



IEEE Foothill

Monthly Newsletter

<http://foothill.ieee-bv.org/>

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**THIS NEWSLETTER IS
BROUGHT TO YOU BY:**

November ExCom/OpCom Monthly Meeting

Prepared by: Max Cherubin

The October ExCom/OpCom meeting was held via BlueJeans last November 9, 2021. The meeting started with an opening remarks from the chair regarding the in-person meeting by January next year.

Section and Committees

As per membership status, we have 990 members, with 30 new members, mostly from student and graduate students, and one associate member. We had one senior elevation, which is Parne Prudhv. Our numbers have been looking great for the past months.

Osman Ceylan reported that we already have a section email to control all our social media platforms. You may not see it on the web page to avoid spam emails though there is a web form on the page where anybody can contact us. They need to fill out the form for their comments and inquiries. As far as social media goes, we have many viewers and maybe because of the events that MTT did.

Student Chapter

Out of 5 universities under our student chapters, 4 universities were able to report about their past and current activities.

Jonathan Rosas, the industry representative of CPP, reported that they did an Oscilloscope Workshop and a representative named Keith Mason. They also had a MatLab Workshop this past month. It was presented by one of their faculty members at SBP and also a so-called Eddison guest speaker. Regarding a future event, they will have a general body meeting and an end of the year's social event after finals week, which will be on the 2nd week of December.

Michael O'Dea, UCR Chair, reported that they had their general meeting ongoing and their technical workshop and they have been successful online. Starting January 2nd, they plan on having personal events since the UCR campus has decided that it will be all in-person as far as classes are concerned.

Conrad Beattie, CBU Chair, reported that their escape room project was put on hold. The dean of their college reached out to their partnering club, and he encouraged them to start working on the students' unmanned aerial systems competition. They are currently developing a multilevel analog to digital converter PCB design lab to allow the student to consider the three fundamental components. Since they started doing weekly study sessions in person, they've been seeing increased activity and have been seeing more members showing up. They will have an industry experience talk coming up with one of their alumni, Ryan Alvarez. He's in the semiconductor industry, and he does lithography for the recruitment team from Southern California Edison that will be coming sometime in the next month. They had a couple of micrometers project meetings every Friday. Last week, they had one general discussion about the internship panel, and they got roughly about 20 attendees. For the technical workshop, they just finished a resume workshop and they had a movie social event through discord, a social channel.

David Palmer from DeVry University reported that they had a few meetings over the last month but it has been busy recently and they have been preparing for a couple of competitions. They had Kalib Perkins, the Global Humanitarian Technology Conference Poster Competition who tied for 3rd place. They had 2 teams registered for the IEEE Extreme Coding Competition. More updates about the competition that DeVry students attended on the next pages.

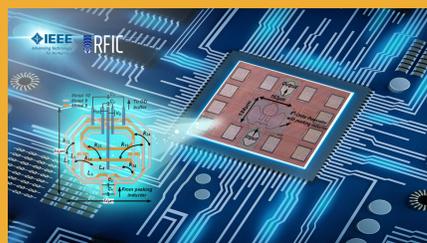
Technical Societies and Committees

MTT/APS had a user group event and they advertise throughout their membership in the ACME Chapters which are the MTT/APS Circuit and Systems and Electronic Devices. This particular topic was on longways, also design using impulse sensitivity functions. Then they did partner with the San Diego section for an additional meaning from Chidi Chidambaram from Qualcomm which is a very interesting talk on semiconductor challenges but it's basically Semiconductor for 5G and 6G and all the issues that are being observed at Qualcomm, primarily through the semiconductor devices that have their sweet spots, particular application areas, frequency, ranges and power levels and how these have to be integrated together and new techniques that are required to do so to form millimeter-wave 5G, 6G technology applications.

Dr. Jenny Yu had her final report about Student Engineering Team Challenge. She said they had already given the students the certificates and the prize money. On behalf of the IEEE Foothill Section, we congratulate our Nanotechnology Chapter for the successful competition and to all the winners.

Dr. Tamer Omar reported about the event last October 29th, and it was about Connecting us in Space to the Internet, Challenges, and Solutions. It was an exciting topic. It was presented by Dr. Mohammed from the University of Manchester, UK. During the presentation they talked about IP connections in order to connect to Space. They had 462 registrants, and the attendance peak was about 184 at the event; the host was from New York Chapter.

YP had an informal event last Nov. 8th and there are about 8-9 people who joined. They are discussing as for next year.



Low Noise Oscillator Design and Semiconductor Challenges for 5G and Beyond

By: Scott Wedge

ED/CAS Chapter members of the Foothill Section participated in two webinars in October 2021. On the morning of October 14th, Chapter Chair Dr. Scott Wedge gave a presentation sponsored by Silvaco entitled Low Noise Oscillator Design using Impulse Sensitivity

Functions". The presentation described circuit simulation approaches useful in determining the steady-state behavior of oscillator and VCO circuits. In addition to traditional SPICE transient analysis, he discussed the additional capabilities of steady-state harmonic balance and shooting Newton algorithms that make possible very good predictions of oscillator waveforms, output spectrum, and frequency tunability. He went on to show how these steady-state analyses can be used by designers to extract information regarding how device noise contributions will perturb oscillator/VCO circuits and generate phase noise and jitter. His presentation discussed capabilities available to obtain accurate Impulse Sensitivity Functions or ISFs. The ISFs represent linear periodic time-varying descriptions of oscillator phase sensitivity to device noise and provide considerable insights to the circuit designer seeking the best noise performance possible.

On the morning of October 22nd, Dr. Chidi Chidambaram, VP at Qualcomm, gave a presentation sponsored by the San Diego Section entitled "Semiconductor Challenges in Realizing the Full Benefit of 5G mmWave and Extending the Roadmap into 6G".

Dr. Chidambaram explained that wireless technologies had been quickly moving from "people-to-people" communications to "thing-to-thing" contacts for 6G. This is creating an explosion of RF activity, with "radios in everything". The communication demands are also increasing and will need order-of-magnitude improvements in performance, guarantees of low Latency, and Design for Durability (DFD). He delved into numerous semiconductor challenges that accompany these demands. Wireless communications need more broadband connections. Filtering is an issue. Current acoustic filtering devices (BAW,SAW) work well for narrowband, but broadband implementations need RLC approaches. QAM modulation needs low noise floors, but this is not easily implemented at the RX side where high gain low flicker noise is necessary. Semiconductor fab technologies each have their nice niche, with Fin FET CMOS dominating digital. GaN HEMT devices are king for power operation, and great for base stations. In DHBT devices have great mobility but are not available on a commercial scale. Gas pHEMT and mHEMT devices work well but have integration issues. RF SOI has a sweet spot for use with LNA and T/R switch circuits. Dr. Chidambaram explained that this diversity of semiconductor devices is pushing the limits for 2D/3D integration using interposers and laminates, some that must include embedded broadband matching networks. This in turn pushes the limits of available EDA solutions. He forecast the need for new and improved System Technology Co-Optimization tools, or STCO tools and languages, to solve these new challenges.

THz and mmWave Circuits and Design in CMOS

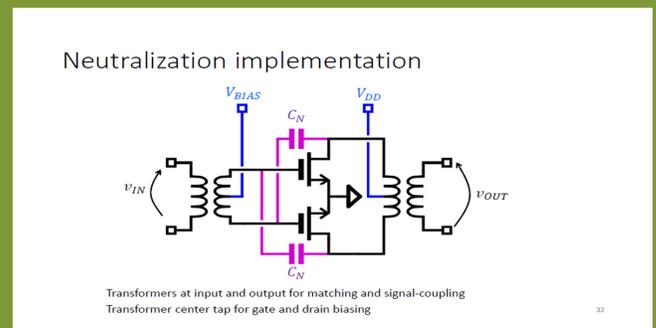
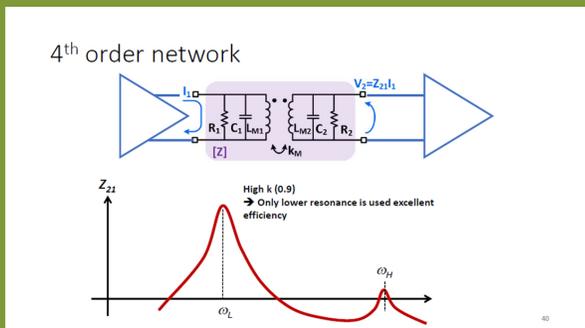
By: Frank Freyne

In this presentation, an early chart mentioned high BW at mmWavefreq, but this was not a systems talk typically in MTT Systems and other MTT (IMS) Forums. Based on the many topics at the component and subsystems level in this presentation, we will be looking ahead to Prof. Reynaert giving us a talk as higher THz BW design and directly systems-directed to the THz specific problems in the future.

The talk initially covered some of the basic issues in higher RF frequency that would be applicable also in the TeraHertz range. Some of the topics covered were:

A chart was presented on the expansion of FT and Fmax over the past years that leads to the question on whether fmax at 600GHz can be demonstrated (or U gain of 0. db at 300GHz) as stated on his charts for a complete RD TX Rx system?

Should microstrip/striplines be used, or should coplanar waveguides/separate lumped (via deposition etching and metalization) be used for what range of frequency and what density on the board? The presenter indicated preference for coplanar lines for CMOS due to need for shielding from lossy Si substrate.



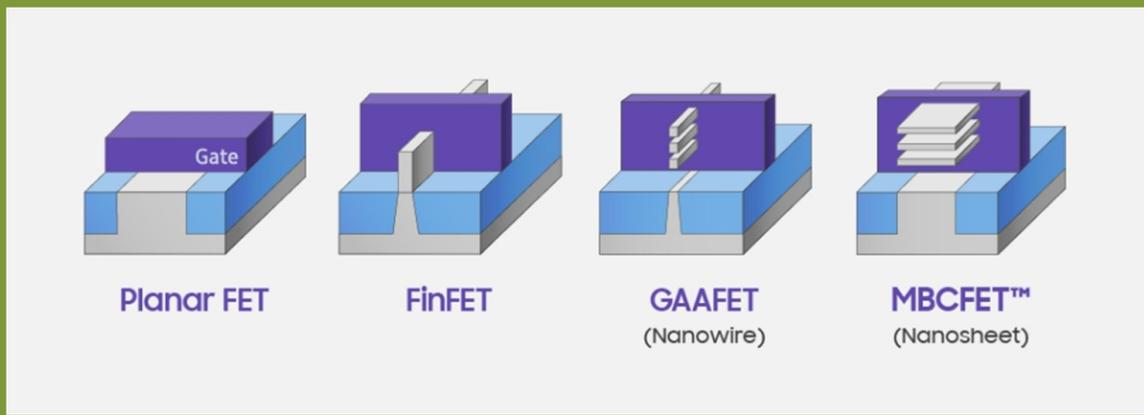
Broadband matching, including transformer coupling, was described by an example of a 4-pole coupling between two amplifier stages where the individual inductive coils as well as their mutual inductance are factored into the impedance equation response.

As with tradition electronic design, neutralization is implemented in CMOS by extending negative FB from output to input resistance at negative bias point. As always, we must calculate stability and stability margins to deal with unwanted oscillations.

- The first topic covered was a 140 GHz power amplifier (PA) in 16nm Finfet.

Data collected in the lab and shown in this briefing covered small signal (s-parameters) large signal (Gain, Psat and OP (1dB backoff)). All presented data were very comparable with other published data in the accompanying table.

For understanding by this reviewer and any IEEE members who read this report, we have added a drawing from the recent Samsung Foundry Briefing, showing a cartoon of FinFET Structure and their planned future efforts to improve FET architecture. Note that Samsung also has efforts at 17nm and 8nm for RF front ends applicable to mobile communication, including 5G. This Fin FET effort by Prof Reynaert's lab is an active research effort across the RF industry. It must be noted that his ESAT-MICRS lab looking at much higher frequencies than those that 5G/6G systems are examining for implementation now. So, we may anticipate different and interesting future results.



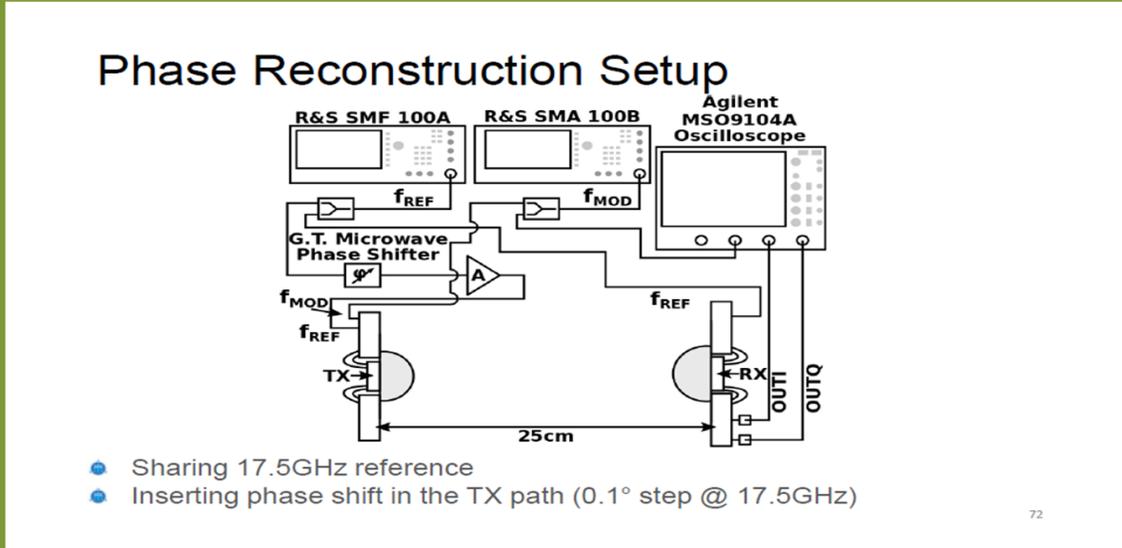
Some notes about the above sketches, as given in a recent SAMSUNG news release. FinFET shows the notional design for such a device. GAAFET--Gate All Around FET. MBCFET -- MultibrIDGE Channel FET.

Samsung's approach toward 2nm and 3nm devices is going towards a changed FET architecture in the next years. Looking for better power lower performance and area (reduced) for its chips. This is something for our IEEE members to be aware of the trends in future chip foundary design goals.

As for other topics that Prof. Reynaert covered in his talk, it is best to note that they were covered quickly in a highlighted fashion. The referenced papers were listed in the charts for further review by IEEE members in their respective fields. These topical areas are:

As for other topics that Prof. Reynaert covered in his talk, it is best to note that they were covered quickly in a highlighted fashion. The referenced papers were listed in the charts for further review by IEEE members in their respective fields. These topical areas are:

- 590 GHz radiator in 40nm CMOS
- 605 GHz receiver in 28nm CMOS
- 420 GHz imaging system in 40nm CMOS. The chart below gives an overview of what was used for the written characters imagery detection test.



A few words are needed for the last technical area. One of the often stated goals for THz system is that it will be able to provide better imaging due to the increased BW that is theoretically available. The tested imaging system is sketched in the figure above, with frequency multipliers (mixers?) used to get to 420 GHz. The test was to read the numbers 1-2-3, written in black on a white background. It appears the phase difference detection, but not amplitude detection was able to provide a discernable image. Again, the algorithm (interferometric) used would be of interest.

We thank Professor Patrick Reynaert for his interesting briefing, and look forward to a future briefing on how far he can advance CMOS devices into THz imaging (biological, medical, spectroscopic and any other areas

ComSoc: "Connecting Space Assets to the Internet: Challenges and Solutions"

By: Dr. Tamer Omar

The NY ComSoc chapter hosted a Virtual Distinguished Lecturer (VDL) talk on Oct. 29, 2021. The presentation is "Connecting Space Assets to the Internet: Challenges and Solutions" by Prof. Mohammed Atiquzzaman, with a ComSoc session number 02136. The event is co-hosted by other 66 IEEE chapters. The NYC Chapter has released the recorded presentation video.

The abstract of the talk tackles on data communications between Earth and spacecraft such as satellites, have traditionally been carried out through dedicated links. Shared links using Internet Protocol-based communication offers a number of advantages over dedicated links. The movement of spacecraft however gives rise to mobility management issues.

This talk will discuss various mobility management solutions for extending the Internet connection to spacecrafts. The talk will provide an overview of the network layer based solution being developed by the Internet Engineering Task Force and compare with the transport layer based solution that have been developed at University of Oklahoma in conjunction with the National Aeronautics and Space Administration. Network in motion is an extension of the host mobility protocols for managing the mobility of networks which are in motion, such as those in airplanes and trains. The application of networks in motion will be illustrated for both terrestrial and space environment.

Just a brief background about their speaker Mohammed Atiquzzaman. He obtained his M.S. and Ph.D. in Electrical Engineering and Electronics from the University of Manchester (UK) in 1984 and 1987. He currently holds the Edith J Kinney Gaylord Presidential professorship in the School of Computer Science at the University of Oklahoma.

Total Registration: 462 (as of 10/29/2021)

Peak Attendance: 184

The screenshot shows a Zoom meeting interface. The main window displays a presentation slide titled "SIGMA: Application to Vertical Handoff" by Mohammed Atiquzzaman, University of Oklahoma. The slide includes a bulleted list of points and a diagram illustrating vertical handoff between different access networks. The Zoom interface shows 184 participants and a list of names on the right.

- Handover is no longer only limited to between two subnets in WLAN or between two cells in cellular network (**horizontal handover**).
- Mobile users are expecting seamless handover between different access networks (**vertical handover**).
- The mobility based on SCTP multi-homing is a feasible approach to meet the requirement of vertical handover.

The diagram shows a "Multi-homed Mobile Host" connected to three networks: "HyperLAN2 WLAN", "Cellular Network", and "Satellite Network". A "Correspondent Node" is also shown connected to the Cellular Network. The slide number "58" is visible at the bottom.

According to a post-survey, from 93 responses (as of 11:59 pm, Oct 29, 2021, there are 83 non-members attended the VDL talk. If the ratio stays the same, among 184 attendees, there could be 164 non-members and 20 members.

WTS Update: Wireless Telecommunications Symposium 2022

We invite the submission of applied research papers to the 21st Annual Wireless Telecommunications Symposium which will be held in Pomona, California, USA on April 6-8, 2022. Because of travel restrictions due to Covid-19, WTS 2022 will be in the form of a hybrid conference, primarily in-person with a virtual format for remote attendance. For further information, visit www.cpp.edu/wtsj.

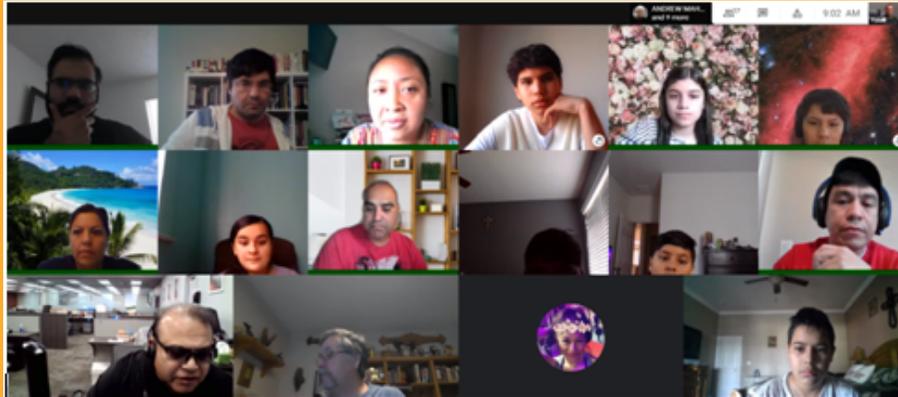
The WWTS brings together industry professionals and academics from companies, governmental agencies, and universities around the world to exchange information on advances in mobile communications and wireless networking technology, business, policy, applications and security.

The theme for WTS 2022 will be "Global Wireless Communications: Theory and Practice." Planned highlights of WTS 2022 include executive presentations and keynote addresses: presentations of accepted academic and practitioner research papers, panel discussions, tutorials, and workshops, a poster paper session and a doctoral students session.

"Making Waves" Arduino Bootcamp

Partnership between IEEE Foothill and Rialto School District

By: David Gonzalez



Dates: June 7th-11th, 2021 | Time slot each day from 9:00 am - 2:00 pm

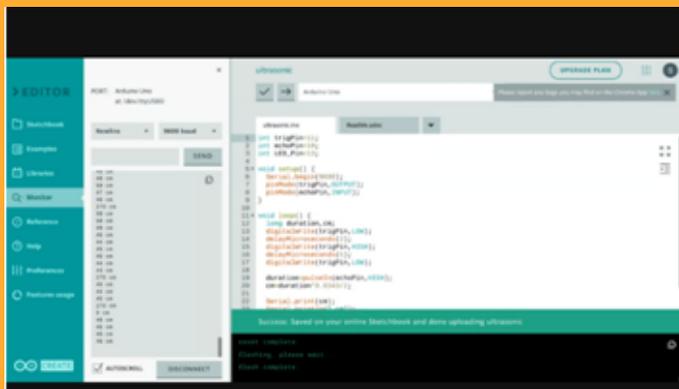
Theme: Since we will use Ultrasonic sensor which function using waves, the theme was "Waves"

IEEE Foothill Section supported this project for the Foothill Educational Activities chapter. The section assisted with the purchased Arduino kits for the participating students and was essential in making this event happen. This was the first time our section participated with a local district and third-party vendor to facilitate this Arduino Bootcamp. The kits were provided by Bytes & Bots in Orange County.

Members of the IEEE Foothill Section over many months of coordination and meetings with senior staff from Rialto Unified District (RUSD) were able to establish and execute our first virtual Science Bootcamp for the students of RUSD. We had 8 students from various middle schools and 5 science teachers and 3 senior staff members from RUSD attend this week-long summer Bootcamp.

The Foothill chair for Educational Activities and the section vice-chair headed this educational bootcamp that allowed students to compete for prizes at the end of the week. The Bootcamp was completely virtual, which made for logistical headaches but was overcome by the IEEE members and the participating RUSD staff.

The first day of the Bootcamp was dedicated to students forming their teams and deciding the project they would be working on during the week for Arduino-based building activities. Their interactive Bootcamp was composed of four-day lectures, presentations, with project building activities. The Bootcamp culminated on the fifth and final day where students were allowed to finish their projects and have a team presentation to IEEE Members and senior RUSD staff for judging. Here is a sample of the coding involved.



Sample of the Coding



Certificate of Completion

Awards for the 1st, 2nd, and 3rd place winners were awarded on the fifth day and all participants received a certificate as seen on this fictitious sample certificate.

The awards were electronics Amazon gift cards that were paid by the RUSD Senior Leadership. We cannot publish the students name due to privacy concerns, but the students were thrilled to have received their prizes and certificates.

- First Place: \$75.00
- Second Place: \$50.00
- Third Place: \$25.00

The event was a great success and all participants and science teachers commented that they are looking forward to next summer for the Arduino Bootcamp.

NOTE: The Arduino kits were donated to the RUSD future Arduino projects their science teachers may want to have during the school year.

There was a lot of long hours and preparation by the IEEE Foothill members, but we felt we truly made a difference to these kinds from socioeconomically depressed areas of Rialto.

Monitoring Coastal Habitats Through Machine Learning

By: Kalib Perkins

The purpose of this paper is to document my experience in the research and planning for the implementation of machine learning services to monitor trash accumulation and pollution in coastal environment and their impact on local flora and fauna. In monitoring trash accumulation in these environments, cities and municipalities around the globe can:

- Better understand the impact of garbage accumulation in coastal environment is having on local wildlife and human ecosystems, as well as its contribution to the overall pollution problem plaguing our waterways and oceans.
- Automate monitoring of coastal garbage accumulation through worldwide remote camera systems and satellite imagery.
- Identify key concerns for the local environment and study current impact on wildlife and compare to historical data.
- Develop autonomous cleaning systems for local municipalities and governments to implement on beaches, high-pollutant waterways, and riverbeds in coastal regions.

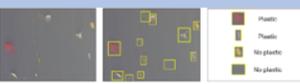
I chose to research a non-profit organization (NPO) called The Ocean Cleanup. Founded by Dutch inventor Boyan Slat, The Ocean Cleanup is an NPO that has been followed closely for several years now. The organization was created with the intent to rid our planet of water 90% of its pollutants by 2040. One of many ways they aim to do this is by monitoring coastal environments to gain a better understanding of how plastic trash fluxes in these environments. My goal with this project was to develop a way to automate the monitoring of local beach cameras around the world to identify patterns in trash accumulation and their impact on the surrounding environment.

The easy-to-build IoT solutions with video analytics capabilities use Microsoft Azure Machine Learning (ML) to build hybrid applications with video analytics capabilities that capture, record, and analyze live videos. Additionally, Google Cloud Video Intelligence API is deployed for Computer Vision Library specially designed, or mobile devices for C++ and Python that work with the images or video streams that come from webcams, Kinects, FireWire, and IP cameras, or mobile devices.

Long term this project will also incorporate the use of Geographic Information Systems (GIS) predictive modeling through satellite imagery. This will make it easier to work with local and state government to develop and implement autonomous cleanup systems along beaches and non-invasive collection methods in highly congested areas where larger river systems cannot reach.

Monitoring Coastal Habitats Through Machine Learning

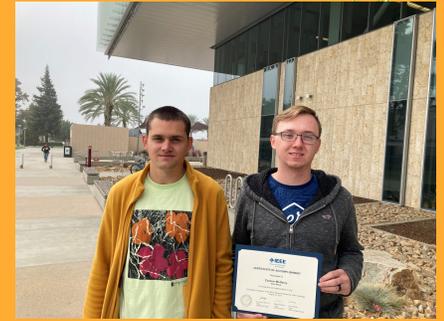
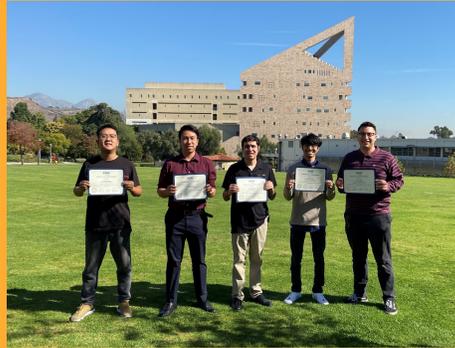
Kalib Perkins, Computer Information Systems
DeVry University

<p>PROBLEM STATEMENT:</p> <p>Understand the impact garbage accumulation in coastal environments is having on local wildlife and human ecosystems, as well as its contribution to the overall pollution problem plaguing our waterways and oceans.</p> <p>INTRODUCTION:</p> <p>I researched a non-profit organization (NPO) called The Ocean Cleanup. Founded by Dutch inventor Boyan Slat, The Ocean Cleanup was created with the intent to rid our planet's waters of 90% of their pollutants by 2040. Inspired by their work, my goal with this project was to research and plan a way to automate monitoring of IP cameras around the world to identify patterns in trash accumulation and their impact on the surrounding environment. This will help identify key concerns for the local environment and study current impact on wildlife and public health.</p> <p>Google Cloud Video Intelligence API offers a user-friendly model to remotely monitor IP cameras. The model can be trained to distinguish between plastics, organic waste, and other floating materials. The ML service will also incorporate the use of Geographic Information Systems (GIS) capabilities by analyzing tens of thousands of satellite images across various light spectrums; generate predictive models in ArcGIS or an open-source equivalent; develop autonomous cleaning systems for local municipalities and governments to implement on beaches, high-pollutant waterways, and riverbeds in coastal regions.</p> 	<p>DESIGN AND IMPLEMENTATION:</p> <p>Step 1: Planning. Review journals, magazines, social media, etc. for new posts and publications. Plan and design project implementation plan; what do we need? What free resources can we use?</p> <p>Step 2: Data Collection. Build model for data ingestion and collect data from IP cameras and remote sensor images. Segment videos and images and input into model.</p> <p>Step 3: Model Exploration. Process images and video through ML program and classify detected debris to discriminate plastics. This will help to establish our performance baselines and understand how model performance scales with more data.</p> <p>Step 4: Model Refinement. Perform model-specific optimizations (ie. hyperparameter tuning). Iteratively debug model as complexity is added. Perform error analysis to uncover common failure modes. Revisit Step 2 for targeted data collection and labeling of observed failure modes.</p> <p>Step 5: Validation and Prediction. Identify key concerns for the local environment and study current impact on wildlife and compare to historical data. Use predictive modeling to back trace the source of pollution.</p> <p>Step 6: Involve Local Support. Develop autonomous cleaning systems for local municipalities and governments to implement on beaches, high-pollutant waterways, and riverbeds in coastal regions.</p> 	<p>RESEARCH:</p> <p>Until just a few years ago, very few people were looking into the problem of how coastal environments are being impacted by plastic pollution. Several groups around the globe have started work on this issue and have made great progress thus far. The Ocean Cleanup is currently working with Microsoft to develop coastal monitoring methods through their Azure Machine Learning services. A team of scientists also created a space called Ocean Plastic Webinars where biochemists, ocean modelers, deep-sea biologists, etc. can meet, collaborate, and undergo interdisciplinary 'open science' global efforts to uncover these knowledge gaps.</p> <p>FUTURE WORK:</p> <p>Since beginning this project, the Ocean Cleanup released their study using Microsoft Azure ML to monitor trash and debris in the ocean and rivers around Indonesia.</p> <p>Utilize GIS services, such as ArcGIS, to build predictive models and density plots for high-pollutant areas.</p> <p>Trash and plastic breakdown technologies.</p> <p>LEGAL & ETHICAL CONSIDERATIONS:</p> <ul style="list-style-type: none"> • Data protection. • Compliance with industry standards. • How applications should handle personal information. • It is important to track if and how personal information of your users is transmitted to a third party, and what plan of action will be taken if the vendor suffers a data breach. • Local regulations, if any, for tapping into and monitoring IP cameras.
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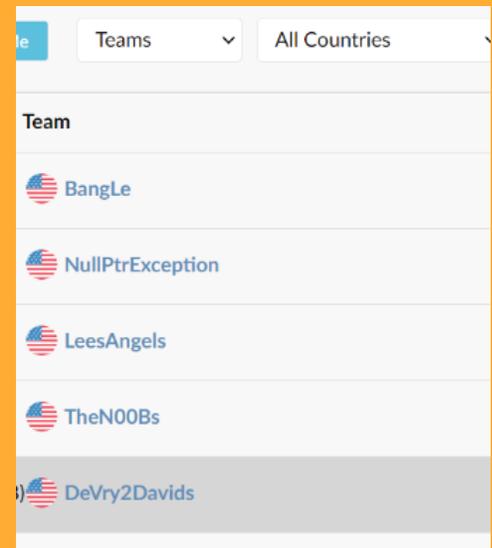


In behalf of IEEE Foothill Section we would like to congratulate the following students for doing an excellent job in the competitions that they attended.



These are the students who placed and participated in the IEEE Student Team Engineering Challenge 2021.

Rank	Team	Score (Penalty)	University	Region
1 (678)	Bangle	250.17 (5667)	University of Delaware	(R2) Eastern US
2 (727)	NullPtrException	231.05 (5609)	University of Delaware	(R2) Eastern US
3 (751)	LeesAngels	223.53 (3025)	Shippensburg University	(R2) Eastern US
4 (973)	TheN00Bs	148.97 (3233)	University of Delaware	(R2) Eastern US
5 (2108)	DeVry2Davids	13.01 (971)	DeVry University Online	(R2) Eastern US
6 (2671)	HuosAngels	0	Shippensburg University	(R2) Eastern US



DeVry University who joined IEEE Extreme Coding Competition represented by **David Rhoades and David Palmer** who ranked 5th in the region, 54th in the US, and 2108th in the world.

Also, we also want to congratulate **Kalib Perkins** for a job well done in GHTC Poster Competition.

Upcoming Events:

December ExCom/OpCom Meeting

December 14, 2021

"We Need Volunteers!"

If you want to be a volunteer email us at sec.foothill@ieee.com

Social Media Accounts:



<https://www.facebook.com/ieeefoothill>



<https://www.linkedin.com/groups/13516173/>



Don't forget to like and share to be updated!