PQI Consulting LLC Customer Solutions
Featuring APNAC/RAC™ Technology

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Introduction

- PQI Consulting LLC offers its customers the finest in analytical products and services, including
  - Technical support for all implementations of its products as embedded subsystems in customer systems;
  - Online consulting and training support;
  - Specialized subsystem coding support.

- PQI Consulting LLC features the use of *Arbitrary Precision Nomographic Analytical Calculations* and *Rational Arithmetic and Conversions* (APNAC/RAC™) technology to address the most important data analysis challenges. and to provide complete, accurate, meaningful, and immediately useful solutions.

- PQI Consulting LLC product licenses are flexible for the particular needs of a customer as systems are updated and/or replaced.

Example Problem: Obsolete Data

- Expert-decision subsystems (such as AI applications) rely on mathematical and statistical inference from potentially large sets of data collected during system operations.
  - This data is most often analyzed in bulk long after they are collected, and conclusions from those analyses often become "obsolete stories" that do not adequately inform, and perhaps outright misinform, the next iteration of expert-decision subsystem updates.
  - This data often becomes corrupt during transfer from one analysis platform to another, and different analysts often "see" different phantom features of a dataset, which leads to inconsistent, if not incorrect, data analysis results.

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The Solution: No Obsolete Data

- When implemented with APNAC/RAC™ technology, a PQIC LLC microprocessor-controlled expert subsystem collects, stores, and uses the same potentially large set of data as is now the case; however, the data are now represented as complete (or minimally) sufficient statistics, and end-to-end analysis of that data immediately takes place **_within the hardware of the PQIC LLC subsystem_**, such as

  - _Analysis of Variance_ (ANOVA) to determine which factors in the data most affect a performance measure to be optimized.
  - _Sequential Least-Squares Estimator Updates_ through incremental updates of the design matrix inverse.
  - _Surveillance of Critical Elements_, where, e.g., a sensor sending high-variance or perhaps impossible data may be shut down, i.e., no longer allowed to contribute to the data under analysis to prevent errant data analysis conclusions.
  - _Real-Time Reporting_ of intermediate results so that other subsystems may also make real-time reactions/adjustments.

Market Opportunity

- The market opportunities for APNAC/RAC™ enabled microprocessor-controlled expert subsystems are **_unlimited_**.

- What is now accomplished by expert opinion based on scant, if any data or metadata, most of which has long ago lost relevance, may now be surpassed with real-time application of that same expert opinion – now based on contemporaneous collected, high-quality, relevant data – in a single, flexible, tunable, and compact hardware subsystem – all enabled and supported by PQI Consulting LLC.

APNAC Technology

- APNAC Technology from PQI Consulting LLC is a microprocessor architecture that uses …
  - a set of stacked dynamic electrically erasable programmable read-only nomographic grid layers …
  - to calculate (output) an arbitrarily-precise evaluation of arbitrary mathematical and statistical functions or their inverses (or algorithms involving such functions) …
  - at an arbitrarily closely-spaced discrete set of domain values (input);

  … as well as …
  - the complete set of RAC technology functionality implemented in hardware (see the next page).

- This architecture allows for the evaluation of multiple mathematical and statistical functions and their inverses, as well as arbitrarily-complicated algorithms (through repeated use in arbitrary order of the implemented mathematical/statistical functions), to any level of precision, in one integrated circuit (using hardware only).

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RAC Technology

- RAC Technology from PQI Consulting LLC (where all values are exclusively expressed and treated as rational numbers) is a significant improvement on floating-point IEEE-754-compliant arithmetic and conversion operators. These improvements include …

  - **_Errorless Calculation Results_**, meaning there is no over/under-flow, round-off, or scale drop-out issues, or any other kind of error when using RAC values; all results are **_exact_**.
  - **_Universal Use_** – every floating-point value may be expressed exactly as a RAC value, but not every RAC value may be expressed exactly as a floating-point value, regardless of how large of a mantissa is available.
    - Example: 1/3 (one-third) has no exact floating-point form with any exponent/mantissa.
    - Furthermore, there is always at least one RAC value arbitrarily close to any irrational number, so constants such as π and the positive square root of 2 may be arbitrarily closely approximated by RAC values.
  - **_Adjustable Size_** – when the numerator/denominator numbers in an intermediate calculation become too large (a programmable parameter), i.e., either has too many (decimal) digits, then the closest RAC value with the required precision is calculated, and subsequent calculations use this RAC value – with numerator/denominator that have significantly fewer digits; this way there is no loss of precision after the conversion in "downstream" calculations.

- Most importantly this means there is no need to change any existing data collection methods in a customer's current systems; any such data may easily be converted to a RAC value with the appropriate level of precision.

Benefit

- No other supplier/consulting entity has APNAC/RAC™ technology products and services; these are exclusively the property of PQI Consulting LLC.

- No other supplier/consulting entity has Hardware Descriptive Language (HDL) versions of thirty-eight (38 – and growing!) RAC operators (with testbenches) for immediate use in designing and building completely custom APNAC/RAC™ subsystems within any small- or large-scale system implementation.

- No other supplier/consulting entity has the ***experience***, ***expertise***, and ***training capabilities*** to be immediately and uniformly productive, and of practical use to a customer to complete an APNAC/RAC™ implementation on time and under budget, and through all phases of development, testing, and placing in an operational environment.

Product: SSOCRTSLMT

- A surveillance systems for using the known locations in a given 2- or 3-dimensional frame of reference of possibly moving (in a known path) or statically located detection units for the simultaneous calculation in real-time of the locations of multiple targets that are either
  - (a) Friend Targets -- transmitting a coded identification signal at regular time intervals on specified yet varying frequencies, or
  - (b) Foe Targets – targets identified by the return of energy from an isotropic radar pulse on specified yet varying times and frequencies, or
  - (c) Mixed Targets -- where non-zero-many friend and non-zero-many foe targets are known to exist in the same frame of reference.
- The calculated position for each target consists of
  - a point in the frame of reference most likely to be the actual position of the target (based on either the expected variability of the coded identification signals or characteristics of the probability distribution of the detection of the return of energy from the particular isotropic radar pulse used to detect the foe target), along with
  - a probability map (a 2-dimensional ellipse or 3-dimensional ellipsoid), separately for each target, presenting the likelihood of the actual position of the target being within a particular contiguous region of the frame of reference.

Product: DSCC

- A device that securely communicates information through
  - the encoding of formatted text at the transmission source into discrete light signals, and
  - the decoding of those light signals at the transmission destination into the identical formatted text representing the information.
- Security is provided by a double-layer of position masking encryption, part of which may optionally be included in the transmission to facilitate quicker destination decoding without compromising the transmission security.
- Any information that may be converted to formatted text using any well-defined, printable or non-printable, character set may be transmitted by the device, including, but not limited to
  - human-readable documentation,
  - images converted to/from numerical arrays,
  - sampled signals,
  - firmware instructions,
  - navigation aides (including maps),
  - compiled binary software object code,
  - hardware descriptions, etc.

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Summary

- PQI Consulting LLC offers its customers the finest in analytical products and services.

- Expert-decision subsystems (such as AI applications) are greatly improved in quality of service and usefulness of results using APNAC/RAC™ technology from PQI Consulting LLC.

- The market opportunities for APNAC/RAC™ enabled microprocessor-controlled expert subsystems are **_unlimited_**.

- No other supplier/consulting entity has the **_experience_**, **_expertise_**, and **_training capability_** to be of such value to a customer when implementing an APNAC/RAC subsystem on time and under budget.

For More Information

Please Contact

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