



Editor's Desk

This is the second time of the year we bring out this half-yearly newsletter. Thanks to the volunteers who make this happen. It is no joke that RuTAG IIT Delhi news will have its 10th edition. I take this opportunity to all RuTAG coordinators at different IITs who have been contributing articles to this newsletter making it a valuable source of information on the works going on at different parts of the country.

I am thankful to the PSA, Dr. R. Chidambaram, who recently announced that every RuTAG centre can have few RuTAG chapter located at nearby institutions/ colleges/ universities. I hope the readers of this newsletter from other academic institutes may consider this an opportunity to work on rural problems for the upliftment of the disadvantaged people around them. I am sure any of the RuTAG IIT centre near to them will assist. Since this is the time when new students come to our campuses, a very hearty welcome to all of them and we can look forward for their associations with the RuTAG activities. All the best!

Prof. Subir Kumar Saha

Senior Project Consultant's Column

At RuTAG IIT Delhi, some very exciting technology up-gradation efforts have fructified in the last few months. While the details of the final product in terms of technical specification and performance standards, etc., are well documented; the process adopted/undertaken for improvisation are usually not very well recorded. Identification and availability of suppliers of materials, vendor development, small fabrication work, repeated testing at various stages take a tremendous effort from the PI's, Staff members of RuTAG and also the students who are involved in the project. It may be worthwhile to document these in some detail because it would give useful information to future researchers in related areas.

Identifying manufacturers to take up production of the improved products still remain a major challenge but definite and perceptible improvements are being noticed. Some entrepreneurs are at least looking at these new technologies as possible business opportunities irrespective of the scale of operations. This is indeed a very welcome development.

Major Sabyasachi Chatterjee

Chairman's Column

Understanding the Creative Problem Solving Process (Part-1)

Effective Research, Design and Development activity requires a clear understanding and meticulous application of the Creative Problem Solving Process, which is also sometimes called 'Design Engineering'. It is essentially a systematic methodology to comprehend the need situation, identify the real needs and translate it into a tractable problem statement specifying available necessary inputs, situational constraints and desired outputs in the form of objective functions to be optimized. In this process of needs analysis and problem formulation, one also has to carefully explore how far and in what way, the existing solutions are considered inadequate or inappropriate in catering to the identified need. Of Course, a clear understanding of the ground reality and close interaction with the prospective users will be essential.

Once the problem has been well-understood and the need authenticated, one has to proceed with an open mind to visualize various alternative ways to cater to given need and evaluate their feasibility to identify the most probable solution concept which should be taken up for preliminary design, detailed design, prototype development etc. It is important to keep in mind that the process of finding an innovative solution to a well- identified need is usually an ITERATIVE process i.e. at any stage, it may be necessary to go back and repeat the previous steps with modified parameters which are better visualized as we proceed towards more and more detailing and testing the chosen concept.

Unfortunately, in the present situation, a large part of training in research, design and development in our higher educational institutions continues to be more of an 'academic' nature, quite far-removed from the ground reality usually beginning with hypothetical needs and ending up with unauthenticated solutions. Often, the exploration is carried out in an adhoc manner. However, in RuTAG projects it is essential that in the process of project formulation, the needs are carefully identified from the field situation in close interaction with the prospective users. The scope of application should be assessed and finally, the project outcome should to be in the form of a field-worthy and user friendly manner which could be widely disseminated.

To augment the quality of these projects, it will be desirable to facilitate the RuTAG working groups by developing a suitable orientational module delivered in the form of a workshop to make them conversant with this Creative Problem Solving process. It is proposed to further elaborate on the salient steps of the Creative Problem Solving process in the next issue of this newsletter.

Prof. R. R. Gaur

Student's View

It is a great opportunity for me to pursue my PhD in RuTAG. RuTAG acts as a bridge between the traditional technologies used in villages and modern technical interventions. The projects are based on real life problems which affect people's lifestyle, health and working conditions. The technical interventions provided by RuTAG have a positive impact on the life of rural masses without altering their existing workflow, which is a challenge in itself.

Suraj Bhat

I belong to a village and was keen to provide technological solutions to rural problems from my school days. When I joined IIT Delhi, RuTAG provided me my dream platform. Being an element of RuTAG IIT Delhi since last two years, I explored many things while contributing in some RuTAG projects. By providing technological solutions to rural problems, RuTAG is making the path for a better India.

Pawan Kumar Tiwari

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IIT ROORKEE	www.rutagiitr.wordpress.com



Figure 1. Damaged hooves from frequent horseshoe removal



Figure 2. Field testing of improved clay core furnace for making bangles



Figure 3. Field testing of new steel casing furnace for making bangles



Figure 4. Sheep hair shearing device



Figure 5. Field testing of sheep hair shearing device at Barot, H.P.



Figure 6. Potters kiln used at Unch village, Bharatpur, Rajasthan

1. Increasing Life of Horseshoes (RuTAG IIT Kanpur)

P.I. - Prof. Sandeep Sangal / Ms. Rita Singh

Collaborating NGO - *Shramik Bharti, Kanpur, Uttar Pradesh*

About 30,000 horse owners in and around Kanpur depend on their animals for their livelihoods. Used mainly to transport goods, horses in the area must have their hooves protected from wear and tear on paved and unpaved roads. Unfortunately, the shoes put on horses barely last eight to ten days, and owners must sacrifice a day's pay in addition to the cost of the shoe to replace them. Moreover, frequent removal and nailing of shoes to a horse's hoof is detrimental to the animal's health (Figure 1), ultimately affecting its useful life to the owner. The RuTAG team took up the problem of short life (about one week) of horseshoes as frequent nailing makes horses prone to injury. Under the leadership of Prof. Sangal, a long lasting (about a month) horseshoe was developed, which has reduced leg injuries of horses and improved the economics for horse owners. This technology was tested extensively both in the lab as well as in the field. Nearly 200 horseshoes have been put on horses for field trial in the city of Kanpur (Uttar Pradesh, India) carrying goods for over a period of 9 months. The results of the field tests show that a large increase in the life of horseshoe is possible by changing the material and the manufacturing methods used.

2. Improvement of Furnace for Bangles Making and Working Conditions of Artisans (RuTAG IIT Delhi)

P.I. - Prof. Sangeeta Kohli

Co P.I. - Prof. M. R. Ravi and Prof. S. K. Saha

Collaborating NGO - *Lupin Human Welfare and Research Foundation, Bharatpur, Rajasthan*

The objective of the project is to improve, both the performance of bangle-making furnace and the working conditions of the bangle making artisans. The focus is on modification of bangle-making furnaces being operated in the Bharatpur district of Rajasthan, India. The furnace has been redesigned for higher efficiency and drastic reduction in smoke. Fabrication and lab testing, along with the artisans from Bharatpur, have been successfully completed at Micro Model Complex of IIT Delhi. The furnace attained a temperature of 1000°C within 15-20 minutes of firing. The percentage reduction in fuel consumption in the operation was found to be between 57 - 67%, compared to that of the traditional furnace. Two new furnaces, one clay core (Figure 2) and another steel casing (Figure 3), were transported and installed at Unch village, Bharatpur during May 4-6, 2017. Field testing was successfully conducted (Figures 2 and 3). The results showed improved performance of the furnaces with increased fuel efficiency.

3. Dissemination of Low Cost Sheep Hair Shearing Device (RuTAG IIT Delhi)

P.I. - Prof. S. K. Saha

Co P.I. - Prof. D. Ravi Kumar and Dr. Deepak Kumar

Collaborating NGO - *Jansamarth, Tehri, Uttarakhand*

Collaborating Funding agency - *CWDB, Ministry of Textile, Jodhpur, Rajasthan*

This project came to RuTAG to indigenise the whole device used for shearing the hair of sheep. For mass production of the machine, various vendors have been shortlisted to make different components, which will be later assembled. Three vendors for comb and cutter, one for motor, and one for flexible shaft have undertaken the job for initial development. All the said vendors have delivered components. Few changes were done based on the feedback from the previous field tests at Una, H.P. The modified comb and cutter were again tested at Barot, Palampur, H.P. during May 21-24, 2017 (Figures 4 and 5). The results were found to be at par with the imported comb and cutter.

4. Design and Development of Efficient and Less Polluting Potters Kiln Furnace (RuTAG IIT Delhi)

P.I. - Prof. M. R. Ravi

Co P.I. - Prof. Sangeeta Kohli

Collaborating NGO - *Lupin Human Welfare and Research Foundation, Bharatpur, Rajasthan*

The Potters' cluster in Unch village near Bharatpur in Rajasthan is plagued by the usual difficulties the potters in Indian villages face: they do not have their own land, so they need to buy clay from far away sources. Besides, they need to buy fuel for firing, and we were told in Unch village that they used powdery biomass in the form of mustard husk or sawdust, or agricultural wastes of different kinds as fuel. The cost of fuel per firing in the existing kiln (Figure 6) is very high and the returns on the sale of pots are not so high, resulting in very small incomes. If the furnace can be made more efficient such that the cost of firing is reduced by 40-50%, the profit margins would improve, making the craft a more viable profession. A visit was made to the Potters Kiln at Unch village, Bharatpur during Feb. 23-25, 2017 to collect data on the existing furnace. A newly improved furnace will be developed based on the data obtained.



Figure 7. Spinning yarn on upgraded Bageshwari wool charkha by women in Uttarakhand



Figure 8. Modified pump used as turbine



Figure 9. Industrial unit of kokum oil extraction



Figure 10. New loom with electronic Jacquard (left) and final product (right)

5. Modified Bageshwari Wool Charkha (RuTAG IIT Roorkee)

P.I. – Prof. R. P. Saini

Collaborating NGO- *NABARD and Uttarakhand state industry department, Uttarakhand*

RuTAG, IIT Roorkee initiated improvement in spinning wheel for reduction of drudgery in spinning and improving the productivity. The charkha has been motorised with speed control mechanism while its foot-paddle mechanism has been retained. Only 80-Watt power is required and speed can go up to 2000rpm. The wooden frame is replaced by lightweight steel pipe. Modified charkha (Figure 7) is an improved spinning wheel, which has speed adjustment, a lightweight structure for easy transportation as its components can be easily assembled and dissembled. High-quality yarn can be produced using the modified charkha. Its cost is about Rs.8,000.

6. Modified Pump Used As Turbine For Pico Hydro (RuTAG IIT Roorkee)

P.I. – Prof. R. P. Saini

Co P.I. – Dr. M.P. Sharma, Dr. S. K. Singla

Collaborating NGO - *Jansamarth, Tehri, Uttarakhand*

RuTAG, IIT Roorkee has designed modified yet low cost centrifugal pumps fitted with flow control mechanism to regulate the flow of water while maintaining high efficiency. These modified pumps (Figure 8) will be useful for the efficient generation of power throughout the year even when discharge in the stream varies significantly. These pumps will also be adapted to wider site parameters rather than just restricted to a specific site. The part load efficiency is improved by providing flow control mechanism. The estimated cost of a pump is about Rs. 0.5-0.6 lakh for 6kW of power generation whereas the cost of complete hydropower generating unit is nearly Rs.1.25 lakh/kW.

7. Designing Small Scale Equipment to Extract Kokum Oil (RuTAG IIT Bombay)

P.I. – Prof. Amit Arora

Collaborating NGO – *Lupin Human Research and Welfare Foundation, Sindhudurg, Maharashtra*

Kokum (*Garcinia indica*) seeds contain 35-40% of oil by weight. The oil is in solid form at room temperature due to the presence of saturated fats. In Konkan region of Maharashtra, it is used to make kokum butter, which has several uses including cosmetics. The villagers, at present, are using traditional method for extraction of kokum oil, which is not necessarily very hygienic. The present project addresses the problem of non-availability of a small-scale machine (Figure 9) to be used at household level for extraction of kokum oil hygienically. The project has the potential for generating livelihood opportunity for the locals.

8. Development of Electronic Jacquard for Korai Mat Weaving Handloom (RuTAG IIT Madras)

P.I. – Prof. K. Badri Nath, R.V. College of Engineering, Bengaluru, Karnataka

Collaborating NGO - *Jeenath Self Help Group, Pathamadai, Tamil Nadu*

The handlooms used in making famous fine Korai-grass straw mats have been attached with an electronically controlled selector for creating designs which give versatility and triples productivity. The new loom (Figure 10) enables the weaver to sit comfortably and achieve weaving of unique and larger complex motifs in shorter working hours. This has been tried out for the first time in Pathamadai, Tamil Nadu and Killimangalam, Kerala.

Regional Workshop

RuTAG IIT Delhi conducted a regional workshop on December 29, 2016 at Hotel Kadamb Kunj, Bharatpur, Rajasthan. Lupin Human Welfare and Research Foundation Bharatpur supported in organising the workshop. The program was attended by about 52 participants which included Dr. Narindera Kumar Gupta, IAS, District Collector, Bharatpur, Prof. R. R. Gaur, Hon. Visiting Professor, NRCVVE, IIT Delhi and Chairman, Core Group RuTAG IIT Delhi, Prof. S. K. Saha, Professor, Head Mechanical Engineering Dept., Prof. M. R. Ravi, Professor, Dept. of Mechanical Engineering, IIT Delhi, Mr. Sita Ram Gupta, Executive Director, Lupin Human Welfare and Research Foundation (LHWRF), Bharatpur, Mr. Yogendra Singh, Joint Director, Animal Husbandary, Bharatpur, Mr. Pramod Paliwal, IIRD, Jaipur, Mr. Abhay Kumar Singh, DDM, NABARD, Mr. Varindera Singh, District Industries Officer (DIC), Bharatpur. Three faculty members from Government Engineering College Bharatpur, three faculty members from Chandravati Group of Institution, Bharatpur and about 25 NGOs representatives were also present.



Central Project Evaluation Committee (CPEC) Meeting, 2017

Meeting of Central Project Evaluation Committee (CPEC) was held on February 14, 2017 at IIT Delhi from the office of the Principle Scientific Adviser (PSA). Dr. R. Chidambaram, PSA to the GOI, Mr. Naveen Verma, Secretary, DoNER, Mr. Pradhan, Joint Secretary, Dr. Basu, Secretary to the PSA, Prof. M. Balakrishnan, Deputy Director (S&P), IIT Delhi, Dr. S. Ayyapan, Chairman, CPEC, Dr. Keitaki Bapat, Scientist 'F', Major S. Chatterjee, Prof. S. K. Saha, Co-ordinator, RuTAG IIT Delhi, members from other RuTAG centres and other committee members participated. The focus of the meeting was promoting RuTAG technologies for the North East Region.



Visits

1. Prof. B. P. Patel and Mr. Prabhat Kumar visited Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar during December 20-21, 2016 to collect information on Salt Iodization Plant. Based on the visit, no need to develop smaller sized unit was realised.
2. RuTAG IIT Delhi Team (Mr. Raj Kumar Gupta, Mr. Davinder Pal Singh and Mr. Mangal Sharma) visited M/s. Santosh Brothers International, Bulandshahr for the inspection of Bullock Driven Tractor (BDT) on January 13, 2017 and conducted the field test of BDT.
3. Seven students of IIT Delhi and one project staff from RuTAG IIT Delhi visited the Society for Sustainable Development, Karauli and Lupin Foundation, Bharatpur during February 23-25, 2017 for field survey of Batasha Furnace, Potters Kiln and Stone Mines.

Exhibitions

RAHA, 2016

Participated in the International Conference on Robotics and Automation for Humanitarian Applications (RAHA) 2016 at Amrita University, Kerala during December 18-20, 2016. Prof. S. K. Saha, Mr. Davinder Pal Singh, Mr. Raj Kumar Gupta, Mr. Sasanka Sinha attended the above said conference at Amritapuri in Kerala. RuTAG IIT Delhi exhibited its prototypes there. RuTAG IIT Delhi gave Tulsi mala making device to the management of Amrita University for use in the clusters of AMACHI Lab.



Tryst 2017, IIT Delhi

Participated in Annual Tech. Fest 2017 during February 24-25, 2017 at IIT Delhi. Mr. Pawan Kumar Tiwari, an M. Tech student in Applied Mechanics, Ms. Airin Dutta, an M. Tech Student in Mechanical Engineering Dept., and Mr. Raj Kumar Gupta demonstrated prototypes at the event.



Destination North East 2017

Mr. Davinder Pal Singh and Mr. Prabhat Kumar attended the event on Destination North East 2017, organised by Ministry of Development of North East Region (DoNER) at Chandigarh during March 06-08, 2017. Few items from RuTAG IIT Delhi were exhibited.



Open House 2017, IIT Delhi

RuTAG IIT Delhi participated in the 13th edition of open house on April 22, 2017 organised by IIT Delhi. Six projects were showcased including five demonstrations.

Workshop at NABHA Power Limited

Mr. Davinder Pal Singh and Mr. Prabhat Kumar attended the workshop on sensitization of local panchayat near the L&T Thermal Plant, Rajpura, Punjab on March 09, 2017. They exhibited few prototypes.



Jammu and Kashmir (J&K) Science Congress, 2017

RuTAG IIT Delhi participated in the Jammu and Kashmir (J&K) Science Congress at Jammu University on March 04, 2017. Prof. M. R. Ravi, Mr. Davinder Pal Singh and Mr. Prabhat Kumar attended the science congress in Jammu and exhibited few prototypes.



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