Conceptual designs for solving problems

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Abstract: The creativity skills of students are required to be improved by making them to work on projects. Project based learning (PBL) helps students to develop their skills. VIT has introduced a project based subject known as Technical Answers for Real World Problems (TARP). This paper presents the details of the mode of handling this subject and the procedures for assigning project works to students and the method of reviewing their progress in their project component. The experience gained through handling this subject is presented in this paper along with the outcome of the project works carried out by a few groups of students.

Keywords: Creativity, TARP, PBL

1. Introduction

Industries are looking for graduates who can work in their industries without imparting training for a period of 6 months or 1 year. Every educational institute is expected to produce graduates who are ‘Industry Ready’. The employability of graduates increases when they exhibit experience in handling project works successfully. Many universities around the World are concentrating on capstone projects through which every student is trained to take up a practical problem, identify a solution, design a product or develop a new process to solve the problem, demonstrate the new product or process and document it following international standards. Multidisciplinary capstone design projects are given to students to satisfy ABET student outcomes [1, 2]. Capstone projects help in bridging the gap between academics and industry practice [3]. Project based learning (PBL) improves students’ creativity and outcome [4, 5]. In additions to capstone projects, VIT has introduced several subjects based on project based learning (PBL) and the subject topping this list is Technical Answers for Real World Problems (TARP). This paper presents the framework for this subject, experiences gained through handling this subject and outcomes of the project works carried out by a few group of students.

2. Framework for TARP subject

Students are motivated to travel in and around Vellore to find real problems experienced by common man. A group of 6-10 students can work in a group to solve these problems by using the technical knowledge that they have gained through engineering subjects. One hour per week, students are required to assemble in a class room and have group discussions in the presence of the faculty and 8 hours per week, they need to work on this project along with his team members for developing conceptual designs, working models and computer simulations to demonstrate how they solve practical problems. 3 credits are given for completing this subject successfully. This subject helps students to have application oriented learning and also inculcates a sense of social responsibility in them. This subject is classified under University Core meaning that every student has to complete this subject before receiving the degree.

3. Details of conceptual design carried out by students

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Students were allowed to form groups and find problems experienced by common man. They went through journal papers, magazines, newspapers, visited a few places, interacted with public, corporation, municipality office, police station to find problems experienced by common man. The responses were good and Government officials were happy to receive university students and gave them insight into real problems faced by the society and gave assurance to give support for solving those problems. The following list of problems was found and each group worked on one topic.

- Smart Pedestrian Crossing
- Oil spill collector
- Solid Waste Management
- Solar Water purifier
- An efficient stove

4. Outcomes of the project works

4.1 Smart Pedestrian Crossing

Pedestrian crossings with traffic lights are used to facilitate the time-sharing of road space between motorists and pedestrians so that pedestrians can cross the road safely. Each of these two groups of users is allocated the right-of-way alternatively with the use of traffic signals. The amount of time allocated to motorists and pedestrians is based on the principle of balancing their demands. The demand for vehicular movement is detected through the sensors placed on the road pavement. Pedestrians register their intent to cross the road by activating the push-button on the traffic light pole. The activation of the push button informs the system that someone is waiting to cross the road, and traffic will then be stopped to allow pedestrians to cross. Pedestrians can proceed to cross the road when the green signal comes on. This work is based on developing a pedestrian crossing system which is both efficient and ensures pedestrian’s safety. Figure 1 shows the assembly of the traffic light post and Figure 2 shows the electronic circuit [6].

Figure 1. Traffic light post [6]

Figure 2. Electronic circuit [6]
4.2 Oil spill collector
Whenever there is an accident between two ships, oil spills on the sea. The spilled oil affects the living creatures of the sea and affects the environment close to sea shore. If the spilled oil is quickly collected by means of a collection mechanism, damage to sea and shore environment can be prevented. Figures 3 & 4 show two different mechanisms which can be used for collecting the spilled oil. Teflon coated on the circular discs are capable of absorbing oil and using suitable wipers, the oil is removed from the surface of the circular discs and to a floating tank through suitable pathways [7].

![Figure 3. Oil Spill Collector Model-1](image)

![Figure 4. Oil Spill Collector Model-2](image)

4.3 Solid Waste Management
Figure 5 shows a waste collector with two doors; one in the upper half and another in the lower half. A movable compressing plate is provided for compressing the waste placed inside the container. Usually, people throw paper cups and empty paper boxes and objects of low density in the waste collector. Usually, the bin will be full within two to three hours and then the bin will start over-flowing. Sometimes, trash is seen above the waste collector and even the trash may spill around the bin causing unhealthy environment. A new design has been developed in which the user will open the upper door, throw the trash and compress it using the handle. The compressing unit will have a spring which will make the plate to stay at the top of the bin always. Lower door will be used by cleaners who empty the bin. More than double of the the normal capacity can be stored in the bin apart from maintaining a healthy environment [8].

![Figure 5. Waste collector](image)
4.4 Solar water purifier
A solar water purifier has been designed, fabricated and tested successfully. Figure 6 shows the conceptual model and Figure 7 shows the working model. 18x18x18 inches glass cubical container was fabricated having 95 liter capacity. An earthen pot with a capacity of 15 liters was procured. These two were connected by means of plastic tubes for condensed water to the pot. Black paint was applied to the glass container to absorb more solar energy. Dirty water was stored in the glass container and the working model was left in hot sun for one full day. About 5 liters of condensed water were found in the pot.

![Figure 6. Conceptual model [9]](image1)

![Figure 7. Working model [9]](image2)

... pH test was conducted in the condensed water and it was found that the water was neither acidic nor basic but neutral in nature. Hardness test was carried out using lume emission photometric method and the water was found to be fit. Water was treated with lime and soda and found to be suitable for drinking [9].

4.5 An efficient stove
A few places in Tamil Nadu, India are very much backward where people are still using conventional fire wood stoves. One of such places is Thandikudi hills in Dindigul district. Places like Dharmapuri and Krishnagiri districts have 40% forest. Jawadhu and Koppar forests which share borders with Vellore district have people who use fire wood stoves. Four different shapes were considered for making the efficient stove. Square, triangle, circle, semi-circle and the square shape was selected since it was stable and easier to fabricate. The stove is made of Aluminium since it is durable, light and easier to fabricate. The stove is efficient as it utilizes the convection to warm up the vessel. The stove has two chambers and there is a gap through which wood is embedded and consumed. After it is scorched, the heat get convected through the inner chamber and warms up the vessel kept over the stove. This stove produces less amount of smoke compared to conventional stove. The top portion of the gap between the chambers is closed and holes are made in the inner cylinder to increase the efficiency of the stove and to reduce the overall weight. Figure 8 shows the conceptual model of the stove and Figure 9 shows the working model of the stove [10].
5. Conclusion

Five conceptual designs are presented in this paper: Smartt traffic light design for pedestrian crossing, oil spill collector design, design of a waste collector for solid waste management, solar water heater and an efficient stove. By working on these projects, the creativity and design skills of students improved. Students had opportunities to go into details of real problems faced by common people and to provide a solution for solving such problems. Since every student who graduate through VIT Vellore has to complete the TARP course, the student will continue to provide solutions for solving the problems faced by humanity through out his professional career.

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