



TURNING POINT

Tata Centre Newsletter, March 2019, Issue No.21

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Reaching out to a hundred

Three project teams from Tata Centre - Hindi Shabdmitra, Waste Sand Reclamation, and Fibre Optics Biosensor - were part of the I-NCUBATE programme recently that helped identify approaches to take their technology to the marketplace.

A seven-week program from November 2018 to January 2019 had three project teams from Tata Centre thrown into the challenges of finding 100 potential customers'

valuable time, identifying their needs without bias towards their technology, travelling thousands of kilometres for interactions, and then analysing all those interactions.

This was a part of I-NCUBATE, a flagship program of Gopalakrishnan-Deshpande Centre, IIT Madras, supported by the Desai Sethi Centre for Entrepreneurship, IIT Bombay. The program

helped identify key market-ready research projects and enabled the respective researchers to take their ideas to market.

All three market-ready research teams were confident with the technical solutions they had developed, but they had a list of challenges to move to market. Each team consisted of a faculty members, research staff and a mentor.



Project groups with the I-NCUBATE program

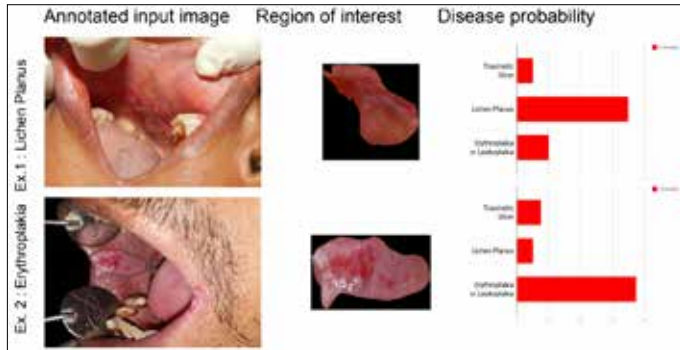
The course consisted of a kick-off orientation workshop, six online sessions, office hours for individualised responses, and a closing session.

To be continued on page 7



Screening app for oral cancer

This project team is developing a mobile phone application to semi-automate the detection of oral cavity lesions



screening is being developed for DSLR images, AI needs to be trained for identifying smartphone images subsequently, as the final product will be a mobile phone application.

Such semi-automated primary screening is expected to not only save the indirect cost of cancer detection for people in rural areas, but to also relieve the strain on doctors by referring to patients with harmful lesions only.

Although oral cancer is preventable when detected early, it has the highest mortality count among cancers prevalent in India. Early detection of oral cancer can easily be done by mass screening using pre-screening visual inspection of the oral cavity. Such mass pre-screening is infeasible in India due to the lack of trained manpower. In order to address this issue, Prof. Amit Sethi, Dept. of Electrical Engineering, and his research team are developing a mobile phone application for semi-automated detection of oral cancer.

The project team is looking forward to collaborating with public and private institutions which already conduct mass screening camps for data collection using smartphones.

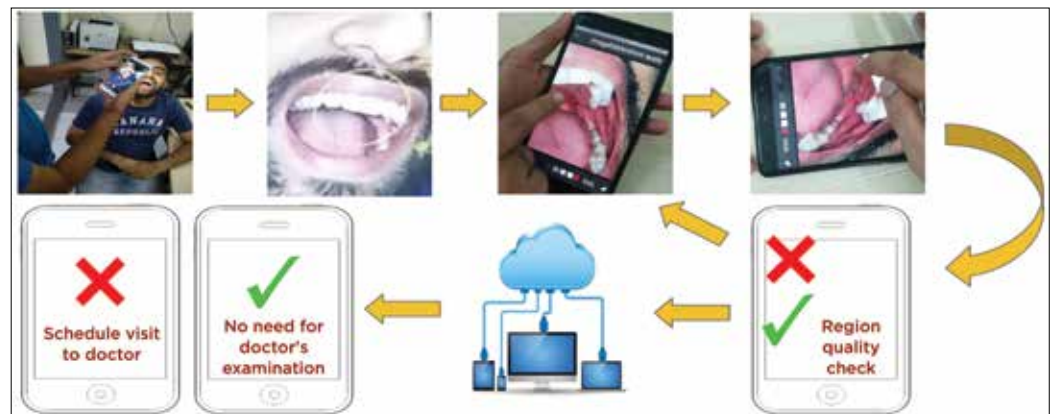
ASHA workers or primary healthcare workers in villages can use this app to take pictures of lesions in the oral cavity. Initially this picture can be sent to a doctor who will identify if the lesion is a dangerous one and accordingly, further treatment will be suggested. However, using artificial intelligence (AI), the detection process can be made faster and will be most useful in the current scenario of lack of doctors in rural areas.

With sound amount of data, an accurate AI system can be developed and then the app will be ready to be used widely.

The long term goal is making this project self-sustainable. Once a certain level of accuracy is obtained with AI, the system will have to be re-engineered for handling larger data sets and then the project will be ready for a mass roll out.

Shraddha Vekhande, Tata Fellow

Images of lesions in oral cavity are being collected in Nair Hospital, Mumbai, and the team is in the process of annotating these images with the help of doctors. There is the challenge of collecting numerous images of one particular type of lesion. While the present AI system of primary



Analysing finances in agrarian homes

It has been a common notion that farmer suicides are driven by the low market for crops, increasing fertilizers costs, extreme weather conditions, etc. However, it is also equally important to understand the inside household activities of a farmer family which lead to such an agrarian crisis. Prof. Bakul Rao at CTARA, and her team are working to analyse the financial habits of farmer households through simple financial tools such as the balance sheet, profit and loss account and cash flow.

The major challenge is getting data from the farmers for which the team follows a participatory approach. For this, they are working in collaboration with an NGO named Deendayal Bahuuddeshiya Prasarak Mandal in Yavatmal district, where a study of about 150 farmer

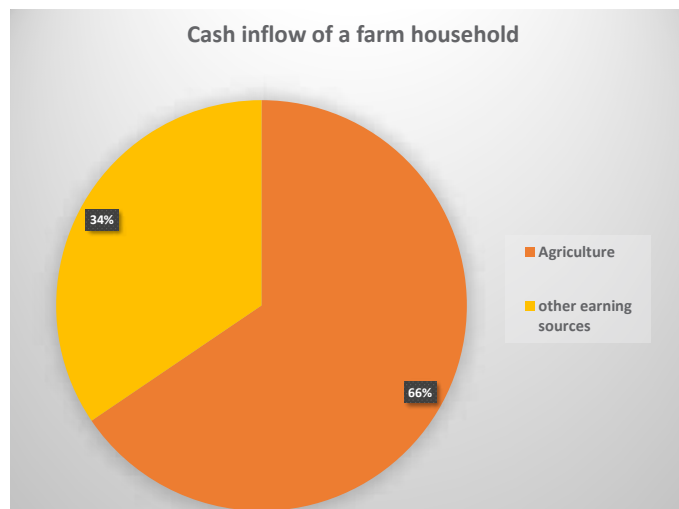
The study aims to empower farmer families to make better decisions while dealing with an agrarian crisis or beforehand itself.



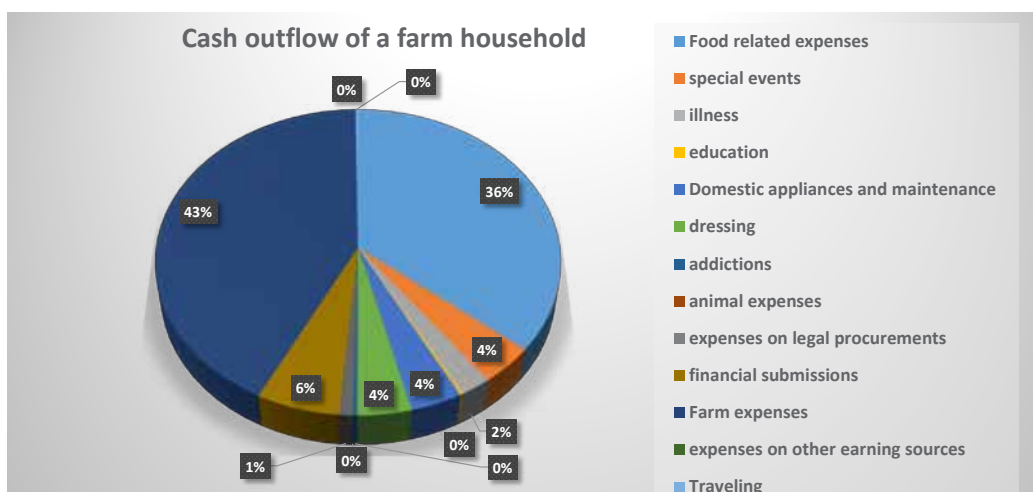
Changing the lives of farmer families

households has been carried out since the past year and both the rich and poor farmers based on their land holding have been observed.

One of the most important findings has been that the families which have other sources of income apart from agriculture are more stable and readier to face any untoward situations.



Societal change is also necessary where a huge amount of money spent on marriages or vices such as alcohol needs to be reduced. It is thus not a single change or solution which can help get rid of such problems, but it is the entire ecosystem that needs to be looked upon for an effective change in the lives of the farmer families.



Vrushali Gardare, Tata Fellow



Sealing the puncture

This sealant works on an oil-based solution to render tires and tubes puncture-proof, claiming longevity and applicability as its strengths.

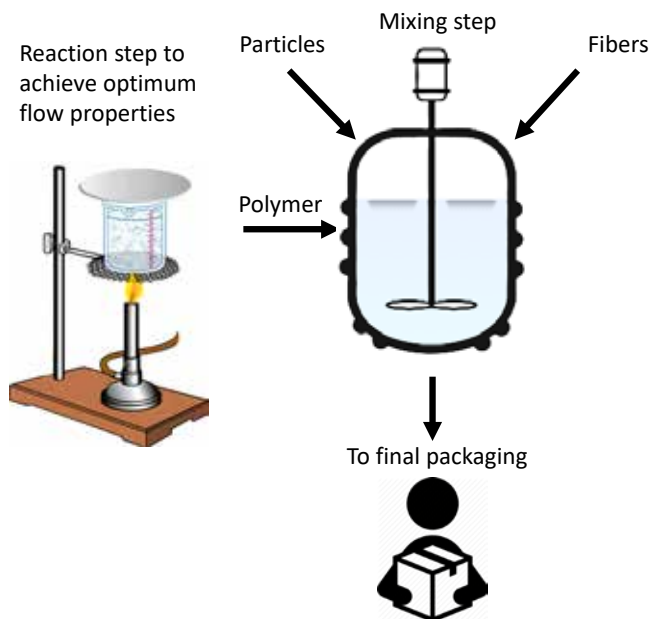
This is an interview with Prof. Mahesh Tirumkudulu, Prof. Jyoti Seth, and Prof. V.A. Juvekar from the Dept. of Chemical Engineering, who are PIs of the Tata Centre project - Design of Puncture Proof Tires and Tubes.

Q. Please give us a brief overview of the project.

The poor road conditions in rural parts of the country are a major cause for the occurrence of a tyre puncture. The puncture making costs incurred by the rural population are also relatively high, consuming the non-expandable income. Thus we started working on sealants for both tubeless and tube tyres.

The idea was to use a liquid that could fill the tube tyre and interior of a tubeless tyre.

In case of a puncture, the liquid would instantaneously flow through the hole and seal it.



In-house set up for mass production of sealant

Q. How does this technology work?

When a puncture occurs in a tyre, it creates a hole. The pressure outside the tyre is atmospheric while inside the tyre is relatively high. The pressure difference created acts as the driving force and causes the sealant to flow. The sealant consists of fibres which form a network and then based on Log-jam principle seal the puncture hole.



Q. Were there any technical challenges faced while coming up with this solution?

The sealants available in the market are water-based. The first challenge was to choose a system that was not water-based, as this kind of sealants tend to dry fast and do not last long inside the tyre. The other challenge was to make this sealant work on a wide range of temperatures. A lot of heating can result while the tyre is in use, hence the sealant must not be inflammable. The flow properties and rheology also play a key role in sealant quality. Lastly, to test the sealant many trials on actual tyre were needed. To get a punctured tyre on demand was another challenge which was resolved by developing a set-up in the lab for multiple iterations.

Q. Who will be your target audience?

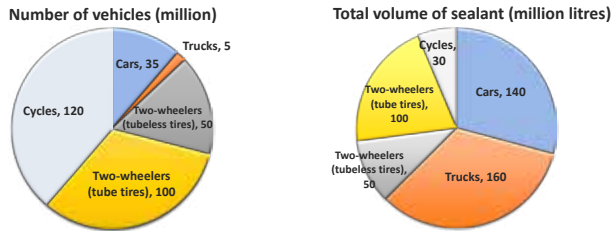
The rural population is directly impacted by the poor road conditions. The defense forces often involve travel on off-roads, hence a potential stakeholder.

Q. What is the market status in this domain? How do you rank the novelty of your solution?

Sealants have been in the market since the 80s. But there are inherent problems such as getting dried up faster and inability to withstand extreme temperatures. Our solution overcomes these limitations with ease. Longevity and applicability are its two main strengths. It is oil-based, thus doesn't dry at all, works at a wide temperature range



Economics for usage of sealant



Vehicle	Cars	Trucks	Two wheelers (tubeless and tube tires)	Cycles
Amount of sealant per vehicle (litres)	4	32	1	0.25



Sealant developed in the lab

from -15 °C to 90 °C, and can seal very large punctures as well. The best claim in the patents to seal a puncture hole is of 6mm while our solution can seal a 9mm puncture hole.

Q. What are the future goals?

We are planning to conduct field trials. A bigger batch of sealants is underway its production. Meanwhile, two management students from K.J. Somaiya College of Management Studies and Research will be conducting a market survey for us. Based on the results, the product will be modified. The other objective is to try to reduce the price point of the product keeping our primary audience in mind.

Q. What challenges do you envision while you complete these objectives?

The major challenge will be to commercialise this product. Stakeholders like puncture makers will be considered while going forward.

Rohan Ohri, Tata Fellow

New patent applications

TCTD, IITB had an encouraging number of new patent applications in the first quarter of 2019. This list includes the following projects that have gone through the invention disclosure process for their innovations, at IIT Bombay.

Project: A digital aid for language (Hindi) teaching and learning

Faculty: Prof Malhar Kulkarni, Dept of HSS; Prof Pushpak Bhattacharyya, Prof Preethi Jyothi, Dept of CSE; Prof Aniruddha Joshi, IDC School of Design

Domain: Education

Patent applied for - Hindi Shabdmitra - the digital aid for language learning and teaching.

Project: Detection and sensing of arsenic in drinking water

Faculty: Prof Rajdip Bandhyopadhyaya, Dept of Chem Engg

Domain: Water

Patent applied for - Methylcobalamin functionalized gold nanoparticles as a novel nanocomposite material for detection and measurement of arsenic in water.

Project: Development of a point-of-care test for the detection of pathogens causing urinary tract infections

Faculty: Prof Rinti Banerjee, Dept of BioSciences and Bio Engineering

Domain: Healthcare

Patent applied for - A substrate for entrapment and detection of bacteria, process for its preparation and a point of care test.

Project: Spoken language training on mobile device

Faculty: Prof Preeti Rao, Dept. of Electrical Engineering

Domain: Education

Patent applied for - Automatic Assessment of Prosodic Fluency from Recorded Speech.

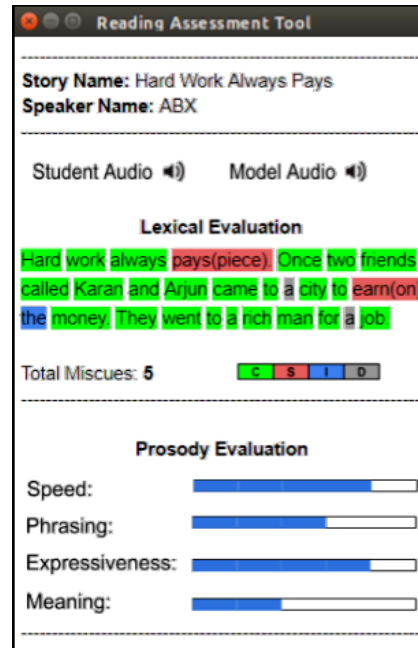


Training the spoken language

This research project targets an affordable and scalable technology solution that gives immediate feedback on pronunciation and fluency in spoken English



Screenshot of a typical narrative



A shortage of teachers and absence of speaking opportunities outside school contribute to a lack of practice in spoken English for children in rural schools. This research project led by Prof Preeti Rao, Dept. of Electrical Engineering, seeks to alleviate the problem by targeting an affordable and scalable technology solution that can help struggling learners with automatic means to obtain immediate feedback on pronunciation and fluency.

so that students can get feedback for improvement. Such feedback gives areas for improvement in the spoken language.

The content for reading is available in the form of stories on the tablet. The level of difficulty for reading can be customized from one line per page to paragraphs as per the reading ability of the student. Though the current focus of the project is English language, this methodology can be used

schools in Mumbai, it is also collaborating with some teachers from British Council and students pursuing their Master's in English Literature from Mumbai University. Ratings are being obtained at the word decoding level and also for overall speech delivery. The students are to work on this



Recording speech delivery

Currently, a basic system has been developed wherein the student can hear a narrative in the application and record it. The recording is processed using speech recognition theory. The research team is now working on developing an evaluation system for these recordings

for developing applications for other vernacular languages as well.

The main target audience is primary and secondary school students especially in rural areas with lack of exposure to spoken English.

It is expected that the product ensures active engagement with the language.

Data collection and transcription of the recording for developing the rating system could be a major hurdle for the team. Another challenge is the availability of professionals to develop the server component and handle heavy voice processing.

While the team is currently getting recordings from some

assessment which can be also used by school teachers for further improvement.

As the team overcomes these challenges, the evaluation and rating system will be developed, and the application will be ready for field testing and dissemination.

Shraddha Vekhande, Tata Fellow

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The teams were required to perform customer discovery each week with an objective to cover at least 100 customers and develop a business model canvas through customer interaction, by the end of the program. In November, the Hindi Shabdmitra team had just too many customers. Waste sand reclamation was proposing a fixed value proposition for their product. The Fibre optics biosensor team for water quality monitoring was looking at private and government testing labs as their market.

The Hindi Shabdmitra team interacted with 100 customers. They figured that their primary customer should be the school principals and they



Presenting their findings

should tap the market with the CBSE education board. Reaching out to 107 customers, the Waste sand reclamation project realised that the value proposition should be moulded as per customer specifications. After analysing 80 customer interactions, the Fibre optics biosensor team found out particular requirements of their targeted customers.

Finding out that there are different publications followed by the different CBSE schools, the major sand clusters are looking for waste sand reclamation as an urgent solution, and the labs in eastern and southern parts of India are open to new methods of water quality monitoring were the different “Aha” moments for the three teams respectively.

Having travelled thousands of kilometres

across the country, talking to multiple customers, analysing the interactions, presenting webinar each week and lastly coming up with a business model canvas for their technology at the end of the program left the respective teams saying, “This is a must for every technical researcher who envisions taking his research to the market.”

Rohan Ohri, Tata Fellow

News Update

Indo-UK project in waste management

Tata Centre has recently collaborated with Queen’s University Belfast in an Indo-UK project on using waste biomass for energy and other high value products. The key part is on using cavitation for pre-treating waste biomass streams from sugar industries: bagasse, press mud, spent wash, cane residues etc. In this project, the vWa team comprising two industrial organisations & three universities from UK, and three industrial organisations & four research institutes from India, will work together on hydrodynamic cavitation, anaerobic digestion and thermal pre-treatments for valorising the wastes from sugar cane and associated industries. An integrated approach to utilize lignocellulosic waste in the form of bagasse, spent wash, press mud, bagasse pitch and cane residue for the production of transportation fuels and value-added chemicals will be developed. The technologies are proposed to be commercialized while making a tangible & significant beneficial impact on the well being of a large population in rural India.

Extension until 2021

An approval has been received from the Tata Trusts for the extension of Tata Centre’s activities for the next two years, until March 2021. The Centre looks forward to work on the ongoing and plan the future activities, and hopes that the social impact can be reflective of the Centre’s growth.



TCTD Symposium 2019



Photo Link: <https://goo.gl/ih8FDu>

Video Link: <https://goo.gl/FMrxSJ>

Editor:	Gayathri Thakoor
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