



Development of compact & affordable network time display device

S. Sardar^(1,2), V. Bharath^(1,2), N. Poudel^(1,2), S. Goel^(1,2), S. Yadav⁽¹⁾, P. Arora^{*(1,2)} and V. N. Ojha^(1,2)

¹Time and Frequency Metrology, CSIR- National Physical Laboratory, Dr. K.S. Krishnan Marg, New Delhi-110012

²Academy of Scientific and Innovative Research, CSIR-NPL Campus, New Delhi 110012

* arorap@nplindia.org

Time is the physical quantity which can be measured to the highest accuracy among all the physical quantities. The base unit of time in System international (SI) is 'second' which has been realized with an uncertainty of few parts in 10^{16} with Caesium fountain clock, also known as primary frequency standard (PFS) [1].

CSIR- National Physical Laboratory (NPLI) is the national measurement institute (NMI) and has been given the mandate, by an act of Parliament, to generate and disseminate Indian standard time (IST). As time keeper of India, it generates IST using an ensemble of Caesium beam atomic clocks and Hydrogen Masers. The IST so realized is kept traceable within few ns with respect to coordinated universal time (UTC) maintained by BIPM (Bureau of International Weights and Measures). At present, there are three different techniques through which NPLI disseminates time and frequency to all over India, Network Time Protocol service through internet is one of them, other two are through telephone network and through satellite.

Over last few years, importance of time synchronization in various networks and services has become crucial. With the rise in use of internet for financial, banking and trading applications, keeping chronological record of events within fraction of seconds has become imminent in order to control cybercrime. NPLI, as timekeeper of the nation, has started a mission to synchronize all clocks within the country to within 1s over next few years. Newer kind of time dissemination methods and devices, which can be useful for public are being designed. In this context, a compact and affordable device has been designed and developed to display IST. The device takes time from NTP service run by NPLI over the domain name 'time.nplindia.org' and displays it on the LCD display integrated in the device.

The device consists of a single board computer which is programmed with an algorithm for setting the NTP server and related settings. An associated circuit has been designed to integrate the single-board computer along with power supply and LCD display. The algorithm developed sends a ping to NTP server (time.nplindia.org) on being connected with internet. The incoming information (package) will be decoded by the device and the time will be displayed. The polling time can be adjusted according to the requirement.

The device is very compact and affordable as one can access NTP service without having a complete computer or laptop. The device is being further evaluated in terms of time accuracy, time delays and time offset. Associated hardware and software details of the device will be discussed in this paper.

[1] T. P. Heavner, E. A. Donley, F. Levi, G. Costanzo, T. E. Parker, J. H. Shirley, N. Ashby, S. Barlow and S. R. Jefferts, "First accuracy evaluation of NIST-F2", *Metrologia* 51 (3), pp. 174, (2014).

[2] R. Krishna, D. Bhatia, A. Agarwal and P. Kandpal, "Network Time Protocol ad its delay calculation at two stratum levels", *Imperial J. Inter. Research* 3(2), pp. 1425 (2017).