this center is the capacity Building among the PG/PhD students and faculties of VNMKV and other universities about recent advances in agricultural science and technology.</p> <p>AIM</p> <p>The aim of this on line training programme is to orient the skills to create and support a safe environment in rural areas in context of COVID 19. This would have significant implications on agriculture students, teachers, other staff and society at large.</p> <p>This training programme would develop awareness about preventive measures against COVID 19 and maintain hygienic habits among the target group. The online training would create awareness about nutritional care in students and all strata of society to fight against pandemic situation. Even after Percolation of knowledge base to grass root level through this online training, it will maintain social distance among the trainer and participants through this digital platform.</p>

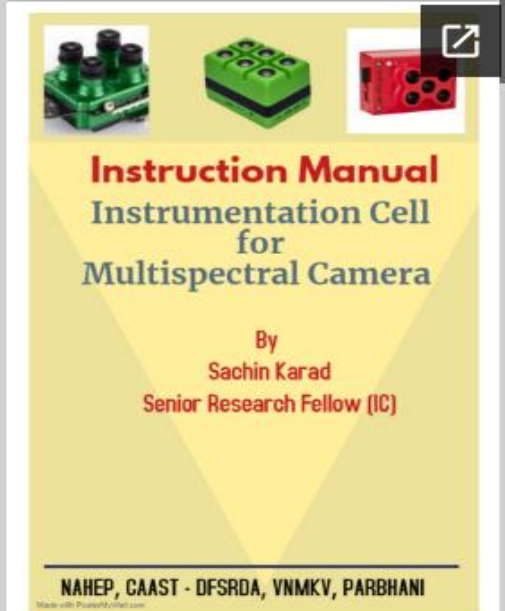
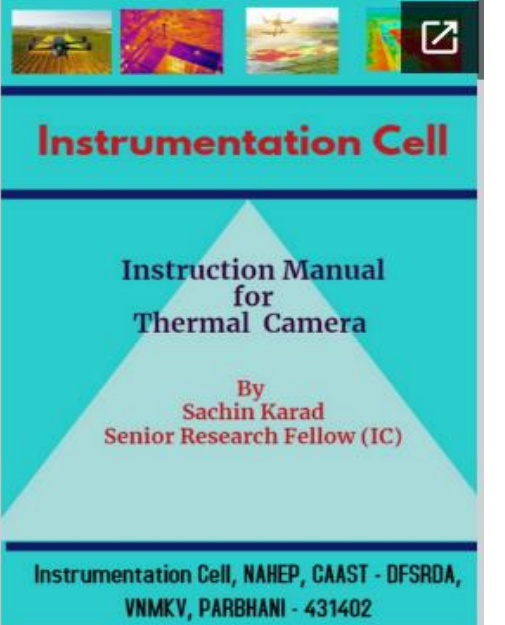
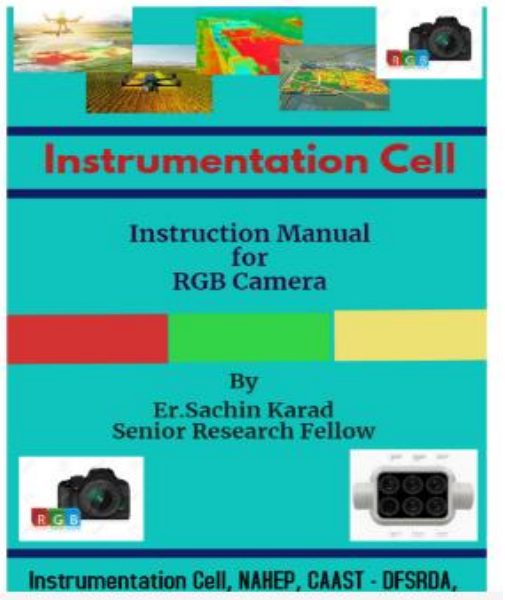
<p>6</p>	<p>Dr. B.V. Asewar HOD Agronomy organized one week online training program on “Climate resilient technology for Rainfed Agriculture”, where 452 participants take advantage of its training program.</p> <p>Training Coordinator: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p> <p>Dates Conducted: 11/06/2020 - 15/06/2020</p>	 <p>National Agriculture Higher Education Project Centre of Excellence for Digital Farming Solutions for Enhancing Productivity by Robots, Drones and AGVs (DFSRDA) Vasantao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.)</p> <p><i>One-week online Training Programme</i> on Climate Resilient Technologies For Rainfed Agriculture</p> <p>11-15 June, 2020</p> <p>Vasantao Naik Marathwada Krishi Vidyapeeth Parbhani (MS)</p>
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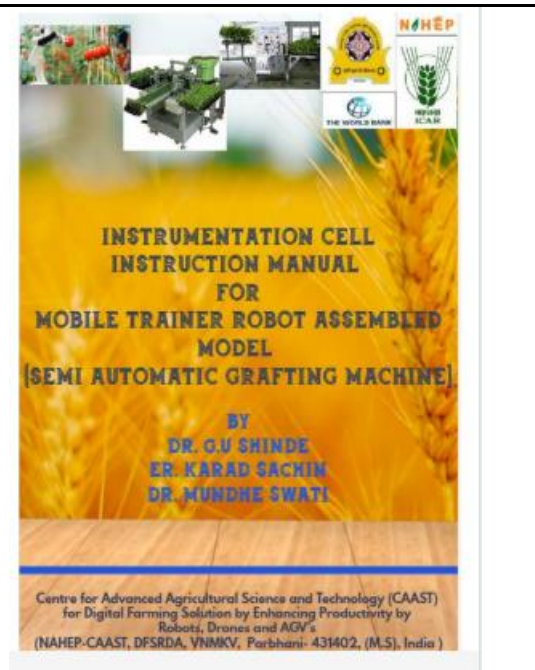

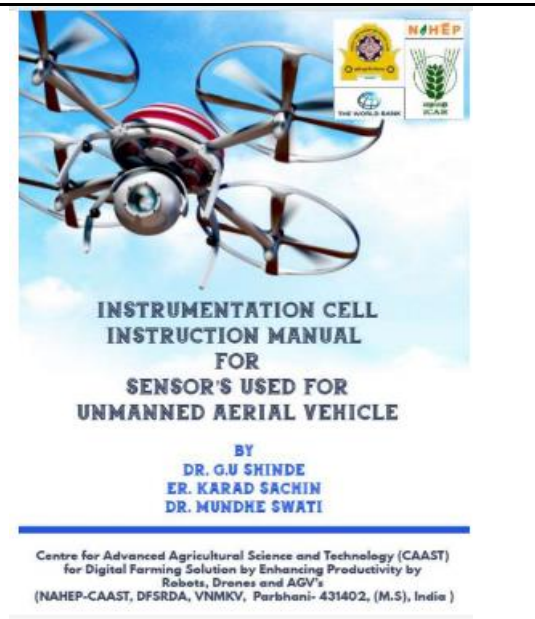
3. Manuals/ Handbooks/ Syllabus Literature Preparation: Instruction manuals are the one of the way to learn new equipment. As always with all the new equipment all manuals come in details of equipment and operations. One of the try has been done for preparation of these instruction manuals of equipments in terms of only theoretical knowledge compiled from lots of research papers as per the guidance of his holiness Dr. Gopal Shinde (Principal Investigator) of this project. It was very fantastic and hard way to prepare Instruction manuals without any real instruments in cell that is without any equipment in practical. So, this is the perfect way which has not only increased knowledge and specification of these equipments in details. This analogy is like before going into battle ground in practical one has to prepare it before. This perspective of our PI has really helped us in hard to prepare these instruction manuals. In this quest Instrumentation Cell (IC) has prepared 10 Instruction Manuals. The names of these manuals are as follows.

1. Attitude Sensor
2. Hyperspectral Camera
3. Multispectral Camera
4. Thermal Camera
5. RGB Camera
6. Semi-Automatic Grafting ROBOT
7. 3D Scanner
8. Sensors used for UAV
9. Spectroradiometer
10. Robotics Manipulator and End Effector

Manuals / Handbook/ Syllabus and Literature prepared by Instrumentation Cell (IC):

Sr. No.	Manual Details	Photo
1	<p>Instruction Manual on Attitude Sensor has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	
2	<p>Instruction Manual on Hyperspectral Camera has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	

<p>3</p>	<p>Instruction Manual on Multispectral Camera has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	
<p>4</p>	<p>Instruction Manual on Thermal Camera has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	
<p>5</p>	<p>Instruction Manual on RGB Camera has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	

<p>6</p>	<p>Instruction Manual on Semi-Automatic Grafting ROBOT has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	
<p>7</p>	<p>Instruction Manual on 3D Scanner has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	
<p>8</p>	<p>Instruction Manual on Sensors used for UAV has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	





<p>9</p>	<p>Instruction Manual on Spectroradiometer has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	
<p>10</p>	<p>Instruction Manual on Robotics Manipulator and End Effector has been prepared by Instrumentation Cell (IC)</p> <p>Compiled By: Er. Sachin Karad, Senior Research Fellow (Instrumentation Cell)</p>	

4. Equipment Validation, Proposal and Demonstration: Equipment procurement, proposal, purchase, validation and caretaking are done under the supervision of only one person who belongs to Instrumentation Cell. Before finalizing specifications of each equipment Instrumentation cell was bit busy in procurement phase I and II. After equipment reception at NAHEP center Instrumentation Cell not only looks In and out for it's better applications. It sometimes happens that some of the procured equipments will not meet to criteria and standards. Then this equipment was refused by NAHEP center on the input of Instrumentation Cell in conjunction with procurement cell. These all be done by taking guidelines of NAHEP Procurement Manuals. The details of some of equipments received at the NAHEP centers with the respective validation and training activities are enlisted as.

International Workshop Instrumentation Demonstration Activity:

Sr. No.	Activity Details	Photo
1	<ol style="list-style-type: none"> 1. International Workshop Day 3: Demonstration of Instruments from different company 2. Dr.Ajay Deshmukh, Director, Affordable robotics automation ltd (ARAPL) PUNE and treasure of IAIAM Pune 3. Dr. Deepak Waiker, Vice Chair, IEEE Education Society chapter. 4. Mr. Aditya Marathe, CEO,NUGENIX, Ichalkaranji 5. Mr. Ajeet Kharjule ASAP Agritech, Nashik 6. Mr. Sandesh Bhagat, SGGs, Nanded. 7. Mr. Salim Pathan Local Entreprenur / Craftman 8. Mr.Shirale, Entreprenur/Craftman <p>Date Conducted: 15/03/2020</p>	



Sr. No	Equipment Name	Event & Activities Are Organized/ Co-ordinated/Participated	Photo
1	<p>Drones:</p> <p>1. Spraying Drone 2. Scouting Drone 3. Mapping Drone</p> <p>Date; 23/12/2020 - 26/12/2020</p>	<p>1. “Hands on Drone Training for Spraying and Mapping.</p>	
		<p>2. Three Days “Hands on Drone Training for Spraying and Mapping” Was organized at NAHEP CAAST DFSRDA, VNMKV Parbhani Centre.</p>	
		<p>3. “Hands on Drone Training for Spraying and Mapping.</p>	
		<p>4. PG Student Miss D. Pranaswi M.Sc Agronomy done the Research work on “Comparative study of Herbicide efficiency using drones” Guided by Dr. Megha Jagtap Nodal Officer (ESP).</p> <p>Date: 16/10/2020</p>	

5. Geospatial mapping & Spray testing by drones at NAHEP CAAAST VNMKV Centre by Technical Staff of NAHEP Centre.

Date: 16/10/2020



6. Demonstration of Drones purchased by NAHEP center at VNMKV Parbhani in presence of Hon. Vice chancellor Dr. A. S. Dhawan and CoPi members and NAHEP Staff.

Date: 28/08/2020



2 **Camera**

Spectroradiometer

Date: 18/12/2020 to 19/12/2020

Applications: Useful to calculate spectral irradiance of any crop. This is working for spectral range of 400 nm to 800 nm. Vegetation indices and crop disease and infection we can predict by comparing healthy and infected spectral irradiance intensity.

1. Training & Demonstration of Radio spectrometer by Willam Joseph from Sinsil International for spectroradiometer



Real Sense

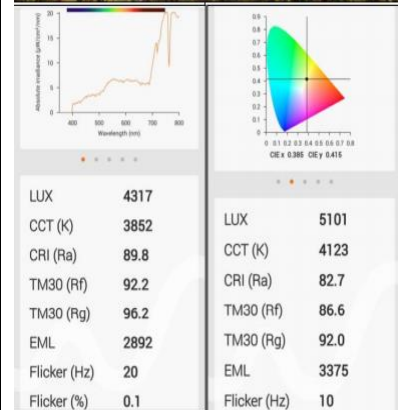
Intel Real sense D435i and Lidar L515 camera Demonstration Training for nahep staff. This camera gives 2D/3D images It has 3 modes of operations i) RGB ii) Depth iii) Infrared/ Thermal images This camera is useful for crop/Soil health monitoring purpose.

Date: 9/11/2020 to 11/12/2020

Applications: This camera gives 2D/3D images It has 3 modes of operations i) RGB ii) Depth iii) Infrared/ Thermal images This camera is useful for crop/Soil health monitoring purpose

2. Real Sense camera, ZED Camera & Spectroradio-meter was tested for pest detection & plant health monitoring detection.

3. Received Intel RealSense Tm Depth Camera D435i & LIDAR L515 Camera to NAHEP Center.



Multispectral Camera
Parrots-Sequoia,
Micasense with Pix-
4D
Software.

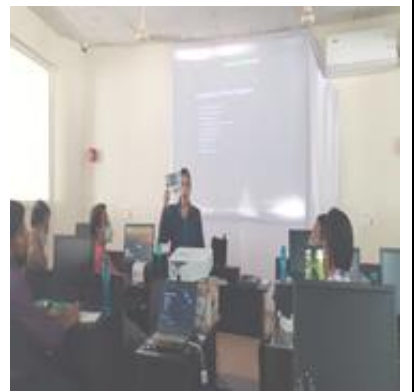
Applications: Useful to calculate vegetation indices of the crops. We can use this camera with the drones. Using drone flight we can able to scout and map the farm land. The data gathered will then processed through respective image processing software PIX 4D. This is working in between approximate spectral ranges of 400 nm to 1000 nm. For this purpose multispectral camera Parrots-Sequoia, Micasense used.


4. Core Team and NAHEP-Staff training conducted for multispectral camera Parrots Sequoia , Micasense with Pix-4D software from Kambil system for mapping Survey, and inspection of field




5. Staff training conducted for multispectral camera Parrots Sequoia, Micasense with Pix-4D software from Kambil system for mapping Survey, and inspection of field.

6. Demonstration and training of multispectral camera such as Parrots-Sequoia, Micasense with Pix-4D software from Kambil system, New Delhi for mapping Survey, and inspection of field.

7. Received multispectral camera Parrots Sequoia , Micasense with Pix-4D software from Kambil system for mapping Survey, and inspection of field.



<p>3</p>	<p>Industrial Grade CCD Camera with NVR</p> <p>Date: 08/01/2021</p> <p>Application: These WIFI enabled 2MP Industrial Grade CCD camera with Network video recorder will be useful for the agriculture robots and agriculture automated guided vehicles for the guidance and navigation purpose. We can gather more information in terms of videos and images of field operation.</p>	<p>Industrial Grade CCD Camera with NVR from E-vision India Pvt. Ltd. Has been demonstrated to staff and faculty of NAHEP Center.</p>	
<p>4</p>	<p>Solar Power Plant</p> <p>Applications: This Solar power plant is useful for generation of 26 KW ongrid power. This is also useful to minimize the whole bill of electricity at NAHEP centre. This centre is also generating revenue for the centre from Maharashtra State Board of Electricity.</p>	<p>26 KW ongrid Solar Power Plant successfully installed at NAHEP CAAST VNMKV Parbhani Centre.</p> <p>Date: 22/12/2020</p> <ol style="list-style-type: none"> 1. Proposal & presentation regarding Green Environment campus in front of Hon. Vice Chancellor. 2. Inauguration of installation of solar structure & Solar Plant Work. <p>Date : 28/10/2020</p>	 

<p>5</p>	<p>Sensors</p> <ol style="list-style-type: none"> 1. Soil Moisture sensor 2. Soil Temperature sensor 3. Soil EC sensor 4. Soil NPK Sensor 5. Soil PH sensor 6. LIDAR sensor 7. 3D Ultrasonic anemometer 8. Optical and stainless steel rain gauge sensor 9. Atmospheric Temperature and humidity sensor with radiation shield 10. Solar sensor for PAR, UV and global radiation 11. GNSS based altitude sensor 12. Digital/ Analog type hall effect position sensor 13. MEMES Sensor for tilt measurement 14. Digital sensor for distance measurement up to 1 m 	<p>1. Received sensors for temperature, moisture, plant stress, water scarcity, NPK identification, etc. Installation process completed for all sensors at NAHEP centre.</p>	
	<p>Applications: These sensors are useful for the measurement of soil properties and agriculture meteorological properties.</p> <p>Date: 06/01/2021 to 09/01/2021</p>	<p>2. Staff training conducted for sensors used in temperature, moisture, plant stress, water scarcity, NPK identification.</p>	
	<p>3. Core team scientist Dr. Kailas Dakhore & Dr. Ashok Jadhav conducted research experiment for sensors application for temperature, Humidity, Wind Speed, Solar radiation, PAR, UV, NPK, Soil moisture, Soil temperature, pH, etc. at cotton research field farm.</p> <p>Date: 12/01/2021</p>	<p>Core team scientist Dr. Kailas Dakhore & Dr. Ashok Jadhav conducted research experiment for sensors application for temperature, Humidity, Wind Speed, Solar radiation, PAR, UV, NPK, Soil moisture, Soil temperature, pH, etc. at cotton research field farm.</p>	

4. Ph.D. Students Mr. A.P. Garde was performed Research activity on Estimation of soil NPK, PH & Electric conductivity.

Date: 15/01/2021



5. Field demonstration and Experiments conducted for PG/PhD students also for NAHEP Staff & Core team member conducted at Agronomy sample field.

Students carried out their experiment using sensors and understand soil temperature, soil moisture, plant stress, water scarcity, NPK in soil



6 Automatic Solar Guided Spraying Vehicle (Agriculture Robots)

Applications: This Automated guided spraying vehicle is working on solar charger battery which has 12 V DC. So there is camera is attached to this sprayer AGV. We can control, navigate and guide this AGV from android IOT application.

Date: 9/12/2020

1. Hon. VC Dr. A. S. Dhawan & District Superintendent of Police and his team Mr. Jayant Meena visited NAHEP Center and took review about Digital technology development.

Date: 03/12/2020



2. Under Rural Horticulture work experience (RHWE & Study tour) student of College of Horticulture, Pune had completed one day study tour.

Date: 9/12/2020








3. Field performance of newly developed Automated guided Spraying Vehicle in presence of IB-18 Lokmat TV channel.

Date: 28/11/2020



		<p>4. Demonstration of Automated Spraying Machine jointly developed by NAHEP team and local vendor Mr. Shirale from Vishwadeep agro services.</p> <p>Date:24/11/2020</p>	
<p>7</p>	<p>Mechatronics Lab</p> <p>Applications: This lab work is in process one of the parts about pneumatic and hydraulic kit has been frizzed. Other part of Industry automation 4.0 with sensor kit is in process. These trainer kits will go to help students learn mechatronics subjects' application in Agri drone, AGV and agriculture robotics division.</p>	<p>MoU Discussion meeting with SMC Noida for Proposal of Mechatronics Lab in presence of Principal Investigator Dr. G. U. Shinde, Core team Member and NAHEP Staff at NAHEP VNMKV center.</p> <p>Date:26/11/2020</p>	
<p>8</p>	<p>Fire safety Balls and fire extinguisher</p> <p>Application: These are installed at whole NAHEP centre for the</p>	<p>Installation of Fire safety Balls and fire extinguisher at NAHEP-CAAST-DFSRDA Parbhani.</p> <p>Date: 13/11/2020</p>	

<p>9</p>	<p>Disinfection box</p> <p>Application: Disinfection box is essential for killing all germs which causes health problems. Using UV rays</p>	<p>Inauguration of Disinfection box with the hands of Hon. Vice Chancellor Dr. A. K. Dhawan 7 DI & Dean Dr. Gokhale</p> <p>Date:03/01/2020</p> <p>NAHEP-DFSRDA-VNMKV developed Disinfection Box for Farming Society in collaboration with Swaraj Engineering Pvt Ltd. Aurangabad.(MS)India</p> <p>Date: 26/10/2020</p>	
<p>10</p>	<p>3D Printer & 3D scanner</p> <p>Application: 3D Printer and Scanner will be very important for printing physical model of any item by scanning them. So, technical demonstration has been done before procuring.</p>	<p>3D Printer & 3D scanner presentation for award of contract proposal finalization at NAHEP VNMKV Centre.</p> <p>Date:15/12/2020</p> <p>3D printing demonstration and webinar at NAHEP centre.</p> <p>Date: 15/08/2020</p>	 
<p>11</p>	<p>Hydraulic & Pneumatic lab</p> <p>Application: Hydraulic & Pneumatic lab is essential for training the students of agriculture through mechatronics lab.</p>	<p>Hydraulic & Pneumatic lab presentation for award of contract proposal finalization at NAHEP VNMKV Centre.</p> <p>Date:16/12/2020</p>	

<p>12</p>	<p>Face Recognition machine</p> <p>Application: Useful for face recognition. With that stated this machine is useful to recognize temperature with real time attendance. Having speech instruction which says to keep mask on face.</p>	<p>Inauguration of Face Recognition machine with the hands of Hon. Vice Chancellor Dr. A. S. Dhawan in presence of Dr. D. N. Gokhale(DI & Dean), Er. Ranjeet Patil (Ragistar VNMKV), Dr. U. M. Khodake (Associate Dean & Principal Agril. Engg.).</p> <p style="text-align: center;">Date: 15/08/2020</p>	
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This is the whole report of Instrumentation Cell (IC) Portfolio. Our portfolio has digital presence. The Link for its digital presence is <https://sites.google.com/view/ic-portfolioahep/home>