



**UNIQUE IDENTIFICATION AUTHORITY OF INDIA
PLANNING COMMISSION
GOVERNMENT OF INDIA
3rd Floor, Tower-II, Jeevan Bharati Building,
Connaught Circus, New Delhi - 110 001**

**NOTICE INVITING APPLICATIONS
FOR HIRING OF BIOMETRICS CONSULTANT
(A-11016/07/10-UIDAI)**

The Unique Identification Authority of India (UIDAI) invites applications from experienced individual professional consultants working in the area of Biometrics for assisting in proof of concept of Biometric solutions for UIDAI project. The duration of consultancy assignment would be for six months beginning March'2010.

For the [details of qualifications and list of deliverables](#), applicant may see www.uidai.gov.in with subject 'Hiring of Biometric Consultant' (under Tenders section).

The applications with CV should reach the Deputy Director General, UIDAI, 3rd Floor Tower-II Jeevan Bharati Building, New Delhi - 110001 and/or may be e-mailed to ddguidai@gmail.com with subject 'Hiring of Biometric consultant' on or before **23th February 2010**.

All queries and clarifications should be addressed to: 'Deputy Director General, UIDAI, 3rd Floor Tower-II Jeevan Bharati Building, Connaught Circus, New Delhi; Tele/Fax: 011- 23752671,23753706.

Sd/-
B.B.Nanawati
Deputy Director General
UIDAI, New Delhi

Please visit <http://uidai.gov.in> for further details.



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F.No. A-11016/07/09-UIDAI

**Hiring of Biometric Consultant for UIDAI
[For assisting in POC of Biometric Solutions]**

Qualifications :Biometrics Consultant

- Doctorate in biometric technology from international university recognized for outstanding biometric work
- Actively involved in research and must have authored numerous research papers and books on biometric technology
- Hands on experience in biometric matching algorithm including original contribution in the same
- 5+ years of experience as chief scientist or CTO in a biometric company or equivalent role in the consulting company.
- Hands on experience in designing and evaluating different algorithms at mathematical/internal level

Deliverables

1. [Build biometric component of enrollment workstation software including automated quality check and enhancement tools for PoC.](#)

The success of the UID project depends on the accuracy of biometric de-duplication to ensure that one person can obtain only one UID number. The most significant factor contributing to the accuracy of biometric de-duplication is the quality of acquired biometric data. Many factors affect quality of biometric data. The most important factor affecting quality of capture is capture process, quality feedback, and quality of capture devices.

The capture process is a combination of logistics of biometric data acquisition, ergonomic considerations (e.g., should the subject be standing or sitting etc.), sequence of actions for the operator, sequence of actions for the subject, the ease of use of the capture software, and type of quality feedback, capture sequence, etc. The capture software should be intuitive, easy to use, and assist in capture

process in such a way as to maximize the quality of captured biometric data as well as throughput.

UIDAI needs high quality design and implementation of capture software as well as process that maximizes the quality of captured biometric data in the Indian context. For the western world, NIST for instance has invested tens of man-years of work to come up with recommendations for biometric capture process. See <http://zing.ncsl.nist.gov/biiousa/>. Studies conducted by NIST have included usability of height and angles of ten-print fingerprint capture, types of instructions provided to the subject, effect of scanner/table height on the fingerprint capture, health and safety perception of biometric devices, effects of habituation to biometric devices etc. UIDAI requires design and development of capture software that is appropriate for the Indian context as well as a detailed process flow that is adapted to rural India. Also, specific considerations need to be made for the particular application of the UID in India.

The Consultant will generate a reference design and implementation of biometric capture software and process be studied, developed, and delivered to UIDAI in source code. The reference implementation will be designed such that biometric device from different vendors can be integrated easily.

2. Design biometric PoC to test key hypothesis (list hypothesis and importance of hypothesis) and to use for benchmarking during pilot biometric vendor selection.

There are two objectives of the UIDAI biometric PoC. The first objective is to assess the biometric de-duplication accuracy that can be achieved in the Indian context. NIST has spent considerable efforts over the past 10-15 years in benchmarking the state-of-the-art extractor and matching technology for fingerprint, face, and iris biometrics on the western population. See <http://fingerprint.nist.gov/>, <http://face.nist.gov/>, and <http://iris.nist.gov/>. While NIST documents the fact that the accuracy of biometric matching is extremely dependent of demographics and environmental conditions, there is a lack of a sound study that documents the accuracy achievable on Indian demographics (i.e., larger percentage of rural population) and in Indian environmental conditions (i.e., extremely hot and humid climates and facilities without air-conditioning). In fact we could not find any credible study assessing the achievable accuracy in any of the developing countries. UIDAI has performed some preliminary assessment of quality of fingerprint data from Indian rural demographics and environments and the results are encouraging. The “quality” assessment of fingerprint data is not sufficient to fully understand the achievable de-duplication accuracy. The next step is to acquire biometrics data from the Indian rural conditions in two sessions (with a time difference) and assess the matchability of the biometric data – each biometric (fingerprint and iris) on its own as well as in a combination.

The second objective of PoC is to collect biometric data to be used in benchmarking biometric de-duplication technology and software. Such a

benchmark will be critical in vendor selection. Biometric de-duplication technology is a complex technology that requires several evaluation criteria to be assessed simultaneously. For example, false positive identification rate (FPIR) and false negative identification (FNIR) rate as well as the change in these error rates as related to number of identities in the gallery. Further, the matching speed is related to the error rates as well as number of identities in the gallery. NIST has conducted a large number of vendor comparisons over the past two decades. However there are two problems in using NIST evaluations for UIDAI. Firstly, NIST has not conducted the evaluation with the UIDAI application in mind, for example, NIST does not benchmark matching speed together with matching accuracy. Secondly, the benchmarks are a snapshot in time while the technology evolves over a period of time. As a result, many of the NIST benchmarks can be outdated. And finally, NIST has not benchmarked fusion of the biometrics relevant to UIDAI.

The Consultant will specify key hypothesis should be tested to understand the achievable accuracy from biometrics on Indian demographics and conditions. The Consultant will design PoC process to collect necessary data to test the hypothesis. The design should be statistically valid and accurate to achieve stated goals.

3. During PoC sample and monitor software and process to suggest improvements in the process.

The UIDAI PoC will commence with biometric enrollment capture software as specified/required above. As the PoC progresses in the field, the operation of capture software and process will need to be monitored. Such monitoring is required to fine tune the software and process to make it as efficient as possible. Example may include a change in the sequence of biometric data capture, a change in the physical setup of the capture stations, a change in the instructions provided to subjects, or a fine tuning of parameters in the capture software may result in a more efficient and more effective process. Efficiency in biometric data capture can result in huge cost savings when the UIDAI program scales to a large population. The capture software and process also needs monitoring to fine tune the quality of biometric capture. It is well known that the quality of captured biometric data is the most important factor contributing to the de-duplication accuracy. The captured biometric data from the PoC is required to be monitored to fine tune the software and process.

The Consultant will visit PoC fields sites, review the operation, make observation, suggest improvement and provide final report stating level of conformance with the designed plan. The Consultant will provide in writing report on recommended changes for the remaining PoC process.

4. Design analytical models and process for calculating accuracy and performance of different biometric traits as well as fusion of multiple traits from the PoC data.

Evaluation of biometric technology is a complex task not only due to the fact that it needs to be evaluated on a number of parameters but also due to the fact that

the evaluation is statistical in nature. The results may not be repeatable if there are even slight changes in any parameters. UIDAI requires design of analytical framework to specify which types of tests are to be conducted and how to assess if the test results are statistically significant. UIDAI requires design of experiments to assess how to combine the biometrics used in the UIDAI application (10 fingerprints, 2 iris, and face) to achieve the correct balance among throughput, cost, and the matching accuracy. If not carefully assessed and evaluated, UIDAI may procure software that is more expensive, requires a larger data center, and yet not very accurate. This balance of accuracy and performance is very delicate and UIDAI application specific.

The Consultant will provide detailed methodology and process for calculating accuracy and performance for each biometric modality separately as well as different applicable combination (fusion) of modalities for PoC.

5. [Review biometric operational best practices document for urban and rural environment including enrollment sequencing and monitoring to result in highest quality of capture.](#)

As mentioned above, UIDAI requires initial enrollment capture software and process design and implementation for the PoC. Fine tuning of the software and process will occur during the data capture of the PoC. After the PoC, the capture software and process will need to be updated and generalized for the UIDAI Pilot. This is due to the fact that post-PoC, the software and process will be required to be more generic. For example, different process may be followed in rural locations than in urban locations. Slightly different processes may be required in different states. While process must be adapted to be more generic, the process should still acquire the best possible biometric data. UIDAI requires expert review of the operational best practices document for urban and rural environment. This review will include the software used for biometric data capture, devices used for the capture, as well as the process followed. The review will be conducted through an examination of the biometric data collected from the field.

The Consultant will review final PoC result documents for accuracy, completeness and best practice recommendations. The Consultant will review final software and provide written report on suggested enhancements for Pilot phase.

6. [Develop biometric technology requirements to be given to PMC for MSP tender](#)

The PMC is responsible for writing tender to select Managed Service Provider. The specific requirements for biometric enrollment, de-duplication and authentication server need specialized knowledge of biometric algorithms, image processing techniques and statistical tools. The requirements will also cover integration of biometric solution with the remaining UID. This integration must be done in a way to avoid vendor lock-in, utilize opens source technology to the extent possible and support e-governance cloud architecture. Each component of biometric solution should be modular and would allow for its replacement without affecting remaining components. The requirements will also include models for balancing accuracy against resource requirements (H/W) and dynamically changing matching algorithm threshold as the database

size increases. Finally, the requirements must meet UID Biometric Standards and other international standards. The Consultant will provide comprehensive requirements to the PMC to be included in the MSP tender. The requirements will include the design of the system as well as the biometric technology requirements and judgment criteria.

7. **Develop biometric de-duplication design for pilot and support integration needs of the Pilot software development team.**

The UIDAI technology team will develop UID Pilot software. The Pilot software will integrate biometric de-duplication software from short listed biometric solution vendor. UIDAI requires the design of biometric software into the Pilot software such that multiple biometric vendor solution can be easily integrated and operated in parallel. The overall design should be robust, general, scalable, and avoid vendor/technology lock-in. It should be standards-based and quality-conscious.

The Consultant will generate a document containing the design of the biometric component for the UIDAI Pilot as well as providing support for the integration of biometric technology into the Pilot software. The integration may combine different biometric technologies from different vendors. The integration design must achieve the right balance among accuracy, speed, and cost of software and computational resources (data center).

8. **Design benchmarking requirements and benchmarking process for evaluating vendor solution during Pilot**

During the tender evaluation process (concurrent with Pilot), the specific proposals of the biometric vendors will be required to be benchmarked and evaluated. Such an evaluation will consider biometric de-duplication accuracy, matching speed, and cost of the software and computational resources. UIDAI needs requirements for vendor in terms of deliverables from the vendors. UIDAI also needs requirements and process for evaluating the vendors on biometric technology as well as integration. The benchmarking protocols must be representative of the UIDAI application. For example, under the patriot act, NIST performed many large benchmarks between 2002 and 2006 for the specific application of border control in the US. See <http://www.itl.nist.gov/iad/894.03/pact/pact.html>. Such efforts are required for the specific application of UIDAI. The design of benchmarking and benchmarking process for evaluating solution during vendor selection is required by UIDAI to be performed diligently. The database during pilot will remain small compared to the eventual target of 1.2B. The benchmarking may consist of synthetically generating biometric samples or collecting data from pre-existing databases of the various GoI departments and agencies. The benchmarking will incorporate several variables: database size, accuracy, resource requirements and performance. Therefore the benchmarking protocol must be designed scientifically to meet UIDAI's goals.

The Consultant will in conjunction with UIDAI Pilot team will develop benchmarking requirements and process for vendor evaluation.

9. Evaluate benchmarking results and provide comparative benchmark assessment

Once the benchmarking is performed as per the design that will result from the point above, the results will be required to be analyzed and interpreted. As mentioned before, biometric evaluations are multi-dimensional. And more importantly the biometric evaluations are statistical. The statistical significance of the test results are required to be analyzed for UIDAI.

The Consultant will develop framework for collecting benchmark results and analyzing the final data. The Consultant will review the results and provide his interpretation of the results. Finally, the Consultant will recommend the biometrics solution based on the benchmarks.