

---

## Technology Robotix Society

Technology Students' Gymkhana  
IIT Kharagpur

# MakerSpace

Academic Session 2016-17

## NECESSITY

IIT Kharagpur is one of the most renowned technical institutions in the nation and attracts national as well as international attention. It has been serving students with high level academic guidance and excellence for over 60 years now. Lately it has started becoming renowned all over the world for the excellent undergraduate research opportunities it offers in a lot of fields. IIT Kharagpur has also taken quite a few initiatives in the field of robotics in the past few years, all of which have received great attention worldwide. Still, one very big problem exists in these organisations as they stand today. The participation in these projects is quite limited and they are very selective. Also they require a high level of commitment and are confined to certain competition specific areas of robotics only. But the field of robotics is very vast and the students here haven't even touched the tip of the iceberg yet. Over the past years Technology Robotix Society has seen a lot of students come up to them with an idea of a robotic implementation that could potentially be very useful to society as a whole, but Technology Robotics Society had to turn down many interested and dedicated students, simply due to the lack of infrastructure, funding and insufficient technical expertise. Over the years, as Technology Robotics Society has grown, the members started becoming more and more inept with the technical details and Technology Robotics Society saw the opening to solve this recurring issue by coming up with a new initiative. Hence the need for a MakerSpace was observed.

## VISION

A MakerSpace is a community-operated workspace where people with common interests, often in computers, machining, technology and science can meet, socialize and collaborate. TRS aims to undertake small scale projects under this wing to make an everlasting impact on the IIT Kharagpur robotics scenario. We aim to make one such Open-Source, Free for All, Open to all lab, where everyone is invited to make their dreams come true. Technology Robotix Society realizes that this is a herculean task for it to undertake without any external help, hence

---

is seeking the help of Technology Students' Gymkhana. Technology has committed resources as well as expertise to the best of it's capability, still it's only being able to scratch the surface.

## OBJECTIVE

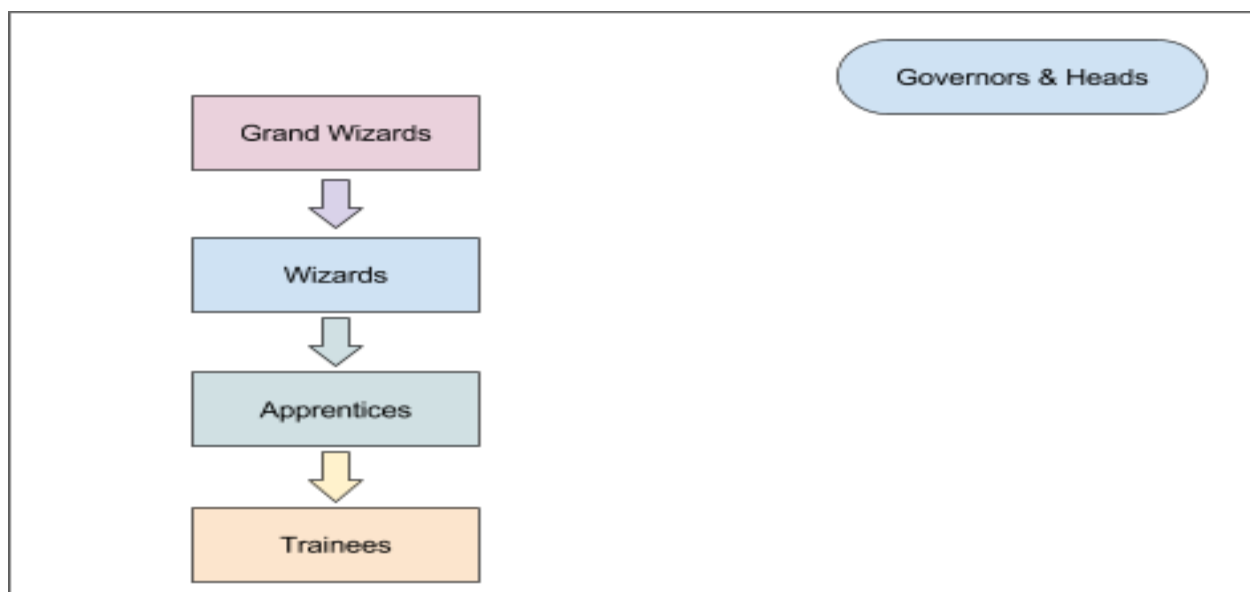
The Objective of this initiative is pretty simple, to look for simple problems, which can be solved using simple technological implementations, then deliberate on the feasibility of the implementations and the societal impact of such an implementation. If it meets the aforementioned parameters, then undertaking the project in a team of appropriate size in a time frame of not more than a semester and then make a proof of concept prototype for the same. Additionally the prime agenda of this organisation is to make hi tech resources, equipment and technical expertise available to the masses residing in the campus and enrolled in any discipline and belonging to any year.

## ORGANIZATIONAL STRUCTURE

### Governance & Maintenance

The initiative, like all the other TRS initiatives will be governed by the Governors of Technology Robotix Society. They will oversee all the executive decisions taken for the initiative. They will also be the formal face of the MakerSpace lab. The heads of the society (Third Year Undergraduate Students) will be responsible for overseeing the maintenance of the components and fixtures in the lab.

### Project Heads, Guidance and Functional Hierarchy



---

One Head or Sub-Head of Technology Robotix Society will be involved in each and every project in a functional role. The heads of the MakerSpace will be two of the Technology Robotix Society's heads.(Third Year Undergraduates). Their decision on any project or any matter is final and binding, unless advised otherwise by the Governors. Also the membership in MakerSpace will have a Four Tier Structure.

- Every Student who registers for the MakerSpace will either be given a role of Apprentice or Trainee, based on previous track record. As they undertake projects in the MakerSpace they'll advance in the ranks.
- The promotion from Apprentice to Wizard will be done, on the completion of two projects and successful usage/debugging of all fixtures in the lab. Any prior incident of harming any equipment will be considered as a negative and may lead to non promotion.
- The promotion from Wizard to Grand Wizard will be at the discretion of the Heads and the Governors of the MakerSpace. Grand Wizards will be technologically very resourceful and very devoted people. A proposal to promote a member to the role of Grand Wizard will be submitted to the Technology Students' Gymkhana.

Also, we would like to have certification for the posts of Head, Governor and Grand Wizard. This would encourage participation and membership even more, which is in sync with the MakerSpace goal to be a lab run by students, for the students.

---

## PROJECTS, UNDERTAKINGS, APPLICATION AND RULES

There will be a portal made on the public forum(robotix.in/makerspace) to handle all the membership and project proposal requests, details of which will be covered in the next section.

Following will be the Ground Rules/Requirements to undertake a project in MakerSpace:

- The Group Members (if any) should be registered on the MakerSpace portal, and be valid students of IIT Kharagpur
- A detailed proposal for the project must be made and submitted on the portal, and the applicant must wait for 2-5 days before contacting Technology Robotix Society about the validation of said Application. Also The user gives Technology Robotix Society the rights to use his/her biometric data for validation.
- The Proposal will be judged on the bases of
  - Feasibility
  - Time Frame
  - Hardware Requirements
  - Long Term Impact

By the Heads & Grand Wizards of the MakerSpace.

- If a proposal passes, then the group will have to give a small detailed timeline of how they'll implement this project.
- All the codes, 3D files and circuit designs that they are going to be used in the project are to be made public and will be uploaded to the respective project GitHub repository.
- The team will then be assigned a Grand Wizard to guide them through the project.
- TRS & MakerSpace governance can forfeit any project, if there is any inexplicable lag in the timeline or for misuse of equipment.
- TRS & MakerSpace assume limited responsibility of any consumables pertaining to a project. If needed, the team would need to arrange a certain consumable on their own.
- The maximum time-frame of the project will be one semester.
- At any point of time not more than four (4) projects will be taken up by the MakerSpace.

TRS is working on getting certification for the projects from IEEE, and is in touch with the student members of the same.

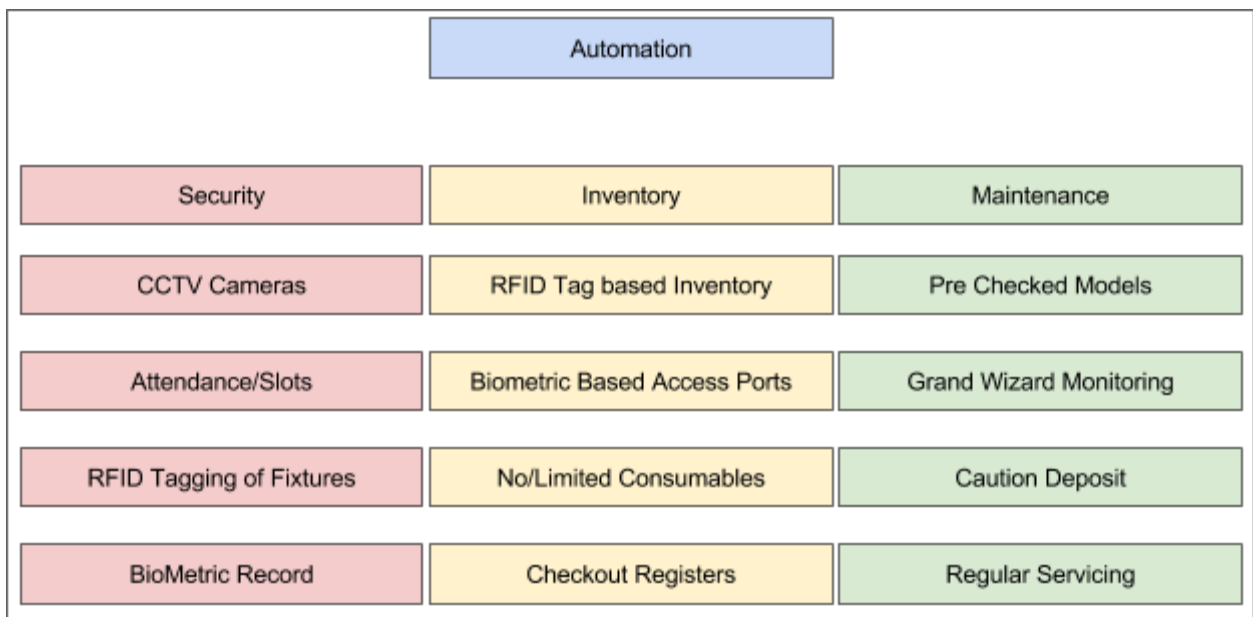
---

The Application portal would open for a limited time period only, at the start of each semester, and also during summers. During Summers, there is a scope of having more than four projects at a single point of time.

The timings of the lab will be flexible, and will be on the convenience of the caretakers.

## MAKERSPACE LOGISTICS AND PORTAL

One of the biggest challenges of such a lab is Inventory management (Logistics) and Manning the lab whenever it is open. Since this is a student run initiative, the latter is very impossible. Hence Technology Robotix Society has made a schematic to automate this whole process. For this automation to take place there are couple of things that need to be arranged.



Above Stated is the model we wish to enforce for the Lab. Steps that have to be taken regarding the same are:

- BioMetric Info needs to be gathered and BioMetric equipment needs to be procured.
- RFID based tags need to be procured and applied on the fixtures.
- A static I.P. CCTV camera needs to be procured, with a server storage of upto 7 days.
- Also a biometric based lock needs to be procured.

---

We wish to exercise this automation by making a web portal on django. The portal will have the following features:

- For Users
  - Login/Sign Up
  - Dashboard
    - Book an Appointment to use a fixture
    - Submit a proposal
    - Check Appointments
    - Change Credentials
    - Ask for Help
    - Submit Maintenance Request
    - Schedule Time Table
  - Profile
    - Add BioMetric Info
    - Add Personal Info
    - Request Promotion
- For Admins
  - Login/Sign Up
  - Dashboard
    - Appointments Request Approval
    - Schedule
    - Failed Appointments
    - Check Proposals
    - “Ask for Help”
    - Inventory
    - Maintenance Status Clear/Set
    - Change Access Rights
    - Add/ Remove Members

We'll discuss each feature in a little bit of detail.

---

## **APPOINTMENTS**

For booking an Appointment, a user needs to login to the portal and then apply for the same. In this step he will be asked the fixture of his choice and time slot when, he/she would like to use it. Then, an authentication (3D Model, Circuit Model, Arduino Sketch) would have to be uploaded. Then, this request goes to the admin, and the admins receive an auto generated mail for approving it. Then an admin would review the appointment, assign a mentor and either accept the booking or refuse, giving proper reasons. A status report of the same is sent to the user.. He/she can take required steps later to make the booking.

## **PROPOSALS**

When the proposal link is on, there'll be a ftp connection to accept proposal docs, and then they'll be forwarded to the admins for further review, who can accept or decline it. Reasons for declining need to be specified clearly.

## **TIMELINE**

This will be a check progress pane, where the mentor can update the status of the project. This is read only for the user.

## **INVENTORY**

All the RFID based inventory at the end of the week will be stored and compared here. This is done to ensure nothing has been taken out of the lab.

## **MAINTENANCE**

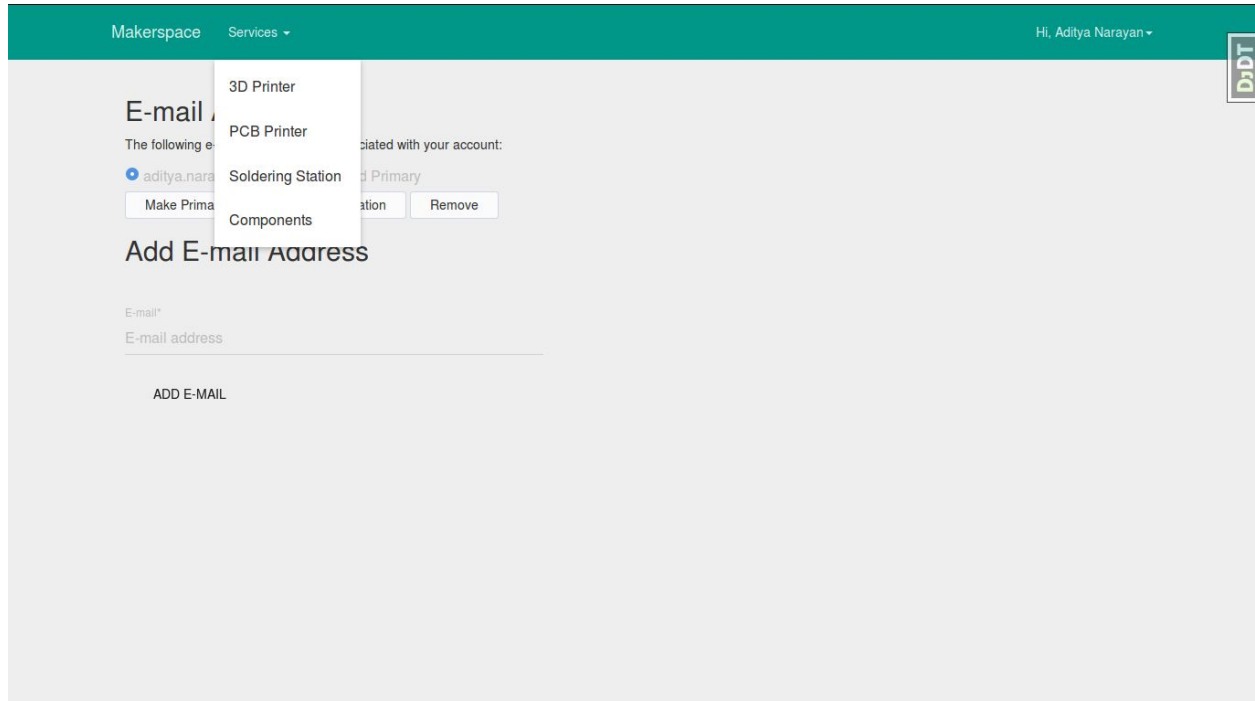
Works similar to the Appointment feature, but there isn't any reject feature. Upon receiving request one must perform proper maintenance. Then he/she can clear the logs for the same. It is more of an admin feature.

## **ACCESS CONTROL**

---

Will be implemented using standard libraries to ensure minimal misuse of the equipments which are present in the MakerSpace. This will be our first and most important pillar for security. Hence this needs to be done via a standard library.

This portal will be made using Django for the Back End and Bootstrap for the front end. A team of six people from Technology Robotix Society are overseeing this, and here are some screenshots of a beta version.



Dashboard



Makerspace Sign Up Sign In

**DDT**

## Sign In

Institute Roll Number\*

Password\*

Remember Me

[Forgot Password?](#)

### Sign In

Makerspace Sign Up Sign In

**DDT**

## Sign Up

Already have an account? Then please [sign in](#).

Institute Roll Number\*

Name\*

E-Mail address\*

Mobile Number\*

Password\*

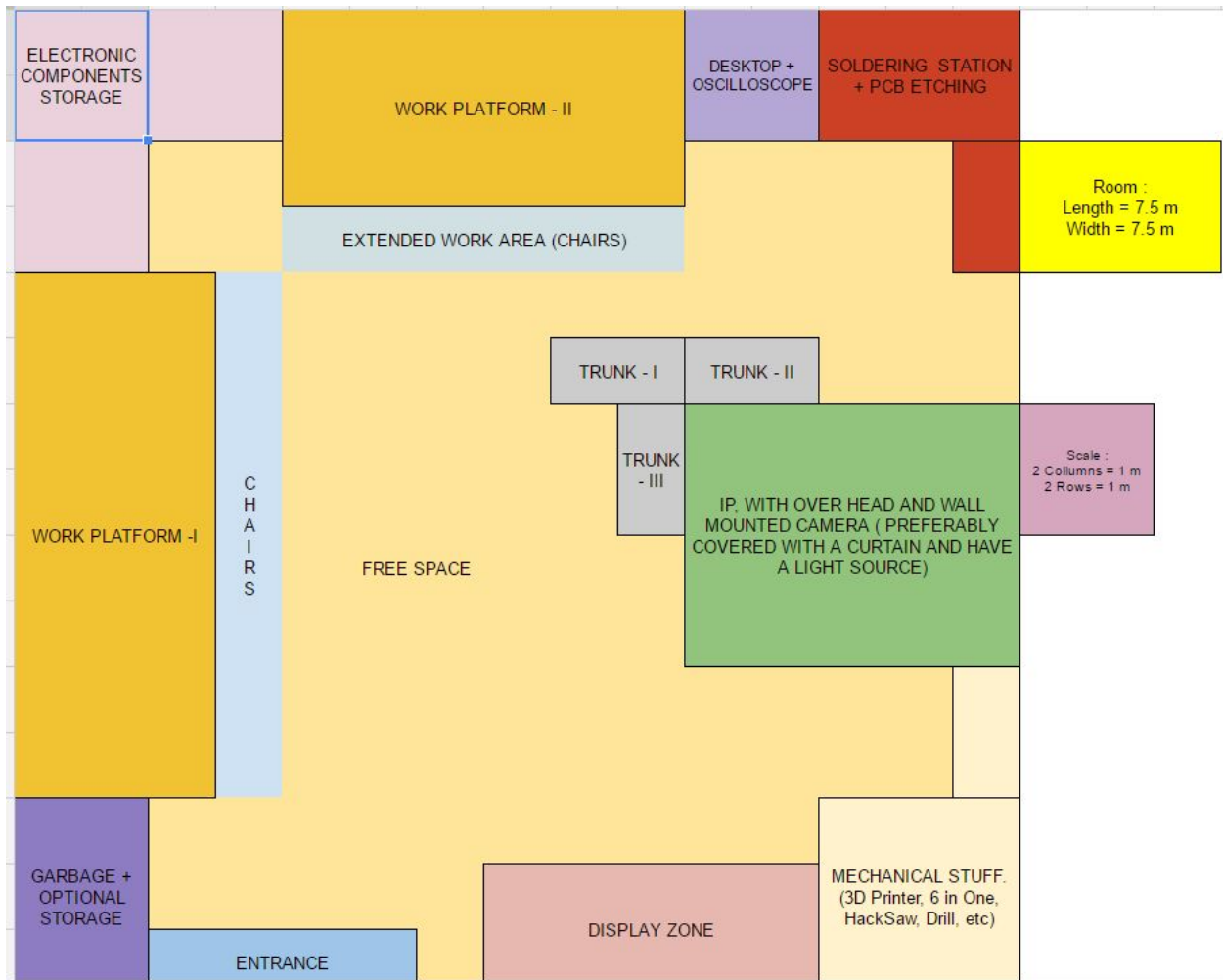
### Sign Up

---

**Note : For the sake of Security and limited resources, TRS has decided to limit the liability to keep consumables in the lab, and they shall be handed out only in the case of emergencies and at the discretion of either**

- A. The Governor/s**
- B. Head/s**
- C. Grand Wizard/s**

**LAYOUT**



## EQUIPMENTS

---

## FIXTURES

### Already Present

| S.No. | Component               | Quantity |
|-------|-------------------------|----------|
| 1.    | Roboduino               | 2        |
| 2.    | Raspberry Pi Kit        | 1        |
| 3.    | Bosch Tool Kit          | 1        |
| 7.    | Soldering Station       | 1        |
| 8.    | RPS                     | 2        |
| 9.    | FabX                    | 1        |
| 10.   | Dremel 4000 Toolkit     | 1        |
| 17.   | RasPi Desktop           | 1        |
| 18.   | 6 in 1 Machining Center | 1        |
| 19.   | Spikes                  | 3        |

### Desired(Short Term)

| S.No.           | Component                       | Quantity | Price (Rs.)  |
|-----------------|---------------------------------|----------|--------------|
| 1.              | Sintron 3D Printer MK8 Extruder | 1        | 8000         |
| 2.              | Universal Battery Charger       | 1        | 6000         |
| 4.              | Digital Oscilloscope            | 1        | 8000         |
| 5.              | White Board Big                 | 3        | 1600         |
| 6.              | Intel NUC Kit                   | 1        | 27300        |
| 7.              | Logitech C920 HD Pro Webcam     | 2        | 16400        |
| 8.              | Peg Board                       | 1        | 400          |
| 9.              | Wireless Controllers Xbox       | 2        | 6800         |
| <b>Subtotal</b> |                                 |          | <b>83000</b> |

## CONSUMABLES

### Already Present

| Sr No. | Component                  | Quantity |
|--------|----------------------------|----------|
| 1      | RF modules                 | 2        |
| 2      | Zigbee                     | 4        |
| 3      | Logic converter            | 4        |
| 4      | Bluetooth Module           | 2        |
| 5      | Servo Motor                | 4        |
| 6      | Iron                       | 1        |
| 7      | ATmega 328 with bootloader | 2        |
| 8      | AVR Programmer             | 1        |
| 9      | Launch Pads                | 2        |
| 10     | PLA material               | 3 kg     |
| 11     | Single Sided Copper Clad   | 20       |
| 12     | Double Sided Copper Clad   | 20       |
| 13     | FeCl3 for PCB etching      | 1 kg     |
| 14     | Jumpers                    | 100      |

#### Desired For Refill

| Sr No. | Component                  | Quantity         | Cost  |
|--------|----------------------------|------------------|-------|
| 1      | RF modules                 | 2                | 1200  |
| 2      | Zigbee                     | 4                | 5600  |
| 3      | Logic converter            | 2                | 400   |
| 4      | ABS Material               | 2                | 2800  |
| 5      | Servo Motor                | 4                | 2000  |
| 6      | Wood Assrtd.               | 5 kg             | 1000  |
| 7      | ATmega 328 with bootloader | 2                | 1000  |
| 8      | AVR Programmer             | 5                | 1500  |
| 9      | Launch Pads                | 2                | 0     |
| 10     | PLA material               | 3 kg             | 3750  |
| 11     | Single Sided Copper Clad   | 20               | 560   |
| 12     | Double Sided Copper Clad   | 20               | 800   |
| 13     | FeCl3 for PCB etching      | 1 kg             | 3500  |
| 14     | Jumpers                    | 200              | 1200  |
|        |                            | <b>Sub Total</b> | 25310 |

## INITIATIVES AND OUTREACH

### THINK A BOT CAMPAIGN

---

To promote MakerSpace amongst the incoming first years, a campaign was launched, whose aim was to identify a problem, pertaining to KGP life and then propose a robotic implementation that could solve the same. The winner would then gain a chance to work in the MakerSpace and make his/her dream come true. The campaign received over 220 entries from the first years. The top 5 entries were as follows. Here is a small teaser of the [MakerSpace](#).

## #think\_a\_bot

*“ A robot which can be installed in cars such that it will scan eyes and heartbeats of driver and check whether driver is feeling sleepy. If so it will automatically shift to auto-pilot and ensure that the car stops without collision. ”*  
*This will reduce the road accidents.*

-Pranav Naik



**ROBOTIX**  
TECHNOLOGY ROBOTIX SOCIETY

## #think\_a\_bot

“ The traffic created by cycles during peak lecture hours is a matter of concern. Not each area is looked upon by the sis security. So I look further for a robot which would examine the traffic discipline and also keep statistical data of traffic. The data can help us to manage the traffic and find us the safest and fastest route to our destination. ”



- Rohit Ner

**ROBOTIX**  
TECHNOLOGY ROBOTIX SOCIETY

## #think\_a\_bot

“ I would like to develop a bot that would guide physically disabled and senior citizens to their respective destinations and enable them to cross roads. ”



- Rakesh Bal

**ROBOTIX**  
TECHNOLOGY ROBOTIX SOCIETY

## #think\_a\_bot

“

*I would like to create a robot that can keep track of all the groceries in our home and can restock the ones which are about to be completed. An added feature would be to analyse the needs and interests of the members of the house and suggest new or alternate products in the market based on the requirement.*

”

- Sai Saketh Aluru



**ROBOTIX**  
TECHNOLOGY ROBOTIX SOCIETY

## #think\_a\_bot

“

*I want a robotic cooler or air conditioner which can sense heat and turns on automatically and adjust itself accordingly so that the user do not have to move.*

”

- Tanmay Yadav



**ROBOTIX**  
TECHNOLOGY ROBOTIX SOCIETY



---

## **AUTONOMOUS CAMPUS BOT**

The ultimate goal of this project is to have an autonomous outdoor robot that can tour the campus on it's own without any human intervention. It should also be able to navigate safely avoiding people and other obstacles. A real life application of this robot would be to deliver objects autonomously from one place to another.

A Detailed proposal of the same is attached here with.