CAREER EPISODE 1

Introduction

CE1.1 This career episode will discuss the academic project that I did in my second year at Jawaharlal Nehru Technological University while studying for the Bachelor of Technology in Electrical and communication Engineering. The project was the development of the GSM BASED LPG MONITORING SYSTEM.I handled this project between May 2011 and October 2011 at the department of electrical and communication engineering laboratory at Hyderabad, Telangana, India. My duty was to completed the project and make a presentation to the faculty members.

Background

CE1.2 Fuel has always been a center of debate with respect to environment friendliness and performance. Liquid Petroleum gas is a very important type of fuel. This is because of the various desirable properties associated with it including being smoke and soot free as well as being a clean energy source. However, it poses a risk to fire hazard when it leaks into the air unmonitored. And accidents associated with it are deadly and often uncontrollable. Systems are continually being developed to address this issue. Existing systems have not fully tackled the issue. This project factors in telecommunications in control of real life parameters.

CE1.3 The objective of this project was to determine the levels of in a given environment being monitored. To use the LPG gas sensor to detect high levels of concentration of LPG in the environment being monitored. To trigger alarm by sending a signal to actuate buzzer and LED and to send an SMS to the owner via a dedicated number. To display via the LCD and show the necessary actions to be taken. To actuate fans to dispel the air and reduce concentration of the gas to acceptable volumes.

Figure 1: organization chart.

CE1.4 During the development of the project I performed various roles including the following;

- Research in the existing systems of LPG gas control in order to identify means and ways to improve and come up with a better system
- Data collection by visiting various LPG gas distribution center=res and hazard management systems
- Analysis of the obtained data and to develop an improved system
- Design and modelling of the system
- Fabrication of the prototype
- Testing of the system and hardware
- Documentation

Personal Engineering Activity

CE1.5 To successfully execute all phases of project development I prepared adequately by conducting a thorough research into the many forms of controlling and minimizing dangers posed by LPG. This involved reading widely and viewing development and discoveries on the same topic. I also utilized the lecture notes on Cellular and mobile communications, and the Microcontrollers and it applications. The units were very helpful because they constituted the core of the project functionalities. I restricted my working to Indian Standards governing microcontroller based systems and also International Standards to ensure that every stage of development would comply with regulations.

CE1.6 The projects were to be completed within the academic year. This called for proper organization and planning. I hence generated a well-articulated time schedule highlighting major task and the respective timeline for execution. I also set off looking for relevant information. I visited licensed LPG gas distributors and engaged them in surveys and interviews to aid me in coming up with the design. I reviewed various gas detection systems and tools that were already deployed in premises and industries in order to identify areas of improvement. I well noted down the findings which became my basic data for starting the project development.

CE1.7 Upon obtaining adequate data and information, I embarked on designing the system. This was boosted by the relevant information which dictated the design procedures and decisions.

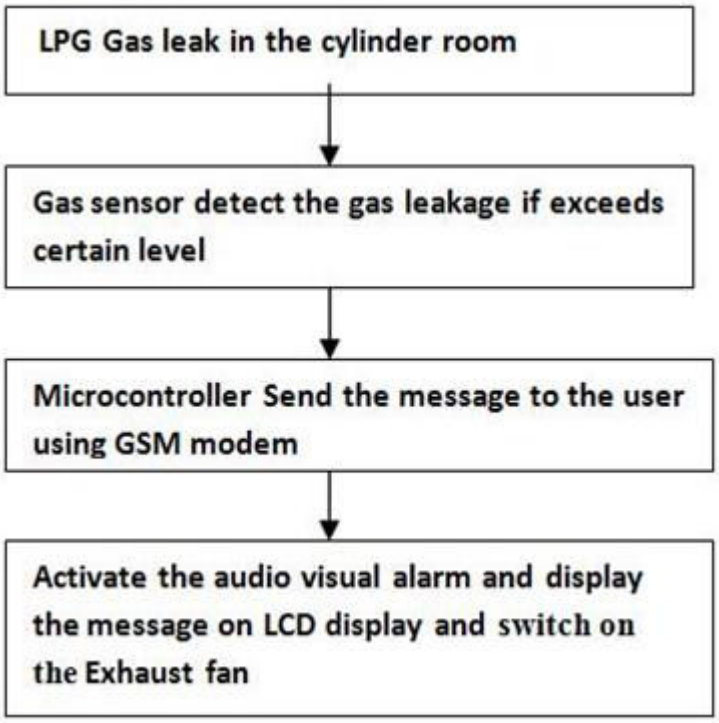

Figure 2: Flow Chart of the System

CE1.8 The flow chart above enabled me to further identify the various components and systems within the design for consideration. The gas sensor serves to monitor the ambient gas levels. Upon detection of LPG gas at some threshold concentration, it would send a notification to the microcontroller LPC2148 microcontroller. The microcontroller is the brain of the system and has been program on the actions to execute chronologically. On receiving a high signal from the sensor, it would actuate the audio visual alarm, to notify the residents within the premise. A signal would also be generated and sent to GSM modem to send a message to the owner. At the same instance, the relay timing circuit would be instructed to switch on the exhaust fan. Eventually, I obtained the overall system block diagram s shown below;

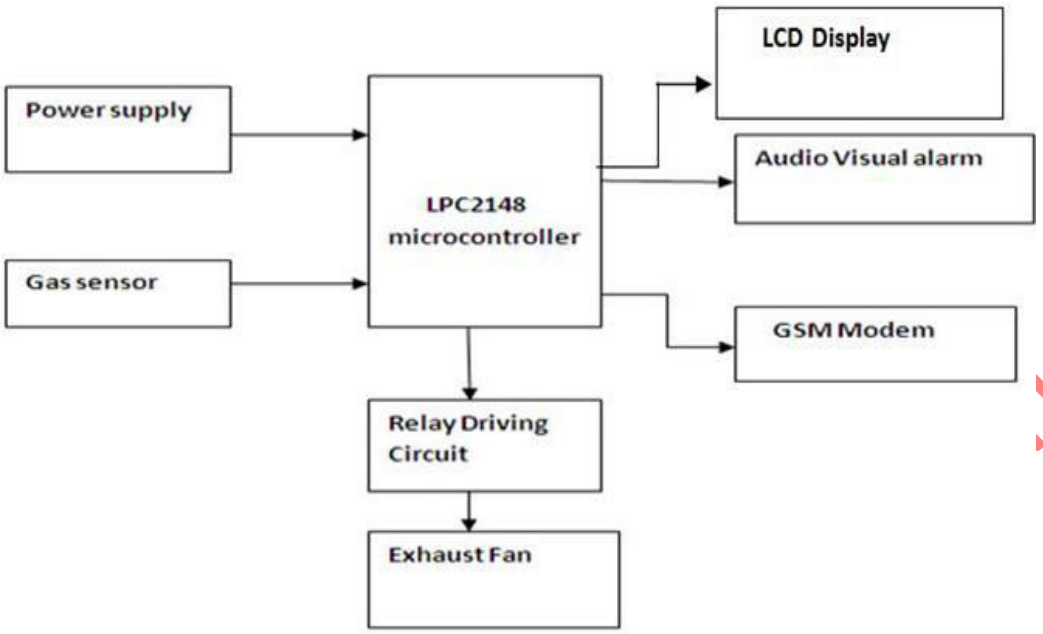

Figure 3: The System Block Diagram

CE1.9 Deriving the above specific and correct components was quite a task. This was due to the calculations involved to ensure that system sensitivity and performance would be optimal. The sensing component would be a resistance based device whose resistance varies according to level of gas in the environment. Therefore, to set the upper and lower limits, it was proper to demarcate the range of resistance variation and to pinpoint the point beyond which the system must automatically activate. The formula below was used to achieve design values;

$$R_S=(V_C/V_{RL}-1)\times R_L$$

Where:

Rs - the sensor resistance

Vc - the supply voltage to load cell

V_{RL} - the voltage across load resistance

R_L - the load resistance

CE1.10 The development process was not without a challenge. However, this was part of troubleshooting and determination of best suited components. First was the sensor which would trigger even with non LPG gas concentration. To overcome this serious issue, I had to look out for the most sensitive sensor according to design, where I resorted to use Gas detection module with extra filtering to discriminate the gas for sensing. The other challenge was delay in sending of the message. A delay of about two minutes was recorded. Because time is a crucial factor in LPG accidents, this had to be real time. After troubleshooting, the program was debugged and the system could the respond as required

CE1.11 Upon successful design, I simulated and modeled the system to check performance and achievement of the objectives. After correcting the challenges of false triggering and delay, I obtained the components based on the specification and system requirement. Assembling and fabrication then kicked off. The various sub-units, Sensor, microcontroller, actuators - GSM modem, relay driving circuit, alarm response, and display units. Were assembled and tested systematically and finally combined and the whole system tested for compatibility and response. The hardware was the fabricated and packaged after posts fabrication tests were done.

CE1.12 Innovation was key in this project. This was necessary because the systems in the market were below bar in sensitivity. The gas sensing module was filtered to ensure that it would only be triggered by LPG only but no other gases. This way false alarms were eradicated. This is because security of such systems must be assured. Alarm must have activated when expected and not activate when not supposed to.

CE1.13 The success of the stages above was closely linked to the tools and software used. Computer aided design in this project included use of Embedded C to develop the command program for the microcontroller. Proteus was used to simulate the input/output responses and debug the system before final fabrication could be done. At some point Arduino Uno was employed specially to improve the time of response for message sending

CE1.14 I ensured that referencing and innovation in the future would be possible by documenting the project. Phase by phase reports were compiled to document the whole project. The various chapters covered included an introduction of the project. Here, objectives and importance of the system were covered. Literature review was put down to appreciate previous related works and to give a way forward in the innovative design. Design and construction was included to give a simplified step by step procedures of analysis and design. Conclusion and recommendation wound up

the document whereby the success of the system was evaluated and possible improvements were captured respectively.

CE1.15 A successful project is complete with proper and thorough documentation. I therefore conducted documentation right from start of project through to the end. Beginning with the first chapter of introduction. Wherein I covered the concept matter and explained the objectives and purpose of the project. Literature review followed suit, the analysis and design phase write up. Penning off was by recommendation and conclusion.

CE1.16 I collaborated with fellow classmates from inception through completion of the project. Their input especially in brainstorming and critiquing became helpful in designing and implementing the project. The assistance of lecturers and the project tutor was sobering into choosing quality and economical components. While conducting the survey and meeting new people, I had to employ the interpersonal skills in order to enhance communication and collection of useful information.

CE1.17 An economical consideration in this project was in the comparison of prices of components as distributed and sold by various dealers. Through consultation and visiting the outlets to make enquiries, I selected the cheap but quality components so as not to compromise on the safety of equipment and users. This is because such a system operation has dire consequences and at all cost, proper functioning must be guaranteed. This however called economic consideration so as not to inflate the costs.

CE1.18 Planning was paramount towards achievement of the set objectives of the project. This ensured that all resources were properly utilized, ranging from time to finances to manpower. By having a projected time schedule, I was able to manage the limited time towards completing tasks phase by phase. By doing so, the project was complete weeks before the deadline of submission. Coordinating the manpower was equally a score because the contributions of the various parties was so harmonious and fruitful. I drew a budget and considered various cost items and cut down unnecessary expenditures. This would help not to burden buyers by throwing cost expenses on them.

CE1.19 I paid special attention to Wireless Communications and Networks and Cellular Mobile Communication Lecture notes and scholarly articles. They became a very vital source of valuable information which guided the design and implementation of the project. I attended workshops and seminars where gas fuels security was being addressed by various concerned groups. It was also very vital to consider the Indian National regulations on wireless systems for control in highly sensitive and hazardous environments.

CE1.20 Safety of personnel and environment was considered by working within the limits of the international and national Indian standards for electronic components and LPG (explosive) gases regulations. While fabricating, the correct tools were used as well as protective gear was regarded. The security of the system, its ability to act when required was tested. Compatibility with other fire alarm systems was evaluated. This is because a falsely triggered can be as dangerous and could cause tragedy due to fear.

Summary

CE1.21 In summary, this project involved various phases of development of a system to detect LPG gas leakage. Beginning with research and brainstorming of ideas after data collection which led to settling upon this particular system. Designing of the various stages and components followed suit. The simulation and modelling was carried out to identify malfunctions of the system and to rectify before progressing to the next stage. The fabrication stage saw the implementation of a working system. When the system worked, it was in order to documents the processes and procedures to facilitate future referencing.

CAREER EPISODE 2

Introduction

CE2.1 My second project to discuss is the design of the GSM BASED INTUDER DETECTION SYSTEM, the project that I did when I was in my fourth year first semester between January 2012 and May 2012.I did the project while I was studying for the Bachelor of Technology in Electrical and communication Engineering at Jawaharlal Nehru Technological University. As part of the academic project I was responsible for handling

the project and preparing and presenting a report to the class. I did the project at Department of Electrical and Communication Engineering located at Hyderabad, Telangana, India.

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Background

CE2.2 Security of premises, homes, business centers, strong rooms, restricted areas, farming lands etc. is always a concern. It therefore calls for protection against unauthorized access to some restricted zones. Mechanisms in place include security guards' presence, dogs, armature alarm systems and strong barriers. However, there have always been instances of breech on above, because intruders, be they burglars would first terminate existing system the proceed to intrude. This way the protected zone is no longer safe. This has always called for system to monitor area real time and even remotely.

CE2.3 This project therefore endeavored to analyze existing intruder systems, to design and model and simulate the proposed system, to fabricate a working system based on design specifications, deploy the system to monitor functionality and to package and document the entire process. To deploy the system in an actual environment to monitor performance.

Figure 1: organization chart.

CE2.4 To successfully undertake the above objectives, there was need to carry out various roles, including but not limited to the following;

- Deep examination and review of existing security and intruder detection systems with a view to understand their existence, pro and cons and hence form basis of innovation

- Wide collection of data from existing security firms offering similar services and research and review of similar work as conducted buy scholars. This would be in a view to understanding the various components and requirement s of such systems.
- Upon collection of data, to analyze the data and use it to identify areas to work on in a manner as to innovate and provide a solution to an existing problem
- To utilize Indian National and International standards governing the manufacture and use of electronic and wireless security systems.
- Model and trouble shoot the designed system using relevant computer aided design tools before fabricating
- To fabricate and posttest the system to check performance. This included sourcing from the components from local stores for use in the project.
- To document the entire exercise for convenience in future referencing

Personal Engineering Activity.

CE2.5 Implementation of all the objectives and roles began by preparation. Herein, I conducted wide studies especially on the lectures covering embedded and real time systems and wireless communications. I also liaised further with respective units' lecturers and Laboratory technicians within the university. Because many projects and journals have been done on the same wide subject, I viewed scholarly articles to fully understand the system, features. I also applied benchmark based in Indian Standards and international standards hence looked at the Resolution 84 (Hammamet, 2016) - Studies concerning the protection of users of telecommunication/information and communication technology services. In this regard, I developed deep insight into the project I was dealing with and hence was in a position to collect relevant and useful information.

CE2.6 Data collection became important in order to make informed choices in design and development. I thus visited various security zones and surveyed. During this time, I administered questionnaires and interview wherever possible and applicable. Industrial, commercial and domestic premises were part of the sites I visited during data collection. I engaged my classmates to brainstorm ideas and critique existing systems.

CE2.7 With relevant data and information at hand, I was in a position to analyze the data and develop a system basing on the previous technologies and recommendations. The

system flow chart helped to identify phases of design. Design entailed close scrutiny of required components and relating to existing systems. From there, the system block diagram as shown below was done.

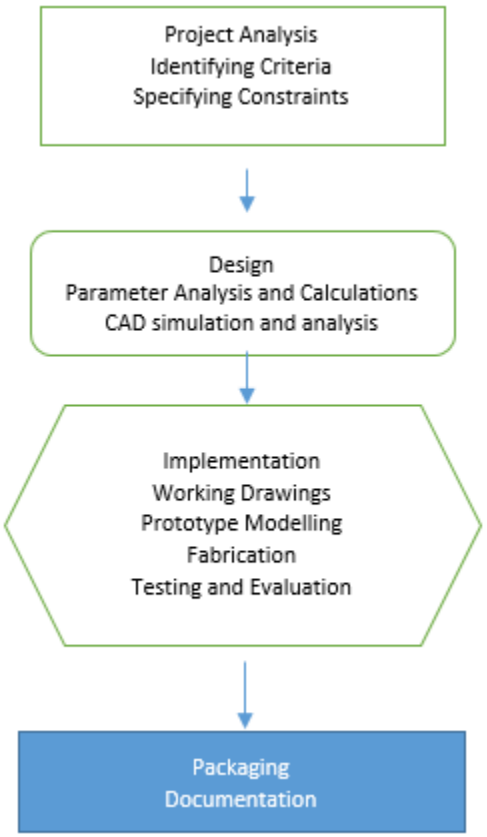

Figure 1: Flow Chart of System development

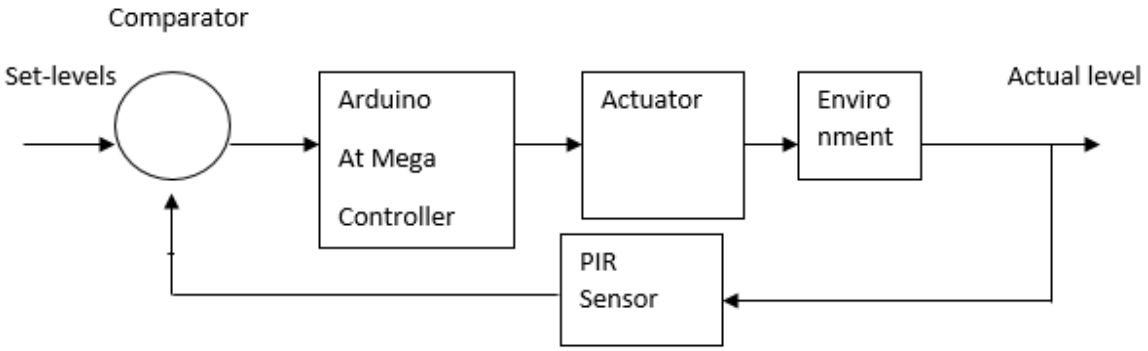

Figure 1: Block Diagram of Proposed Intruder Detection Security System

CE2.8 The design phase entailed identification of the above components for use in actual working system. The sensor used in this case was PIR sensor, to detect the heat radiated from the human body. It generates and output which is fed to the microcontroller which housed the various other systems. The microcontroller compares the input sign against programmed values and then acts based on the set program logic. SIM900 was used as an actuator such that upon receiving a high signal (1) from the microcontroller, it would send an SMS to a dedicated number. It does this by using AT commands to send text messages over GSM module. The microcontroller was based on 8051 microcontrollers to control the entire system based on the program written into it.

CE2.9 The working principle of the sensor, PIR in this case, is based on black body radiation. The signal reaching the microcontroller is generated by sensor based on changes in heat radiation of the environment under question and Planck's law o black-body radiation is the principled utilized by the pIR sensor. This sensing and transduction is as shoen below. Planck's law states that

$$B_\nu(T) = \frac{2h\nu^3}{c^2}\frac{1}{e^{\frac{h\nu}{kT}} - 1},$$

$B_\nu(T)$ is the spectral radiance

h - Planck constant;

c - speed of light in a vacuum;

k - Boltzmann constant;

ν - frequency of the electromagnetic radiation;

T- absolute temperature of the body.

CE2.10 One serious challenge that I incurred was the false triggering of the system. As intended, it was that the system would actuate if an object came in the line of the PIR sensor. However, during testing, it was possible to trigger it even by change in ambient temperatures. Because this is unacceptable for such a security system, I had to obtain a more sensitive and reliable sensor. I also experienced challenges with GSM SIM900 module. It would load messages upon switching it on, as though preloaded. The messages kept reappearing so as to prevent any typing or actions being done on it. After a series of troubleshooting, I noted that the source of the error was the insufficient current to the module. I thus changed the power supply from LM7805 with LM317. After this, the module worked perfectly.

CE2.11 After the design phase was well done, I went about modelling and simulating the system to monitor response with the design values. I arranged the components on simulating tools, Proteus and fed in the values of the components accordingly. This allowed me to make adjustments on the projected performance of the real prototype by considering power supply and related losses and electromagnetic interference. Using Computer Aided design tools ensured that the design phase values were correct.

CE2.12 The innovative ideas put in practice in this system include placing the PIR (Passive Infrared Sensor) sensor strategically on the side to test area in order to only detect passage by tall enough objects, in working state human being. This would prevent triggering by unintended passage. I also used the Arduino GSM shield which is cheap and simple. It works best with LM317 to and allowed the Arduino board to make phone calls, connect to internet and send text messages.

CE2.13 The success of this project is attributed to the software that I used in development through to implementation. After carrying out design and obtaining figures from calculations involved simulation and modelling was used to strike a compromise of values of components available and to factor in environmental changes. Here, Proteus and P-spice tools were very helpful. Matlab was equally use to simulate signal propagation across the GSM. Arduino with its inbuilt language was used to program the

microcontroller based on 8086.

CE2.14 Such a project is successful with proper documentation. I ensured to keep track of the processes from beginning through development to the end. I produced a chronologically arranged write up of the project. In the chapters covered, the following were included, introduction of the concept and the scope of the project. Following was literature review in which I excellently highlighted similar research projects and developments as done by other researchers and scholars. I also gave a systematic procedure on design and analysis stage. This would make it easy for future reference to identify terms and pinpoint areas of improvement, and also make it easier for upcoming hobbyists to understand. I wrapped it up with a conclusion and recommendation on areas worth researching into and improving.

CE2.15 Teamwork was very helpful in the entire process. Coupled with my excellent interpersonal skills, I marshaled the immense workforce of the colleagues, lecturers, laboratory technicians, and security systems personnel. Through interaction with all these people, I obtained valuable information which I would not have garnered on my own. This is because I took positively their suggestions, knowledge of terms, and positive criticism which they voluntarily offered.

CE2.16 To ensure a cost effective projects, I obtained voluntary information whenever it was possible. This is because economic considerations were important in order not to use unnecessarily high amounts of finances. With the advice of laboratory technicians, I identified various electronic components outlets who deal in cheap but quality components. I compared their online prices against specifications for different outlets I endeavored to visit to purchase the components.

CE2.17 Telecommunications and all engineering projects require adequate planning in order to meet set objectives and standards. Therefore, to fully and efficiently utilize resources amidst related constraints, I set up a plan. It covered the time schedule of phases by phase expected time of executions. I also laid down the particular personnel to meet and exact place to do it. Because of this planning, I managed to finish the project exactly on month before presentation, hence I could not work under pressure and the

work was quality because I had time to review and make necessary adjustments.

CE2.18 With the proper understanding and apprehension of lecture coursework, especially Microcontrollers and Applications and Wireless Communication and Networks, of which both are year four units, I had all prerequisite knowledge to set off the project. During the development, I attended various telecommunications workshops as organized by Engineering Students Associations.

CE2.19 This project involved use of devices propagating radio and electromagnetic waves for wireless and cellular communication. There are regulations governing such undertakings, and I was keen to ensure that the set limits were not crossed. Therefore, during fabricating, safety procedures were strictly adhered to in order to prevent possible harm of radiations and to avert attraction of penalty for breach of regulations by enforcing bodies, especially LIRNasia's Telecommunications Regulatory Environment Index, especially on quality of service, for mobile and broadband sectors.

Summary

CE2.20 In summary, this project was birthed in order to develop and implement a system to monitor intrusion to restricted areas and use mobile networks to notify via GSM. It entailed various stages. First was the research into existing security remote systems and do analysis and comparison order to develop and innovative system. It was followed by series of design and analysis after reviewing previous successful projects by other researchers. The successful model as simulated was fabricated ant tested by following the required standards and procedures. The prototype was the packaged. When all was in place, the project was documented.

CAREER EPISODE 3

Introduction

CE3.1 This Engineering experience is the project that I did when I was studying for the Bachelor of Technology in Electrical and communication Engineering at Jawaharlal Nehru Technological University. The project was the DESIGN AND CONSRUCTION OF A UHF-AERIAL FOR OPTIMAL RECEPTION and I did it in my final year second semester from June 2012 and November 2012.The venue of the project was electrical and communication laboratory at department of electrical and communication engineering

in Jawaharlal Nehru Technological University located in Hyderabad, Telangana, India. I was supervised by the professor and I was task with the design and implementation, before preparing report and presentation.

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Background

CE3.2 Antennas constitute important tools of wireless communication. The antennas allow the transfer of the signal from sending end which happens in a wired system and in form of waves which it is transmitted through space and received by receiver in the next antenna. The receiver antenna works by turning the received electromagnetic wave and demodulate it into voltage or a signal at its terminals followed by processing at the receiver. The transmitter and receiver functions of the antenna is characterized by Maxwell's law.

CE3.3 The main objective of this project was to design of a UHF antenna by initially ascertaining an optimal length for directors and subsequently obtaining the optimal distances of separation between them. The designed antenna was optimized with respect to the gain. The antenna was designed for the portion of the UHF band used for television broadcasting. The project also aimed to establish the optimal normalized spacing between directors to facilitate design of antennas for other frequency ranges. The design of the antenna was done using an electromagnetics simulation software program. Subsequent construction of an antenna having the simulated antenna parameters was also carried out.

Figure 1: organization chart.

CE3.4 To successfully execute the research project, I had to carry out the following roles;

- Studied and researched widely in order to very well understand antenna theory, performance and look into the associated problems
- Conduct an interview within various antenna users to understand performance
- Consolidate the information obtained from research and surveys/interview and propose a solution basing on previous systems thus innovate
- Analyze the various proposals and arrive at the most suitable and workable solution
- Conduct a thorough design and implementation of the tool
- Tested the functionality and performance of the fabricated system.
- Compiled a final documentation explaining the entire process of development to the implementation

Personal Engineering Activity

CE3.5 I prepared myself by broadening and enriching my knowledge by reviewing various articles, journals and lecture notes anchored on antenna design and construction. I studied widely on theory of antenna operation and Yagi Uda antenna. In order to have a global outlook and satisfaction, I used the Telecommunications models and standards, Standard for Environmental Testing of Telecom Equipment SD: QM-333 issue, March 2010. I also reviewed the Resolution 18 like the, the ITU Radio communication, ITU Telecommunication Standardization and ITU Telecommunication Development Sectors. The very important units that offered a deeper insight into the problem were Antennas and wave Propagation and Microwave Engineering. I also liaised with the Telecommunications Laboratory technicians in the university in order to confirm most of the yet unclear things.

CE3.6 I collected data from various households using antennas and from local vendors distributing antenna to customers and I got great information towards implementation of project. In my interaction with them, I sought to find out the architecture of the antenna construction, the considerations in design and the pros and cons of the various antennas in the market.

CE3.7 Equipped with the information, I embarked on the design process for the system. With proper understanding of the cloud architecture as shown in figure 1, it was possible to identify areas of interest. Since the UHF frequencies range from 300 MHz to

3 GHz it was necessary to select the portion of the spectrum that would be targeted by the project. The portion that was ultimately selected was that between 470 MHz and 700 MHz this portion was selected since it is used for television broadcasting and would enable easy viewing of the efficacy of the antenna design. This frequency portion also yields a Yagi-Uda antenna with dimensions that are relatively easy to construct. The challenge thus was to produce an antenna that would produce satisfactory performance over this entire range.

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CE3.9 From the theory of dipoles we know that the folded dipole is supposed to be half a wavelength across. This means that the length across the folded dipole in ideal conditions should be equal to half the free-space wavelength associated with the design frequency. In such a case the free space wavelength is determined using the following equation

$$c = f\lambda$$

This equation relates the speed of an electromagnetic wave, its frequency and its wavelength. The speed of all electromagnetic waves in air is given by 299792458 m/s. From these, the wavelength is readily determined by:

$$\lambda = {}^{c}/_{f}$$

From the design frequency of 578 MHz the wavelength i found to be:

$$\lambda = {}^{c}/_{578Mhz} = 518.7\ mm$$

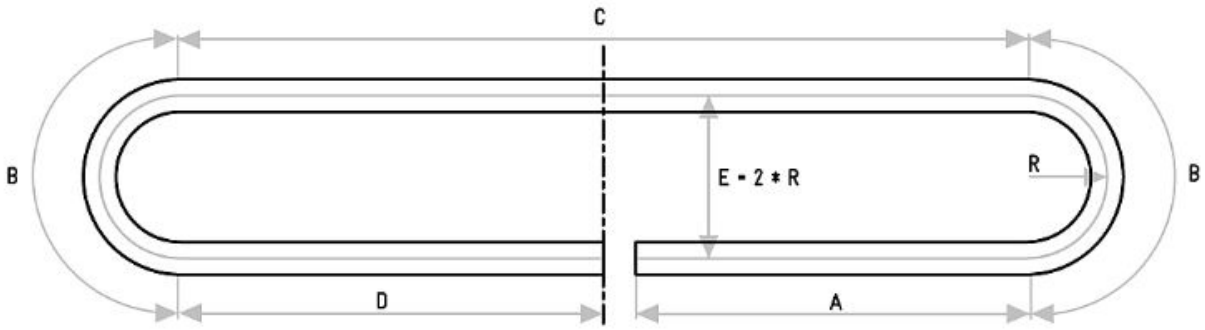

Figure 2: Folded Dipole

CE3.10 After designing was completed, I was able to specify various components by processes of modelling and simulations then the actual fabrication of the antenna. Key among the required materials was metallic rods. These form the main part of the antenna structure. Accordingly, most of the early effort was geared towards construction of the folded dipole. To construct a folded dipole, it is essential to make a bending jig. The bending jig employed in this project was made of wood. The first step in making the bending jig was fabrication of round wood segments on which the curved segments of the dipole are bent. These round wood segments were then nailed to a supporting wood structure. The resulting structure was as follows. The folded dipole was made of aluminum rod secured on the bending jig using screws at the holes drilled onto the jig. Other peripheral parts included reflector, directors, insulators and coaxial cable.

CE3.11 The success of development stages i.e. analysis, design and implementation is determined on testing of the system. Hence I had to perform tests and evaluation. The best setup that I used for checking the far-field radiation properties of an antenna then, is when the test antenna is illuminated by plane waves. This condition can be approximated if the receiving antenna is placed well into the far-field region. Thus qualifying the project with satisfactory performance for IEEE and ITU standards. By local scales, the results were high considering the Telecom Regulatory Authority of India Codes and Standards.

CE3.12 The project design, modelling and implementation phases posed challenges. The most significant one being the fact that it was not possible to conduct testing as per standards. This was attributed to unavailability of the testing equipment in the laboratories. This was overcome by designing a test set-up. The test set-up, though it called for extra resources was worth the expense for the success of the project because the testing phase.

CE3.13 The innovative ideas employed in this research to select a frequency of operation. It was so chosen as the geometric mean of the frequencies assigned to channels on the DVB-T2 scheme. Information on channel arrangement on the DVB-T2 standard is provided in Appendix B. The value so obtained was 578MHz. This frequency is located near the center of the spectrum portion used for television broadcasting.

CE3.14 The software used to aid the design in this research was the electromagnetic simulation software program. By utilizing this tool, it was possible to make adjustments and carry out debugging of the system at the simulation stage, which is economical and friendly, compared to troubleshooting a defectively designed final system. The software was able to simulate the signal across the physical network as well as the air medium. However, this represents and ideal case, lossless, losses are considered in an actual system.

CE3.15 Documentation of this research was a continuous process and started at the onset of the project. This ensured that every small detail of the development of the system

would be factored in and that future referencing would be possible and wholesome. The document covered five chapters with the following stages; Abstract, Introduction which gives a brief background to the study, Literature Review and covering the literature about similar works other researchers have done regarding the same work, Methodology of the research topic. Analysis and Design and the conclusion chapter. The summary of the thesis, recommendations and also a proposed future work to be pursued became part of the research paper. Instructional manuals were also prepared in order to guide non-technical users to be able to use the software without the physical presence of programmer.

CE3.16 Besides working tirelessly individually, I also managed to work with a team of professionals. Collaboration and brainstorming of the ideas towards coming up with a functional system was the core business of the team. By virtue of the project being my brainchild, I acted as a team leader. I effectively demonstrated leading and interpersonal skills towards realization of the objectives utilizing the limited financial and time resources. This proved to be economical and effective.

CE3.17 The success of such a system relied greatly on the planning model that I employed. Right from the beginning, I put in place the time schedule with which different phases of the project would be completed. This brought a big breakthrough as the timeline of the institution was met. Managing the limited financial resources was very important. I ensured that the right quality and cost of components was so selected so as not to negatively impact on the cost. I thuds was able to sufficiently use the originally allocated budget.

CE3.18 Antenna design and operation is a very important area which attracts a lot of regulations and codes of practice. Thus to ensure compliance and safety, I worked in close adherence to the ITU Resolution 79 (Dubai, 2012). The standards that I also I followed enabled me to to come up with the design that was environmentally friendly. This way the design, construction and testing would pose no harm to the public and interference to other radio equipment.

Summary

CE3.19 Basically, this research entailed a thorough analysis of antenna theory, and the related different types of antenna designs. I conducted wide research and collected necessary information by collaborating and working with professionals in the wireless communication field. With the data, I analyzed preexisting systems in households and used findings to design and construct an optima antenna with improved reception. I undertook series of designing the system, modelling and testing to evaluate performance. Computer Aided design was important in simulating before actual implementation. By abiding by local and international standards, I implemented the system and tested it. It was successful because the objectives of the research were achieved. Finally, documentation was wound up by factoring in every stage of the process in order to allow future researchers to access and make reference to.

SUMMARY STATEMENT FOR PROFESSIONAL ENGINEER

Competency Element	A brief summary of how you have applied the element	Paragraph in the career episode(s) where the element is addressed
PE1 KNOWLEDGE AND SKILL BASE		
PE1.1 Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	a) With my knowledge and skills in Telecommunication Engineering, I was able to apply Engineering theories to find the solution of the problems in the society. I also utilized natural and physical science to find solution to the problems in society.	CE1.7, CE1.8, CE1.9, CE2.7, CE2.8, CE2.9, CE3.7, CE3.8,CE3.9,

PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics and computer and information sciences which underpin the engineering discipline	a) I gather the important data in telecommunication engineering that gave me the basis of my projects. b) I did telecommunication calculations that was paramount in determining the important parameters. c) I used softwares that gave me the alternative design method	CE1.6 CE2.6 CE3.6 CE1.9 CE2.9 CE3.9, CE1.13 CE2.13 CE3.14
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	a) I am an expert in telecommunications calculations because I did mathematics that helped me in the design. b) I am knowledgeable in softwares that are important in Telecommunication filed. c) I am an expert in Telecommunication design as shown by the projects that I handled.	CE1.9 CE2.9 CE3.9, CE1.13 CE2.13 CE3.14 CE1.7, CE1.8 CE2.7, CE2.8 CE3.7, CE3.8
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	a) I solved the challenges in my projects through research and consultative. b) I review the information that was available so as to understand the details of the project.	CE1.10 CE2.10 CE3.12 CE1.5 CE2.5 CE3.5
PE1.5 Knowledge of contextual factors impacting the engineering discipline	a) I leveraged on team work to complete my project on time and for ideas exchanging. b) I did clear and easy to understand	CE1.16 CE2.15 CE3.16 CE1.15 CE2.14, CE3.15,

	documentation. c) I used my skills to manage the schedule of my projects.	CE1.18 CE2.17 CE3.17
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline	a) I used project management tools and resources for success of the projects. b) I followed well know Indian and international standards and codes to implement my projects. c) I followed all the safety precautions as the best way of managing and preventing accidents.	CE1.18 CE2.17, CE3.17 CE1.5 CE2.5 CE3.5 CE1.20 CE2.19, CE3.18
PE2 ENGINEERING APPLICATION ABILITY		

PE2.1 Application of established engineering methods to complex engineering problem solving	a) I research and consulted my supervisor when I was solving the complex problems that I faced in my projects. b) I did Telecommunication engineering calculations when I was designing to get the specifications of components. c) I followed relevant international standards and codes.	CE1.10 CE2.10 CE3.12 CE1.9 CE2.9 CE3.9, CE1.5, CE2.5 CE3.5
PE2.2 Fluent application of engineering techniques, tools and resources	a) I observed safety on my projects as per the regulations at university. b) I used the telecommunication softwares as part of an alternative design methods and to reduce the errors. c) I managed my projects with the aid of the project management tools and resources.	CE1.20 CE2.19, CE3.18 CE1.13 CE2.13 CE3.14 CE1.18 CE2.17, CE3.17
PE2.3 Application of systematic engineering synthesis and design processes	a) I embraced and adopted the use of ICT in my projects in the design where I used engineering softwares. b) I documented the activities in my project for easy reference and communication.	CE1.13 CE2.13 CE3.14 CE1.15 CE2.14 CE3.15

	c) As part of the design process, I did research and consultations when I encountered challenging problems.	CE1.10 CE2.10 CE3.12
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	a) I managed my project quality by following the standards and codes. b) I managed the safety by following standards and safety precautions that were in place during the implementation of the projects. c) I managed the implementation schedule by using my skills in project management.	CE1.5 CE2.5 CE3.5 CE1.20, CE2.19 CE3.18, CE1.18, CE2.17, CE3.17
PE3 PROFESSIONAL AND PERSONAL ATTRIBUTES		

PE3.1 Ethical conduct and professional accountability	a) I implemented the projects with safety in mind as the regulations that were set Jawaharlal Nehru Technological University. b) I respected and embraced the views of my team mates during the project implementation. c) My project met the standards and quality as per department regulations because I followed standards and codes in Telecommunication industry.	CE1.20, CE2.19, CE3.18, CE1.16, CE2.15, CE3.16 CE1.5 CE2.5 CE3.5
PE3.2 Effective oral and written communication in professional and lay domains	a) I communicated well when we held discussion with my supervisor. b) I did documentation in professional manner since I am good in written communication.	CE1.5, CE2.5, CE3.5 CE1.15 CE2.14 CE3.15

PE3.3 Creative innovative and proactive demeanor	a) I used the telecommunication softwares for simulation and design as part of embracing innovation in my projects. b) I used creative methods to solve the problems that I met during the implementation. c) I introduced creative and innovative approaches to my projects.	CE1.13 CE2.13 CE3.14 CE1.10 CE2.10 CE3.12 CE1.14 CE2.12 CE3.13
PE3.4 Professional use and management of information	a) I managed information from the project by documenting my reports accurately b) I collected the important information at the beginning of my projects that helped me in kick starting the implementation. c) I studied the information that was available because I wanted to understand the details of my projects.	CE1.15 CE2.14, CE3.15 CE1.6 CE2.6 CE3.6 CE1.5 CE2.5, CE3.5

PE3.5 Orderly management of self, and professional conduct	a) I followed the standards and codes as part of managing my projects deliverables. b) I followed the project management tools to closely monitor the implementation and made sure the objectives were achieved.	CE1.5 CE2.5 CE3.5 CE1.18 CE2.17 CE3.17
PE3.6 Effective team membership and team leadership	a) I was the team leader and I teamed up with other Engineers like my supervisor to ensure successful implementation of my projects.	CE1.16, CE2.15, CE3.16