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Compact chips advance precision timing for communications, navigation and other applications

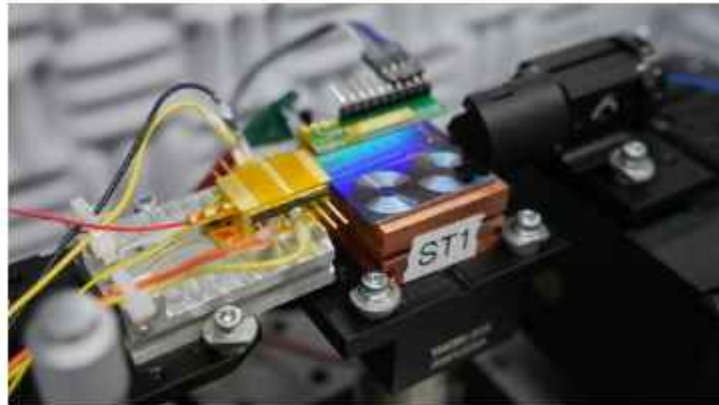


Image Credits: K. Palubicki/NIST

The National Institute of Standards and Technology (NIST) and its collaborators have delivered a small but mighty advancement in timing technology: compact chips that seamlessly convert light into microwaves. This chip could improve GPS, the quality of phone and internet connections, the accuracy of radar and sensing systems, and other technologies that rely on high-precision timing and communication.

This technology reduces something known as timing jitter, which is small, random changes in the timing of microwave signals. Similar to when a musician is trying to keep a steady beat in music, the timing of these signals can sometimes waver a bit. The researchers have reduced these timing wavers to a very small fraction of a second – 15 femtoseconds to be exact, a big improvement over traditional microwave sources – making the signals much more stable and precise in ways that could increase radar sensitivity, the accuracy of analog-to-digital converters and the clarity of astronomical images captured by groups of telescopes.

Shining a Light on Microwaves What sets this demonstration apart is the compact design of the components that produce these signals. For the first time, researchers have taken what was once a tabletop-size system and shrunken much of it into a compact chip, about the same size as a digital camera memory card. Reducing timing jitter on a small scale reduces power usage and makes it more usable in everyday devices. Right now, several of the components for this technology are located outside of the chip, as researchers test their effectiveness. The ultimate goal of this project is to integrate all the different parts, such as lasers, modulators, detectors and optical amplifiers, onto a single chip. By integrating all the components onto a single chip, the team could reduce both the size and power consumption of the system. This means it could be easily incorporated into small devices without requiring lots of energy and specialized training.

Compact chips advance precision timing for communications, navigation and other applications

"The current technology takes several labs and many Ph.D.s to make microwave signals happen," said Frank Quinlan, NIST physical scientist. "A lot of what this research is about is how we utilize the advantages of optical signals by shrinking the size of components and making everything more accessible."

To accomplish this, researchers use a semiconductor laser, which acts as a very steady flashlight. They direct the light from the laser into a tiny mirror box called a reference cavity, which is like a miniature room where light bounces around. Inside this cavity, some light frequencies are matched to the size of the cavity so that the peaks and valleys of the light waves fit perfectly between the walls. This causes the light to build up power in those frequencies, which is used to keep the laser's frequency stable. The stable light is then converted into microwaves using a device called a frequency comb, which changes high-frequency light into lower-pitched microwave signals. These precise microwaves are crucial for technologies like navigation systems, communication networks and radar because they provide accurate timing and synchronization.

"The goal is to make all these parts work together effectively on a single platform, which would greatly reduce the loss of signals and remove the need for extra technology," said Quinlan.

"Phase one of this project was to show that all these individual pieces work together. Phase two is putting them together on the chip."

In navigation systems such as GPS, the precise timing of signals is essential for determining location. In communication networks, such as mobile phone and internet systems, accurate timing and synchronization of multiple signals ensure that data is transmitted and received correctly.

"There are all sorts of applications for this technology. For instance, astronomers who are imaging distant astronomical objects, like black holes, need really low-noise signals and clock synchronization," said Quinlan. "And this project helps get those low noise signals out of the lab, and into the hands of radar technicians, of astronomers, of environmental scientists, of all these different fields, to increase their sensitivity and ability to measure new things."

Science Daily
March 6, 2024

Source: National Inst. of Standards & technology

Expert Lectures/Seminars/Courses Organised

- Department of Electronics and Telecommunication Engineering of K. K. Wagh Institute of Engineering Education and Research Nashik, Students' Association of Electronics Engineers (SAEE) in collaboration with IETE Nashik subcenter organized a 2 day hands-on practice workshop on "Fundamentals of MATLAB and Simulink" by Mr. Ankit Kumar from 1st February 2024 to 2nd February 2024.



- Training and Placement Cell and the Department of Electronics and Telecommunication Engineering of K. K. Wagh Institute of Engineering Education and Research Nashik, Students' Association of Electronics Engineers (SAEE) in collaboration with IETE Nashik subcenter organized an expert talk on "Guidance Session on Interview Preparation" by Ms. Shrisha Sudhir (Technical Consultant, Birlasoft technology, Bangalore.) on 10th February 2024.



Expert Lectures/Seminars/Courses Organised

- Department of Electronics and Telecommunication Engineering of K. K. Wagh Institute of Engineering Education and Research Nashik, Students' Association of Electronics Engineers (SAEE) in collaboration with IETE Nashik subcenter organized a 1 day hands-on practice workshop on "PCB Design and Simulation Features of Proteus" by Mr. Prudhvi Talluri on 16th February 2024.



K. K. Wagh Education Society's
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Website: www.engg.kkwagh.edu.in
(An Autonomous Institute from A.Y - 2022-2023)

Department of Electronics & Telecommunication Engineering
in collaboration with IETE

Organizes
Expert Talk on

"PCB Design and Simulation features of Proteus"

Mr. Prudhvi Talluri
Dr. Embedded Engineer,
Cybernetics Technologies Pvt. Ltd.,
Hyderabad, Telangana

On 16th February, 2024 From 01:00 pm to 03:00 pm
Venue: Research Lab , Third floor, E&TC Department, KKWIEER

Dr. S. A. Pelt/Dgale U.G. Co-ordinator | Dr. D. M. Chinnabhai Dean, Student Affairs, HOD, E & TC Engg | Dr. K. N. Nandekar Principal

Department of Electronics and Telecommunication Engineering of K. K. Wagh Institute of Engineering Education and Research Nashik, Students' Association of Electronics Engineers (SAEE) in collaboration with IETE Nashik subcenter organized a Mock Interviews in a hybrid mode by alumni working in Emerson, L&T InfoTech, Mahindra, Infosys, Infovision, Wipro, Dynamisch.



K. K. Wagh Education Society's
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Department of Electronics & Telecommunication Engineering
in collaboration with IETE

Organizes
Organizes Hybrid mode

"Mock Interview"
by
Alumni Working in Emerson,
L&T InfoTech, Mahindra,
Infosys, Infovision, Wipro and Dynamisch

On 17th February, 2024 From 03:00 pm to 05:00 pm
Venue: E&TC department Attendees: TE (E&TC) Students

Dr. N. N. Shinde U.G. Co-ordinator | Dr. S. A. Pelt/Dgale U.G. Co-ordinator | Dr. D. M. Chinnabhai HOD, E & TC Engg | Dr. K. N. Nandekar Principal



Training and Placement Cell (Campus Placement)

Sr. No.	Name of Student	Company Name	Package
1.	Abhishek Chandanse	Fox solutions Pvt. Ltd	5 LPA

Industrial Training / Seminar/Workshop done by Staff

Dr. Saurabh Shrivastava is selected as a reviewer for Journal of Engineering Research and Science under the Mentioned research areas.

Artificial Intelligence, Computer Science (AIC),
Telecommunication (TEL)



Dr. Saurabh Shrivastava is also selected as a reviewer for Advances in Science, Technology and Engineering Systems Journal that is a well-reputed Journal. Successfully registered under the subject codes EEE, EMU, TEL





Intellectual
Property
Office

Certificate of Registration for a UK Design

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Grant date: 04 December 2023

Registration date: 25 November 2023

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Govindrao Jadhav, Dr. Kandavalli Michael Angelo, Dr. Ravindra Bhardwaj, Dr.

Javed Akhtar Khan

in respect of the application of such design to:

Next- Gen Medical Imaging Diagnosis Using ML

International Design Classification:

Version: 14-2023

Class: 24 MEDICAL AND LABORATORY EQUIPMENT

Subclass: 01 APPARATUS AND EQUIPMENT FOR DOCTORS, HOSPITALS
AND LABORATORIES

Adam Williams

Comptroller-General of Patents, Designs and Trade Marks

Intellectual Property Office

The attention of the Proprietor(s) is drawn to the important notes overleaf.



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VISION

Excel in quality technical education and research in Electronics and Telecommunication (E&TC) Engineering for sustainable solution development for industry and betterment of society.

MISSION

M 1: To provide quality education for the preparation of technically and professionally competent E&TC engineers.

M 2: To create an environment to enhance life-long learning and 21st century skills

M 3: To inspire students' innovative thinking and creativity to promote research culture.