CHANGING INDIA WITH TECHNOLOGY

AS WE ENTER A BRAND NEW YEAR, WE TAKE A LOOK AT GEEKY INDIANS THAT ARE HARNESSING THE POWER OF TRULY INNOVATIVE TECHNOLOGY TO DO SOMETHING FOR THE GREATER GOOD. THEIR CAUSE IS A NOBLE ONE, AND WE SALUTE ALL OF THEM.

IMAGING: SHIGIL NARAYANAN

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Revolutionizing medicine

Just close your eyes and try to imagine this scenario – it's not difficult thing to think – just go along. Imagine a scenario that is almost synonymous with India up until 2013. The sight of a poor, neglected farmer trying to make ends meet in a god-forsaken part of the country that has no basic sanitation, water or electricity supply. His children struggle to get basic education, and his wife has no idea that a concept like women's rights exists in our country. With the onset of winter comes the cruel cold from which there is no escape; only pain and suffering with the fight against the elements. Down with an especially furious bout of cold and flu, the farmer tries to go past the village *Vaid* and try his luck with a traditional doctor. It's after all a matter of life or death, as far as he's concerned.

The doctor looks upon the farmer as nothing but a shrivelled 100 rupee note, one that he can quickly scare, intimidate and ensnare in a vicious circle of medication, consultation and expensive tests. Imagine the plight of this man who, in trying times, has to take a loved one or his relative to a doctor who isn't trying to serve but fill his coffers. The doctor tries to make a mountain out of a mole hill, advising the poor farmer to have his ill family member undergo a series of tests that he could easily have done without. Think of these additional tests like pathology reports, Xrays, etc, that pile up on the head of this farmer who has no choice but to get wringed by the corrupt and ineffective system that he's born and brought up in. He probably has to travel several kilometres to the nearest town to something as basic as a pathology, a privilege we enjoy with a second thought in bigger towns and large cities.

As is evident, our country needs an intervention. To alleviate India's woes and pull it out of these dark ages a new kind of geek is rising. A geek that's harnessing technology to build ideas that truly have a far-reaching effect, and enough potential to fundamentally correct something that's wrong in our way of life, the government, and everyone in between. Let's take a look at what these guys are up to, and the technology that's

India is eyed by the world as a destination of medical tourism, where we provide quality medical services to the ones who can afford it at a fraction of the cost of what medical practitioners demand in the West. But even today, in 2013, millions of Indians all over the country don't have access to basic health care. One of the reasons for this is the high costs of diagnostics and specialized equipment, going far beyond a GP's consultation fees and basic prognosis. In the absence of practical solutions, millions of Indians suffer. But not if we decided to do something about it.

Myshkin – co-founder of Biosense, an internationally recognized med-tech venture building innovative mobile based health technologies – and his dedicated team are trying hard to make reliable diagnostic services affordable and accessible to everyone. They provide highly sophisticated mobile diagnostic units called uChek, that are powered by the Android OS, and are capable of doing more than 14 parameter testing on urine and blood. These are powering diagnostic labs, doctor's clinics and government centers across India, at a fraction of the cost of existing equipment, but at the same

MYSHKIN INGAWALE

BIO: Before starting Biosense, Myshkin has worked at Mckinsey & Company, where he advised Fortune 500 companies on M&A and strategy. He has been a researcher at the Massachusetts Institute of Technology, where he was part of the team that conceptualized and built the Copenhagen Wheel, demoed at the United Nations Climate Summit 2009. He holds a PhD in Management Information Systems from the Indian Institute of Management, Calcutta and a B.Tech in Electrical Engineering from the National Institute of Technology, Bhopal. He is a regular speaker at TED and TEDx events, and a co-author of the book "The Unreasonable Fellows". His passions are tech startups, writing, teaching and football.

"The inspiration (for UChek) was the mobile phone and how it has revolutionized small businesses in India. Healthcare can also be revolutionary in the same way, and provide more affordable and accessible services to common people, if we are smart with technology."

accuracy and reliability levels. The uChek units also provide advanced data analytics using the cloud.

How does it work?

For uChek, right from the start, technology enables everything: The test is done by imaging urine and blood reagent strips on Android powered devices. The data is processed on the mobile device, providing a real time reading and recommendation on the fly, to the health worker doing the testing in front of the patient. The doctor is consulted over the phone/on video. All the data and the test report, as well as the doctor's recommendation is logged on the mobile device, and simultaneously, syncs with the cloud, whenever network connectivity is available. If network is not available, the system will carry on regardless and wait to upload data whenever network is available. All the data can be accessed by program managers and different levels of the health system, at all locations. Everything is geotagged with GPS and timestamped, so real time decisions are made backed by data that is current and relevant. All this runs on the internet infrastructure, most of which is open and freely available.

Myshkin is extremely bullish about UChek and other affordable healthcare ventures he's working on currently. When we asked him about how this will benefit India, Myshkin said, "The uChek and similar mobile based healthcare solutions we are developing cost 1/10th of what other more "traditional" diagnostic equipment cost, and thus make healthcare available for a new strata of society, that had otherwise been underserved or not served at all. Going forward, we think that health is going to follow telecom: In India, instead of going the way of expensive landline infrastructure (telephone poles, lines, etc as in other developed nations) whole districts and states started accessing voice and data on mobile, over the air. Mobile has leapfrogged ahead at an unprecedented rate in India. I believe in Dr Mashelkar's words "Affordable Excellence" and that India will be the first country where per capita income and quality of healthcare will be totally separate: i.e everyone will have access to affordable, high quality healthcare, the same way they have access to affordable mobile talktime."

Part of the new India, which says no to cushy well-paid jobs at MNCs or government desks and cherishes entrepreneurship and starting your own venture, Myshkin suggests that India has never lacked in entrepreneurial spirit. He points out that the "Old India was one of the power centres of global trade and commerce because of the symbiosis between trade, religion and science. We seem to have lost our way somewhat in the last few hundred years, but it seems we are making a come-back now! I think an open society does not banish the failures, it cherishes them. Each failure is a better teacher than any professor or guru in any university, and open and innovation driven societies have learnt how to harness the power of failure to power future successes, in a systematic way. I don't think we are there yet, but the difference in attitudes are already perceptible: From IAS and MBA, the new thinking now is slowly changing to *kuch hatke karna hai, kuch jabardast karke dikhana hai."*

WHAT'S THE DIFFERENCE BETWEEN THE INDIA YOU WERE BORN INTO AND THE INDIA YOU ARE LIVING IN RIGHT NOW?

"The difference is that the old India was always looking for a free lunch. We always looked to other countries to help us, and we always looked to even our own government to "save us", whereas now, the young India is looking inwards and starting to come up with indigenous solutions, innovative ways to address age old problems. Truly transformative change is only possible if it comes from within, is driven organically. And that is what is happening in India, as a whole new generation of doers is getting to work, getting things done in their own innovative way."

Going beyond just entrepreneurship and harnessing technology to its fullest, saving costs on already available medical diagnostic tools, Myshkin feels there's a strong need for indigenously developed solutions to tackle India's medicare and healthcare sectors. Until we do that, there can be no true salvation for Indian healthcare and the problems that plague the medicare system (or its lack thereof) in our country.

He continues to mention that most of India's medicare "systems" have been borrowed from the West. "Sometimes this works, but other times, India needs its own thinking. For example, all equipment in medicine has been invented in Europe or US, mostly. But this solves the problems of the West, and has been designed with their existing infrastructure in mind. India is different and Indian health care problems need special thinking," says Myshkin. He continues to urge all engineers, designers and doctors to "think different, and think out of the box to solve India's health problems." How many of you reading will take up the cause of doing something truly path-breaking to disrupt medicare in the country?

3D Printing: Giving you the power to do

As Digit readers, the concept of 3D printing isn't an alien one for you. This isn't a new phenomenon, you may even find a few 3D printing solutions near where you live. However, apart from academic pursuits and geeks trying to earn bragging rights, there has been precious little substance to tell in the early days of 3D printing. But the space is maturing, not only internationally, but closer to home here in India. This is the story of two youngsters from Mumbai, literally working on the cutting edge of technology, trying to make innovative solutions that will help others pursue their dreams like never before.

ANGAD DARYANI

"I'm a maker. I've been developing technology since I was in the 4th grade (Was a lego mindstorm robot at that time though). I've made things through online tutorials and open source instructions till july 2013. Post that, I have been working at MIT workshops and have used technology to solve real world problems like building low cost eye diagnostic tools or low cost assistive technology for the blind. I've worked on 3D printing using FDM since 2011."

Angad makes...

We met Angad at TEDx recently and were easily impressed with both his nervous excitement and calm composure. The kid's a genius! If you meet him now, he can easily give you an inferiority complex. Why? Because he's doing things that a traditional 15-year-old boy isn't supposed to do, which is to innovate, build ideas, start a business and launch a product that has a truly disruptive potential.

Angad built his first robot when he was just eight years old, and built a modified version of the open-source RepRap 3D printer by the age of 13. One of his prototype 3D printers is being used at the Indian Institute of Technology in Mumbai. At the tender age of 15, he's working on a project that's nearing completion, which is called "SharkBot" a dirt-cheap version of the RepRap which he's planning to sell in India soon, making it India's first home-grown 3D printer. And Angad claims SharkBot will be "the fastest and most robust desktop 3D printer that can print any material except metal."

His relentless passion for building things also led to the invention of Virtual Brailler, a project developed in collabo-

ration with DIY Workshop, Hyderabad. Virtual Brailler is a device that converts digital text to Braille in real-time allowing the visually challenged to have tactile Braille feedback to the tracked finger thereby discerning unique letters and words. Needless to say, this low-cost eBook reader for the visually challenged has truly disruptive capabilities, especially when existing Braille printing costs several lakhs of rupees and text-to-speech softwares aren't accurate or localized.

Angad calls himself a maker, as he's been obsessed with making things from a very young age – taking apart toy cars, building structures out of lego blocks, doing a lot of art work, designing automobiles, soldering, etc. His goal in life? "To try to start the Maker Movement (http://www.techopedia.com/definition/28408/maker-movement) in India to give rise to youngsters who are more passionate about and who wish to solve real world problems through technology." In a suburb in Mumbai, along with the help of like-minded enthusiasts, he's even helped start the Maker's Asylum, a place where people can come and just make things. It's fully equipped like a professional workshop, the intention of which is to give anyone who wants to transform their idea into a tangible item a fair shot at making it happen.

He also has a website (www.angad-makes.com) on which he uploads all the projects he's working on along with tutorials and open source instructions to help anyone interested to learn how his devices function, and even re-make them. Angad also conducts talks and events at schools to encourage kids to explore hands on learning through workshops – e.g. something as simple as water rocketry. He has a startup which provides low-cost DIY kits to get young minds started off with DIY learning.

Being homeschooled from a young age, Angad has strong views on our education system as well. He says, "The problem is partially with the system and partially with people's mindset. The formal classroom education system does not allow a person to learn at one's own pace and innovate. Emphasis on exam performance corrupts the very purpose of education. Also, many people (parents/institutions) are not willing to invest time and money in youngsters who have curious minds."

Angad respects technology, knowing fully well how it has inspired him to pursue his dreams. "Technology helps me learn and do things even without having to enroll in any particular institution or programme," says Angad. "It helps me see science happen in front of my eyes and gets me more and more interested in solving real world problems. Technology helps me to create technology. I can also share information and instruct people on how they can create the same technology as I have been using the technology available to them." Angad also acknowledges the Internet as an instrument of self-empowerment and learning, and he owes 90% of his tech knowledge to the Internet.

We asked this truly remarkable 15-year-old on his vision and how his breakthroughs will help millions of Indians. "I'm trying to make technology cheaper, more portable and faster. Having low cost prototyping devices, low cost health diagnostic tools, low cost and fast communication, faster and cheaper educative tools, etc will make not just India but this world simpler, faster, reliable and better!"

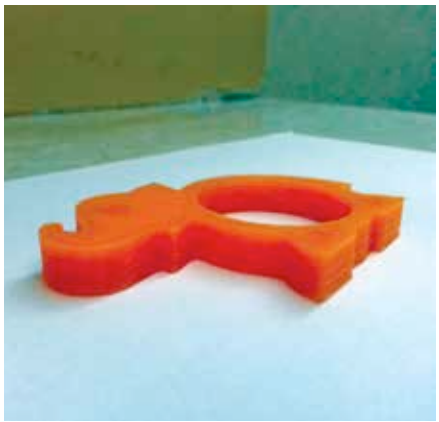
FOOD FOR THOUGHT

What are some of the applications of 3D printing that you can think of? Can it be used to 3D print your own medicines? Can you, perhaps, make synthetic organs to help someone's life? Or print out prosthetics to enrich the lives of millions of people with disabilities? Can we 3D print our own garments, for instance, with synthetic fabric? Can we print out a basic circuit board or a transistor on a 3D printer? 3D printing is nothing short of a second Industrial Revolution, empowering not only industries and companies, but every single individual to take control of their lives like never before. We leave you to imagine the endless possibilities of this truly revolutionary technology.

Karan Chaphekar

Calling himself the Maker-in-Chief at KCbots.com, Karan Chaphekar is cut largely from the same cloth as Angad Daryani. Karan has been tinkering with hardware and dabbling in robotics for as long as he can remember. After getting his degree in Electronics Engineering, Karan, now in his early twenties, dedicates most of his time focusing his efforts on 3D printing. Karan and his team has been active in the maker community for the past three years, where they're utilising their expertise in the 3D printing and robotronics domains and coming out with a revolutionarily simple and powerful 3D printer. He claims it to be uber simple – works "out of the box" – while retaining a powerful print performance. It is called, simply, the KUBE.

The KUBE allows anyone with a desktop computer to "grow" and build a real object from plastic, by just clicking



Angad's soon-to-release 3D printer is a cool device to spend time around, no?

This is a 3D-printed plastic bracelet, produced by Karan's invention

As you can see through these 3D-printed scale models, the force is strong in Karan

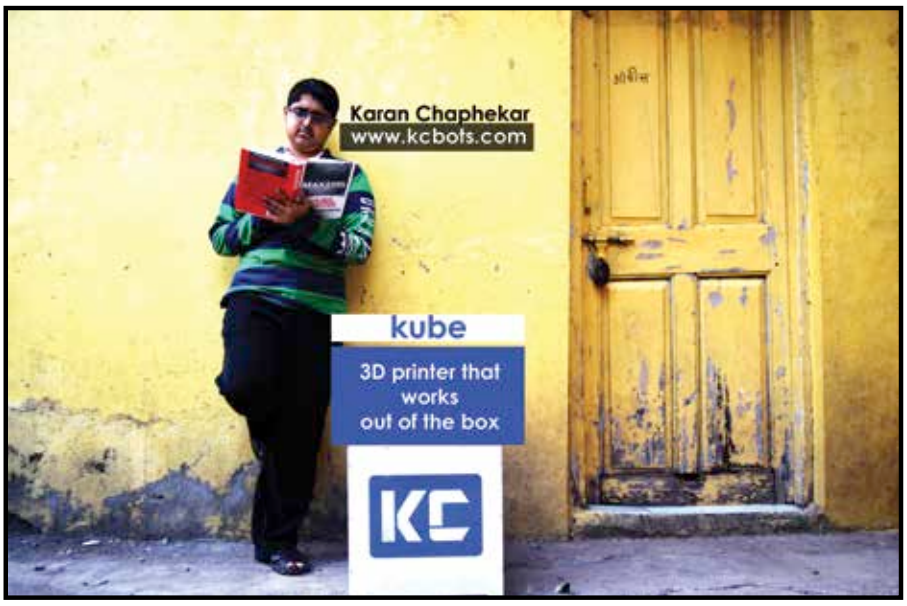
the print button. The intention, of course, is to allow anyone with imagination to build their own designs, allow anyone to make anything that they can dream up. He's especially motivated by the thought of kids in school harnessing 3D printers to make their imaginations come to life.

"I believe this is a world-changing technology whereby people's creativity can be unlocked in unimaginably wonderful ways. It can have as much impact or more as the computer has had, in the way we live our lives. At this stage, rapid prototyping is mainly used by industrial designers and professionals using very expensive and niche machines but I am amongst an increasing number of 'makers' who are working to bring these powerful tools to everyone's desktop. This maker community is open, friendly and accessible." he says.

The technology in the KUBE 3D printer is loosely based on the open source RepRap models, explains Karan, where a moving nozzle deposits molten plastic layer by layer onto a bed, "growing" the object being printed, player by layer. Imagine your regular 2D printer, but with an added Z axis, so it can not only inject ink on a 2 dimensional paper, but rather plastic in 3D space. This is not a new concept, but the evolution of the open community has made the hardware and software accessible. With the KUBE, Karan has designed a machine that is powerful enough to print complex objects with high precision, but at the same time is simple and reliable enough that non-engineers can start using it, just by plugging it in. "Now, anyone with an idea can make it happen. With great ideas being converted to reality, I think the world can only benefit," says Karan optimistically.

When asked how India would benefit from devices like the KUBE, Karan had this to say: "India is poised between an old world – of poverty and imperialist past and a new world – of opportunity, of becoming a truly knowledge driven powerful economy. I don't think it makes sense for India to become another "low cost" service center of the world. We need to innovate. What 3D printers and these type of technologies offer is the most powerful tool possible to unlock innovation on a massive scale. Imagine every person with an idea being given the license to prove the idea by making it happen, and you can imagine the positive power that can be unlocked. I want the KUBE to be one of many other useful tools in the common person's arsenal, to make everyday lives better by creating more and more innovative solutions to problems that surround us."

The KUBE is being shipped in 2 versions: The KUBE for ₹49,000 and a KUBE Mini for ₹34,000. Learn more on his website: www.kcbots.com



KARAN CHAPHEKAR

CAN INDIA INNOVATE?

"I don't think it makes sense for India to become another "low cost" service center of the world. We need to innovate. What 3D printers and these type of technologies offer is the most powerful tool possible to unlock innovation on a massive scale. Also I would LOVE kids from all parts of India, irrespective of gender, economic or social or religious backgrounds – to be given chances to be more creative, to show what they can dream of, from a very young age. I think there is huge power in the dreams of children. Even if we can make 1% of their potential happen, the future will be amazing," says Karan.

Re-engineering behaviour

We all know by experience, and countless New Year's resolutions to attest to the fact, that changing one's habits is easier said than done. Habits are deeply ingrained memory blocks in our brain that are difficult to erase, change, or re-engineer. Habits, often as we know, can also be more than just a nuisance. Spitting on the roadside is more than just bad habit – for instance, it can come back to bite you in the form of sickness and disease-spreading germs that fester in exposed saliva. Similarly, noise pollution is another social evil that's practiced by millions of Indians on roads every day, despite the fact that this #1 cause of noise pollution increases heart rate and blood pressure, leading to hypertension and increased stress. Prolonged exposure to noise can lead to potentially fatal consequences.

Tackling the menace of "bad habits" among Indians with the help of behavioural science is Anand Damani, easily one of the most interesting people we've encountered. Along with his cousin, Mayur Tekchandaney, Anand works for consultancy firm Briefcase in which he uses science to change human behaviour – apply the knowledge of behavioural economics and cognitive neuroscience to change consumer, organisational and social behaviour. Amongst many social problems, excessive honking happens to be the first anti-social behaviour they're trying to tackle.

Honk, begone!

Angad's invention, a Behavioural Design intervention device makes the driver conscious of his/her honking. It makes the driver deliberate whether the honk is really required or not. The technology they've used to make drivers reduce their honking is a little red button placed on the dashboard of a car. When the horn is pressed, the button beeps and flashes, and basically annoys the driver. To turn it off, the driver has to press the red button. "We've called this little button Bleep," says Anand, "because we believe indiscriminate honking is like an abuse and this device helps Bleep out that abuse. The patent includes several additional features like capturing honking and vehicle data, displaying it with the driver, making sure the driver knows he/she is in a silence zone, etc."

ANAND DAMANI

BIO: "I'm a partner in consultancy firm Briefcase in which I use science to change human and social behaviour. In addition I handle the business and strategy of our Branding practice. Have worked 13 years in sales, marketing and advertising in the past."

Anand explains that he enlisted the services of Dhruv Chaudhry, an automobile engineer, who helped them create Bleep as a fully functional product. His team then tested it amongst people – office-goers, housewives, chauffeurs and measured their honks per km without and with Bleep over six months and 3,800 kms. Thanks to Bleep, he claims that his test candidates reduced their incessant or unwarranted honking by over 60 per cent.

Knowing fully well that Bleep won't be something that people will install voluntarily in their cars, Anand is trying different approaches to promote Bleep. "For it to become a reality," says Anand, "Bleep needs to be made mandatory in all vehicles because it's for the benefit of everyone in society. So we're not selling Bleep to individual customers. Rather we are approaching Govt. authorities to guide us with how to go about making it a reality. We're also in talks with the NY Taxi and Limousine Commission to see how it can be piloted in NY cabs as its drivers are known to honk unnecessarily and cause noise pollution."

Behaviour change is not easy, according to Anand. We know we should exercise but we don't. We know we should eat in moderation but we don't. So we are irrational beings and often we do things against our self interest. And conventional awareness based campaigns and education are ineffective at changing behaviour.

On a parting note, Anand leaves us to mull over the following: So we use Behavioural Design which is typically about creating small nudges that have a lasting measurable impact on behaviour. And there are so many applications of it for changing public behaviour in India and the world. From health to sanitation to education to employment to managing money better – the list of places where it can be applied for the betterment of society is endless. US and UK governments have begun using behavioural science for effective public behaviour changes and it's time for the Indian government to adopt such effective practices too. "

HOW DO YOU USE TECHNOLOGY?

"We use technology in creating interventions to change behaviour. Our objective is to nudge people and make them act in a particular way. We do not use technology for its own sake. In certain cases of behaviour change, the technology is very simple or not even used. In other cases technology is critical to behaviour change. But as technology is becoming more embedded in our lives we will be using more and more of it to create behaviour change. Overall we use technology with respect to all senses – sight, sound, smell, taste and touch," says Anand.

A government intervention

It is no open secret that we – as honest, tax-paying, law-abiding citizens of this country – just absolutely love to hate our government with great amount of disdain, no matter whatever they do in our interest. Putting politicians and elected officials aside – the one that folks like you vote for – Indian bureaucracy isn't without its bright spots. Here we highlight one such star who, with the help of technology, is trying to make systems more efficient and the wheels of government machinery work flawlessly, with greater accountability within all stakeholders.

The single-minded aim is to bring in simplicity, efficiency and transparency with the help of technology. Efficient service delivery is at the top of Mr. Aggarwal's mandate to give the government a much-needed facelift. He's quick to highlight innovative steps taken by the government in the last couple of years in this regard. "More than 35,000 Common Service Centers (CSC) have been set up across Maharashtra, primarily in rural areas, to facilitate delivery of services near the doorstep of citizens. Focus has also been on e-Services, thus reducing the public's need to travel to Government offices. Websites, applications, forms have been designed in Marathi to enable greater reach," says Mr. Aggarwal. He also mentions that applications are now being made WCAG compliant (http://www.w3.org/WAI/intro/wcag) to enable differently abled citizens to access them, thus fostering inclusive growth.

RAJESH AGGARWAL

Rajesh Aggarwal is currently serving as the Secretary IT, Govt. of Maharashtra. A B.Tech. in Computer Science from IIT Delhi (1983-87), Mr Aggarwal has been a technology enthusiast focusing on a wide array of aspects including Natural Language Understanding, Algorithms, Artificial Intelligence, Fuzzy matching and de-duplication of databases, GIS, Analytics and has the experience of working with very large citizen databases. He is also a prolific writer and has written numerous articles and papers on e-Governance, including the much acclaimed paper titled 'e-Gov 0.0 – the fundamentals of e-Governance'.

While working in the Election Commission of India, Mr Aggarwal found it exciting to work on the merging of two very different databases of Voter Cards and Voter Lists. Now the photo rolls, which have photos of voters printed in the voter lists, are being used across the country, substantially reducing the false voter fraud.

With regards to efficient citizen analysis, a UID Innovation Center has been setup in Mumbai to focus on deduplication, seeding, analysis and research based on UID, according to Mr Aggarwal. Due to this, UID data is increasingly used for linking with various beneficiary data to identify and remove potential bogus and duplicates, thus ensuring that benefits reach the intended beneficiaries. State Data Center has been established in Mumbai, including a fully functional Government Cloud. "This is the first instance of any State Government implementing a Government cloud," claims Mr Aggarwal. "This has significantly reduced the time taken to deploy applications and resulted in reduction in cost of deployment. We have introduced e-Tendering for all tenders above ₹10

"UID linkage with various scheme data has shown potential duplicates. Similarly, we have analyzed data of multiple departments and have seen issues in data quality including inconsistency in name, age, address etc. for which corrective action is being taken by the respective line departments. Our UID Innovation Center has played a significant role in data analysis. There is a need to link databases which in turn would ensure services reach the right person."

"Technology has helped us in providing better services in a cost effective manner. However, the focus also needs to be on process improvement, simplification, standardization etc. and not just on computerization. Before computerization, question needs to be asked if the process if needed at all and can it be eliminated instead of being computerized."

lakhs and e-Office for internal office automation and file management. This has further enhanced speed and efficiency in functioning of the State Government."

Mr Aggarwal's quick to point out that there is full political support for introducing enhanced IT practices and policies in government services, and being the Secretary IT of the State, he has been given a free hand to ideate and conceptualize new projects and initiatives. "There haven't been any significant challenges while ideating new projects.We have introduced new concepts like Virtual IT Cadre, Tech Saturday training program, online e-Governance training and certification program etc. for capacity building. We have also taken lead in setting up a Government cloud, IPV6 implementation etc," says Mr Aggarwal.

Mr Aggarwal also highlighted the fact that many of the applications developed by the State of Maharashtra are being shared with other states for adoption. "Source codes have been shared with other State Governments so that they may benefit from the application development work undertaken by us. For example, the UID linked SADM application has been appreciated by Government of India and the source code has been shared with all State Governments for their use. We have offered our Android based application for audit and survey to various other states on cloud. We have been pushing for sharing of source code with all Government entities to ensure optimal usage of taxpayers' money."

The magic of electricity... in every home in India

We all know that with great power comes great responsibility. But never has power been as wantonly abused as it is here in India. Much as we'd like to talk about the corridors of power inside government institutions, we'd like to stick to electricity (or power, as it's generally referred to here in India) for the purpose of this article. Every year, around US $30 billion worth of electricity is wasted in India – primarily due to theft and pilferage. That's about 185.6 lakh crore rupees. That's roughly 80 per cent of our country's defence spending for the year, 12 times the annual budget of the Ministry of Drinking Water and Sanitation, and six times the budget assigned for the Ministry of Health & Family Welfare.

While all this is happening in the country's power sector, 77 million households in India don't have access to a basic resource that we city slickers take for granted. This is where Yashraj Khaitan, the co-founder and CEO of Gram Power, is trying to remedy the situation and bring in accountability. Khaitan claims that the effective use of technology and innovative business models can reduce electricity losses on the National Grid by an amount which can be used to electrify the entire nation within three years.

So what is Gram Power?

"It's simplest explanations would be its analogy to cell phones, I guess," explains Yashraj. "Where everybody is privy to how they use prepaid cell phones, and they are also aware of the advantages that a prepaid cell phone brings to them. So the main advantage that GP brings is that it just allows them to essentially get a lot of control on their electricity bills. It allows them to purchase power in an easy, transparent and affordable manner. And it ends up giving, just as your cell phone gives you, connectivity on demand. Also the reliability that we end up bringing to the entire infrastructure allows the consumer to get power on demand."

This is a far cry from what we're used to on the existing grid, which we have to supply power in our homes where electricity and its consumption is difficult to understand and analyze.

There are essentially two models of electrification that Gram Power delivers: One is the smart microgrid that they set for villages that are completely off

the grid, that do not have access to any form of power or wires or distribution lines. In those areas Gram Power has to set up the entire micro grid with its own renewable power generation, distribution infrastructure, etc. and they end up supplying single phase power to every single consumer just like we receive in our homes in urban areas. In these areas, for instance, if in the future the national grid were to arrive, then since Gram Power's distributional infrastructure is already distributing the standard single-phase power, the grid basically becomes another source of power in that microgrid.

"Whenever the grid integrates with our system, we'll just sync the phase with a step down transformer, because we're supplying AC power on our line and there will also be AC power coming from the grid, so you just have to sync both the supplies," says Yashraj. "And whenever grid power is available, you have grid power on the lines, whenever grid power is not available, you have your renewable generation or you have your backup power from the batteries getting into that local micro grid. So that is making power actually reliable in these off-grid areas."

Challenges in rolling out Gram Power

Volatility in the electricity market in India is something that Gram Power had a major headache in dealing with. Yashraj explains, "Well, one challenge is of course that the market changes very quickly, so when we were in college, at that point the energy situation in India was quite different. To give you an example, when I started research on this project, at that point we were working in purely off grid areas, and we were only working on this simple smart battery that people could use to run a whole range of low-power appliances like DC fans, and some small TVs and lights and things like that.

"But by the time we completed that product, came and launched it here in India, the villages in those two-three years that we were doing research, had already been electrified. So since all that electrification does not equate to access to power, because having a wire in your house in no way means that you're actually getting power supply as well."

But this lead to a unique problem, even a desirable problem, Yashraj explains. People's needs for power started getting converted into demand. Instead of being content with having electricity at all, people wanted access to electricity for much larger appliances. Yashraj states that this was a great thing to witness, spurring Gram Power on to electrify rural India with much gusto. "I think what was challenging was to make sure that what you're developing is something that can really have a strong fundamental impact in the sector that you're working in, and it is something that is bringing in much more sustainability like a lot of our technology development is focused on how to make power distribution much more sustainable in rural India, which today is completely loss-making sector for all power companies," feels Yashraj.

Then there were business challenges, since the market for off-grid energy in India is so big, it also attracts a whole lot of shoddy suppliers and shoddy products out there, claims Yashraj. "So initially it was a big challenge for us because we burned our fingers with a lot of shoddy suppliers over equipment. And that was a major challenge – the subsidy environment. The regulatory environment in the country is so ambiguous and the subsidy environment keeps changing. Every year the government comes up with a new policy which makes private investment quite difficult. That was one of the main reasons why we started moving from the government funded, government subsidized solar micro grid to the pure smart grid module. We're moving now to a business module where it's completely unsubsidised, like we don't require subsidy from the government to make our business model and our technology sustainable."

Technology powering Gram Power powering Social Change?

Yashraj isn't coy about the pivotal role that modern technology has played in the development and deployment of the Gram Power electricity model across 17 off-the-grid rural villages in the country. Technology is definitely an enabler for them, becoming a key USP that differentiates Gram Power from the existing power grid operational in the country.

"Technology is actually helping us solve almost all the problems that we identify," says Yashraj, "like the payments system that we've developed is possible only because of the wireless technology that we're using. All the remote monitoring, all the remote two-way communication, grid monitoring, theft detection systems, it's all been made possible because of the hardware and software that we've developed. While of course there is a strong social component to the entire thing, you can't just go ahead and put technology in the village and expect that everything will suddenly change. People have to be told of the advantages of using electricity in the right manner and how technology is enabling the entire distribution to become more sustainable, but at the end of the day, it is the technology that is allowing us to put the right kind of checks and balances in the power distribution. So technology is the enabler for everything that we're doing."

And so far, in the pilot runs that Gram Power's had across villages, rural India's becoming more efficient than city slickers

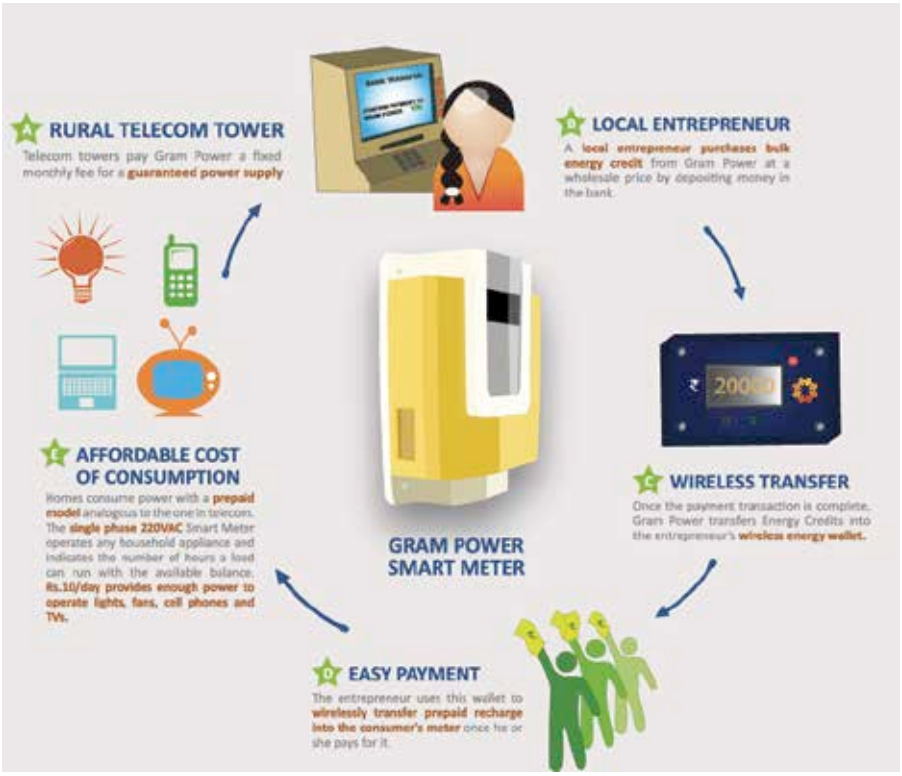
YASHRAJ KHAITAN

Yashraj Khaitan is the co-founder and CEO of Gram Power, an energy technology company out of University of California - Berkeley that is working on introducing a new paradigm of power distribution in rural India. Twenty-four year old Yashraj started working on Gram Power when he was 19 and prior to that worked on cutting edge solar cell research as a high school student. He completed his B.S. in Electrical Engineering and Computer Science from the University of California - Berkeley and then opted out of his post graduate program to work on Gram Power permanently.

"The first such smart grid village in the country is something that we're currently negotiating with the government. It is going to be implemented in 2014 to be the first smart grid village in India. Once we prove what we are trying to prove with the technology and the business model, then of course we'll be scaling up in that sector predominantly."

when it comes to power consumption. Gram Power has received a lot of feedback from consumers similar to the manner in which they've been using their cell phones, because it's the exact same model. When asked about specific examples, Yashraj had this to say, "We've had instances where just by looking at the information that we display on our energy meters, we've had people who are switching to more efficient appliances. But then they keep comparing the numbers with their neighbours, and they'd be like, 'oh, they're using this appliance or this fan which is consuming only one rupee an hour while my fan is consuming four rupees an hour.' So they end up switching to the one rupee an hour fan."

Gram Power's also had consumers who look at the information from the meter, and they plan and purchase their entire monthly expenses on power. For instance, if they have to spend ₹400 per month, they know that they'll be able to use their light bulbs for X hours, operate the fan for Y hours and watch the TV for Z hours. Then they actually end up using their appliances for only those many hours so that they fall within their budget.



This infograph neatly explains how Gram Power operates. It's pretty much like recharging one's cell phone balance, that's how easy it is to top-up your electricity quota.

"These things are just not possible with the conventional system, because the conventional system is one cryptic thing," says Yashraj. "The consumers don't understand what that meter says or what the bill says. It just comes once in two months or once in five months and you just have to pay if you want to continue receiving electricity."

And the other thing that it does is that it makes power purchase extremely affordable for consumers. It's like a monetized power just like they purchase their daily quota of wheat and rice, or their daily quota of veggies from the local vendors. So there's a lot of advantages, a lot of behavioural changes that the model has proven. Of course the social impact of just electricity reaching areas that don't have it. That's of course very visible in all our work and systems. I mean there's a direct offset of kerosene powered lights, we've installed some systems in very remote forest areas where because of the absence of electricity wild animals used to eat up the cattle of the villagers. So that's stopped, now. Life no longer ends post-sunset. People actually gather in community areas and they're able to connect with the rest of the world through television and things like that. So, yeah, those things are definitely there.

Coming back to the original problem of electricity theft as the leading cause of unprecedented losses in the power sector, Gram Power's smart grid is capable of accurately identifying and isolating a wire or distribution cable which is tampered with on their grid, therefore effectively making the power theft problem a thing of the past.

Just think of all the money saved, money earned by state and power discoms. Something that'll definitely contribute towards the prosperity and development of India.