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A NEW MODELING PERSPECTIVE ON VOCAL TRACT

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Abstract: *The paper will discuss about a new perspective regarding the modeling process of the vocal tract. Our approach is more technological, trying to combine some fundamental characteristics of biometrics in order to create a vocal profile analysis for different corpus of recordings. A comparison between Mel Frequency Cepstral Coefficients (MFCCs) and Long-term Formant Distributions (LTFDs) will be presented with the goal to see as output some similar information. The output will be used in order to create a report with the characterization of the voice, which could be used in a forensic context.*

Keywords*: security, UML, integrity, software analysis.*

1. Introduction

The point of this article is to explain a new way of how the vocal tract can be modelled, using theacquire process of the information that will bring as definite sound recording and simulated human proliferation with a recording framework called "Discourse Device".

Theory: "on the off chance that we accept that the sound generation is entirely physical cooperation marvels of a section of air with dividers of <Tubing>, the unit of discourse is viewed as a <instrument>. Such a framework can accomplish without anyone else's input to record all physical marvels and barometric weight material weight and which later can reenact. This is conceivable utilizing countless loyalty sensors " [13-18].

Making a parallel between discourse generation framework and a musical instrument, musical instrument the bagpipes is comparative [23].

The sounds duplicated by the human species in the discourse are acquired by discharging a section/volume of air from the lungs under some weight, at first through 2 "tube" (= bronchi) and thusly by a "tube" (= trachea) . This section of air going through the trachea to the mouth. The larynx, the segment of air going through a strait created by the vocal lines. Here's first measured air. Sound waves are delivered by the segment of air hitting the dividers of the trachea and vocal lines under some weight. These structures have a specific versatility. The pharynx happens a widening of pipelines intersection the section of air.

The section of air can pass pharynx:

- Only in the mouth and with the tongue, lips, cheeks intervened in the way of the air segment delivered sounds (vowels and consonants) (articulator framework)
- Both in the mouth and nasal pit (and thus the sinuses) offering nasal tone sounds.

The oral pit, nasal cavity and sinuses are composed resonator, sound intensifier items.

Dividers ought to be considered as "funnels" through which air section dividers with wallpaper certain versatility and are a fluid film (emissions, liquid). This sounds open up sound waves and gives a specific eccentricity not at all like the sounds that have been misleadingly proliferated "metal/simulated" [22].

The task that we have investigated during our research are based on logical targets that prompt a definitive objective:

- 1. Making a framework/gadget of nanotechnology autonomous, empowering recording amplitudes and weights dialect and facial muscles on the sense of taste and oro-alveolar edges + teeth amid discourse - called "Discourse Device" ;
- 2. Enrollment weight air volume (weight gadgets), which acts/ricochet off dividerssense of taste and alveolar edge in amid discourse;
- 3. Enrollment methodology for appropriation of the securities in the joint and generation of sounds in discourse, accomplishing both representations of the spatial dispersion of material weight and the barometric weight (continuously and at the same time on an outer/show with a software application called*SpeechTract*);

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- 4. Sound recording (time, wavelength, and gaseous tension that are leaving the hole buccal).

1.1. Physiology Phonation

Fundamental sound occurs through conversion of air energy to acoustic energy achieved by the larynx whose vibration function takes place in exhalation phase, when the vocal cords are in adduction (closed position) and exhalation air column pressure (subglottic pressure) slams them causing the pushing of chordal free edges, which are easily apart. After the passage of air flow it will produce the closure of the vocal cords through three mechanisms:

- decreased subglottic pressure;
- Bernoulli effect;
- elasticity of chordal mucosa [25].

So the cycle of vibration is achieved and the functioning of the vocal cords can be compared to that of a vibrator characterized by:

- small and very fast closing – opening moves of the vocal cords, representing the fundamental frequency of the voice (number of vibrations per second expressed in Hertz) - determine the amplitude of vibration;
- mucosa undulation, which slides on underlying ligament during the passage of the exhalation air, causing vertical movement of lifting the free edge of the vocal cords.

The most accepted theory of phonation is mioelastic-aerodynamic theory of Van den Berg, who argues that the achieving vibration cycle of phonation involve four types of forces:

- two muscle - is important the muscle elasticity and as a result the muscle tension of vocal cord;
- two aerial - subglottic pressure and the speed of the intraglottis air flow [26].

The intensity of the sound depends directly on subglottic laryngeal pressure and the speed of the intraglotic air flow. Issihiki conducted a studio which has demonstrated that in regulation of intensity at low frequencies glottal resistance is more important than the expiratory force and vice versa at high frequencies sound intensity is influenced by expiratory force[24].

Fundamental frequency or pitch of sound is influenced by:

- the effective mass of the vibration part of the vocal cord, which depends on both the morphology of the larynx (constitutional length and thickness of vocal cords) and intrinsic stretching developed in the vocal cord by laryngeal muscle contraction; cricothyroid muscle whose contraction causes the vocal cord lengthening and internal tiroaritenoidian muscle;
- effective tension/stretching in the vibration part of the vocal cord, attend both laryngeal intrinsic muscles (determine changes in glottis morphology, but also variations in joining length of vocal cords) and the extrinsic laryngeal muscles that modifies vertical tension / vocal cord thickness by up and down movement of the larynx;
- vocal cord damping;
- subglottic pressure of exhaled air;
- glottis hole diameter, which determines also the Bernoulli effect value.

The timbre of the voice participate in enriching the sound fundamental frequency of the larynxdue to the harmonics produced at the level of pharyngeal-oral-labial resonator. Some of these are called formants and are 2-4. Any change of shape and volume of the resonators corresponds to a change in formants. For the same formants group some small frequency changes cause a different timbre even if issued phonemes are identical. This explains the great diversity of timbre, which allows individuals by voice recognition [3]. Therefore resonators (pharyngeal-oral-labial resonator, nasal and sinuses cavities) are very important, in phonation mechanism; they transform and enrich laryngeal sound adding their own consonants production allowing articulation of phonemes. Timbre depends also on how vocal cords are joining, in particular on the area, duration and pressure of joining, and also on changes in the thickness of the free edge of the vocal cords.

2. The technique used for data achievement used in our speech device and software application

The patient will be dealt with in like manner as far as dental prostheses. The upper and lower dentures, both are secured by staples or embeds. In parallel, the patient will accomplish a "Discourse Device" with the outside shape indistinguishable dentures, by copying models in dental research center and external sides of the fingerprinting last prosthesis.

Making the dentures anchored prosthetics patient

1. Fingerprinting upper and lower prosthetic field in order to obtain study models;
2. Achieve individual upper and lower trays in order to fingerprinting systems for achieving special root cemented or screwed into the implant (inserted intraosseous);
3. Impression prosthetic field with individual spoons;

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4. Casting of special systems / special adaptation for the systems of creating the templates Occlusion + achievement of occlusion templates.

2.1. The methodology of the survey and registration data

The patient will be tested in a special room for sound recording, and the recording will be made separately for each sound (vowel / consonant / word) to record each and every sound is repeated 5 times [19][20].

Laser scanning of "Speech-Device-Jaw" and "Speech-Device-mandibular" getting their 3D representations. Reprezentarile3D define positions on recognition of all sensors, assigning each sensor (from 3D representations) parameters recording features.

3. Software Application for Data Processing

Step1. Scan "Speech-Device-Jaw" and "jaw-Speech-Device" in a "3D recognition software" in which we will define each touch sensor and sensor barometric:

- Amplitude as a scale of values;
- Spatial distribution (position identification);
- Time.

Step2. Creating files recording the "Data obtained" in testing a memory card. The files that contains data, will be classified as follow:

- File data recording captured pressure of all sensors (amplitude);
- Recording data files captured from all walks and all sensors Barometric Sensors (amplitude);
- Recording data files captured GPS Sensors (Positions);
- Recording data files captured by cameras (separate for each);
- Microphone recording files separately for each position the amplitude of the air pressure will be as "color scale tangential arrow" or into a different presentation graphics.

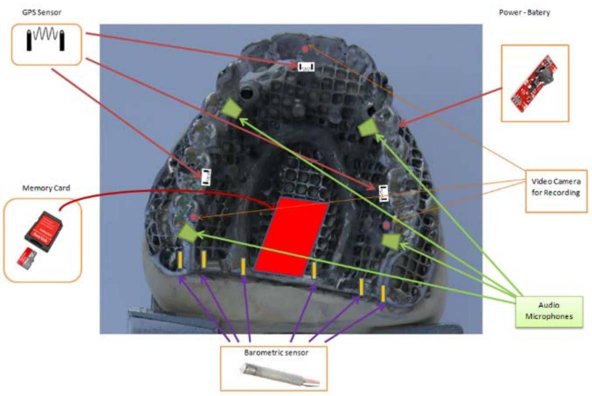

Fig. 1. Position of the devices

As indicated by the hypothesis of the slightest square technique, the best possible determination of adjustment focuses impacts the fitting result. The adjustment in the entire weight and temperature range for the sensor is tedious work. The strategy can be excessively convoluted if the quantity of the adjustment focuses is too high while the remuneration exactness may diminish if the quantity of the alignment focuses is too low. Along these lines, it's important to appropriately choose the adjustment focuses to discover a harmony amongst precision and intricacy. What's more, contrasted with the weight adjustment, the temperature alignment has a much higher level of multifaceted nature because of the warm conduction delay. In this way, the improvement was centered on picking the quantity of temperature alignment focuses [1-12].

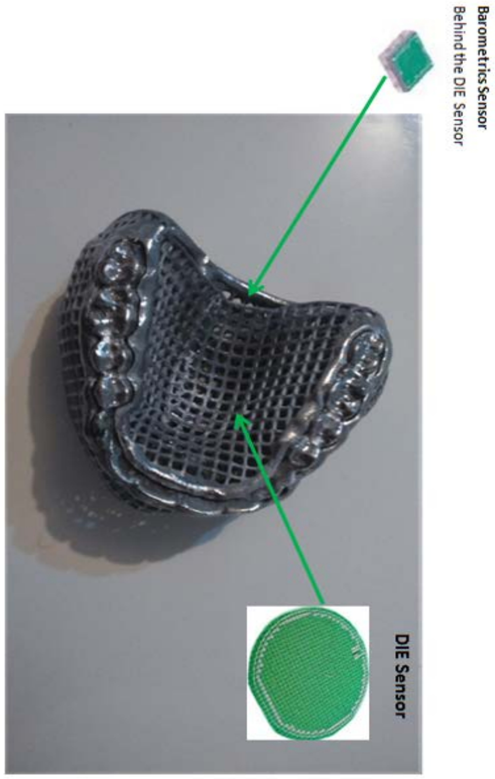

Fig. 2. DIE and Barometric Sensor

In Figure 2 we can see how the DIE and barometric sensor are placed in order to record the data which are send to the processes module in order to make an analysis.

We have demonstrates the aftereffect of the streamlining, where m is the quantity of temperature alignment focuses in the scope of -40°C~70 °C, and blunder is the rate outright mistake between the ascertained weight esteem

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by pay capacity and the adjustment weight worth, and multifaceted nature is the rate of the time required to finish the alignment process contrasted with that when m = 12. At the point when m was diminished from 12 to 7, the maximal blunder fundamentally stayed unaltered. At the point when m was further diminished to 6, an expansion of the maximal mistake after remuneration was watched. Taking into account this outcome, m = 7 is the streamlined number for temperature alignment, which keeps up a high precision and lessens the multifaceted nature by 41% contrasted with the first adjustment technique when m = 12.

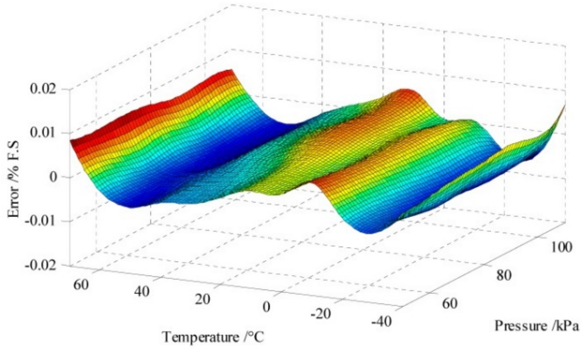

Fig. 3. Temperature representation

CONCLUSIONS

This paper exhibited a thunderous weight micro sensor equipped for self-temperature remuneration. Thunderous weight micro sensors with two doubly-clasped "H" sort full bars were created and portrayed. The calculation empowering the computation of temperature and weight taking into account two thunderous frequencies was proposed and upgraded. After pay, the mistakes were under 0.01% of the full weight scale (temperature scope of −40 °C to 70 °C and weight scope of 50 kPa to 110 kPa), and along these lines the resounding weight micro sensor can work in the self-temperature pay mode.

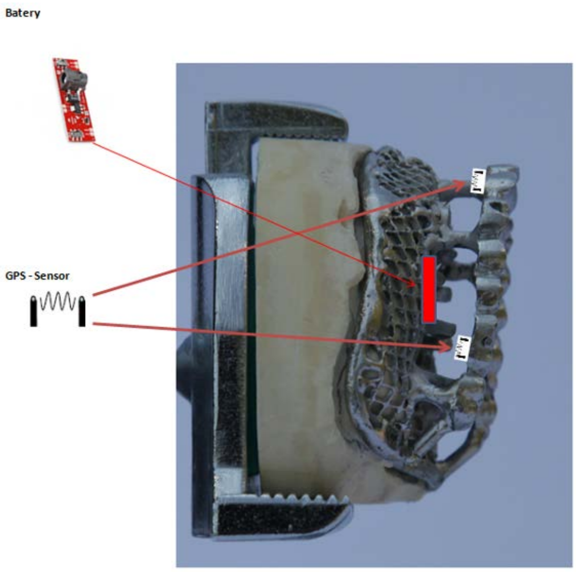

Fig. 4. The GPS sensor and battery

BIBLIOGRAPHY

[1]. Ma Z.B., Jiang C.Y., Ren S., Yuan W.Z. Fabrication of a novel resonant pressure sensor based on SOI wafer. Chin. J. Sens. Actuators. 2012;25:180–183.
[2]. 2. Kasten K., Amelung J., Mokwa W. CMOS-compatible capacitive high-temperature pressure sensors. Sens. Actuators A Phys. 2000;85:147–152. doi: 10.1016/S0924-4247(00)00385-X.
[3]. Santo Z.M., Mozek M., Macek S., Belavic D. An LTCC-based capacitive pressure sensor with a digital output. Inf. MIDEM. 2010;40:74–81.
[4]. Pramanik C., Islam T., Saha H. Temperature compensation of piezoresistive micro-machined porous silicon pressure sensor by ann. Microelectron. Reliab. 2006;46:343–351. doi: 10.1016/j.microrel.2005.04.008.
[5]. Otmani R., Benmoussa N., Benyoucef B. The thermal drift characteristics of piezoresistive pressure sensor. Phys. Procedia. 2011;21:47–52. doi: 10.1016/j.phpro.2011.10.008.
[6]. Damjanovic D. Materials for high-temperature piezoelectric transducers. Curr. Opin. Solid State Mater. Sci. 1998;3:469–473. doi: 10.1016/S1359-0286(98)80009-0.

DOI: 10.21279/1454-864X-16-I1-059

[7]. Schulz M., Sauerwald J., Richter D., Fritze H. Electromechanical properties and defect chemistry of high temperature piezoelectric materials. Ionics. 2009;15:157–161.
doi: 10.1007/s11581-008-0284-2.
[8]. Beeby S.P., Ensell G., Kraft M., White N.M. MEMS Mechanical Sensors. 1st ed. Artech House; Boston, MA, USA: 2004. pp. 97–99.
[9]. Greenwood J.C., Satchell D.W. Miniature silicon resonant pressure sensor. IEE Proc. D Control Theory Appl. 1988;135:369–372. doi: 10.1049/ip-d.1988.0056.
[10]. Greenwood J., Wray T. High accuracy pressure measurement with a silicon resonant sensor. Sens. Actuators A Phys. 1993;37:82–85. doi: 10.1016/0924-4247(93)80017-B.
[11]. Du Y.P., He X.Y. Brief discussion on temperature compensation technology of sensor.Electron. Des. Eng. 2009;6:63–64.
[12]. Li L.L., Zhao Q.M. Temperature compensation of pressure sensor. Sen. World.2000;8:16–19.
[13]. Su Y., Sun Y.C., Li G.Y. Comparing the different arithmetic methods for the offset drift compensation of pressure sensor. J. Transduct. Technol. 2004;9:375–378.
[14]. Ji H.X., Yu P., Liang X.J. Research of sensor nonlinear compensation. Machinery.2000;10:1127 1130.
[15]. Sun Y.C., Chen Z.Y., Wang J. Normalizing the polynomial-match for a non-linear function in sensors and solid electronics. J. Electron Devices. 2004;1:1–7.
[16]. Liang W.F., Wang X.D., Liang P.E. Pressure sensor temperature compensation based on least squares support vector machine. Chin. J. Sci. Instrum. 2007;12:2235–2238.
[17]. Yang L., Su Y., Qiu A.P., Xia G.M. Self-temperature compensation for high quality factor micro machined gyroscope. Opt. Precis. Eng. 2013;11:2870–2876. doi: 10.3788/OPE.20132111.2870.
[18]. Wang J.C., Xia X.Y., Zou H.S., Song F., Li X.X. Piezoresistive pressure sensor with dual-unit configuration for on-chip self-compensation and suppression of temperature drift; Proceedings of the 2013 Transducers &Eurosensors XXVII: 17th International Conference on Solid-State Sensors, Actuators and Microsystems; Barcelona, Spain. 16–20 June 2013.
[19]. Wang J.S., Dong Y.G., Feng G.P., Wang X.H. Temperature characteristics of quartz resonant force sensors and self-temperature-compensation. J. Tsinghua Univ. (Sci. Technol.) 1997;8:12–14.
[20]. Luo Z.Y., Chen D.Y., Wang J., Li Y., Chen J. A High-Q resonant pressure micro sensor with through glass electrical interconnections based on wafer-level MEMS vacuum packaging. Sensors. 2014;14:24244–24257. doi: 10.3390/s141224244.
[21]. Chen D., Li Y., Liu M., Wang J. Design and experiment of a laterally driven micromachined resonant pressure sensor for barometers. Procedia Eng. 2010;5:1490–1493.
doi: 10.1016/j.proeng.2010.09.399.
[22]. Luo Z., Chen D., Wang J. Resonant pressure sensor with through-glass electrical interconnect based on SOI wafer technology; Proceedings of the 2014 9th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS); Waikiki Beach, HI, USA. 13–16 April 2014; pp. 243–246.
[23]. Chen D. Ph.D. Thesis. University of Chinese Academy of Sciences; Beijing, China: 2002. Research on Micromachined Resonant Beam Pressure Sensors.
[24]. Issihiki N., Vocal Mechanism As the Basis for Phonosurgery , The Laryngoscope, 108, 1761-1766, 1998, KHAMBATA A. S., Laryngeal disorders in singers and other voice users.
[25]. Kirchner S. A., Physiology of the Larynx, Otolaryngology, Vol. I, M. M. Paparella, Third Edition, Sounders Company, 1991.
[26]. Sarafoleanu C., Esentialul in Laringologie, EdituraAcademieiRomane, 2007. (Essential in Laryngology, Romanian Academy Ed., 2007)

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