

Technology aided and Practical Oriented Innovative Trends in Engineering Education

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Abstract: The mission of Electrical Engineering department of Atharva College of Engineering (ACE) is to create a new generation of engineers right from the first batch with a spirit of innovation and creativity. The Institute cherishes a dream of becoming a leading centre in Engineering and Technology with an international outlook in the years to come. As a first step, a sincere effort has been started to remove the considerable gap between education and employability of the much-in-demand graduate pool. For excellent placement opportunities, special sessions have been arranged to provide training to students in order to inculcate problem solving approach in them for clearing entrance exams, mock GD for placement in companies with an emphasis on various programming languages. This paper innumerate several steps taken in Electrical department of ACE to improve the skill set of graduates, emphasize soft skills, refocus the assessments, teaching-learning process and curriculum away from remembering but including

analysis, research and innovation as per the Blooms taxonomy. The interaction with various employers has been carried out by conducting Industry Institute Interaction (III) to understand the present demand of skills e.g. basic knowledge of the subjects, software-C, C++, Java programming, Autocad, Matlab coding and simulation etc. required in the corporate sector.

Keywords : Innovative trends, Moodle, Wiksate, IEDC, Ember E-cell, E-yantra

1. Introduction

Engineering has always been a profession that demanded excellence. Right from the era of technological development till date, it has emerged in various forms, helping and guiding a sustainable and comfortable life for human beings. Today life cannot be imagined without electricity. It is present in your life from the time you rise from your bed, helping you to carry out all the important tasks in few seconds, heading towards your workplace, creating an ease in everything you do and planning to do. Understanding all these objectives, we, the Electrical Department of ACE studied, did research and took necessary steps for implementing each and every possible aspect to lead us to a place where electrical engineering is supposed to be. With our efforts, we are trying to develop strategies such as Technology aided teaching, emphasis on Practical training, Application oriented

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initiatives, Training and Placement classes etc. and train students to face the hurdles that may come in their path in present as well as in future while working in national and international firms. Thus we provide them a research environment that helps them to think and boost their technological outlook towards life.

2. Technology Aided Teaching

For the students, merely understanding theory is not sufficient but understanding the practical aspects of the subject is of greater importance. Hence, our department keeps on modifying the teaching schemes.

A. Innovation in teaching

This includes imparting knowledge of the latest developments related to the subject, making the lecture interactive, question and answer session after completion of each topic, motivating students for their doubts getting cleared, inducing them to think about the applications of that particular topic and so on.

B. Counseling Students

Faculties cannot pay attention on every individual student in lectures. For this reason, our department made provisions in timetable for each category such as practical, mentoring, counseling etc. so that small batches can approach teacher for clearing their problems faced in any subject. In this way each and every student gets a chance to speak freely and openly about the difficulties he/she is facing.

C. Writing of assignments in lab periods

Assignments writing were always considered to be written at home, which has always rendered to be ineffective as the students just used to copy from text books or from colleague's assignment. But this paper filling practice has been removed from our department completely. Assignment questions are given to students in advance, students are supposed to study the answers at home and write it as a test in the first 30 minutes of practical sessions. Thus, now learning becomes a mini preparation for the final exam.

D. Presentation (ppts) by students

Distributing different topics to different groups of students to make ppts after the topic is taught in the class was also tried. The output of this is that the

students who make the ppt themselves study a particular topic more seriously, try to include what their fellow friends expect from the teacher and teacher corrects it further to ensure perfectness. Thus another way is being adopted to make teaching more fruitful for the students.

3. Teaching Aids

VCLASS, NPTEL, MOODLE, and WEBINARS- make teaching further interesting when such facilities are available. Atharva Virtual Classroom is capable of transmitting and receiving interactive high-definition video classes through Polycam and skype. This room is also connected with campus LAN and Wi-Fi facility. Sometimes, video quality is not good for interaction between faculty giving virtual lecture and students. To avoid this, we ask faculty to upload their lecture in advance and audio mode is kept on. For Q & A session, both audio and video mode is kept on for interaction and doubt solving.

In Virtual class period, students get an opportunity to listen to an expert's views about the subject from higher institutes like IITs and NITS. They also get an opportunity to interact with them and clear their doubts. Examples include Control system modeling: State space approach- Dr. Prasiddh Trivedi, IIT Bombay, Cyclo and Matrix converters- Mr. Nimish Soni, Bosch engineering & Business solutions limited etc.

In case of NPTEL video lectures, the concerned subject teacher can even explain in between the topic in a simpler language. E.g. includes Multi-level inverter - IISc Bangalore, Control engineering - IIT

Bombay etc. For webinars, updates are uploaded on moodle every week and individual faculty as per his/her subject and research interest, attends webinar with all students of his/her class.

Moodle software has been adopted by college for the students. All the necessary assignments, e-books, syllabus, university question papers, notes, ppts, lab manuals etc. are posted on it.

Wiksate is an improved version of Moodle in which students can give online tests and provide feedback, join groups, post their CVs and the recruiter can view their profiles. The students have direct access to it enabling them to study at their own convenience at home.

4. Practical Training

A. Simulation of Experiments

Students are made to simulate the experiments using softwares such as Matlab, Scilab, P-spice etc to perform actual experiment with deeper understanding. This enabled the students to understand designing circuits, selection of component ratings, simulation, plot results and finally implementing hardware connection. They can practice more by modifying various parameters and understand the concept more thoroughly.

B. Reduction of batches

The department of Electrical Engineering has arranged small practical batches so as to reduce the number of students performing one practical.

Total number of students=80

Number of batches made =4

Students per Experiment =4(maximum)

C. Mini projects for each subject

The department augments conceptual learning by introducing practice of mini projects. There is no use of theory if they don't know the actual practical use. For this purpose students are divided in different groups and are guided to make small working mini projects e.g. Characteristics of devices, Charging and Discharging of Capacitor, use of Nano-Technology, Innovative Smart Cards, Electromagnetism etc. under the supervision of respective subject teachers. The students are asked to first do literature survey, prepare block diagram, design circuit, do simulation, plot graphs, verify results, report preparation, hardware implementation and finally display and compete in Techfests and EESA. Obviously this creates a hectic schedule for them, but this is what engineering is all about, "HARDWORK". Efforts are being taken to make it more enjoyable.

D. MATLAB Training

Students from second year and onwards are given Matlab training. Whatever they learn from textbooks, they can experiment by themselves e.g. design and simulation of controlled rectifiers, buck-boost converters, inverters, HVDC link, hybrid systems etc.

E. Virtual Lab

With this facility students read instructions, list of experiments available and theory, download pre-requisite software, understand animated demonstrations and perform various experiments. Examples include V-I characteristics of MOSFET-IIT Guwahati, Diode as half wave rectifier-IIT Kharagpur, Study hardware and software used in PLC, Implementing logic gates in PLC-IIT Bombay etc. in their Virtual Lab period.

5. Application Oriented Initiatives

A. EESA activities

Besides designed curriculum, students are also encouraged to participate in various extra-curricular activities.

We call it as Electrical Engineering Student's Association (EESA).

The details of various activities conducted this year by this association are as follows --

- 1) Poster Presentation Competition: Students are made to show their art through posters based on engineering topics e.g. Electric power supply position in India, Renewable sources and their implementation, Details of power plants in India etc. Through this activity, they learned newer technologies and got updated of current power situation in India which is essential in the current scenario and in upcoming future.
- 2) Expert lecture: A session by "TIME" institute has been arranged for the students where they were trained for group discussion and personal interview.
- 3) Workshop on AutoCAD Training dated 11/09/2015: Students were given training in AutoCAD where they started with basics, drawing shapes (triangle, circle, and polygons), scaling, mirror image, chamfering, and fillers in 2D and then transforming 2D drawings into 3D. It also included 3D Isometric drawings.
- 4) Electrical Wiring & Maintenance Workshop: Students took initiative to guide their classmates in having hands on practice on house wiring so that they can handle minor repairs.



Figure1: Series and Parallel connection: Demonstrating effects of differing wiring schemes on bulb intensity

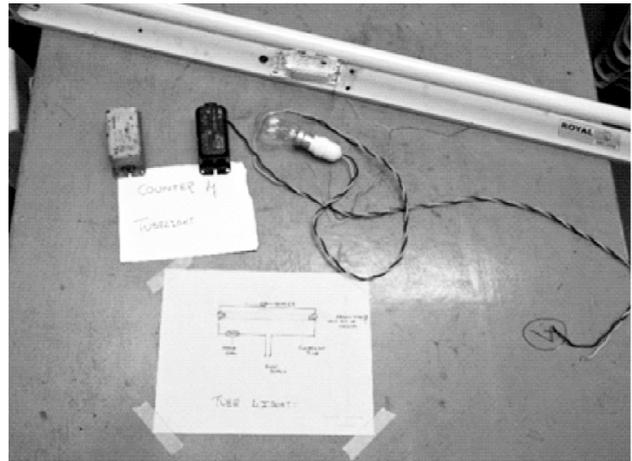


Figure 4: Demonstrates construction,function of Choke and Starter and causes of faults in tube light.

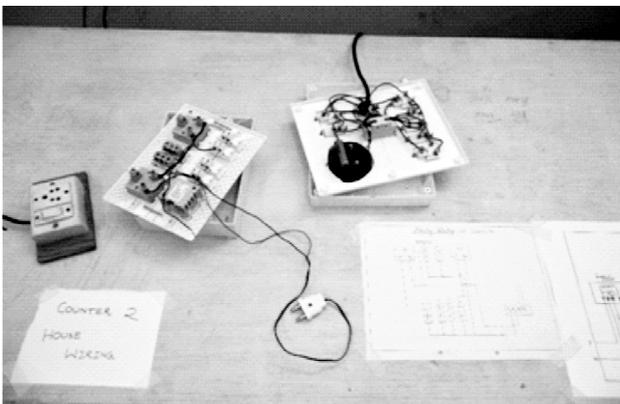


Figure2: Demonstrates House wiring, Residential gadgets and Safety measures.

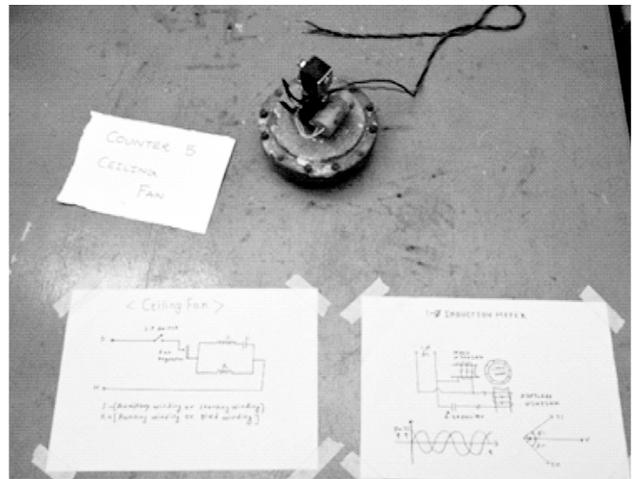


Figure5: Demonstrates Ceiling Fan details: Construction and Working and Fan Regulator, Fault detection and measures.



Figure3: Demonstrates construction of Electric Ironconsisting of bimetallic strip and Thermostat.

5) Mini Projects Competition and Technical quiz: This initiative created a fully competitive spirit among the students. Now they compete on technical aspects by showing their self-made working projects to the 'external judges'. They are made to participate in technical quiz which adds great amount of knowledge to their engineering career.

6) Latex Workshop: Latex is being used for writing technical reports. The students were successfully exposed to Latex workshop. They successfully completed its application and understood the significance of technical report writing.

B. Ember E-cell (Entrepreneurship cell of Atharva)

This cell was started since 2007, founded by Dr. Anupama Deshpande and supported by NEN, National Entrepreneurship Network. Electrical students are actively participating in Ember activities.

C. Workshop Committee

The Electrical engineering department recently organized one day workshop on "Renewable Technologies for Electricity Generation". Several prominent speakers were invited. Topics covered:

- 1) Wind Turbines: types, construction, working, Failures and applications
- 2) Load calculation and Cost estimation: Entails 1 MW grid connected solar PV power plant, load requirement, space constraints and payback period calculation.
- 3) Concentrating solar power: Solar energy solutions.

D. IEDC (Innovation and Entrepreneurship Development Cell) Projects

Founded by Dr. Anupama Deshpande. Every year 5 projects are selected and funded by DST for 5 years.

Annually, the IEDC meeting is held by the Advisory Board of Members. The main aim of IEDC is to motivate students to develop innovative products, community based projects for society welfare and become an entrepreneur.

Results of IEDC initiatives:

Got a funding of Rs. 13.3 lakh from DST (Department of Science & Technology) in the year 2012-2013, 8 lakh rupees in the year 2014-2015. Following projects of Electrical department were selected:

Grid Inverter and Smart Floor Cleaner

Following are the selected IEDC projects of EE department for the academic year 2015-2016 for which funding is yet to be received:

Automated Farming system with pilot irrigator
Solar based hybrid refrigeration system

Fire Extinguisher using sound waves

E. E-Yantra Robotics

It was initiated by Dr. Deshpande with the help of IIT Bombay in 2012, a program sponsored by MHRD. Atharva was among the first 15 colleges to get approval. Many competitions were organized since 2013 till 2015 on how to run robots on given track.

Students learn about robotics, micro-controller programming and interfacing to control the e-yantraRobo for various tasks as how it actually works and its ultimate output (competing in Robo wars in IIT Bombay).

F. Training and Placement (T & P) Classes

This is the most beneficial step taken by our department which is being much appreciated by the students. With the responsibility of completing the academic portion, our teachers are making sure that the students are ready for their campus interviews also.

As four batches were made for practical sessions, one batch was given T & P training for 2 hours once every week. The training included subject basics, Qualitative and Quantitative aptitude, Logical Reasoning, General Knowledge, Maths (Calculus, Probability, Permutation and Combination etc.). Efforts are taken to give them practice of Online Aptitude tests. The aim is to upload 1000 aptitude papers on Moodle and students to appear for the online test series. Students now realize the importance of proper preparation for Campus Interviews.

Extra T & P lectures on C, C++, Java, GD and PI etc. have been conducted. Students also attended IIT Bombay spoken tutorial and gave online C test in which the students who scored above 40% in the 45 Minutes test consisting of objective questions got an E-Certificate from IIT-B on completion of the test.

The Complete Info is as follows:

No. Of Students Appeared for Test: 63

No. Of Students Passing the Test: 37

Result of T & P Activities in our college: Following top 5 companies agreed to come for placements in

Table I: Database of Number of Students Appeared For Online Tests and Their Results

Range of score	No. of students
70% and more	5
51% to 69%	11
40% to 50%	21
30% to 40%	11
Below 30%	5

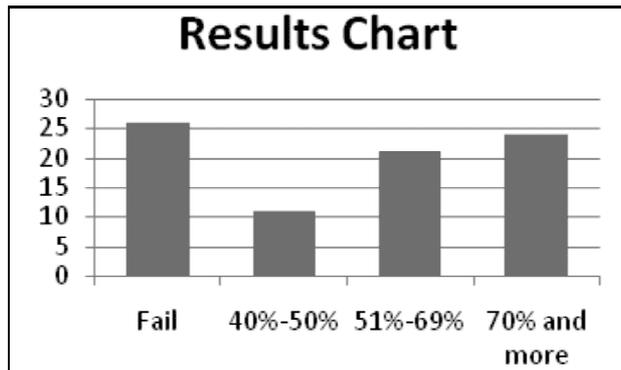


Figure 6: Bar chart representing student's database.

Atharva:

Infosys - 1st and 2nd Oct, 2015

Accenture - 5th and 6th Oct, 2015

Tech Mahendra, IGate and L & T - Upcoming weeks.

G. MOOCS

Till date, 24 courses are being offered to 250 students for T & P.

H. ISO, IEDC, E-YANTRA, ATHARVA SATELLITE GROUND STATION, E-CELL, APPLE LAB, ROBOTICS LAB, TECHITHON

These are the various bodies which make the students to deal with better levels of engineering and inculcate in them inter-disciplinary approach.

6. 3600feedback

This includes online feedback, Suggestion Box, Mentoring and Counseling.

A. Feedback activities

Students having 65% above attendance in lectures are only allowed to participate in feedback activities. All the teaching procedures carried out in the class are being judged by the students by a marking process. Keeping in view the outcome of this process, all the

necessary changes that could be made for enhancement purposes, are being undertaken by teachers.

B. Suggestion Box

If the students are not satisfied with any of the patterns or if they demand any changes to be brought by any staff member in teaching scheme, then they can write it in and put it in a suggestion box kept in every classroom. At the month end, these chits are being collected and given to the HOD for further action. Every possible suggestion which actually seems to be really beneficial or important is being carried out.

C. Mentoring & Counseling activities -- Each and every student of each and every batch is given personal attention by teachers from different classes. 100% authentic and cheat-free examinations are being conducted. Students are made free to ask any doubts as many times as required in order to ensure concept wise learning.

7. Knowledge through Industrial Database

Table 2: Companies Database

Company Name & Address	Brief Info of Company
APJ Enterprises Limited	Power solutions firm specialized in DG sets
Power System Consultants	Electrical system Design, Testing & Commissioning
Siemens Limited	Automation & Drives, Consumer Products
Larsen & Toubro	Technology, Engineering, Construction, Manufacturing & Financial services conglomerate
Crompton Greaves	Global pioneer in Electrical Energy, Power systems, Industrial systems, Consumer Products
Airon Corporation India Private Limited	Engineering services & management solutions, Control Panels, EPC
Euro Power	Leading manufacturer of power components e.g. Power Amplifiers, Inverters etc.
Parikh Energy Systems Private Limited	Erection, Testing and Commissioning of electrical power substations, Manufacturer of Switchgear
Power Linker Group of Companies	Power system Analysis & Protection, Condition Monitoring & Training courses

Industry Institute Interaction (III): In order to develop interaction of various Industries with Electrical

students, the department organized an Industry Meet for increasing student's awareness about working of electrical industries and enabling them to choose the right career.

Few eminent speakers discussed following points regarding career and opportunity in Industries:

- 1) Skills required in students: Passion, Hard work, Self-learning, Punctuality, Research and Thought process.
- 2) Students should have knowledge of basic concepts in every subject.
- 3) Motivated students to become entrepreneurs by making such BE projects which can be further transformed into business or some venture.
- 4) Asked students to think innovative and convert their passion into vision and vision into action.
- 5) Guided students to study abroad and do some work on company sponsored projects.

Through the ppts & photographs presented by the Companies, the students got the idea of management procedures and experienced the scenario that goes on inside the industry. A feeling of being an engineer started inculcating within students that they will be engineers one day, at some post, where machines will be all around them and they will play with technology.

8. Results

The graphs are plotted according to the feedback given by students for the improved teaching methods.

The grading system adopted is as under:
Average, 2- Good, 3- Very Good, 4- Excellent

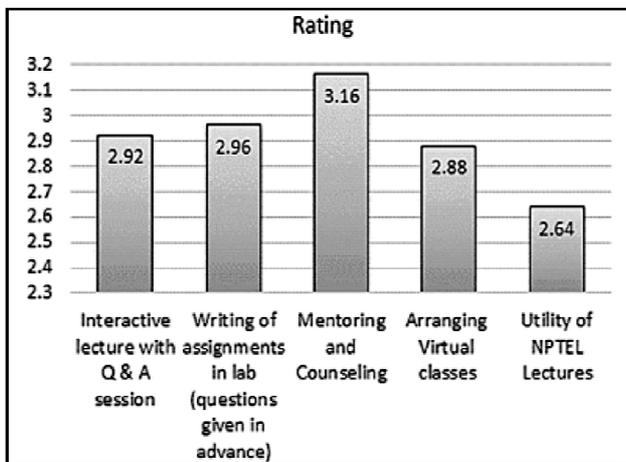


Figure 7: Innovation in Teaching & Teaching Aids

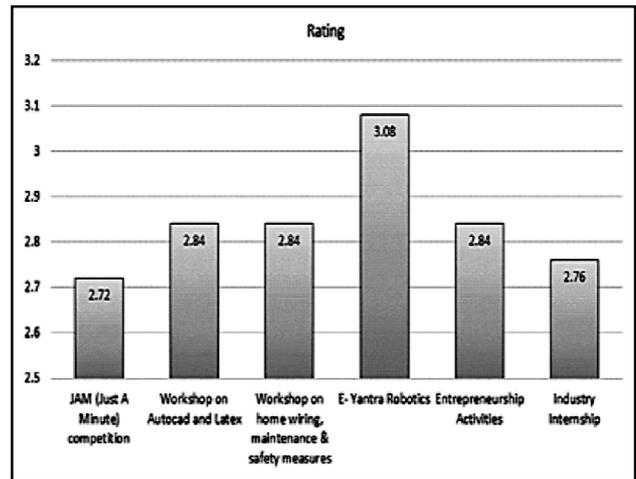


Figure 8: EESA activities

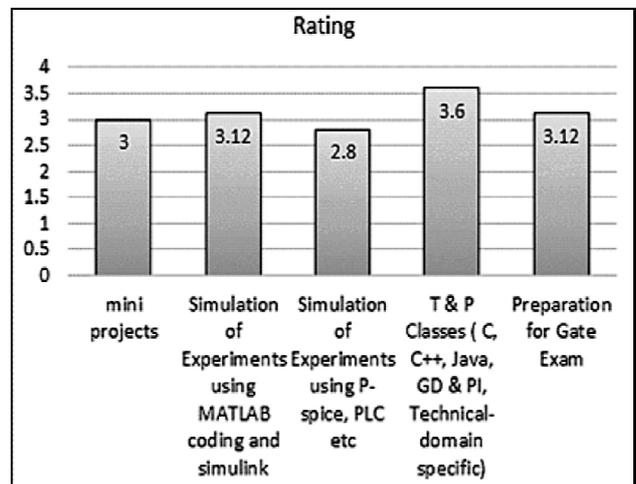


Figure9: Approach for Practicals and Placement Initiatives

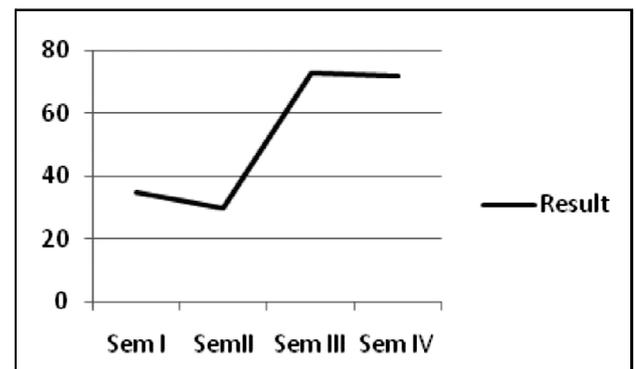


Figure 10: The graph represents information regarding marks obtained by TE students of EE department in different semesters

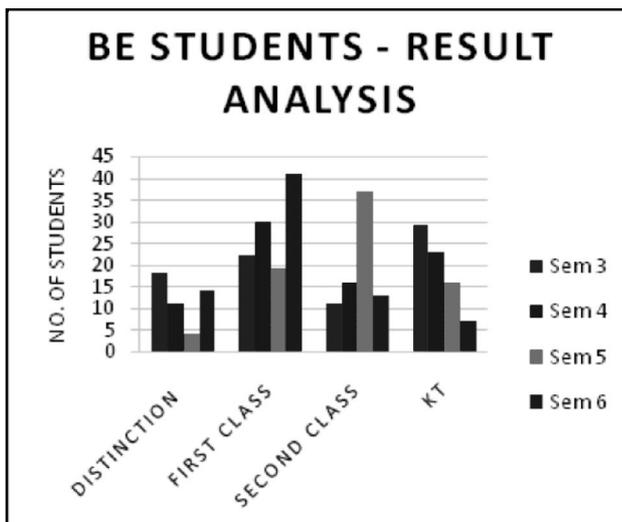


Figure 11: Demonstrates improvement in marks obtained by final year EE students from SE to TE

9. Conclusions

Planning, Implementation and Dedication is essential to become an engineer. The ideas and innovations initiated by your department have led to building up of a right culture to nurture practical engineers and not just bookworms. A feedback form was designed for all the points mentioned in this paper and student's opinion are plotted in the graph. This has been verified with the results obtained by plotting graphs of 1st batch SE and 1st batch TE students.

An attitude of continuously applying theoretical knowledge was gained by the students to solve community problems technologically. Students should always keep themselves working in some or the other technical innovations, as it helps them to utilize what they have studied in the whole engineering career, otherwise it will just remain to be mere certificates collection.

Acknowledgement

We would like to thank Shri Sunil Rane sir, President, Atharva Group of Institutes for his constant support and encouragement. He has already

sanctioned the following projects for Electrical department and SE Electrical students are working on it.

- 1) Removal of milk adulteration.
- 2) Making helicopters using scooter engine.
- 3) Avoidance of train collision.
- 4) Use of carbon from the atmosphere as ink for printer
- 5) Wireless remote control without battery.

Also, we would like to thank our students for their active support for implementing above changes and realizing its effects.

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