Hello,

I'm Chirag Shetty, graduated with dual degree (B.Tech + M.Tech) in EE from IITB in 2017. Tinkerers' Lab (TL) has played a very pivotal role in my life@IITB. Here's a personal account of why I think idea of TL is so awesome.

In 2014, towards the end of my second year, a mail was sent to all the members of Students' Technical Activities Body (STAB) . STAB is a collective of 6 technical hobby clubs of IITB, like the robotics club, aeromodelling club etc. The organizing committee of STAB consisted of one Overall Coordinator (OC), a 4th/5th year student, 12 to 15 third year 'Managers' and about 40 second year coordinators, across the different clubs under STAB. I had been a coordinator of the Electronics Club for the past year and had helped organize technical workshops/events for incoming freshmen.

 The mail by Ashima Mittal, then OC of STAB, announced the inauguration of Tinkerers' Lab of IITB, a lab of the students, for the students, supposed to be a very exciting news for engineering enthusiasts. But I, like many others, didn't pay much attention and didn't even attend the inauguration. In the summer that followed I began working on a project in Neuromorphic Systems (Brain-like computing) in the EE Department. I never visited TL that summer, though I walked past it every now and then to reach the EE Department. Meanwhile some of my fellow coordinators had become Managers. They were conducting the Institute Technical Summer Projects (ITSP) in TL wherein about 250 students stay back in vacation and build a project funded by the Institute and managed by STAB.

A month into my third year, I realized that the my classmates in the STAB team, now with Rahul Prajapat as the OC, were having a fun time. So I joined the team as 'Media Manager', wherein my responsibility was to write articles related to technical activities in the campus for the institute media body and the PRO. Our STAB team would meet in TL often, to plan technical events. And I became a regular visitor to TL.

Alongside I and a batch-mate continued to work on the project started in summer and my guide suggested that we submit a proposal to a conference. The subject of the project was a worm called C.elegans. C.elegans has only 302 neurons and is a well-studied organism. It performs 'theromotaxis' i.e if you drop the worm in some region, it forages over it to sense the temperature and follows a trajectory of constant temperature. So the idea was to build a robot which works using algorithm like the one used by neurons in C.elegans and demonstrate thermotaxis. Instead of having one code in a single micro-controller, we would have multiple micro-controller in a network, each independently acting like a neuron, but having an emergent behavior of C.elegans. But since temperature can not be seen for us to validate the outputs, we couldn't demonstrate using temperature sensors. Inspired by the 'Line Follower Competition' organized by the Electronics Club, for freshmen, we decided to use light intensity sensors. But it was all on paper, and submitted.
I did not think it would be selected and didn't work much on it for the next two months.

But in December 2014, we got the invitation to present a live demonstration of the robot in the conference in May 2015 at Lisbon, Portugal! We had about 15 days to reply with acceptance. We had to build a prototype within this time. Fortunately, it was winter vacations and lab courses weren't running. So
we began working at the Wadhwani Electronics Lab (WEL) of EE department. We worked for 14-15 hours a day, but we were limited to working in the mornings and on weekdays. But in WEL we had the luxury of asking the staff to give us the components we want rather than searching it ourselves and also get some advice from them. So we would stay at WEL till the evening and then move to TL when the WEL closed. This allowed us to work continuously and prepare a very basic circuit on time in January 2015 . Now we had to refine and build three such boards, mount them on a chassis and plan for the demonstration.

But then the Spring semester started and stakes were higher now because we had accepted the invitation and our guide had arranged for funds for travel, tickets were booked etc. We had classes in the morning and WEL was full in the afternoon due to labs. This is when TL became our home. The two of us stayed at TL most of the time after classes. The beds in TL were very useful! By now we knew in and out of TL. We knew what components were there and where they were kept. We could build circuits or code or build the chassis at will, because all the stuff required was within the room. The two of us could share the work but be within a shouts length to get instant feedbacks, so that finally integrating the parts becomes easier. Owing to this, our robot worked exactly as expected the first time we put it all together. But it is not just the easy availability of equipments and 24X7 access that makes TL amazing. It is the chaos in there, as against the strict discipline in a well-maintained lab like WEL. Here's an example: After having made the robot, we had to devise a way to display the output of each neuron micro-controller for an observer to verify. Putting wires to the bot would have completely spoiled the aesthetics of the demonstration. We considered wireless solution like bluetooth etc. For long we were searching for an easier solution, when we came across some wireless ASK transmitter-receiver pairs in TL, used by the robotics club in a freshmen remote control car competition called 'XLR8'. It is still the simplest solution I could think of for the purpose. There were many other instances where we tried tires of different kind spread across the lab, body of bots someone had left behind etc. But there is something more. There were many other students across departments and year of study visiting the lab for their own work. And this is one of the most important contributions of TL – bringing together different kinds of people, enabling exchange of ideas which otherwise wouldn't have happened. In our case, it was the batteries. We were using the bulky lead acid battery for our bot. One day a member of the aeromodelling club was working with quadcopter in TL. Lithium-ion batteries are used in quadcopters, and after this encounter we decided using lithium-ion was a much better alternative. But TL didn't have a Li-ion battery of the size which fits inside our bot. But the guy we had met at TL lent us his on of his own and we ended up using it even in the final demonstration. All in all, by end of February we were ready with three working robots. TL came to our rescue one more time when we were about to pack for Portugal in May. We realized then that we will need Oscilloscope and other equipments to quickly debug the bots incase something

goes wrong there. But at the time, my team-mate was interning in Bangalore and I in Mumbai. I could be in institute only on weekends and was not able to get equipments from EE dept. With the permission of the student manager of TL, we carried the TL equipments with us. On 25th May 2015, we proudly demonstrated our project to a crowd of electrical engineers from around the globe. We were relishing the appreciation as the bots, with 'Made in TL' sticker on them, moved around. Personally, attending the conference, my first ever, was an enriching experience. Exposure to work by engineers presenting at the conference inspired me. And on returning I decided to not accept a job offer from the Bank I interned at, instead converted from B.Tech to Dual degree (B.Tech + M.Tech) program to study more of engineering, but with greeter conviction than the first three years at IITB.

Packing TL equipments for the Conference

In January that year, just as we had built the first version of our project, I approached Rahul (then STAB OC) and expressed interest in standing for the post of STAB OC in the upcoming Institute General Elections. Working in TL fulfilled the conception I had while preparing for JEE, about how engineering at the Indian Institute of Technology ought be. Inspired, I believed that I was uniquely positioned to lead TL. My own experience had taught me that it isn't enough to have a room full of equipments and a campus full of enthusiasts. A catalyst is necessary for magic to happen. TL had to be advertised well, both among students and faculty. More and more reasons had to be created for more and more people to visit TL. I became the STAB OC in my fourth year, and thus began another wonderful year at IITB. Over the next year, along with Umang Chhaparia (the TL manager) and other club managers, we tried many interesting things as a team.

TL enables realizing an idea extremely simple. In my first year (2012), before TL was built I had been a part of 6 member team participating in the Robowars Competition in Techfest. We built the bot using IITB's workshop and several trips to lamington road. But it was only possible due to a kind person from the workshop who gave us access to the tools and because it was vacations. TL eliminates any such preconditions to building things. For instance, early last year, Kuldeep, a
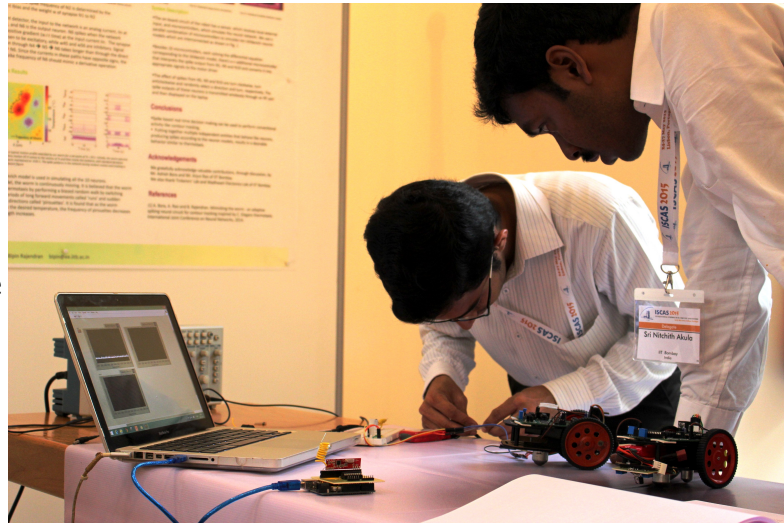
Setting up for the final demo

friend of mine had just returned from his home in Rajasthan. He had an observation. In his village the water pump to the fields had to be switched on and switched off at specific times of the day for some reasons. The Sarpanch of his village had to hire a person daily just to walk a few kilometers to the pump station, switch it on, sit there for three hours, switch it off and return. There obviously was an automated solution. We went to TL, spent the night and put together a device to control the pump station using the Sarpanch's phone. We used the kits lying in TL from Dandekar Sirs Arduino workshop. Kuldeep took it to his village, and came back with demands for more such devices!

From not being amused when TL was setup to becoming an ardent fan of the idea I learnt a lot. During my tenure as the STAB OC, several parameters were used to judge the success of TL, by students, by the IITB administration, by the alumni. Somehow, the number of startups working in TL, or significant practical ideas that have come out of TL, the finishing and quality of the projects were some regular metrics of success. More like how you would judge a startup incubator. In my project, we were not building a product, we weren't trying to be entrepreneurs, we were not even trying to solve a pressing problem. But if I were to do any of these someday, the skills and inspiration from having done the project will

Final Demo

be key. It is true that most of the project done at TL are hobby projects, spontaneous in nature, not goal directed and often unfinished. But that precisely is what makes TL so unique, so amazing. For every 1000 naive attempts, 100 may attempt turning it into a product, 1 may sustain and hit a jackpot. TL allows for those naive attempts in the first place by making it easier to build, by causing serendipitous events. By inspiring.

As a result of the research activities and my involvement with STAB and TL, I won the Dr. Shankar Dayal Sharma Gold Medal at the 55th Convocation (awarded to 1 graduating student for the best overall, both academic and non-academic activities throughout the stay in institute). Incidentally, Ashima Mittal (STAB OC 2013) had won it three years ago. Would all the above have happened without TL. I'm convinced 'No'. I was lucky to have the Tinkerers' Lab.
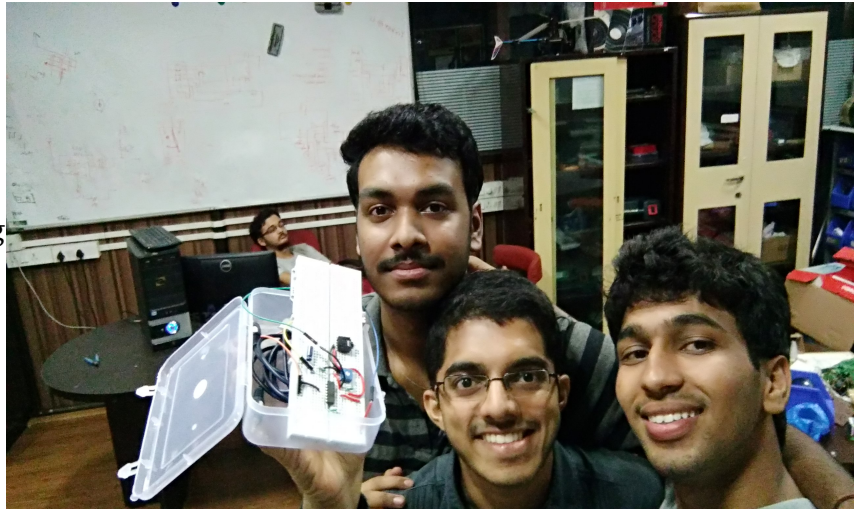
The night we solved a Sarpanch's Problem in TL

Receiving the Medal from Chief Guest Manohar Parikkar

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