Time and frequency digital platform

Diego Luna, INTI MWG 5, Time and Frequency



(M)



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Objective

This project aims to conceptualize, design and implement an economic and open platform for time and frequency measurements.

Expected impact

The main goal of this project is to propose and build a modular and economic measurement system capable of performing time and frequency measurements with traceability to a known reference.

How did we came up with this initiative?

A variety of new instrumentation options are available at low costs:

- Open-source electronic prototyping platform (Arduino, ESP32, etc.)
- Single board computers (like raspberry pi)
- Sensors (temperature, humidity, pressure, etc...)
- FPGA to replace lab instruments (like Red Pitaya)

Question:

Are these tools useful for time and frequency metrology?

We think the answer is YES!

Example:



"single-board computer"



Question: Can the GPIO ports be used to sinchronize the raspberry, and serve as a stratum 1 NTP server?

We think the answer is YES!

Example:



"Red Pitaya is a Zynq7 FPGA – based low cost electronic board "



Question: Can this board be used to perform measurements with traceability to a national standard?

We think the answer is YES!

Measurement Systems:



Blanco, B. I. C., Cordero, O. G. F., & Salazar, J. D. R. (2017). Calibración automatizada de cronómetros por el método de inducción con medidor de frecuencia de refrescamiento de pantalla.

Diaz, H., & Palma, L. (2014).

Calibration of optical tachometers using a generator system of light pulses. (CPEM 2014) (pp. 596-597). IEEE.



Question: Can these developements be integrated in one platform? We think the answer is YES!

Proposal:



3D printed or standard case?





Time and Frequency Survey in SIM

Which of these calibrations are performed in your laboratory?

12 responses



14 responses



Time and Frequency Survey in SIM

Are there any services that you are interested in developing?

10 responses

Time scale difference
NTP Time dissemination
Calibration of Stopwatches, Timebasis, Tachometers, National Time Service
tachometers
Automatized Stopwatches System Calibration
Secure Time dissemination over internet
Optical Frequency Measurements
Yes
Timebasis, Time Interval, Stopwatches, Stroboscopes, Tachometers, frecuency/time counters

Time and Frequency Survey in SIM

From the services that you would like to develop, which are the difficulties your NMI faces?

14 responses



Lack of equipment
More training is needed
More personnel is needed
All of the above

Time schedule (2021/2022)

	IADB SIM RESEARCH ENGAGEMENT SIM TF PROJECT															
	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cost	-				\$15,000.00						\$14,000.00					
Investigation of measurement needs																
Consult SIM NMIs to identify needs	Х															
Definition of components required		х	х													
Partner Institutes Meet				Х												
Design and implementation																
Component's Purshase					Х	Х	х									
Define modular system design specifications (SDS)					x	x	x									
Adjust electronic circuits to match wiht SDS							х	x	х							
Simulation and develop of modules									Х	Х	Х	Х				
Partner Institutes Meet									Х			Х				
Exchange of scientists/metrologists (site visits, assemble/join modular pieces)																
Visit of experts to NMI for transfer of expertise and emsamble													х		х	
Partner Institutes Meet														Х		X
Research and TF guidelines proposals																
Investigate technology solutions to implement					х	х	х	х	х	x	х	х				
Developement of guideline documentation							х		х			х		x		x
Partner Institutes Meet							Х			Х			х			Х

Participating NMIs

CENTRO NACIONAL DE METROLOGÍA



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CENAMEP AIP



Questions

- Are there any other features that can be added to the platform?
- Can this platform be compatible with other initiatives ? (DCC, ambient condition measurents, etc...)

Thank you!

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https://tf.nist.gov/sim/

https://sim-metrologia.org/about-us/structure/technical-committee/time-and-frequency/