ICSBB 2007

International Association of Engineers

World Congress on Engineering 20

- Home Page
- Conference Topics
- Publications
- Paper Submission
- Registration
- Important Dates
- Conference Committee
- Travel & Accommodation
- Conference Program
- Past Conferences
- Contact WCE 2007

London, U.K., 2-4 July, 2007

Conferences Publications Membership Abc
FAQ Contact Us

Conference Program

The WCE 2007 is organized by the International Association of Engineers (IA international association for the engineers and the computer scientists. The focus on the frontier topics in the theoretical and applied engineering and subjects. The WCE conferences serve as good platforms for our memb engineering community to meet with each other and to exchange ideas. THE are formerly parts of the International MultiConference of Engineers and C (IMECS). The last IMECS 2006 has attracted more than four hundred partici countries.

The summary of submissions and accepted papers in WCE 2007 is as foll
Total number of submissions received in WCE 2007: 756
Total number of papers that have been accepted for WCE 2007: 431 (Acceptar

The titles and contact authors of submitted papers that have been reviewed and accepted with minor revisions) for WCE 2007 are listed here:

titles_A_B, titles_C_N, titles_O_Others.

The Best Paper Awards and Best Student Paper Awards of the WCE 2007

WCE 2007 Program Schedule Details

The pdf file of the program schedule outline is also available for download (dow

Skempton Building, South Kensington Campus, Imperial College London, Lond U.K. (Download Venue Map)

- Seminar Room A: Skempton Lecture Theatre 201
- Seminar Room B: Skempton Lecture Theatre 207
- Seminar Room C: Skempton Lecture Theatre 208
- Seminar Room D: Skempton Conference Room 227
- Seminar Room E: Skempton Conference Room 228

Program Schedule

Day One (2 July, 2007, Monday)

	Room A	Room B	Room C	Room E
8:00 – 8:30	Tea/Coffee Break			
8:30 –10:30	Keynote Speech & ICCSE I	ICFE	ICSIE Invited Lecture & ICSIE I	ICDMKE I
10:30 –11:00	Tea/Coffee Break			
11:00 – 12:30	Keynote Speech & ICME I	ICAEM I	Keynote Speech & ICWN I	ICEEE I
12:30 – 13:30	WCE Congress Lunch			
13:30 – 15:15	ICAEM Keynote Speech I & ICAEM II	ICMEEM I	ICCSE Keynote Speech & ICCSE II	ICDMKE II
15:15 – 15:45	Tea/Coffee Break			
15:45 – 18:00	ICME Keynote Speech & ICME II	ICCSDE Tutorial & ICCSDE I	ICCIIS Invited Talk & ICCIIS I	ICEEE II
The End of the First Day of the Congress				

Day Two (3 July, 2007, Tuesday)

	Room A	Room B	Room C	Room D	Room E
8:00 – 8:30	Tea/Coffee Break				
8:30 –10:30	ICAEM Keynote Speech II & ICAEM III	ICMEEM II	ICIE	ICWN II	ICSIE II
10:30 –11:00	Tea/Coffee Break				
11:00 – 12:30	ICME Invited Talk & ICME III	ICMEEM III	ICEEE Invited Talk & ICEEE III	ICCSDE II	ICAEM IV
12:30 – 13:30	WCE Congress Lunch				
13:30 – 15:15	ICWN Tutorial	ICMEEM IV	ICEEE Keynote Speech & ICEEE IV	ICME IV	ICAEM V
15:15 – 15:45	Tea/Coffee Break				
15:45 – 18:00	ICWN Invited Speech & ICWN III	ICCSDE III	ICSIE Invited Talk & ICSIE III	ICCIIS II	ICAEM VI
The End of the Presentations of the Second Day of the Congress					
19:00 – 21:00	WCE Congress Dinner				

Day Three (4 July, 2007, Wednesday)

	Room A	Room B	Room D	Room E
8:00 – 8:30	Tea/Coffee Break			
8:30 –10:30	ICSIE Keynote Speech & ICSIE IV	ICPDC Keynote Speech & ICPDC	ICME V	ICSBB I
10:30 –11:00	Tea/Coffee Break			
11:00 – 12:30	ICEEE Tutorial & Invited Talk	ICSIE V	ICME VI	ICSBB II
12:30 – 13:30	WCE Congress Lunch			
13:30 – 15:15	ICME Tutorial & ICME VII	ICISIE Invited Talk & ICISIE	ICCSE III	ICCIIS III
15:15 – 15:45	Tea/Coffee Break			
15:45 – 18:00	ICME VIII	ICEEE V	ICCSE IV	ICCIIS IV
The End of the Third Day of the Congress				

Congress Topics

ICAEM	The 2007 International Conference of Applied and Engineering Mathematics
ICCIIS	The 2007 International Conference of Computational Intelligence and Intelligent Systems
ICCSDE	The 2007 International Conference of Computational Statistics and Data Engineering
ICCSE	The 2007 International Conference of Computer Science and Engineering
ICDMKE	The 2007 International Conference of Data Mining and Knowledge Engineering
ICEEE	The 2007 International Conference of Electrical and Electronics Engineering
ICFE	The 2007 International Conference of Financial Engineering
ICIE	The 2007 International Conference of Information Engineering
ICISIE	The 2007 International Conference of Information Security and Internet Engineering
ICME	The 2007 International Conference of Mechanical Engineering
ICMEEM	The 2007 International Conference of Manufacturing Engineering and Engineering Management
ICPDC	The 2007 International Conference of Parallel and Distributed Computing
ICSBB	The 2007 International Conference of Systems Biology and Bioengineering
ICSIE	The 2007 International Conference of Signal and Image Engineering
ICWN	The 2007 International Conference of Wireless Networks

Venue

South Kensington Campus, Imperial College London, London, U.K

- Seminar Room A: Skempton Lecture Theatre 201
- Seminar Room B: Skempton Lecture Theatre 207
- Seminar Room C: Skempton Lecture Theatre 208
- Seminar Room D: Skempton Conference Room 227
- Seminar Room E: Skempton Conference Room 228
- Refreshment and Congress Meeting Lunch: Skempton CL Level 1 & 2 Foyer/Outdoor
- WCE 2007 Multiconference Dinner: Skempton ANTE

Note: WCE 2007 reception counter is situated directly outside Skempton Lecture Theatre 201

Map

Refer to the back cover

Sessions Details

There are fifteen to twenty minutes for each presentation (including questions and discussions). LCD projectors are available for the presentation (A few overhead projectors are available at the reception counter). And, it would be our convenience if the PowerPoint/PDF presentation files can be loaded into the provided notebook/PC before the start of the corresponding sessions. In each session, the presentation will follow the order shown below in its corresponding session.

WCE Keynote Speeches

By Prof. Magdi Bayoumi
Director of The Center for Advanced Computer Studies (CACS)
Department Head of the Computer Science Department
University of Louisiana at Lafayette, USA

Topic: Wireless Sensors Networks: Current and Future Challenges

Day One (11:00 - 11:40) at Seminar Room C

By Prof. Andrew Hunter
Head of Department
Head of Vision and AI Research Group
Computing and Informatics
Lincoln University, UK

Day One (8:30 - 9:30) at Seminar Room A

By Prof. Leonid Gelman (honorary co-chair)
Chair in Vibro-Acoustic Monitoring Chairman of COMADIT,
British Institute of NDT Director, Centre of Vibro-Acoustics and Fatigue
Cranfield University, UK

Day One (11:00 - 11:40) at Seminar Room A

Conference Keynote Speeches

ICAEM 2007 Keynote Speech I

By Prof. Sergei V. Utyuzhnikov
Senior Research Fellow
School of Mechanical, Aerospace & Civil Engineering,
University of Manchester, UK

Topic: Methods for Quasi-even Generation of Pareto Frontier in Multiobjective Optimization used in Engineering Design

Day One (13:30 - 14:20) at Seminar Room A

ICAEM 2007 Keynote Speech II

By Prof. Alexander G.Ramm
Professor, Mathematics Department,
Kansas State University, USA

Day Two (8:30 - 9:30) at Seminar Room A

ICCSE 2007 Keynote Speech

By Prof. Tarek El-Ghazawi
Professor, Department of Electrical and Computer Engineering,
Founding Co-Director of the High-Performance Computing Laboratory
The George Washington University, USA

Topic: Design and Application of Adaptive Cerebellar Model Articulation Controller

Day One (13:30 - 14:20) at Seminar Room C

ICEEE 2007 Keynote Speech

By Prof. Noel Shammas
Professor in Microelectronics and Solid-State Power Semiconductor Devices
Faculty of Computing, Engineering and Advanced Technology, Staffordshire University, UK
Topic: Semiconductor Devices and their use in Power Electronic Applications
Day Two (13:30 - 14:20) at Seminar Room C

ICME 2007 Keynote Speech

By Prof. Dimitris Drikakis, FRAeS, FIoN
Professor and Head of Aerospace Sciences Department
Chair of Fluid Mechanics and Computational Science
Cranfield University, School of Engineering
Day One (15:45 - 16:25) at Seminar Room A

ICPDC 2007 Keynote Speech

By Dr. Khaled Benkrid
Lecturer in the School of Engineering and Electronics,
The University of Edinburgh, UK
Topic: High Performance Reconfigurable Computing: From Applications to Hardware
Day Three (8:30 - 9:30) at Seminar Room B

ICSIE 2007 Keynote Speech

By Prof. Andrew Todd-Pokropek
Professor of Medical Physics and Head of Department
Department of Medical Physics and Bioengineering
University College London, UK
Day Three (8:30 - 9:30) at Seminar Room A

Invited Talks

ICCIIS 2007 Invited Talk

By Prof. Bogdan Gabrys
Head of Computational Intelligence Research Group
Chair of Computational Intelligence
Chair (Academic Affairs) of KES International Research Organisation
School of Design, Engineering & Computing
Bournemouth University, UK
Topic: To Combine or Not to Combine? Multiple Classifier and Prediction Systems.
Day One (15:45 - 16:25) at Seminar Room C

ICEEE 2007 Invited Talk

By Dr. Gunti Gunarathne
Lecturer and Industrial consultant, Electronics, industrial and biomedical instrumentation,
School of Engineering, The Robert Gordon University, UK
Topic: Ultrasonics Imaging – Advancements in Non-conventional Methods
Day Three (11:00 - 12:30) at Seminar Room A

ICEEE 2007 Invited Talk

By Dr. Michael Kraft

Senior Lecturer in MEMS
Nanoscale Systems Integration Group
Electronics and Computer Science
Southampton University, UK

Topic: Microfabricated Atom Chips

Day Two (11:00 - 11:40) at Seminar Room C

ICME 2007 Invited Talk

By Dr. Mike Richardson
Manager, JLR Sustainable Mobility Projects and Hybrids, Jaguar and Land Rover

Day Two (11:00 - 12:30) at Seminar Room A

ICSIE 2007 Invited Talk

By Prof. Charles M. Falco
Chair of Condensed Matter Physics
College of Optical Sciences
University of Arizona, USA

Day One (8:30 - 9:30) at Seminar Room C

ICISIE 2007 Invited Talk

By Dr. Antoni Martínez-Ballesté
Research scientist and coordinator of the Ph.D program
Department of Computer Engineering and Mathematics, Rovira i Virgili University of Tarragona, Spain

Topic: Privacy of ICT Users: what and how

Day Three (13:30 - 14:20) at Seminar Room B

ICSIE 2007 Invited Talk

By Dr. Christos Grecos
Senior Lecturer (Associate Professor), Department of Electronic/Electrical Engineering,
Loughborough University, UK

Topic: The H264 video coding standard: Capabilities and Application Range

Day Two (15:45 - 16:25) at Seminar Room C

ICWN 2007 Invited Talk

By Dr. Elena Gaura
Reader in Pervasive Computing
Director of Cogent Computing Applied Research Centre
Faculty of Engineering and Computing
Coventry University, UK

Day Two (15:45 - 16:25) at Seminar Room A

Tutorials

ICWN 2007 Tutorial

By Dr. Elsa María Macías López and Dr. Álvaro Suárez Sarmiento
Associate Professor, and Full Professor and Head of the Telematic Engineering Department
University of Las Palmas de Gran Canaria, Spain

Day Two (13:30 - 15:15) at Seminar Room A

ICME 2007 Tutorial

By Dr. Panagiota Pantazopoulou
Research scientist
Aerospace Sciences Department
Cranfield University, UK

Topic: Introduction to computational methods in aero acoustics

Day Three (13:30 - 14:20) at Seminar Room A

ICCSDE 2007 Tutorial

By Prof. I. C. Demetriou
Professor and co-chair of ISC Comp. Stat. & Data Eng.
Department of Economics, University of Athens

Day One (15:45 - 16:25) at Seminar Room B

ICEEE 2007 Tutorial

By Dr. Gunti Gunarathne
Lecturer and Industrial consultant, Electronics, industrial and biomedical instrumentation,
School of Engineering, The Robert Gordon University, UK

Topic: Using the Universal Concept of Feedback as a powerful tool in Electronic Circuit analysis and Design

Day Three (11:00 - 12:30) at Seminar Room A

An Implantable Retinal Stimulator Design for Long-term Animal Experiments

J. A. Zhou, S. I. Park, J. M. Seo, S. W. Lee, E. T. Kim, H. Chung and S. J. Kim

Abstract— **this article reports on an electrical retinal stimulation system for use in long-term animal electrical stimulation experiments. The presented system consists of an implantable stimulator, which provides continuous electrical stimulation and an external component, which provides preset stimulation parameters and power to the implanted stimulator *via* a paired RF (radio frequency) coil. A rechargeable internal battery and a parameter memory part were introduced to the implantable stimulator to avoid use of the external component during the stimulation cycles. The same inductive coil pair was used to pass the parameter data and to recharge the battery. To separate the stimulation mode and the battery recharging mode, a switch circuit is used. The implantable stimulator was implemented with IC chips and the electronics except the stimulation electrodes were hermetically packaged in a biocompatible metal case.**

***Index Terms*—electrical neural stimulation, neural prosthesis, long-term animal experiment, neural implant system, RF telemetry**

I. Introduction

Retinal prostheses are under investigation by several groups [1], and some preclinical and clinical trials have been reported [2]-[5]. Preclinical experiments are intended to estimate the stimulation parameters and to evaluate the efficacy and the safety of the devices while the clinical trials are aimed at demonstrating the feasibility of the prosthesis. Although the electrical stimulation of the retina in preliminary clinical study showed encouraging results such as the patient's perception of a small spot of light or basic shapes according to the stimulation pattern [3], there is much to be investigated and revised.

Before the implantation of the retinal prosthesis into the eye of the real patient, the electrical stimulation conditions, the long-term stability and durability of the retinal prosthesis *in vivo* should be verified. Previous reports showed either long-term biocompatibility of various electrodes without stimuli [6]-[9] or a safety threshold of electrical stimulation in acute experiments [10]-[12]. In the previous studies, electrical stimulation systems needed a wired or a wireless external component to provide parameters and power to the internal electrodes. When using these systems for long-term electrical stimulation tests in animals [13, 14], some difficulties arose. Systems with a percutaneous connection restricted the test animal's movement and sometimes posed an infection risk. In transcutaneously connected systems, the external controller was worn by the test animal and usually came off the test animal or was damaged by the animal.

In this article, an implantable retinal prosthesis system is proposed for a chronic electrical stimulation test in an animal model. For this purpose, a small rechargeable battery and a parameter memory were introduced into the implanted stimulator so the external power supply and control part could be removed during a chronic stimulation experiment. The external unit is needed for two purposes only: parameter passing and battery charging.

Manuscript received March 22, 2007. This work was supported by the Nano Bioelectronics and Systems Research Center of Seoul National University, which is an ERC supported by the Korean Science and Engineering Foundation (KOSEF) and by the Nano Artificial Vision Research Center supported by Korea Health 21 R&D Project, MOHW Grant No. A050251.

S. J. Kim is with the School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea. (corresponding author, phone: +82-2-880-1812; Fax: +82-2-882-4158; e-mail: kimsj@snu.ac.kr).

J. A. Zhou is with the School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea. (e-mail:sally55@snu.ac.kr).

S. I. Park, is with the Nano Bioelectronics & Systems Research Center of Seoul National University, Seoul, Korea. (e-mail: psi@helios.snu.ac.kr).

J. M. Seo is with the Ophthalmology Department, Dongguk University School of Medicine, Seoul, Korea. (e-mail:callme@snu.ac.kr)

S. W. Lee is with the School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea. (swlee@helios.snu.ac.kr).

E. T. Kim is with the School of Electrical Engineering and Computer Science, Seoul National University, Seoul, Korea. (arnoldk2@snu.ac.kr).

H. Chung is with the Ophthalmology Department, Seoul National University School of Medicine, Seoul, Korea. (e-mail:chungh@snu.ac.kr)

II. Method

The implantable retinal prosthesis system for a chronic animal experiment consists of an external unit for stimulation control and battery charging, and an internal unit for retinal stimulation (figure 1). A paired RF coil links these two units for data and power transmission.

The external unit has a stimulation waveform parameter selector to control the channel selection, amplitude, duration and rate of stimulation. This parameter selector generates a parameter data frame and was implemented using a commercially available digital signal processing chip, and the control codes, which were implemented in-house using the C programming language. The parameter data frame consists of 22-bit. To transmit this parameter data into the internal stimulator, pulse width modulation (PWM) encoding method is

used. Logic '1' and '0' are encoded to have a duty cycle of 75% and 25%, respectively, and 'end-of-frame (EOF)' bit has a 50% duty cycle [15]. Such an encoding method enables easier synchronization and decoding because each bit has a uniform rising edge at its beginning. The transmission data rate is 125 kbps. For transmission of PWM encoded data, a class-E tuned power amplifier (data/power transmitter) is used with amplitude shifted keying (ASK) modulation. The carrier frequency is 2.5 MHz.

The transmitted data are received by the internal coil and then an envelope is extracted through a half-wave rectifier and a low-pass filter. Using this envelope signal, a data decoder in data/power receiver chip recovers the parameter data and saves it to the parameter memory chip. Using the same envelope signal, a voltage regulator generates power to be consumed by the data/power receiver chip (figure 1).

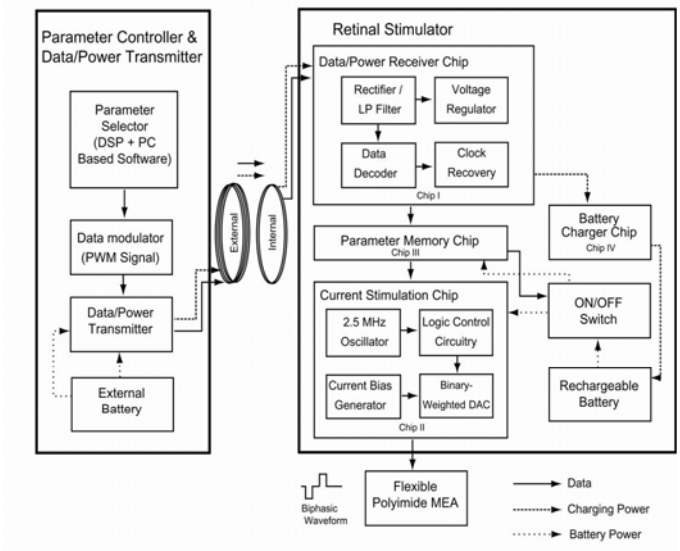

Fig. 1 System block diagram

The internal unit, *i.e.* the retinal stimulator, was implemented with a rechargeable battery and IC (integrated circuit) chips: the data/power receiver chip, including data decoding and voltage regulation functions, and current stimulation chip are custom IC's designed by our laboratory (0.8 ㎛ CMOS (complementary metal-oxide semiconductor) technology), and the parameter memory chips and battery charging chip are off-the-shelf commercial chips (figure 1). Except for data/power receiver chip, the other chips in the stimulator are powered by a rechargeable battery. Therefore, once the parameters are passed to the parameter memory, the external unit can be removed from the animal during the electrical stimulation test. The retinal stimulator has two modes of function: a stimulation mode and a battery recharging mode.

In stimulation mode, the saved parameter data in the parameter memory part are provided to the current stimulation chip. The parameter data do not change unless a new parameter is transmitted from the external part. The current stimulation chip consists of current generator circuitry and timing logic circuitry. The current generator circuitry has current bias circuitry (8 ㎂) and an 8-bit binary current-weighted DAC (digital-to-analog converter). The timing logic circuitry has a 2.5 ㎒ oscillator and switch control logic circuitry for controlling the current stimulation waveform.

In the battery recharging mode, 2.5 ㎒ sinusoidal waves were transmitted with no data. A rechargeable coin-type lithium ion battery is used as the power source for the internal implant. A charging chip is used to control the battery recharging.

In this work, only one inductive coupling was used for data transmission and battery charging. Simultaneous transmission of the stimulation parameter and charging power is difficult because the battery charger circuit affects the precisely designed load value of the data/power receiving circuit and can induce the failure of data reception. To separate the stimulation mode and battery charging mode, a switch circuit was positioned between the voltage regulator in Data/power Receiver Chip and the Battery Charge Chip to control the recharging of the battery. The introduced switch circuit consists of two p-MOS transistors, one capacitor and one resistor (figure 2). The resistor and capacitor comprise a parallel connection with an RC time constant of 100 ms, which is very long compared to the 8 us period of the clock of Data/power Receiver Chip. Therefore, the voltage of the 'a' node is higher than the threshold of the Q2 switch when a data signal (PWM) is applied causing the Q2 to turn off. The data decoding can therefore be successfully carried out with no load effect. However, when only a sinusoidal wave without data is applied to the retinal stimulator through the inductive link, the level of CLK is logic high. In this case, Q1 will be turned off and the voltage of node 'a' will be logic low, so Q2 will be turned on. Therefore, the battery can be recharged.

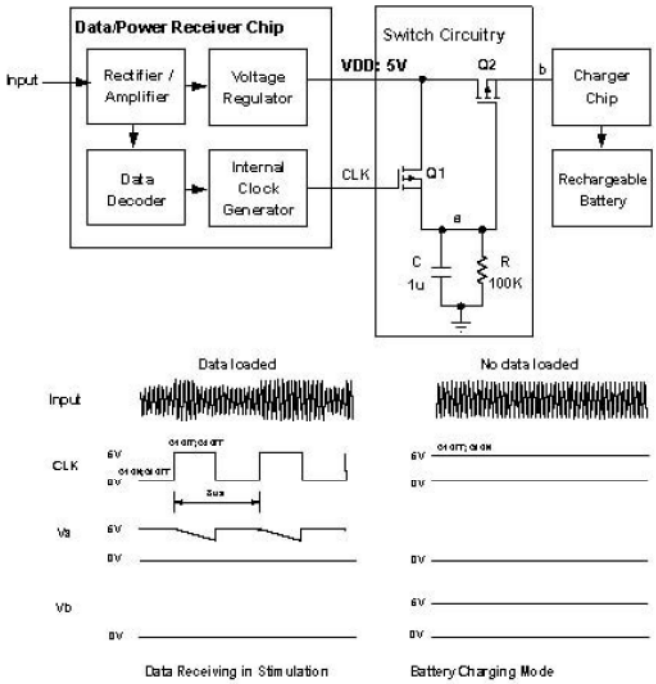

Fig. 2 Operation of switch circuitry in stimulation and battery charging modes

To protect the ICs from body fluids and mechanical forces, the electronics of the stimulator were hermetically housed in a

metal package which consists of biocompatible titanium housing, platinum feedthroughs, and a ceramic plate. The feedthroughs connect the electrode array and receiver coil to the retinal stimulator. A ceramic sintering process is used to fix the feedthroughs in the ceramic plate that provides electrical isolation. Brazing and laser welding techniques were employed to achieve hermetic sealing of titanium housing.

A polyimide-based seven-channel, strip-shaped (750 x 300 μm) gold electrode array was used. The stimulating sites were constructed in a 4 mm x 4 mm area [14]. One side of this array was lengthened and connected to the stimulator *via* feedthroughs.

III. Results

A current mode, charge-balanced, cathodic first-biphasic stimulation waveform was generated in the stimulation mode and provided to a stimulation electrode array. The current stimulation chip can simultaneously deliver a stable current from 8 μA to 2 mA to all channels. The pulse width and the interphase delay can be changed up to 3 ms. The interphase delay was designed to have the same time duration with the pulse width.

The fabricated polyimide electrode array was checked for electrode impedance. Impedance for the electrode site (750 μm x 300 μm) was typically 1.3 kΩ in phosphate buffered solution (pH 7.4) measured at 1 kHz with a potentiostat (Zahner Elektrik IM6e, Germany).

The stimulator consumed around 2.35 mA current when delivering 520-uA biphasic current pulsed of 1-ms pulse width at a stimulation rate of 10.4 Hz to all seven channels.

The capacity of the battery was 75 mAh (4.2 V) and the battery could supply the power to the internal circuitries for over 30 hours under the 520-μA amplitude, 1-ms stimulation condition. The battery was fully recharged within 3 hours with 25 mA charging current through the RF inductive link when in the battery recharging mode.

IV. Discussion

In the retinal prosthesis research, long-term animal electrical stimulation experiment is needed to verify the long-term stability and durability of the system before clinical use. Retinal systems using an electrical stimulation test usually consist of external and internal units [13]. The external unit is a necessary to change the stimulation parameters and to provide power for the implanted stimulator, but it is also burdensome especially in long-term animal electrical stimulation experiments.

The stimulation system presented in this paper is intended to provide a useful tool for long-term animal experiments on retinal prostheses. To remove the external connection or the external unit from the animal during electrical stimulation, we used a small rechargeable battery in the implantable stimulator. This battery can be simply recharged using an RF inductive link while the system is idle. This system makes it possible to conduct the chronic electrical stimulation tests in such a way that the animal can move and act freely without any external unit during the stimulation test. Therefore, there is no need to anesthetize the test animal and the stimulation system is also protected from the animal's claws and teeth.

The implantable retinal stimulator was built using IC chips and discrete elements for this proof-of-concept. An integrated IC chip can be developed to reduce power consumption and further miniaturize the implanted component of the device.

References

[1] E. Margalit et al., "Retinal prosthesis for the blind", *Surv. Ophthalmol.* **47 (4),** 2002, pp. 335-356..

[2] J. F. Rizzo, J. Wyatt, J. Loewenstein, S. Kelly, D. Shire, "Perceptual efficacy of electrical stimulation of human retina with a microelectrode array during short-term surgical trials", *Invest. Ophthalmol. Vis. Sci.* **44,** 2003, pp.5362-5369.

[3] M. S. Humayun, J. D. Weiland, G. Y. Fujii, R. Greenberg, R. Williamson, J. Little, B. Mech, V. Cimmarusti, G. Van Boemel, G. Dagnelie, E. de Juan, Jr., "Visual perception in a blind subject with a chronic microelectronic retinal prosthesis", *Vision Res.,* **43,** 2003, pp. 2573-2581.

[4] R. Hornig, T. Laube, P. Walter, M. Velikay-Parel, N. Bornfeld, M. Feucht, H. Akguel, G. Rossler, N. Alteheld, D. L. Notarp, J. Wyatt, G. Richard, "A method and technical equipment for an acute human trial to evaluate retinal implant technology" *J. Neural Eng.* **2** , 2005, pp.S129-S134.

[5] A. Y. Chow, V. Y. Chow, K. H. Packo, J. S. Pollack, G. A. Peyman, R. Schuchard, "The artificial silicon retina microchip for the treatment of vision loss from reinitis pigmentosa", *Arch Ophthalmol.* **122,** 2004, pp. 460-469.

[6] A. Y. Chow, M. T. Pardue, J. I. Perlman, S. L. Ball, V. Y. Chow, J. R. Hetling, G. A. Peyman, C. Liang, E. B. Stubbs, N. S. Peachey, "Subretinal implantation of semiconductor-based photodiodes: durability of novel implant designs" *J. Rehabil. Res. Dev.* **39,** 2002, pp. 313-322.

[7] D. Güven, J. D. Weiland, M. Maghribi, J. C. Davidson, M. Mahadevappa, R, Roizenblatt, G. Qiu, P. Krulevitz, X. Wang, L. LaBree, M. S. Humayun, "Implantation of an inactive epiretinal poly(dimethyl siloxane) electrode array in dogs" *Exp. Eye Res.* **82,** 2006, pp. 81-90.

[8] T. Schanze, H. G. Sachs, C. Wiesenack, U. Brunner, H. Sailer, "Implantation and testing of subretinal film electrodes in domestic pigs" *Exp. Eye Res.* **82**, 2006, pp. 332-340.

[9] J. M. Seo, S. J. Kim, H. Chung, E. T. Kim, H. G. Yu, Y. S. Yu, "Biocompatibility of polyimide microelectrode array for retinal stimulation" *Mater. Sci. Eng. C- Biomimetic Supramol. Syst.* **24,** 2004, pp. 185-189.

[10] P Walter and K Heimann, "Evoked cortical potentials after electrical stimulation of the inner retina in rabbits" *Lab. Invest.* **238**, 2000, pp. 315-318.

[11] Y. Yamauchi, L. M. Franco, D. J. Jackson, J. F. Naber, R. O. Ziv, J. F. Rizzo, H. J. Kaplan, V. Enzmann, "Comparison of electrically evoked cortical potential thresholds generated with subretinal or suprachoroidal placement of a microelectrode array in the rabbit" *J. Neural Eng.* **2**, 2005, S48-S56.

[12] E. Margalit et al., "Visual and electrical evoked response recorded from subdural electrodes implanted above the visual cortex in normal dogs under two methods of anesthesia" *J. Neurosci. Methods* **123**, 2003, pp.129-137.
[13] D. Güven et al., "Long-term stimulation by active epiretinal implants in normal and RCD1 dogs" *J. Neural Eng*. **2**, 2005, pp.S65-S73.
[14] J. A. Zhou, E. T. Kim, J. M. Seo, H. Chung, S. J. Kim, "A seven segment electrode stimulation system for retinal prosthesis" *Invest Ophthalmol Vis Sci 2006* **47**: E- Abstract 3178.
[15] S. K. An, S. I. Park, S. B. Jun, C. J. Lee, K. M. Byun J. H. Sung, B. S. Wilson, S. J. Rebscher, S. H. Oh and S. J. Kim "Design for a low Simplified cochlear implant system" *Manuscript, IEEE Trans. Biomed. Eng.,* Accepted for publication.