



Use of wireless technology ECT: Engineering perspective

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Introduction

With the advent of various engineering practices, Electroconvulsive Therapy (ECT) technology has evolved to make devices more user friendly for ECT practitioners to deliver targeted and personalized treatment protocols to patients. The use of Bluetooth technology in ECT is a relatively new development and has several benefits. Bluetooth allows for wireless communication between the ECT machine and other devices, such as smartphones or tablets, which can be used to control the machine's settings, monitor patient progress, and collect data on treatment outcomes. This technology allows for more efficient and convenient treatment, as well as the ability to remotely monitor patients and adjust treatment parameters as needed. It may also enable the collection of more detailed and accurate data on ECT outcomes, which could be used to improve the therapy and better understand its mechanisms of action.

The design and software development has been made under 'DBT-Wellcome India-Alliance Clinical Research Centre for Neuromodulation in Psychiatry' funding, coordinated by NIMHANS, Bangalore.

Aim

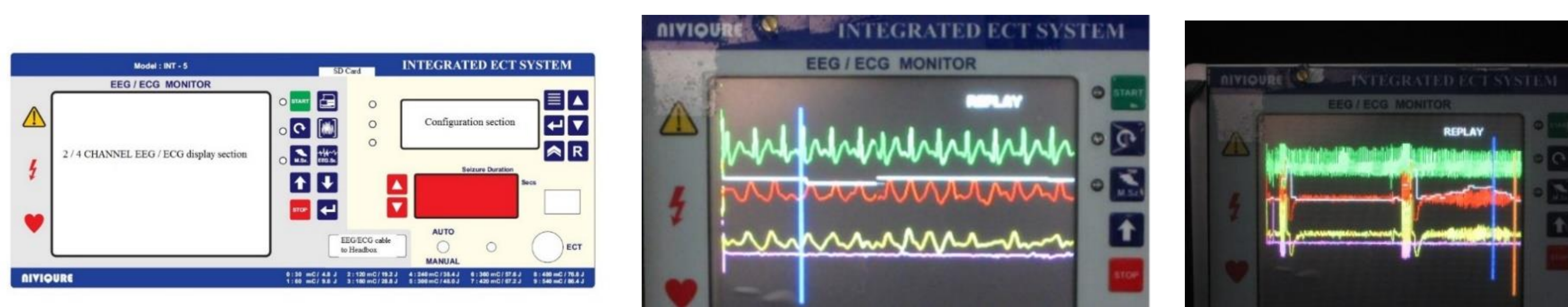
To develop enhanced features to the conventional ECT machine to enable:

1. Remote manipulation of ECT parameters (COVID-19 necessitated)
2. EEG / ECG / OMS (biological parameters) data gathering
3. Wireless transmission of EMR (Electronic Medical Record) data for uploading into Main frame Database

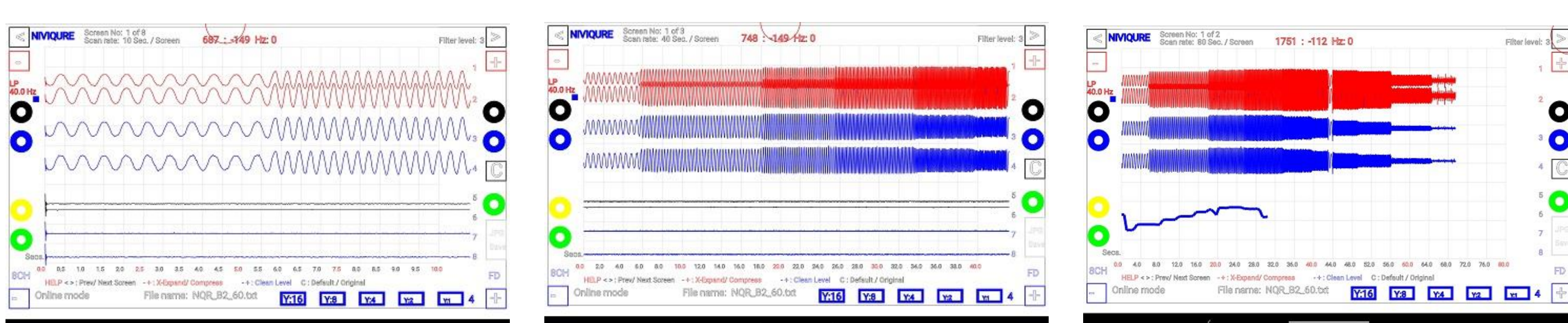
Methods

1. Compact BLE (Bluetooth Low Energy) modules are readily available which meets the CE Regulatory requirements. We have used these modules to interface with our existing hardware and micro-controller designs, for controlling the machine parameters including Pulse amplitude, pulse-width, pulse frequency and duration.
2. This BLE module can also simultaneously monitor and transmit waveform data like EEG / ECG / OMS (Optical Motion Sensor) during ECT procedure.
3. Presently, the Smart device software development is Android based as this is popularly used in India.
4. Ease of data transfer through 'SHARE' or by email transmission makes it elegant and quick to send them from the Smart device to remote destination.

Conventional ECT design:

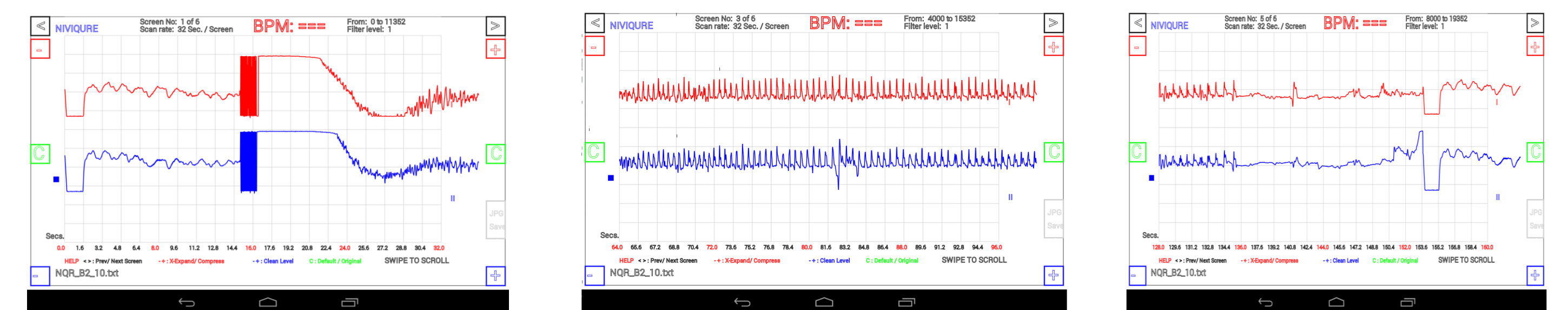


New design with enhanced features:



Representational waveform from sine wave generator with controls and monitoring on smart device

Results



2-channel EEG during ECT procedure

- Over the last 15 months, the new design has been used at 11 centres all over India. Apart from this, a few private practitioners (Psychiatrists) use in their personal clinics.
- Average number of patients are about 25 - 30 / day.
- Time saving for the ECT procedure is ~50% with the following advantages:
 - No knob / switch setting operations on the machine.
 - If the Doctor opts for 'AUTO' settings, the software is pre-programmed for the user to select dosage level. In case of 'inadequacy of seizure' the machine AUTOMATICALLY gets set to the pre-determined higher dose level. This decision can either be based on 'seizure duration' or 'seizure index' (based on Fractal-Dimension: FD) basis. Doctor can also opt to set individual parameters. Seizure duration data gets registered on the Smart phone at the end of ECT procedure.
 - Outcome results / data of ECT procedure as well as EEG / ECG / OMS monitoring can be saved for sharing immediately through Email / Drive / Cloud services. All data are digitally saved and thus 100% paperless.
 - Since the basic ECT machine is designed to be small and compact (excluding controls, switches, and associated hardware) the cost is cheaper. Software is presently designed to work with Android Smartphone / device. Any updates can easily be done remotely without any alteration in the machine. The machine pairs only with one device – no fear of multiple controls points.

Conclusions

Remote manipulation of pulse parameters and paperless EEG monitoring is achievable and has been demonstrated successfully for ECT procedure in India. The new ECT machine design enables remote manipulation of ECT parameters and digital data transfer post-ECT procedure, resulting in a 100% paperless procedure with data that can be stored, archived and retrieved at any time and place.

References

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2. ECT and heart rate changes: an alternative to EEG monitoring for seizure confirmation during modified ECT, Nov. 2003, German Journal of Psychiatry, Ranganath et al (includes Niviqure).
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4. Poster presentation "Maximum Fractal Dimension of Cerebral Seizure Remains Constant through the Course of Electroconvulsive Therapy", IBMISPS-Conference, 2011, San Francesco.
5. Indian Patent "A DIGITALLY IMPLEMENTED MULTI-CONFIGURABLE BIOMEDICAL ECT WITH EEG/ECG APPARATUS", Sept. 2005 – Joint submission by Vittal Candade (Niviqure) and Dr. B. N. Gangadhar (NIMHANS).
6. CB Certificate (safety standards) conducted by Ukraine Regulatory body.
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Caveat: The device is under-going IEC tests for EMI / EMC / BLE safety standards.

