Minutes of the Meeting of the Project Monitoring and Review Committee, IIITB COMET Foundation

Date: 31st March 2023
Time: 1400 hrs. to 1730 hrs.

Members present:

1. Prof Debabrata Das: Chairman, IIITB COMET Foundation
2. Prof Shabbir Merchant: Emeritus Fellow, EE Department, IIT Bombay; Member PMRC
3. Mr R Prakash: Technical Expert, C-DOT, Member PMRC (nominated by Secretary, Department of Telecom, GoI)
4. Dr Rajeev Shorey: CEO UQIDAR, IIT Delhi; Member PMRC
5. Dr Milind Gandhe: CEO, IIITB COMET Foundation
6. Mr Amudheesan N: Program Manager, IIITB COMET Foundation
7. Dr Astha Sharma: Program Manager, IIITB COMET Foundation

1. The Chairman, IIITB COMET Foundation welcomed all members to the meeting and gave an overview of IIITB COMET Foundation. He also explained the four projects that have been awarded.
2. The Committee invited the project team for the project "5G ORAN Base Station" led by Prof Kiran Kuchi (with members from IIT Hyderabad, IIIT Bangalore, IIT Roorkee, IIT Bhilai and IIIT Naya Raipur) to present.
    a. Prof Kiran Kuchi first presented the technical progress and financial status of the overall project.
        i. Prof Kiran said that without 5G massive MIMO (mMIMO) technologies, all aspects and functions of 5G cannot be realized. Prof Kiran further emphasized that indigenous mMIMO stack is not available in India. Having access to an indigenous stack will have multiple technical, commercial and security benefits for the nation.
        ii. This project aims to integrate ORAN compliant sub-systems to develop near commercial-grade 5G mMIMO base station, with the mMIMO scheduler being one of the biggest challenges to develop and deploy in mMIMO systems.
        iii. Prof Kiran then presented his experimental results for the mMIMO setup. He showed that with UEs distributed in azimuth and elevation; 11 out of 17 UEs paired in a 30-degree sector. This improved throughput by up to 11 times. This is a significant R&D achievement. These algos will be pushed into the stack being built.
        iv. He also presented the ongoing work on training and skill development. He introduced the FWC program which was created for the purpose of training skilled HR (final year engineering students were inducted into the program) to work on 5G (and beyond) wireless systems. He said that these resources were now being recruited as project staff. A key highlight of the course is that students use their Android phone with Bluetooth keyboard, FPGA, and microcontroller in lieu of a laptop. The focus of the program is to teach embedded programming using C. 109 student have been skilled so far
    b. **PMRC Observation 1**: After the above presentation, the PMRC agreed that the project was on the right track and recommended continuation of the project. They felt that this project had put together a strong team. The PMRC had two specific feedback for this team

i. It is important to segregate the IPR being used in this project as background and foreground.
ii. A document summarising the roles and responsibilities of each Co-PI in the consortium is needed.

c. Dr(s) Prem Singh, Amrita Mishra, Vinod Reddy and Priyanka Das presented the progress of the tasks at IIIT Bangalore.
   i. Dr Prem Singh presented the efforts at IIITB to develop the hardware solution for an O-DU and explained how
      1. This effort complements the effort at IIT Hyderabad. IIT Hyderabad is developing the software stacks of O-DU which will be installed on the card being developed.
      2. This hardware effort is an indigenous design of a critical component of the ORAN based O-DU. This design will enable both hardware and software indigenous development (which will be advantageous from cost and security perspective).
   ii. Dr Amritha presented her work on mMIMO Beam forming and beam management solutions for better performance. Due to stringent requirement of 5G and beyond, these beam steering solutions will have a huge positive performance impact.
   iii. Dr Priyanka presented her work on usage of AI-ML for Channel estimation. Dr Priyanka explained the results so far with regard to channel estimation.

d. **PMRC Observation 2**: The PMRC was appreciative of the efforts of the above presentation of the team. The PMRC recommended continuation of the project.
   i. The PMRC offered suggestions on component selection and procurement. In particular, they recommended that given long lead times for some of the components, the team should consider choose components that have better availability even if this may mean compromising on a couple of features.
   ii. On the AI part of the tasks, the PMRC recommended that the team reach out to other labs across the world to get channel data, as there were no openly available datasets and getting channel data would be difficult without resources.

3. Next, Prof Navin Kumar from Amrita Vishwa Vidyapeetham, Bangalore Campus, presented his project on AI Co-Design and Development of 5G Hardware and Software for 5G Network in a Box.
   a. Prof Navin presented his work on establishing a "Centre for Advanced Communications and Networks" at Amrita Viswa Vidyapeetham. He also presented his experiments to establish an end-to-end connection (youtube video streaming) using an Open Source core (OAI) and a COTS UE.
   b. The PMRC felt that this project was on the right track and recommended continuation of the project.
   c. **PMRC Observation 3**: They had two specific feedbacks for the PI after above presentation,
      i. They recommended that the project should refine its focus and define the problem statement more sharply.
      ii. On the AI part of the tasks, the PMRC recommended that the team reach out to other labs across the world to get channel data, as there were no openly available datasets and getting channel data would be difficult without resources. (Same comment as 2(d)(ii) above)
4. The next presenter was Prof Arzad Kherani from IIT Bhilai for the project "Smart Radio Environments – Implementation and Deployment for Targeted Use-Cases". He presented on behalf of the consortium consisting of IIT Bhilai, IIT Delhi, IIT Indore, IIIT Naya Raipur, IIT Jodhpur, IIT BHU (Varanasi), IIIT Bangalore and IIT (ISM) Dhanbad. He said that, it is a 5G-Advance and 6G problem,

a. Prof Kherani explained that the aim of the project was to develop a Smart Reflecting Surface for improving coverage using mmWave. He gave an update on the fabrication of the prototype. The system setup is being developed at several institutes across India and the test setup is being brought up at IIIT Naya Raipur and IIITB. He said that there is a strong interest in Commercialization within TSDSI and outside. First (demo) deployments in 4G systems (with respect to available equipment in market/institutes) with passive RIS are expected Oct/Nov 2023. The algorithms thus developed will be later shifted to 5G and 6G specifications.
b. **PMRC Observation 4**: The PMRC felt that this project was on the right track and recommended continuation of the project.
    i. The PMRC recommended that that the CEO should encourage the project to speed up lab establishment and procurement. They suggested that the CEO should ask the project for a revised proposal if more funds are needed.
    ii. The PMRC recommended the PI should create a document summarising the roles and responsibilities of each Co-PI in the consortium is needed.

5. The final presenters were Dr(s) Ekant Sharma (IIT Roorkee) and Prem Singh (IIIT Bangalore) for the project "Design and Development of New Prototype for RIS-aided Communications". They presented on behalf of the consortium consisting of IIT Roorkee, IIT Patna and IIIT Bangalore.
    a. Dr Ekant introduced the project. He present the plan for the development of the RIS prototype and presented the milestones completed so far
        i. RIS control circuitry being developed
        ii. Simulation in EM simulator
        iii. Initial design and simulation for the reflective elements shared
        iv. Initial transmit/receive chain design – without RIS used as baseline
    b. **PMRC Observation 5**: The PMRC felt that this project was on the right track and recommended continuation of the project.
        i. The PMRC recommended that that the CEO should encourage the project to speed up lab establishment and procurement. They suggested that the CEO should ask the project for a revised proposal if more funds are needed.
        ii. The PMRC also suggested that the team should be open to experimenting with a Passive Reflecting Surface as this use case could be quite common.
6. **PMRC Observation 6**: The PMRC advised the CEO the following:
    a. Create a dash board to track the progress of the projects monthly
    b. Closely monitor expenditure of the projects as a proxy for their progress and capacity to absorb funds
    c. The CEO should encourage cross pollination of ideas between the two RIS related projects – "Smart Radio Environments – Implementation and Deployment for Targeted Use-Cases" and "Design and Development of New Prototype for RIS-aided Communications" as this would benefit the standardization effort
    d. The PMRC felt that the overall progress of the projects was satisfactory. They recommended continuation of financial support to all the four projects, according to the reports submitted.