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Spiral Course Activity to Strengthen Process Automation

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Abstract: The proposal describes about a course activity designed for fifth semester students of Instrumentation Technology for the course Process Instrumentation. The quantifiable short term outcome of the acitivity is to propose a sensor model with new operating principle. Student undergoes phases of field exercise, lab experimentation, literature survey that helps in proposing a sensor model. Course activity has been designed to address exploratory learning, better communication skills and industrial perspective of the course. Thus strengthening Process Automation vertical at program level. This progress justification can be made by mapping the rubrics formed for the evaluation of activity with the attainment of program outcomes.

Key words: Field exercise, Sensor modelling, Process automation

1. INTRODUCTION

The term process in an industry refers to a set of well defined sequential tasks to convert raw material into an intended end product. Process field mainly consists of three important phases namely sensing phase, signal conditioning phase and actuating phase.Three theory courses of four credits each, namely process instrumentation, process control and Automation in process control have been introduced in the under graduate curriculum at the fourth, fifth and sixth semester of Instrumentation department in order to impact the students with the inter subject relationship and enable them to progressively gain the application vertical perspective in process control and automation. This in turn helps the students to pursue research and/or career in the said vertical. Course process instrumentation deals with the study of operating principles of various transducers used for the measurement of temperature, pressure, flow, level, humidity, displacement, pH.

The teaching learning approach adopted for the knowledge transfer and assessing learning outcomes for the said subject involves introduction to various transducers for measuring physical parameters as discussed and use of those transducers through experimentation to study the characteristics of those transducers. It further involves proposing a sensor with different operating principle and develop a prototype to demonstrate the same. The importance of this phase is to augment the concepts studies through course with that of design phase. The said approach is a part of curriculum charter which provides a practical hands-on experience of the industrial process.

Activity started with assigning a physical parameter to each of the group at beginning of the semester level and were directed for thorough study of these parmeter measurements through field visits.

In the next phase, it involved use of those sensors for determining the static and dynamic characteristics. In the third phase, teams are expected to come with new design for sensors with different operating principles as shown in spiral model in figure 1

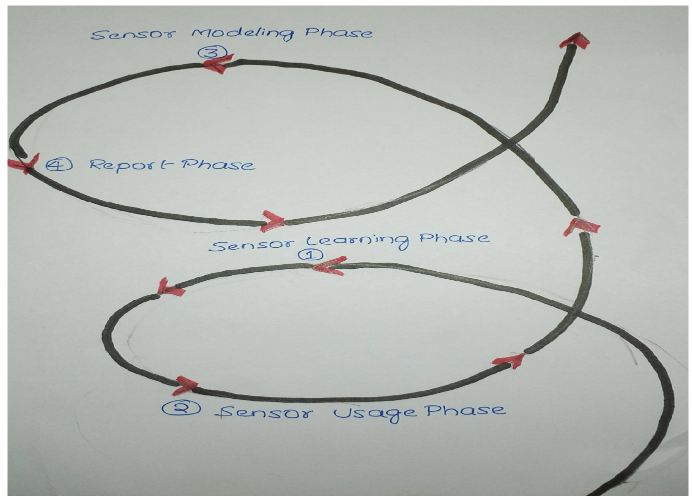

Fig. 1 Spiral model of activity

Organization of the paper is as follows, Section 2 deals with the details of enhanced learning process, Section 3 discusses about implementation details and assessment, Section 4 with effectiveness of the activity followed with experimental outcome, discussion and conclusion

2. ENHANCED LEARNING THROUGH ACTIVITIES

The details of the course project are presented in this section. The activity involves the following

- **Field exercise:** An intensive field visit was done by the students as apart of course activity to know the use of modern use of transducers for the process parameters measurement. Students shared their experience through presentation that included working videos of several modern transducers employed in industry. Before they executed field exercise they were asked to learn about allotted parameter through transactions, journals and correlate concepts connected to theory. Survey included detailed study of components

- **Experimentation:** This phase consisted of use of those studied sensors to study the static and dynamic characteristics through experimentation.
- **Prototyping:** Prototype for the assigned parameter was done that demonstrated the sensing of parameter using different operating principle.
- **Report Writing:** Information collected is organized for meaningful interpretation and analysis and submitted in the form of report, reflecting all the activity details including animation and snaps of the built process.

3. IMPLEMENTATION

This section deals with the details of Process execution and assessment methodologies

3.1 Process execution involves various stages as mentioned below.

- ***Team formation:*** Groups were formed comprising four students in each team and team leader was identified. Roles and responsibilities of each student were also defined. Team leader has to coordinate, plan, organize and track the activities within a team. Each and every role within a team was accountable.

- ***Field visit:*** All the teams are required to identify the nearby industries where measuring those parameters has potential significance and execute field visit and details are shown in figure 2 .
- ***Parameter assigning & understanding:*** Once team formation was done each team was assigned with one parameter and they were asked to do detailed study of the parameter before they execute field exercise.
- ***Demonstration:*** Students have to effectively demonstrate the experiences of field visit
- ***Experimentation:*** This phase included the use of transducers in laboratory for demonstrating the understanding of its usage and static and dynamic characteristics.
- ***Sensor design phase:*** Teams developed a sensor

1	Shantala power ltd	14	Agriculture university
2	South western railway	15	Sushruta hospital
3	Nectar beverges	16	Vaatsalya
4	Pepsi	17	Tatwa darsha hospital
5	Canara Aerated soda factory	18	Shakti Hydair
6	Navya biologicals	19	Channabasaveshwar oil mill
7	Miven machines and tools	20	Yarana weighing bridge
8	Ultra tuffcold retreads pvt LTD	21	Mahanth automotive pvt LTSD
9	Mahadev metals	22	Karnataka material testing cer
10	Apex auto LTD	23	Swarna giri wires
11	Dev priya Industries LTD	24	Microfinish valves
12	Proline engineering	25	KMF
13	SDM medical college	26	Kaiga Nuclear plant

Fig. 2 List of identified industries

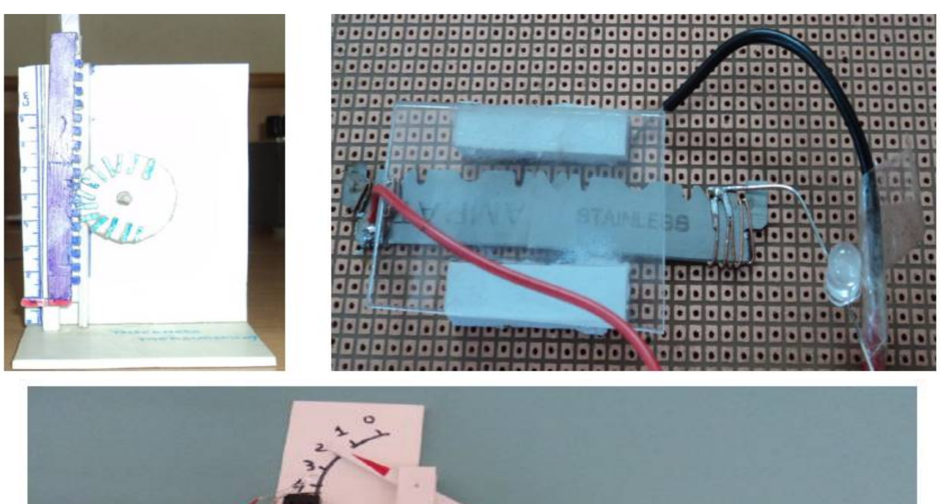

Fig. 3 Prototypes developed by students for measurement of (i)

3.2 Assessment

Method of assessing the effectiveness of activity includes student performance assessment, student self assessment and student feedback. Contributions to the activity can be assessed in terms of individual deliverables and group deliverables. The assessment metric/rubric for evaluating the performance of the students is as shown in table 1.

Table 1 Assessment phases

Sl.No	Assessment rubric	Weight age
1	Literature survey	20%
2	Field visit	20%
3	Presentation	20%
3	Experimentation	20%
4	Demonstration & report writing	20%
5	Sensor design (part of SS component)	25

4. EXPERIMENTAL OUTCOMES AND DISCUSSION

The activity designed focused on communication skills, team building, experimenation skills and attainment is as shown in figure 4 with respect to performance indicators developed at program level.

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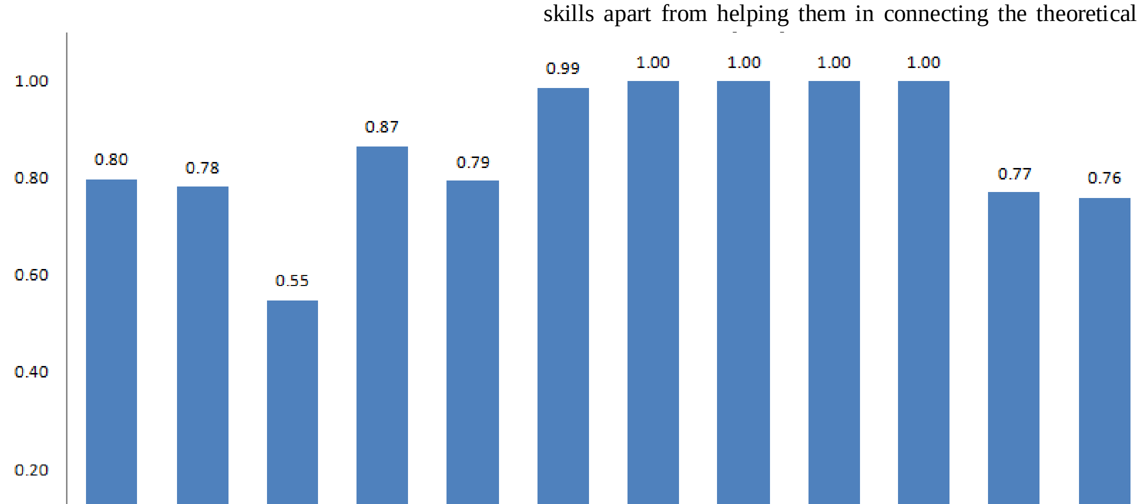
Students were able to develop a device that can sense parameters like thickness, level, flow, temperature, displacement, magnetic field. In most of the cases it used resistive or capacitive principles to detect the above parameters.

CONCLUSION

The details of the activity planned and executed for the subject Process Instrumentaion as a part of an innovative approach to enhance the learning outcome of the students have been presented. The metrics and the techniques adopted for the assessment of the learning outcome have been listed and the results are presented.

The overall outcome as seen from the result analysis clearly indicates that the approach adopted has indeed significantly been encouraging in terms of the holistic student development.

The most prominent positive outcome of the experiment is that over 90% of the students have clearly indicated that this has given them a very good opportunity to evaluate, work on and improve their verbal as well as written communication skills apart from helping them in connecting the theoretical



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