Project Analysis

Solar Powered Auto-Irrigation

Project Analysis:

Life Long Learning:

The purpose of the project was to develop a better understanding of the concepts which we have got in the class. It was also aimed to provide a practical perspective of what we have been learning so far. The project has been of great value as it provided a wonderful opportunity for us in learning. It not only, increased our knowledge and learning of new things to great extent, but also enabled us to increase our knowledge of the existing things which we have already studied in our course. It enables us to learn the practical perspective of what we have studied. We faced different problems at different stages, however we were able to deal with the problems effectively learn on our own and sort out a solution to the problem. Since it was a hardware based project, both hardware and software perspective of learning was achieved by us.

Given below are few of the mentionable things which we have learnt during our project:

Hardware devices:

Arduino:

Arduino is one of the most widely used microcontrollers due to its onboard functionalities and simplicity of use. Due to the excessive use of Arduino in our project, we were able to learn many new functionalities of Arduino. Due to hand on experience, we were able to explore the usability and importance of Arduino.

FPGA:

The FPGA used for the project was Nexys4 DDR FPGA Board. The FPGA was used for the generation of square wave pulses. We were able to develop a thorough understanding of the use and functionality of FPGA. Implementation of different types of logic functions on FPGA was learnt and understood.

Solar Cells:

Solar cells are a very common topic of study. However by working on solar cells practically, we were able to develop a complete understanding on the working of solar cells, as well as different characteristics of cells, which otherwise, would not have been learnt by us.

Converter Topology:

Boost converter, which is one of the most basic converters used in power electronics. The converter was however selected after detailed research on different converter topologies and theirs pros and cons. Due to detailed study of various types of converter topologies and having their practical insight; it largely helped us to develop a better understanding of converters. Our

researcher helped us greatly in understanding and learning of converter topologies and their use and implementation practically.

Sensors:

Different types of sensors were also interfaced with the controller. This allowed us to develop a thorough learning of different types of sensors, actuators and other circuitry. Few of the sensors which we learned about, in our project are:

- Hall Effect Sensors.
- Current sensors.
- Voltage sensors.
- Irradiance sensor
- Temperature sensors.
- Light sensors.
- Heat transducers.

Apart from sensors, different type of new ICs were also tested, used and learnt about. The components which we learnt about weren't essentially used in the project. This is because for choosing the suitable components in the project, different types of solutions were planned and tested. And the most suitable solution was only implemented. However testing of different type of solutions enables us to learn regarding different components and approaches. Major ICs which were studied are given below:

- Voltage Regulator **LM7805**.
- MOSFETs, BJTs and IGBTs **(SKM100GAL12T4SK).**
- IGBT Driver Gate Driver **(SKHI 23/12 (R)).**
- Time IC **555.**
- Gate Pulse Generation IC **TL 494.**
- Gate Driver IC **IR2010** and **IR 2110.**
- Battery Protection IC **bq29330**

Software tools:

Apart from hardware devices, many useful software tools were also used and learnt. The project enabled us to work on much useful and extensively used software. Such software includes Matlab, MikroC and VeriLogger Pro.

Matlab:

Matlab is one of the vastly used software in the field of electrical and power engineering. The usability and importance of Matlab cannot be ignored. Whether it is some basic project related

to programming, or may it be a very complex simulation of come project on simulink. Matlab plays a vital role in understanding and implementation of the projects. Given below are few of the basic learning which we developed using Matlab:

- Understanding of important Matlab functions.
- Real time implementation and interfacing using Matlab.
- Simulink and Simspace modeling.
- Interfacing of Matlab with External Controller like Arduino.
- Data acquisition using Matlab.
- Frequency domain analysis.
- Modelling and implementation of power based models.
- Linking of Simulink models with Matlab programmed functions.

Without Matlab, the project would not have been easier to simulate and implement in real-time scenarios. Matlab developed a great degree of learning and practical insight among us.

MikroC:

MikroC is a Arduino compiler software. The introduction of MikroC was new to us. We studied the manual and developed an understanding of the compiler before using it. It proved to be a very useful and helpful software in implementing the project. We were able to track and learn much new functionality in Arduino using MikroC which we were not aware of, before. Furthermore MikroC also have sister software to burn and program the Arduino kit. Serial interfacing of Arduino with computer was also learnt while working on MikroC.

VeriLogger Pro:

VeriLog is a language which is used for programming FPGA. Verilogger Pro is one of the most widely used software for interfacing the FPGA with the computer and for implementing the Verilog code on the FPGA. Verilogger PRO proved to be a very important tool for developing the learning and understanding of FPGA. We were able to learn the use of software confidently, adding important software in our skills.

Skills:

Skills play an important role in the development of one's professional career and confidence building. The basic purpose of the projects in not only to learn the technical tools and information, but is also to polish the important skills in the person, which will enable him to build up confidence and lead a competitive and successful professional career.Apart from learning about many useful and important hardware components and software, many important skills were also gained by working on the project. Given below are few of the important skills which we attained by working on the project:

Project Management skills:

Project management is one of the important skills which will prove to be very useful for us in our professional life. Whether it be some managerial responsibility, or should it be dealing with some project or any other kind of responsibility, project management is one of the core skills which help the person to deal with the responsibility effectively. By facing different types of targets and challenges in the project, the project developed new skills among us and polished out existing project management skills.

Time Management Skills

Time management was one of the most critical issues in the project. A proper schedule for all meetings, deadlines, target accomplishments and report submissions was made and was duly followed. Sometimes it got a little difficult to manage the time and follow the schedule. However doing so, enabled us to develop skills of time management. Following the deadlines, as well as the habit of punctuality was developed among us.

Teamwork:

Team working skill is perhaps the most important skill that is needed in projects. It involves dealing with the team members and making the output of project as maximum as possible. Sometimes you have to deal with disagreements or may have to support your team member who is unable to reach his goal. It develops helping, understanding, unity and trust relationship among the team members. This enables the team to collectively achieve the goal.

Sources:

The above mentioned tools and skills were attained by mutual working, as well as taking help from different sources. Such sources include:

- Our Supervisor.
- Co-Advisor
- Internet (Google, Wikipedia, YouTube, IEEE Xplore, Howstuffworks, and Google Scholar).
- Friends.
- University Library.
- Books, Magazines, Journals.
- Other sources like consulting the retailer for suitable components, writers of the journal and conference papers, a solar cell implementation company etc.

Impact of Engineering Solutions:

The importance of the project can be directly measured by the impact it is having on the society, environment and economy. No project is good if it is not focusing and providing a solution of some serious issue which we are facing.

Given below are few of the vital impacts of our project:

Environmental Impact:

Current methods of energy harvesting are widely dependent on fossil fuels. Although efficient, but these methods pose a serious threats to the environment. Environmental issues are threatening the peaceful and healthy existence of living beings. This issue needs to be addressed and is successfully addressed by our project by offering a completely green and renewable energy solution.

Economical Impact:

Economical viability of any project is the core issue in the success of the project. Our project is proposed to have a highly effective economical benefit for the users. Although initial investment may seem to be a little drawback, however in long term scenarios, out project proves to be highly economical as it allows the users to harvest the solar energy totally free of cost. Except installation and maintenance cost, there is no additional cost required for harvesting the energy. Hence the project proves to be a very economical solution to the problem.

Social Benefits:

As discussed above, most of the sources of power are totally dependent on fossil fuels like generator, turbines, engines etc. The project proves to be of great motivation for the society in diverting their attention to the environmental friendly and more suitable renewable energy solutions.

Contemporary Issues Addressed:

The project discusses few of the core issues which today's world is facing:

- Energy Crises issue.
- Environmental Pollution Issue.
- Health related Issues.
- Global warming issue.

Saudi Arabia uses the largest amount of crude oil for the generation of electricity according to a report in 2010. Currently Saudi Arabia Heavily depends on the hydrocarbons for the energy requirements. This may seems to be a viable solution; however we need to see towards the

futuristic solutions if we run out of the fossil fuels The project suggest a very effective and easy to implement energy harvesting solution.

Furthermore, the environmental pollution generated by the use of fossil fuels has been addressed before. About 95% of Saudi population uses automobiles according to a source. This is giving rise to the environmental issues at a very high pace. These issues need to be addressed before the situation gets worst. According to the estimations, the pollution levels in 2011 in Saudi Arabia are measured to be : *43 ug/m3.* These pollution levels are affecting the health of almost every citizen directly or indirectly.

Global warming is another serious issue which is arising by use of harmful ways of generating energy. We need to look towards these issues if we need to save our future and existence of mankind on the planet.

The issues discussed above although, specifically focused on Saudi Arabia, but are also being faced by the whole world. The project proposes a viable solution to the problems discussed above.

Hence the project is proved to be not only a locally successful solution, but it also addresses and proposes a solution to the many key issues which we are facing today and will face in our future.