

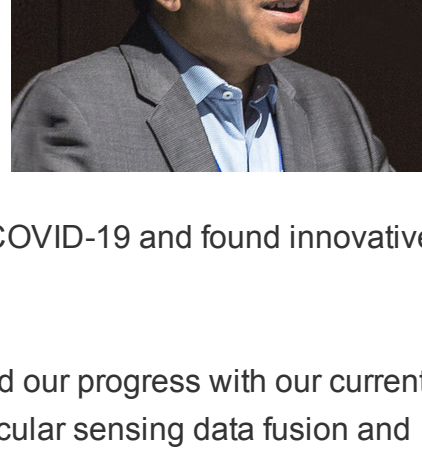
# CWC NEWSLETTER

Summer 2021

## Message from the Director

Dear CWC Community,

I hope this newsletter finds you, your family, and friends in good health. As we have weathered challenging times, CWC's research projects and partner engagements continued. Countless Zoom meetings were the "new normal" and Zoom fatigue became very real. We forged ahead despite restrictions placed on occupancy in our labs due to COVID-19 and found innovative ways to manage our research remotely.



Our virtual Research Review in May 2021 highlighted our progress with our current research projects in the areas of 5G/6G circuits, vehicular sensing data fusion and communications, edge and hybrid computing and communications, and more. We also announced multiple new initiatives with our member companies, notably modeling and testing for 5G RF Radiation Safety in partnership with Safe Dynamics and Keysight Technologies, mmWave based ambient sensing and networking in partnership with Samsung Research America, a C-V2X testbed for multi-modal fusion and mobility research in partnership with Qualcomm, and 28 GHz mmWave radios and networking for future V2X communications in partnership with pSemi. You can read more about some of the new initiatives in the newsletter below.

As 5G technologies become commercially available, and we and our partner companies engage to define the fundamental contours and research focus for 6G, we continue to explore new applications that can use 5G and define 6G while making fundamental changes in the lives of individuals, communities, and enterprises. Towards that goal, we have been making significant progress in using existing wireless innovations and discovering new needs for novel applications in the areas of connected health, smart transportation, and futuristic x-reality experiences. You can find more information about these application explorations at our website [cwc.ucsd.edu](http://cwc.ucsd.edu).

We also welcomed two new Board Members: Steven Truong, CEO of VinBrain, a company focused on research and development in AI and machine learning for medical applications, and Vikas Choudhary, VP Sales and Marketing for pSemi, a leading designer of innovative semiconductor solutions and manufacturer of RF, power management, and sensor products. We greatly value the insight and support provided by our new and existing board members, as well as other colleagues at all of our partner companies.

In closing, I would like to thank all our students, faculty, and member companies for the remarkable progress we have made in the last six months, and I look forward to exciting new progress in the coming six months. To the broader CWC community, I would like to thank you for your interest and support, and I hope to see you in person at our CWC 6G Forum which will be held in November 2021.

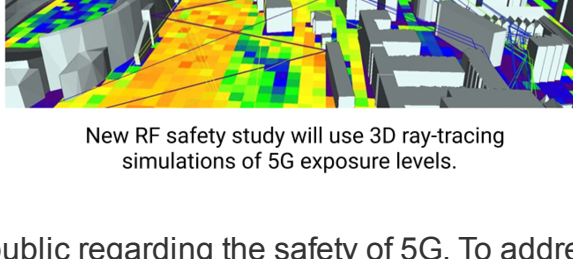
Warmest regards,

**Sujit Dey**

**Director**

**Center for Wireless Communications**

## CWC News and Events



New RF safety study will use 3D ray-tracing simulations of 5G exposure levels.

### RF Safety Study Aims to Address Public Concerns over 5G

Wireless communications such as 5G bring a host of benefits to users, but, as with many new unfamiliar technologies, questions have been asked by the public regarding the safety of 5G. To address the public health concerns and help answer some of these questions, CWC has partnered with Safe Dynamics and Keysight Technologies to conduct a 5G RF safety study, led by Xinyu Zhang and Sujit Dey, professors with the Electrical and Computer Engineering Department at the UC San Diego Jacobs School of Engineering. The goal of the study is to characterize and validate the RF emission levels from 5G base station antennas and the corresponding exposure levels.

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### Smart Transportation Testbed Made More Intelligent with C-V2X Technology

Researchers with the Center for Wireless Communications, in partnership with Qualcomm and CommSignia, deployed Cellular-Vehicle to Everything (C-V2X) equipment on the UCSD campus in June, enabling a new testbed for evaluating vehicle communications and safety technology. C-V2X is an approach to vehicular communications that couples sidelink communications in a dedicated band with the more well-known licensed cellular bands that are commonplace today. Cooperative perception efforts will be contrasted with ongoing mmWave V2X research ([m3.ucsd.edu](http://m3.ucsd.edu)) to see how the two can function symbiotically as a hybrid V2X networking system.



An employee from UCSD Facilities Management mounts a mmWave radio on a pole above the C-V2X radio and accompanying compute and green energy.

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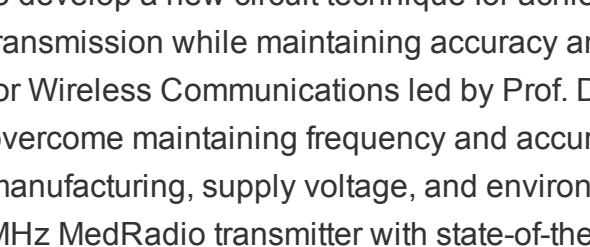


Fig. IoT transmitter chip on a PCB and the wireless test set-up for short-range communication.

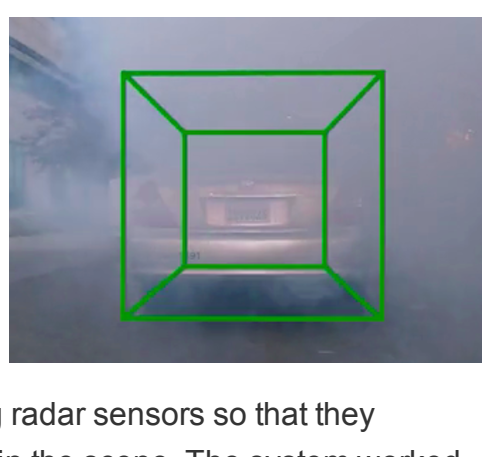
### New Chip Enables Ultra-Low Power Wireless Transmission for the Internet-of-Things (IoT)

The Internet of Things may soon become more efficient thanks to researchers at the Center for Wireless Communications who recently overcame a longstanding technology hurdle to develop a new circuit technique for achieving ultra-low power wireless transmission while maintaining accuracy and robustness. Researchers at the Center for Wireless Communications led by Prof. Drew Hall developed a technique to overcome maintaining frequency and accuracy irrespective of variation due to manufacturing, supply voltage, and environmental temperature. This work on a 400 MHz MedRadio transmitter with state-of-the-art ultra-low power was presented by UC San Diego alumnus Dr. Somok Mondal (Ph.D. '20) at the 2020 Radio Frequency Integrated Circuits Symposium.

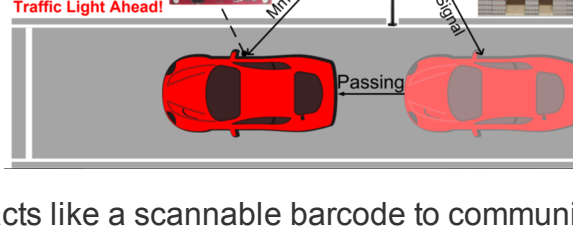
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### Upgraded Radar Can Enable Self-Driving Cars to See Clearly No Matter the Weather

A new kind of radar could make it possible for self-driving cars to navigate safely in bad weather. Electrical engineers at the University of California San Diego developed a clever way to improve the imaging capability of existing radar sensors so that they accurately predict the shape and size of objects in the scene. The system worked well when tested at night and in foggy conditions. The team is now working with Toyota to fuse the new radar technology with cameras. The researchers say this could potentially replace LiDAR.



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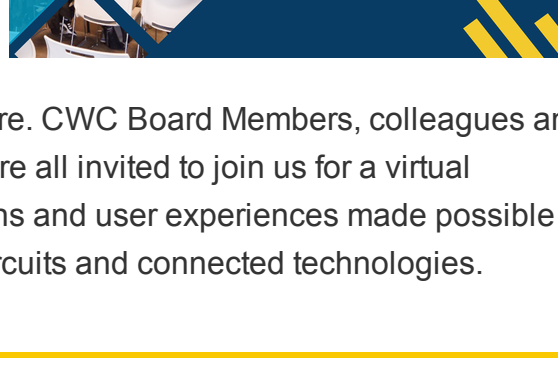
### RF "Barcode" Advances Smart Transportation Infrastructure

Smart cars may soon get a boost from smart infrastructure thanks to an intelligent reconfigurable surface developed by CWC researchers that acts like a scannable barcode to communicate with automotive radar and assist self-driving vehicles for better safety. A project headed by Associate Professor Xinyu Zhang is investigating the feasibility of smartening transportation infrastructure for the purpose of conveying richer information to automotive radars. The results of this innovative new work will appear in ACM SIGCOMM 2021 Conference (SIGCOMM '21), August 23-27, 2021.

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### CWC May 2021 Virtual Research Review

In the recent CWC 2021 Research Review faculty and students presented their latest research on 5G/6G circuits, vehicular sensing and communications, mmWave sensing and networking, and more. CWC Board Members, colleagues and guests, along with faculty and students, were all invited to join us for a virtual gathering as they looked at new applications and user experiences made possible by the exciting new developments in 5G circuits and connected technologies.



## CWC Faculty Highlights



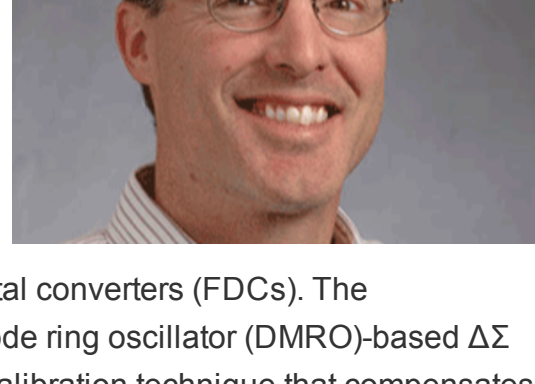
### Sujit Dey and Jyoti Mishra Published in Nature Translational Psychiatry

CWC congratulates Jyoti Mishra and Sujit Dey for their groundbreaking study "Personalized Machine Learning of Depressed Mood Using Wearables", recently published in Nature Translational Psychiatry, which integrates medical and behavioral approaches for improving and sustaining mental health. Professor Dey stated, "This research enables personalized and quantified understanding of mental health, and will lead to more precise and personalized mental healthcare."

[Read Full Publication](#)

### IEEE Featured Author Ian Galton

CWC congratulates professor Ian Galton on becoming a featured author on IEEE Explore for his publication "Delta-Sigma FDC Enhancements for FDC-Based Digital Fractional-N PLLs". His paper describes all-digital enhancements for digital fractional-N phase-locked loops (PLLs) based on delta-sigma ( $\Delta\Sigma$ ) frequency-to-digital converters (FDCs). The enhancements include an improved dual-mode ring oscillator (DMRO)-based  $\Delta\Sigma$  FDC architecture and a digital background-calibration technique that compensates for the  $\Delta\Sigma$  FDC's forward path gain error.



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