Proforma for submission of proposal under the

RESEARCH PROMOTION SCHEME

Research Promotion Scheme is aimed to create research ambience in the institutes by promoting research in engineering sciences and innovations in established and newer technologies; and to generate Masters and Doctoral degree candidates to augment the supply of research experience faculty and research personnel in the country.

Research and development activities are considered as an essential component of higher education because of their role in creating new knowledge and insight and imparting excitement and dynamism to the educational process, as well as make them need based in view of the national requirements. The objective of this scheme is to create and update the general research capabilities of the faculty members of the various Technical Institutes. The proposal should include a specific project theme with a clear statement of the objectives, details of equipments and other research facilities proposed to be acquired and the expected deliverables from the project.

<table>
<thead>
<tr>
<th>Name of the Institute</th>
<th>Computer Application Centre, Heritance Institute of Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>Chowbaga Road, Anandapur, PO: East Kolkata Township, Kolkata 700 107, INDIA</td>
</tr>
<tr>
<td>Contact details</td>
<td>Email <a href="mailto:siuli.roy@heritageit.edu">siuli.roy@heritageit.edu</a>, FAX +91 33 24430455, Telephone +91 33 24430455, 98303-42404 (m)</td>
</tr>
<tr>
<td>Permanent Id of the Institute</td>
<td>1-4847141</td>
</tr>
<tr>
<td>Application Id</td>
<td>1-1329769222</td>
</tr>
<tr>
<td>Department</td>
<td>Computer Application Centre</td>
</tr>
</tbody>
</table>

Strength & Weakness of the Institute

**Strengths:**

1. **Quality of student intake and output:** Because of a good institutional reputation it attracts good quality students with rank as high as 179 in West Bengal Joint Entrance Examination (WBJEE). Students of the institute received 15 gold, 12 silver and 8 bronze medals in the University Examinations in last 4 years. The institute has 2 University Toppers (covering all engineering disciplines in West Bengal with approx 30,000 students) in 2006, 2007 and 1 in M. Tech in 2009. Students of the institute are pursuing post-graduate/doctoral studies in IITs, IISc, IISER, and several universities of the US and Europe.
2. **Accreditation:** Of 6 UG programmes, 4 has got accreditation from NBA.
3. **Faculty quality and achievements:** The institute has a strong faculty pool with 36 PhD-holders -- 23 in degree awarding department and 13 in support department, and 2 D.Sc. holders in the degree-awarding departments.In last 3 years, the institute has 29 papers in international & 8 papers in Indian journals with high impact factors (1.5 to 6.389) and 4 patents in last 4 years, which is the highest among the private institutes in West Bengal.
4. **Congress, CHEMCON, West Bengal State Science & Technology Congress**
and IEEE seminars. In 2010, 45 students attended 7 conferences so far and 15 of them presented papers in the same. 7 students have publications in refereed journals with faculty members and one co-authored a chapter of a book published by Springer and Verlag.

5. **Collaborations with other academic institutes**: MOU signed with New Jersey Institute of Technology (NJIT), USA, College of Natural Science Sungkyunkwan University, Korea, and Deakin University, Australia, for summer research programme of students, reciprocal exchange of faculty, staff and students and joint research programmes. 3 batches of 34 students have already completed summer training programme each of duration of 6 weeks at NJIT. MOU signed with National Environmental Engineering Research Institute (NEERI), Nagpur, and KEE GAD BioGen Pvt. Ltd for joint research work in environmental engineering and nanotechnology. The institute is an empanelled centre of WBREDA, Department of Power & NEC, WB, for carrying out awareness programmes on renewable energy.

6. **Infrastructure facility**: The institute’s campus is spacious having an area of 29,558 sq. m with lots of greenery, excellent landscaping, architectural beauty and stainless housekeeping. There are excellent student amenities like professional quality tennis court, football ground, basketball & badminton court, special facilities like photocopying, on-campus bank. The institute has state-of-the art laboratory, workshops and good library.

7. **Employability of students/ Placement rate**: Success rate of placement of students is high -- 98.1% and 95.7% in 2009 and 2008 respectively. Students were placed in companies like IBM, TCS, Infosys, Wipro, Tech Mahindra, L&T Infotech, Phillips Carbon to name a few.

8. **Teaching-learning process**: Pass rate of students (98% on an average), placement percentage of students (above 95%) and performance of students in GATE (overall and within top hundred), CAT (percentile over 90) and GRE reflect the outcome of teaching-learning process.

**Weaknesses:**

1. **Industry-institute interaction**: Industry academic interaction is weak with respect to joint R&D and consultancy work.

2. **Tracer study for alumni**: No methodical tracer study has been carried out for the last four batches of students passed from the institute.

3. **R&D for consultancy and industrial applications**: Faculty members of the institute are mostly involved in basic research. Though there are 4 patents no technology transfer has taken place so far.

4. **Lack of Ph.D. programmes**: The institute does not have its own doctoral courses.

5. **Availability of senior experienced faculty**: As many other institutes of India, Heritage Institute of Technology lacks faculty members at the senior levels.

**Academic autonomy**: Being non-autonomous in nature, the institute does not have the freedom of curriculum design, which often prevents it from providing market-driven training in spite of its best intention.

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**Technical Field of proposal**

Application of Information and Communication Technology in Disaster Management
Title of proposal

ShelterTrack: A Smart-phone based Shelter Management System for Post-Disaster Relief Operations using Opportunistic Wireless Networks

Abstract

During disaster, victims normally take shelters in groups in some nearby safe areas (for example, some school buildings, and temporary tents in some highland areas, etc.). Therefore, the post-disaster relief operations and distribution of resources are normally shelter-centric. So, dynamic tracking and assimilating shelter information (regarding available resource, required resource, status of victims and volunteers at the shelter, etc.) at a control station is important for overall need assessment from the piecewise localized views at each shelter. However, in a typical disaster scenario, communication infrastructure gets disrupted very fast and the cellular connectivity may be sparsely available in some parts of the disaster-struck area. Therefore, direct communication of shelter information to control station is ruled out. The objective of this project is to explore the use of smart-phone based opportunistic network for tracking and assimilating shelters’ information and supporting the communication with control station. In this context, the mobility of relief workers/ ambulance/ police van with cell-phones plays a vital role to create the required dynamic communication infrastructure.

Objective - Project Significance / Relevance with ongoing academic activities

Wireless communications and networking is one of the fastest-growing areas that are still lacking adequate experienced professionals. In order to bridge this gap, we propose to initiate research activities in wireless domain in our institutes where we will provide the students and researchers an environment with necessary infrastructures/ facilities for getting hands-on exposure and familiarity with the evolving technologies and standards in wireless communication and networking. An important and potential application area of wireless communication and mobile networking is Disaster Management. Globally, all the countries are now taking initiatives to develop technologies for early warning before disaster and post-disaster management. So, researchers are now taking active interest to address the challenges posed in a post-disaster scenario when the communication infrastructure gets disrupted partially or completely.

In order to support disaster rescue and recovery operations after any disaster, effective communication amongst the diverse rescue workers, as well as providing connectivity to survivors is a primary requirement. In a typical disaster scenario, the available communication resource is very limited and heterogeneous in nature (such as few WiFi towers, sat-phones, smartphones, cell phone towers). A mobile ad-hoc wireless network can be formed in this situation with the Bluetooth interface of cell phones carried by relief workers. These kinds of networks are formed exploiting the mobility of the cell phone users as the opportunity for communication. This rapidly deployable wireless network can provide the most effective data collection technology that gives authorities better visibility of available resources and need.
Smart phones become an integral part of an individual’s life as smart-phone based applications like, mobile banking, location based services, and online games etc. are gaining lots of popularity. Industries are now looking for trained man-power with exposure in smart-phone based application development preferably on android platform.

In this situation our objective of this project is two-fold:

i) **Research activity:** Our research activity will include the following topics in context of disaster management
   
a. Design an easily deployable hybrid ad hoc network (opportunistic network) out of heterogeneous, limited resources (such as few WiFi/ GSM towers, sat-phones, smart phones) to assure almost 100% data delivery within a stipulated latency.

   b. Design of routing protocols for the above architecture which deals with trade-off between fairness and prioritized access, protocol inter-operability, universal user/device identity, and packet priority.

   c. Develop mechanisms for authentic propagation of information even in the face of challenged environment. In this process, apart from identifying trusted nodes, collecting and disseminating data from sensors in the phones can also be an important step.

      a. Develop mechanisms for producing a globally consistent snapshot of the situations from the “local snapshots”.

ii) **Man power development activity:** In this project, we have an aim to develop trained man-power (through student projects/ research) in the field of smart-phone based application development. We will set up a testbed on smart phone based opportunistic network in our lab where student and researcher will get hand-on exposure on software development on android platform and will gain practical experience on different aspects of opportunistic network. Our smart phone based development will include the following topics.

   a. Developing Disaster Management Services: The most crucial types of information that need to be shared in this situation are 1) *Situation analysis and Need Assessment* which involves an ongoing assessment of what the disaster situation is and what disaster countermeasures need to be undertaken; 2) *Location and presence services* (who is where), which involves a real-time assessment of the locations of services, individuals and social groups

   b. A very important component of any Disaster Management Service is its user interface. The interface has to be so designed that it is possible for anyone in the rescue team (with minimal computer proficiency) to handle the different control panels of the interface. Therefore, while designing client interfaces, it is important that the task handling interface should attract the user attention only when it is absolutely indispensible. In order to accomplish this, one can introduce pop-ups and sonorous alarms to draw immediate attention. Further, assuming that most of the
operators are “noncomputer- savvy” and they need to work under extreme stressful conditions, it is very likely that they would tend to forget the basic layout organization multiple times; the interface therefore should be so designed that they are able to recover the whole arrangement of the items through a fast glance. We also need to provide support for query formulation and query extraction.

Project Impact - Expected outcome

The broader impacts of this project will stem from its innovative integration of network and distributed systems algorithms and protocols with domain specific disaster management services. This project will improve safety and save lives by improving communication and resource distribution during the aftermath of a disaster. Experiences from this project will enhance the preparedness of the relief agencies and the first responders, and improve the use of smart devices for the better coordination of relief efforts.

The major intellectual merit of the proposal lies in the development of distributed mechanisms for dissemination of information from each shelter and gradually building up a global snapshot about the disaster affected zone. This, in turn, helps to estimate the location, status of victims & volunteers, their immediate needs and availability of relief materials at different parts of affected areas. This knowledge about the affected areas at the control station enables distribution of resources in a more coordinated and effective manner. In addition to simulation study of the developed schemes, a smart-phone based testbed will also be set up in this project to evaluate the effectiveness of using opportunistic and delay-tolerant communication in a disastrous situation.

We will explore the following aspects in a post-disaster relief operation management scenario

✓ A robust framework that will lead to a global need assessment from piecewise localized views of the rescue teams and victims once a disaster occurs, and
✓ A coordinated location-aware system to guide the resource distribution process, thus providing core disaster management services to the victims.
✓ Validation of proposed solutions through simulation and smart-phone based test-bed implementation.

The expected deliverables of the project will be:

i) Providing guidance to 1 PhD scholar and submission of PhD thesis at the end of 3rd year
ii) Providing guidance to 4 MCA projects every year for 3 years
iii)Organizing 1 seminar in the related field in 2nd year for sharing research output
iv)Organizing 1 workshop at the end of 3rd year showcasing the developed system to user group and awareness generation
v) Apply for patents of technology developed under this project

The proposed smart-phone based communication system framework is discussed in Annexure-I
Literature survey on National & International scenario

In this section, we will present a brief literature survey on the underlying challenges in establishing communication and networking infrastructure and information management in a post disaster scenario. We analyze the limitations of state of the art followed by the motivation and objective of our proposed project.

Review of communication and network infrastructure for Post-Disaster Management

Systems like the Serval Project [Stephen 01], WMIDAES [Dilmaghani 08], AirJaldi [Airjaldi], and JaldiMAC [Ben-David 10] use wireless mesh architectures that suffer from large set-up delays and low coverage.

Use of low power GSM (Village Base Station) [Heimerl 10], WiMax and VSAT technologies can provide high coverage but they are costly due to the use of licensed bands and require considerable planning. To address scalability, the project Daknet [Pentland 04], [Seth 06] uses buses/cars as ‘mechanical backhaul’ to ferry data but incurs high latency. Projects LifeNet [Mehendale 11] and Twimight [Hossmann 11] provide connectivity under transient conditions in the self-organization phase using only handheld devices using Delay Tolerant Network (DTN) protocols which however cannot cater to a wide affected area. Wireless hybrid networking solutions ENS [Braunstein 06], although do not optimize resource utilization, have the potential of combining the advantages of different technologies to provide low-cost, scalable and reliable solutions. Moreover, except ENS and WMIDAES, most of the above systems aims at enhancing rural infrastructure providing telephony/Internet etc., and hence do not meet post-disaster requirements like ease of deployment, budgetary constraints and reliability during the transitional phase.

Among several hybrid architectures proposed for disaster communication, it has been observed mostly ad hoc network protocols has been used in the lowest layer. However, noting the problems of intermittent connectivity and sparseness of device density, opportunistic network is often chosen as a better technological option in a disruption prone network. Opportunistic network is an attempt to extend the reach of traditional networking methods where nodes are intermittently connected and an end-to-end path from source to destination does not exist all the time. Traditional Delay Tolerant Network (DTN) routing protocols [Link 09], [Hui 08], [Lindgren 04] are unable to capture requirements of Post-Disaster Management. Hence designing services using group-aware, energy-aware routing protocols optimizing some multidimensional routing utility vectors are highly desired but currently unavailable. Protocols need to be designed leveraging inter-group node meeting patterns to implement both the inter-service-group as well as intra service-group communication routing.

Review of information management systems for Post-Disaster Management

Efficient information management is the cornerstone of any disaster response system [Legendre 11]. Several systems exist to address issues like situational awareness (SA) and informed decision-making. However, the key limitations are as follows: first, existing systems like Ushahidi [Okolloh 09], [Liu 08], Site-seeing [Hughes 09], [Hughes 08] and Google’s PeopleFinder assume that the victims have continuous access to the Internet or use server-based...
architectures like WIISARD [wisard]. Secondly, system features like design of multilingual user interfaces [Knoche 11] to feed information and designing GIS map-based user interface for integrating GPS-tagged snapshots and automatic report generation for future planning and preparedness has hardly been addressed in the existing literature.

We will try to address the above limitations in our proposed project.

References:

Please see Annexure - II

Techno-Commercial status / Outcome / IPR / Social benefit /other

Since the project is dealing with finding technical solutions to a great social problem like disaster management, societal sensitization of our project team with User-Groups including Government and NGO, Community Based Organizations and disaster victims in the field is necessary to gain awareness of ground-level realities. The project is expected spread awareness on how technology can contribute towards the mitigation efforts through workshops with user groups.

We would like to involve the user group to evaluate the effectiveness of our developed technologies. If they are satisfied, we will explore the commercial potential of the proposed system. We will also apply for patent on the IP developed under this project.

The expected deliverables of the project will be:

i) Providing guidance to 1 PhD scholar and submission of PhD thesis at the end of 3rd year
ii) Providing guidance to 4 MCA projects every year for 3 years
iii) Organizing 1 seminar in the related field in 2nd year for sharing research output
iv) Organizing 1 workshop at the end of 3rd year showcasing the developed system to user group and awareness generation
v) Apply for patents of technology developed under this project

Technical Consultancy / Revenue generation

The technical expertise and the domain knowledge developed under this project will definitely help us to share our knowledge in the form of technical consultancy to NGOs and Govt. organizations associated with disaster management. We may also think of revenue generation through workshops, seminars in this domain along with some NGOs, Govts.
### Year – I

<table>
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<tr>
<th>Activity</th>
<th>Months (add columns as required)</th>
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<tbody>
<tr>
<td>Receive Grant</td>
<td>0 1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>Recruitment of Research associate, Purchase of equipment, Analysis of Requirement from domain knowledge experts and user groups, Lab setup</td>
<td></td>
</tr>
<tr>
<td>Learn smart phone based application development</td>
<td></td>
</tr>
<tr>
<td>Finalization of GUI’s and software requirement for disaster management services</td>
<td>0 1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>Identification of research problem, Preparation of synopsis for Research and Registration of Researcher, 1 conference publication</td>
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This is sample activity chart. Modify as needed. Add activities/rows as required.

### Year - II

<table>
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<th>Activity</th>
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<tr>
<td>Study the simulation environment for opportunistic network (like ONE)</td>
<td>0 1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>Publication of 3 conference papers and 1 journal paper, Guiding student projects on smart phone based application development for post-disaster management, developing a course on &quot;smart phone based application development&quot;</td>
<td></td>
</tr>
<tr>
<td>Development of software at control station for generation a global view on affected areas integrating the local snapshots</td>
<td>0 1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>Organization of a Seminar</td>
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### Year - III

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<th>Activity</th>
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<td>Publication/communication of 3 papers in conference and 1 journal paper</td>
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<tr>
<td>Lab-scale prototype testing, field trial of the proposed technology</td>
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<tr>
<td>Rectification of system based on user feedback, Preparation of system</td>
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<tr>
<td>Organization of Workshop on &quot;ICT in Disaster Management&quot;</td>
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<tr>
<td>Submission of Research thesis</td>
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#### Facilities / equipment available in the area of research proposed: NIL

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<th>Cost in Rs.</th>
<th>Year purchased</th>
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#### Budget Estimates – Non Recurring

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<th>Proposed equipment/s</th>
<th>Specifications</th>
<th>Cost in Rs.</th>
<th>No of units</th>
<th>Justification</th>
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<td>Intel Xeon X 3430 (Quad Core) (2.40 Ghz, 8 Mb Cache, 1333 Mhz), RAM 2GB Upgradable to 32GB in 6 Slots, 1 X 146GB SAS3.5&quot; Hot Swap HDD, 4 bay, DVD ROM, Full High PCI Bays: Max-3, Half High PCI Bays: Max-2, Integrated RAID 01(BR10I RAID) RPS Standard1, Wireless Card, 3 Years Onsite, 18.5&quot; TFT Monitor</td>
<td>70,000</td>
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<td>Will be used as remote control station where data from various shelters will be accumulated</td>
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<td>Smart phones</td>
<td>Sensors Accelerometer, gyro,</td>
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<td>10</td>
<td>4 smart phones (carried by relief workers) and 1</td>
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</table>
proximity, compass, barometer  
**Data**  
GSM, GPRS, WLAN, BlueTooth, USB, LTE  
**OS version**  
Android OS, v4.0.4 (Ice Cream Sandwich)  
**Camera**

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<th>Wireless broadband USB Modem</th>
<th>Tata Photon plus</th>
<th>2000</th>
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<th>At control station for collecting data from different shelters</th>
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<td><strong>Printer with scan and copy facilities</strong></td>
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<td>15,000</td>
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<td>For printing reports, papers etc.</td>
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### Budget Estimates –Recurring

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<th>Estimate for Year 3 (RS.)</th>
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<td>(included in contingency)</td>
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### Profile of collaborating/participating Industry/s or other organisation/s, if any.: N/A

<table>
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<tr>
<th>Name</th>
<th>Address</th>
<th>Website</th>
<th>Contact person , designation, email</th>
<th>Role$^2$ in collaborating/participating</th>
<th>Financial commitment$^3$ towards project in Rs.</th>
<th>Total Rs. (C)</th>
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**Total Rs.** 20,80,000/-
## Details of Project Investigator

<table>
<thead>
<tr>
<th>Name</th>
<th>Dr. Siuli Roy</th>
</tr>
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<tbody>
<tr>
<td>Exact designation</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Date of joining</td>
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<tr>
<td>Qualifications</td>
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<td></td>
<td>PhD (Engg.) From Jadavpur University</td>
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<td>Experience in years</td>
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<td>International √ (25)</td>
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<td>Books √ (1)</td>
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<tr>
<td>Relevant experience</td>
<td>Dr (Ms) Siuli Roy has experience of research related to the development of routing protocols in ad hoc wireless network using directional antenna and actively worked in a DIT-funded project entitled “A Secure Decentralized Disaster Management Information Network using Rapidly Deployable Wireless and Mobile Computing Technologies” funded by DIT, Govt. of India. Please see Annexure-III for brief bio-data of Dr. Siuli Roy</td>
</tr>
<tr>
<td>Other information</td>
<td>1. Awarded TePP project (Technopreneur Promotion Programme), funded by DSIR, Govt of India towards development and commercialization of Wireless Intrusion Detection System based on Multi-Radio Data Communication.</td>
</tr>
<tr>
<td>Cell number</td>
<td>+91-9830342404</td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:siuli.roy@heritageit.edu">siuli.roy@heritageit.edu</a></td>
</tr>
<tr>
<td>Signature</td>
<td>[Signature Image]</td>
</tr>
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## Details of Project Co Investigator

<table>
<thead>
<tr>
<th>Name</th>
<th>Prof. Souvik Basu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exact designation</td>
<td>Assistant Professor</td>
</tr>
<tr>
<td>Date of joining</td>
<td>22nd July 2004</td>
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Application Id - 1-1329769222
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<td>Computer Application Centre</td>
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### Qualifications
- **UG (Statistics Hons)** From Calcutta University
- **PG MCA,** From Burdwan University
  **M.Tech,** From WBUT
- **PhD (N.A.)**

### Experience in years
- Teaching 10 years
- Industry Research

### Students guided
- UG ✓
- PG ✓
- PhD

### Publications
- National
- International
- Books

### Relevant experience
Prof. Souvik Basu has experience in teaching M.Tech, MCA and B.Tech students along with guiding final year projects. His core area of interest is data communication & networking and network security.

**Please see Annexure-IV for brief bio-data of Prof. Souvik Basu**

**Cell number**
+91-9903998511

**Email**
souvik.basu@heritageit.edu

**Signature**

---

**Details of earlier grants awarded to the Institute**

(Give details of grants received in last three years)

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Name of the coordinator</th>
<th>Amt sanctioned</th>
<th>Sanctioned letter details</th>
<th>Funds Utilisation position as on today</th>
<th>Utilisation Certificate details/ Reason for non-submission of Utilisation Certificate</th>
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<td>Prof. Siladitya Sen</td>
<td>19,00,000/-</td>
<td>8023/RID/RPS-24/Pvt(II Policy)/2011-12</td>
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<tr>
<td>Travel Grant</td>
<td>Prof. Mousiki Kar</td>
<td>1,00,000/-</td>
<td>1-7/RIFD/TR/(161)2010-11</td>
<td>Attached with the document</td>
<td></td>
</tr>
<tr>
<td>MODROBS</td>
<td>Dr. Narayan Chandra Maiti</td>
<td>6,00,000/-</td>
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<td>Dr. Bibhuti Ranjan Saha</td>
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<td>Prof. Sangita Bhattacharjee</td>
<td>13,67,000/-</td>
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<td>Prof. Srabasti Chakraborty</td>
<td>4,00,000/-</td>
<td>8024/RID/BOR/MOD/921/9/10/953</td>
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<td>MODROBS</td>
<td>Prof. Siladitya Sen</td>
<td>15,00,000/-</td>
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MODROBS  Prof. Tapan Chakrabarti  5,00,000/-  8024/RID/BOR/MOD/883/9/10/944  Attached with the document

MODROBS  Prof. A.K. Ray  15,00,000/-  8024/RID/BOR/MOD/882/9/10  Attached with the document

By signing this certificate, I/We undertake to

☒ Abide by all the rules / regulations regarding utilization of amount that may be granted to the Institute.
☒ Submit timely progress reports about grant utilization.
☒ Submit utilization certificate duly authenticated by CA on/before project period is over.
☒ Return full/partial unutilized grant amount to the Council.

Project forwarded to AICTE

Date: 24.9.2012

Important: You need to apply on web portal using your Institute login and password. Select tab “AQIS application”. Press “New” to create new application. Your application is assigned unique application Id. Fill all the details over there. Prepare application in this proforma also. Attach PDF of it to the application on web portal. Now press “submit” on web portal to submit application. Pay processing fees on web portal using appropriate payment option.

Office use only:

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Annexure – I
Details of the proposed project

Use of Bluetooth-enabled Smart Phone as InfoStation (store house of shelter status) to store updated shelter information at each shelter

Researchers have already explored the advantage of using mobile wireless networks (aka, opportunistic network) for several mission critical applications like, military communication, disaster communication, vehicular communications etc. Low cost smart mobile phones are now coming up with increasing computing capability, high storage capacity and multiple wireless communication interfaces (GSM/ WiFi/Bluetooth etc.). In this project, we like to exploit these capabilities of a smart phone to create an alternative mobile communication backbone in a disrupted communication environment like disaster.

We propose to use a smart phone with blue-tooth interfaces in three roles at each shelter.

(i) Blue-tooth enabled smart phone, placed at each shelter, will function as **InfoStation** for that shelter. All the relevant information about a shelter is aggregated at this InfoStation.

(ii) Other smart phones with bluetooth interface, carried by the relief workers or victims, may form an ad hoc network among them. So those smart phones will be used as **data collector and router**. A relief worker/ victim may capture some information/ messages about the shelter and that information may be sent to InfoStation automatically as and when the worker passes by the infestation. It may be possible to send updated information to InfoStation in multi-hop through other mobile nodes (smart phones).

(iii) Ambulance/ Police Van equipped mobile phone may also act as a **ferry boat** to carry and exchange information among different shelters while moving across shelters.

Some of the information that can be stored at InfoStation is listed below (Figure 1).

- location of a shelter
- Name of the groups working there (Group-Ids/codes may be allocated beforehand by the central office)
  - name of the victims currently staying in that shelter
  - name of the sick victims and type of diseases they are suffering from
  - name of the victims who needs immediate medical attention
  - name of the dead persons found in that area
  - name of the persons of that locality still untraceable
  - current stock of food, medicine, clothing and other basic commodities in that shelter
  - Information about the available source of drinking water in that area etc.
  - Number of tube-wells need to be repaired urgently in that area etc.

Above information can be uploaded to or downloaded from the **InfoStation** by the blue-tooth-enabled cell-phone carried by the relief workers/ relief vehicles. The information can also be sent to the remote control station for monitoring with the proposed opportunistic network infrastructure.
Exchange of information between InfoStation and relief worker around a shelter for storing/modifying, reading using Multimode Interface (Bluetooth + GSM/GPRS) of cell phone:

The bluetooth-enabled cell-phone will function here as message readers/writers/carriers.

As the volunteers move around a shelter with their Bluetooth enabled cell phone, an ad hoc wireless network is formed among them automatically. Using this wireless network, information may be exchanged among relief workers and with workers and InfoStation.

So if any worker comes from a different shelter, it is possible to get status of that remote shelter from his cell phone. This way an InfoStation at a shelter can gradually become aware of status, need and available resources of other shelters. Similarly, the visitor may also get information about the availability of resources at this shelter by reading the data stored at the InfoStation.

Volunteers moving between shelters or ambulance / police van equipped with smart phones plying across different shelters may be used to share knowledge between InfoStations at different shelters.

**Sensing data to remote control station**

As soon as the volunteers moving between shelters or ambulance / police van equipped with smart phones gets access to a reliable communication infrastructure like GSM, the recorded data is transferred immediately to remote control station.
Web-based ShelterTrack software enables the Govt. and other related authorities to monitor the disaster situation in near real time from anywhere.

Data Acquisition and Information Management System at Host Machine

- A Data-Acquisition Software needs to be developed to run on the host computer at the central office which will accumulate the information received from different shelters and will display the up-to-date information. As and when new information about a shelter is received, then the system will update the corresponding information in the host database and will display the updated information on the GUI.

Applications Software at the Cell-phone

Applications need to be developed to run on the relief worker’s cell-phone
- to upload information about any shelter on the InfoStation (static smart phone) placed at that shelter through a proper GUI
- to download stored data from the InfoStation using the same cell phone through proper GUI
- to EDIT some fields of the stored data at InfoStation

Architecture of the proposed system is shown in Figure 2 (a), 2 (b).

![Diagram of the proposed system](image-url)

**Fig 2 (a):** Cellular Network based Remote Data Acquisition System architecture for better Resource Management during Post-disaster Relief Operation
Fig 2 (b): Proposed Generalized Architecture of Remote Data Acquisition System for better Resource Management during Post-disaster Relief Operation
Annexure – II

References


[wisard] https://www.wiisard.org/
Annexure – III

Dr. Siuli Roy, Associate Professor
Heritage Institute of Technology, Chowbaga Road, East Kolkata Township, Kolkata 700 107, INDIA
Ph: (033)-24430455, Mobile: 98303-42404, e-mail: siuli.roy@gmail.com

Educational Qualifications

- PhD in Computer Science & Engineering from Jadavpur University (2005)
- MCA from Jadavpur University (1993)

Work Experience

1. Associate Professor, Master of Computer Application at Heritage Institute of Technology
2. Sr. Software Engineer at Dynamic Digital Technologies [2011 -2012], working on developing various test tools emulators for various Wireless Networking technologies.
3. Principal Research Engineer in Ad Hoc Network Research and Application Group, a center of Excellence at Indian Institute of Management Calcutta [2002-2011]
4. Visiting Researcher in Advanced Telecommunication Research Institute, Japan in 2004 on Ad Hoc Wireless Networks using Smart Antennas.
5. Faculty in Computer Science & Engg Department, Netaji Subhash Engineering College [1999-2002]
6. Technical Officer in IMPACT Project, Jadavpur University with an aim to improve the manpower in the field of IT through “Train-the Trainer (IEP)” programs [1995-99]

Research Interest

She has around 17 years of experience in business, academic research and software development in several organizations of international repute. With a unique combination of business & entrepreneurial acumen and research excellence in the area of pervasive computing and communication system, she has co-founded PervCom Consulting Private Limited in 2005 in order to bridge the gap between academic research and business practice. She has more than 25 research publications in international journals and conference proceedings of repute and two pending patents in the area of wireless networking and pervasive computing.

Entrepreneurial Activities

Co-founder-Director, Pervcom Consulting Private Limited [2005 till date]: PervCom Consulting Private Limited (www.pervcomconsulting.com) is focused on developing products and system solutions for remote tracking, monitoring and management of objects, human being and environment for business and societal benefits using Active RFID tags / sensors and actuators with wireless networking technologies. Funded by WEBEL Venture Capital Ltd., Govt. of West Bengal, and supported by STEP, IIT Kharagpur and TePP, DSIR, Govt of India, PervCom is the first Indian company to have designed, developed and productize real-time wireless tracking, sensing and wireless security & surveillance solutions for mining and manufacturing industries with four patent pending technologies.
Award

1. Awarded TePP project (Technopreneur Promotion Programme), funded by DSIR, Govt of India towards development and commercialization of Wireless Intrusion Detection System based on Multi-Radio Data Communication.


Research Activities

Principal Research Engineer and Technical Head at IIM Calcutta in the following Govt. funded projects:

a. “Smart-Road: An Intelligent Traffic Congestion Management system using RFID and Wireless Networking Technology”.

b. “Agro-Sense: Real Time Monitoring of the Climatological conditions of the agricultural field for Precision Agriculture using sensor based Wireless Mesh Networks”

c. “Pollution Monitoring and Evaluation System using Sensor Based Wireless Mesh Networks for the protection of public spaces”.


e. ADHOCNET Project, a collaborative research venture of India Institute of Management, Calcutta and Advance Telecommunication Research Institute (ATR), Japan.

Societal Involvement Activities

Siuli is the President of an NGO, Institute of Nature Care and Development, working on empowering the people from underprivileged backgrounds by providing them Govt. approved one/ two year vocational training on Physiotherapy and help them to become self-reliant.

Relevant Publications

1. Somprakash Bandypadhyay, Siuli Roy, and Tetsuro Ueda, ”Enhancing the Performance of Ad Hoc Wireless Networks with Smart Antennas” CRC Press, Taylor and Francis Group, 2005


5. Tetsuro Ueda, Shinsuke Tanaka, Siuli Roy, Dola Saha and Somprakash Bandyopadhyay, “A Priority-based QoS Routing for Multimedia Traffic in Ad Hoc Wireless Networks with Directional Antenna using a Zone-


Annexure – IV

Prof. Souvik Basu, Assistant Professor
Computer Application Centre, Heritage Institute of Technology, Chowbaga Road, East Kolkata
Township, Kolkata 700 107, INDIA
Ph: (033)-24430455, Mobile: +91-9903998511, e-mail: souvik.basu@heritageit.edu

Present Employment

- **Institute:** Heritage Institute of Technology, Kolkata.
- **Tenure:** 22nd July, 2004 onwards.
- **Job Responsibilities:**
  - Teaching M.Tech., MCA and B.Tech students of the institute and conducting laboratories of different subjects.
  - Guiding final year projects of B.Tech and MCA students.

Previous Employment

- **Institute:** University of Burdwan.
- **Designation:** Faculty in the Department of Computer Science of the University.
- **Job Responsibilities:**
  - Teaching MCA students of the University and conducting laboratories of different subjects.
  - Setting questions and evaluating answer scripts of the MCA, BCA and B.Sc. (Computer Science, IT and E-Commerce) students of the University.
  - Acting as external examiner of MCA practical examination in NIT Durgapur.

Summary of qualifications

2008
West Bengal University of Technology Kolkata, West Bengal

M. Tech. (Computer Science & Engineering)
- Secured *8.65 DPGA* (First Class).

2002
The University of Burdwan Burdwan, West Bengal
MCA
- Secured *83.7 %* marks. Stood **First Class Second** in the University.

1998
Ramakrishna Mission Residential College, Narendrapur
B.Sc. (Statistics Hons.)
- Secured *63 %* marks (First Class).

1995
Jodhpur Park Boys School Kolkata
Higher Secondary
- Secured *68.6 %* marks (First Division).

1993
Nava Nalanda High School Kolkata
Secondary (Madhyamik)
- Secured *73.2 %* marks (First Division).