CENG IN 7 DAYS

SECOND EDITION

BENJAMIN ASANE ASANTE

[ALASKA McKRONEY]

CENG IN 7 DAYS

Benjamin Asane Asante

[Alaska McKroney]

McKroney Inc.

CENG IN 7 DAYS
By Benjamin Asane Asante

Published by McKroney, Inc., NT 275, New Town, Accra.

Editor: Benjamin Asane Asante
Proofreader: Christabel Ofori-Atta
Cover Page: Benjamin Asane Asante
Interior Designer: Benjamin Asane Asante

Publishing History:
June 2015: First Edition

ABOUT THE AUTHOR

BENJAMIN ASANE ASANTE
[Alaska McKroney]

BENJAMIN ASANE ASANTE is a Bsc. Computer Engineering Student in Kwame Nkrumah University of Science and Technology (K.N.U.S.T). He is a proud old student of St. Augustine's College, Cape Coast. He is a former president of the Association of Computer Engineering Students (A.C.E.S) – K.N.U.S.T and presently the president of the Ghana Engineering Students Association (G.E.S.A) – K.N.U.S.T. Through his dedication and commitment to causing a positive change in his society, he was presented with an honorary award as the most influential student in the College of Engineering for the 2015/2016 academic year.
His sole principle in life is to be the change he wants to see around him. He enjoys researching and programming during his leisure hours.
He believes in hard work and also upholds the fact that Science and Technology has a major role to play in making the world a better place to live in.

Benjamin Asane Asante is also the author of *The McKroney Calculator Tricks Handbook, first edition.*

TABLE OF CONTENTS

This page was intentionally left blank.

Preface

Who Is This Book For?

This book is meant for any engineering student who is undertaking a maiden design project, either for private or academic (examinable or gradable) purposes, and is in search of a reference material on the necessary steps and methods required to produce a standard end product which includes reports and presentation slides.

Who Should Probably Back Away From This Book?

Anyone who falls under any of these categories should back away from this book.

- Any individual who is in search of a source material for his or her design project.
- Any individual who is in search of a sample design project report to use as his or her personal project report.
- Any non-K.N.U.S.T engineering student who is undertaking a similar design project with restrictions and rules which do not fall within the scope of this book.

Conventions Used In This Book

 This icon signifies an idea, a tip or a suggestion.

 This icon signifies a warning.

Find your purpose, live happily ever after.

– A. McKroney

PREPARING YOURSELF FOR THE JOURNEY

Imagine what will happen to a student who has never read any study material or any sort of relevant information concerning a course he is expected to write an examination on in the future. Imagine what will happen to an individual who unexpectedly an alert concerning an interview he is supposed to attend later the same day. Imagine the outcome of any endeavour one pursues without thorough planning or preparation.

Indeed, planning or preparatory processes and procedures form a major aspect of our lives. The things we do or want to do cannot become a success if we do not spend adequate time on planning them. This makes the planning stage of every human endeavour a key and essential prerequisite for success.

Why Do You Need To Prepare?

Of course there should be some allocated advantages one should benefit from the preparatory process if it is rendered important. These benefits however come in different ranges distinguished by the type of activity one is undertaking. Some general benefits from the preparatory process include:

- Adequate preparation saves you time and effort.
- Adequate preparation equips you with the relevant resources for any activity or project.
- Adequate preparation makes you finish projects on time.
- Adequate preparation makes you know what to do at what time.

Why You Need To Prepare For The CENG Project

Just like any other project, it is very important that you plan and prepare yourself for the CENG project. It is very evident that the preparatory stage of this project does not receive much emphasis as the other requirements such as the writing of the report but passing through this stage would save you a great deal of stress and help you create a more standardized end product. The following are general benefits you receive from preparing yourself adequately before embarking on the CENG project.

- Adequately preparing yourself for the CENG project makes you finish the project of time.
- Adequately preparing yourself for the CENG project makes you appreciate engineering better and the role it has to play in the society.
- Adequately preparing yourself for the CENG project makes you understand its other purposes aside the fact that it is an examinable course on its own.

Preparing Yourself For The CENG Project

Preparing yourself for this project has more to do with changing one's way of thinking about the project and engineering as a whole. Additional requirements will be physical materials that would become vital in the course time.

Mental preparation will become our prime target here since the physical preparations are mostly met. These constitute acquiring the necessary materials that would become useful for the whole project. Some of these include: computers, calculators, measuring instruments, pens, pencils, sheets of papers, camera, sound or voice recorder, etc.

Preparing Yourself Mentally

To prepare yourself mentally, you would have to allow yourself to undergo the following mental changes:

- See this project as a stepping stone towards becoming that self-actualised engineer that you have always dreamt about.
- Never allow the aspect of marks allocation overshadow the main aim of this project which is to enable students appreciate engineering and how the field helps to identify and solve our societal problems.
- Know that within every community, society or place of existence, problems exist and are meant to be identified and solved.
- Though students would be required to submit or perform a personal work, that should not prevent you from seeking extra assistance from friends or resource personnel who would avail themselves to you. You should know that engineers always work as a team even if each member has a distinctive role to play.

PROBLEM IDENTIFICATION (DAY ONE)

Science can be best described as the method of obtaining knowledge through observation, research and experimentation. Also, technology is the application of scientific knowledge to make work easier and faster for mankind.

The birth of a new technological advancement or innovation could never be in existence if one never observed present occurrences to find out which of them needed immediate addressing. In other words the new inventions and innovations we see around lately would never have existed if people had not identified the problems for which these inventions are intended to solve.

Thomas Edison invented the electric bulb because he probably identified a problem of darkness during certain times of the day.

All these sum up to the fact that the ability to identify a problem forms a major part of providing solutions to problems.

How To Identify A Problem

Though the problem identification stage is very important to the problem solving process, it can sometimes prove to be a very difficult stage especially for beginners. The following standard procedure is what one has to look out for when trying to identify a problem in a given area:

- Any occurrence or situation that may endanger lives could be recorded as a problem.
- Any occurrence that raises enormous concern among the inhabitants of the society could be a problem.
- Any occurrence that reduces productivity and growth could be a problem.

After running through the above procedure, you should be able to pinpoint or record certain occurrences per the criteria provided above. Then run a confirmatory test on each of the occurrences. The following is a typical confirmatory test one may use:

- Does this occurrence endanger the lives of people in the society?
- Does this occurrence raise enormous concern among the inhabitants of the society?
- Does this occurrence reduce productivity and growth?

If you are able to answer ‘Yes’ to any of the questions in the confirmatory test for any of the occurrences recorded, then you have successfully identified it as a problem.

What Problems Do You Need To Identify Per The CENG Project Standard?

The CENG Project has restrictions with respect to the nature of the problem one needs to identify and work on. More preferably, students are required to identify and provide solutions to the identified problem using knowledge based on their field of study in engineering. Meaning a Computer Engineering student should be able to identify a problem which can be solved with knowledge from Computer Engineering.

In order to ensure that the above preference is observed, the confirmatory test now becomes:

- Does this occurrence endanger the lives of people in the society?
- Does this occurrence raise enormous concern among the inhabitants of the society?
- Does this occurrence reduce productivity and growth?
- **Can this occurrence be solved with knowledge from your given field of study in engineering?**

If you are able to answer 'Yes' to any of the first three questions and the last one in the new confirmatory test for any of the occurrences recorded, then you have successfully identified it as a problem suitable for your CENG project.

Make sure your identified project can be solved using knowledge obtained from your field of engineering. That is why it is very imperative for you to allow all your recorded occurrences to pass through the confirmatory test.

An individual's project may be tagged as non-standard with respect to the CENG project if the containing solution to the identified problem is not related to his field of engineering.

Engineering And Its Fields

Engineering is the application of mathematics, empirical evidence and scientific, economic, social, and practical knowledge in order to invent, innovate, design, build, maintain, research, and improve structures, components, materials and processes.

The discipline of engineering is extremely broad, and encompasses a range of more specialized fields of engineering, each with a more specific emphasis on particular areas of applied science, technology and types of application.

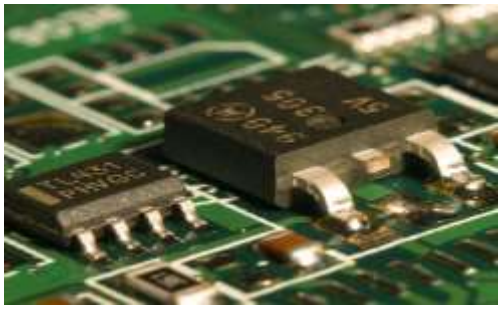
The following are some common fields in engineering:

- Computer Engineering
- Telecommunications Engineering
- Electrical Engineering
- Biomedical Engineering
- Petroleum Engineering
- Petrochemical Engineering
- Chemical Engineering
- Civil Engineering
- Geological Engineering
- Geomatic Engineering
- Mechanical Engineering
- Aerospace Engineering
- Agricultural Engineering
- Materials Engineering
- Metallurgical Engineering

In order to ease the process identification stage and how to solve it with knowledge obtained from your particular field of engineering, the following section has been fully dedicated to explaining what that particular field of engineering is about, common identified problems as well as common and known solutions to the respective identified problem.

This is intended to help students have a general idea of how to get a good matchup between identified problems and solutions to that problem which are related to your field of engineering.

Computer Engineering



Computer chips

Computer Engineering is a discipline that integrates several fields of electrical engineering and computer science required to develop computer hardware and software. Computer engineers usually have training in electrical or electronic engineering, software design, and hardware-software integration.
Computer engineers are involved in many hardware and software aspects of computing, from the design of individual microcontrollers, microprocessors, personal computers, and supercomputers, to circuit design. This field of engineering not only focuses on how computer systems themselves work, but also how they integrate into the larger picture.

Some Common Identified Problems In Computer Engineering

- Improper data management in a given institution such as community library or hospital.
- Lack of a website.
- Lack of interactive learning materials in schools.
- Tedious process involved in marking objective exams questions in schools.
- Improper collection and storage of data.
- High power consumption due to people not switching off some electric gadgets before leaving home for work.
- Lack of a remote booking system leading to people forming long queues.
- Lack of a credible registration system.
- Increased cases of theft (people breaking into other peoples' homes) in the society.
- Tourists getting missing due to lack of a proper navigation system.
- Fall in the standard of education due to students receiving inadequate mock exams to gain the needed experience.
- Laziness among community workers due to an ineffective employee scrutiny system.
- Waste of water in storage tanks through the process of spillage due to the lack of a system to check the water level.
- Lack of traffic lights leading to many accidents on the roads.
- Distortion of information due to lack of a network system.
- Wireless insecurity
- Inadequate power supply.
- Increased cases of accidents due to drivers not obeying traffic rules and road signals.
- Increased rate of unemployment.
- Lack of monitors in systems in industries leading to over or under production.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of a data management system.
- Creation of a website or web application.
- Creation of an E-learning software or application.
- Creation of a smart electronic marking system.
- Creation of a biometric validation system and using a remote or local electronic and more secure data storage system.
- Creation of a computerized home management system.
- Creation of a mobile application to ease booking systems and long queues.
- Creation of a biometric registration system.
- Creation of an automatic alarm system that sends signals in the form of text messages to the nearest police station and the owners of the house.
- Creation of a localized navigation system.
- Creation of an E-learning software or application with questions to which students are required to provide answers and marks are allocated after each session.
- Creation of a daily biometric registration system and proper surveillance system.
- Creation of a water level detection device that automatically closes the valves when the water is at maximum level and opens when the water is at minimum level.
- Creation of a road traffic control system.
- Creation of a proper network system.
- Improving on the wireless security in a given area.
- Creation of an alternate source of power.
- Establishment of a proper surveillance system.
- Creation of a website of mobile application to serve as a centralized hub where job offers can be publicized.
- Establishment of control systems with sensors to monitor and manage elements of interest which may include temperate, liquid level, pressure, etc.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Computer, Telecommunications and Electrical Engineering.

Telecommunications Engineering

Telecommunication satellites

Telecommunications Engineering is an engineering discipline that brings together electrical engineering with Computer Science to enhance telecommunication systems. The work ranges from basic circuit design to strategic mass developments.
A telecommunication engineer is responsible for designing and overseeing the installation of telecommunications equipment and facilities, such as complex electronic switching systems, copper wire telephone facilities, and fiber optics.

Some Common Identified Problems In Telecommunications Engineering

- Wireless insecurity.
- Distortion of information due to lack of a network system.
- Increased cases of theft (people breaking into other peoples' homes) in the society.
- Tourists getting missing due to lack of a proper navigation system.
- Bad and non-reliable communication methods in the society.
- Regular breaking or leaking of underground pipes without authorities noticing
- Poor means of information dissemination.
- Lack of surveillance monitoring system.
- Lack of an electricity theft monitoring system.
- Lack of a traffic light control system.
- Lack of a remote tracking device.
- Frequent power outages due to overloading or faults in main transformers.
- No means to contact security and health personnel in times of emergency.
- Poor network signals.

Some Common And Known Solutions To The Respective Identified Problems

- Improving on the wireless security in a given area.
- Creation of a network and file sharing system.
- Creation of an automatic alarm system that sends signals in the form of text messages to the nearest police station and the owners of the house.
- Creation of a localized navigation system.
- Creation of a new or alternate communication method.
- Establishing tracking devices or monitors that send signals upon detecting leaks.
- Creation of an electronic information dissemination system.
- Establishment of a proper surveillance system.
- Creation of a theft control device for the electricity meters.
- Creation of a road traffic control system that uses wireless communication.
- Creation of a remote tracking device that continuously sends signals of its present location to a main display.
- Creation of an automatic voltage monitoring device that cuts power supply or sends details of faults to main stations for easy identification and solving.
- Creation of an emergency dial up system.
- Establishment of extra base stations.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Computer, Telecommunications and Electrical Engineering.

Electrical Engineering

Transformers

Electrical Engineering is a field of engineering that generally deals with the study and application of electricity, electronics, and electromagnetism.
Electrical engineers design, develop, test and supervise the manufacturing of electrical equipment, such as electronic motors, radar and navigation systems, communication systems and power generation equipment. Electrical engineering has now been subdivided into a wide range of subfields including electronics, digital computers, power engineering, telecommunications, control systems, radio-frequency engineering, signal processing, instrumentation, and microelectronics.

Some Common Identified Problems In Electrical Engineering

- Lack of an access control system.
- Increased fire outbreak due to lack of fire and smoke detectors.
- Increased cases of accidents due to lack of traffic control system.
- Lack of an electricity theft monitoring system.
- High power consumption due to people not switching off some electric gadgets before leaving home for work.
- Waste of water in tanks due to the lack of a system to check the water level.
- Frequent power outages due to faults in main transformers.
- Lack of a thermal overload protection and temperature monitoring device in main transformers.
- Lack of street lights control system in the community leading to high power consumption.
- The need for an automatic door at hospitals.
- Frequent power fluctuations causing damages to home appliances.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of an electronic access control system with detectors.
- Creation of a smoke and fire detection device.
- Creation of a road traffic control system.
- Creation of a theft control device for the electricity meters.
- Creation of an automatic shutdown system.
- Establishment of control systems with sensors to monitor and manage elements of interest which may include temperate, liquid level, pressure, etc.
- Creation of an automatic voltage and temperature monitoring device that cuts power supply or sends details of faults to main stations for easy identification and solving.
- Creation of a temperature monitoring device in transformers.
- Creation of automatic switching devices in street lights.
- Creation of an automatic door with sensors.
- Creation of a voltage stabilizer to minimize the effect of fluctuation.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Computer, Telecommunications and Electrical Engineering.

Biomedical Engineering

Biomedical Prosthetics

Biomedical Engineering is the application of engineering principles and design concepts to medicine and biology for healthcare purposes. This field seeks to close the gap between engineering and medicine. It combines the design and problem solving skills of engineering with medical and biological sciences to advance health care treatment, including diagnosis, monitoring and therapy.

Some Common Identified Problems In Biomedical Engineering

- Sick patients have to be carried into the hospital due to lack of a transportation device.
- Lack of an alternate temperature measuring device.
- Lack of a user authentication system.
- Inefficient storage facilities for medical samples.
- Lack of hearing enhancement tool for the deaf students in schools.
- Lack of prosthetic materials for the physically challenged.
- Increased hospitalized patients death due to no oxygen level detecting device.
- The need for a better heart rate detecting device.
- The need for an automatic controlled wheelchair at hospitals.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of an automatic stretcher that senses specified directional markings on the ground.
- Creation of an alternate temperature measuring device.
- Creation of a secure biometric identification system.
- Creation of a better and more efficient storage facility for medical samples.

- Creation of hearing aids for students.
- Creation of prosthetic materials for the physically challenged.
- Creation of an oxygen level detecting device that signals doctors upon reaching a minimum requirement.
- Creation of an alternate heart rate detecting device that uses frequency sensors.
- Creation of a patient controlled wheelchair

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Petroleum Engineering

A Platform Structure

Petroleum Engineering is a field of engineering concerned with the activities related to the production of hydrocarbons, which can be either crude oil or natural gas. Exploration and production are deemed to fall within the upstream sector of the oil and gas industry. Exploration, by earth scientists, and petroleum engineering are the oil and gas industry's two main subsurface disciplines, which focuses on maximizing economic recovery of hydrocarbons from subsurface reservoirs

Some Common Identified Problems In Petroleum Engineering

- Lack of a device to separate components of crude oil.
- Lack of an underwater or underground pipe leakage detection device leading to massive oil spillage.
- Lack of a device to control the flow of crude oil leading to overflow of oil in reservoirs.
- Improper disposal of gases leading to pollution.
- Lack of a petroleum reservoir monitoring system
- The need for a crude oil component testing device.
- Lack of a proper oil transportation device or method.
- Lack of well depth detection devices.
- Lack of a proper gas storage device.
- Improper dig site selection.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of a crude oil separation device or instrument.
- Establishing tracking devices or monitors that send signals upon detecting leaks.
- Creation of a liquid level detection device that automatically closes the valves when the liquid level is at maximum level and opens when the liquid level is at minimum level.
- Creation of a device to manage the disposal of gases.

- Creation of a reservoir gauge system.
- Creation of a device to test the various crude oil components.
- Creation of a device to transport oil efficiently.
- Creation of a device that uses ultra-sonic waves to detect the depth of wells.
- Creation of a storage device to store gases.
- Creation of a device to detect the availability of oil before digging.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Petrochemical Engineering

A Refinery Station

Petrochemical engineering is a specialized branch of chemical Engineering which deals with the operations of refining and petrochemical technology. The term petrochemical refers to the organic chemicals which are obtained directly or indirectly from crude petroleum. The petrochemical industry uses petroleum and its derivatives as raw materials to produce chemicals, solvents, adhesives, detergents, plastics, polymers and fibers, lubricants, fertilizers, and agrochemicals.

Some Common Identified Problems In Petroleum Engineering

- The need for an alternate source of fuel.
- Water pollution leading to cholera outbreak.
- Lack of proper sewage treatment before injection into water bodies.
- Land degradation due to lack of synthetic recycling.
- Lack of an alternate food preservation methods.
- Lack of a proper gas storage device.
- The need for a crude oil component testing device.
- Lack of a device to separate components of crude oil.

Some Common And Known Solutions To The Respective Identified Problems

- Finding an alternate source of fuel.
- Creating of water cleansing agents that make it safe for domestic purposes.
- Creation of chemicals that nullify dangerous chemicals in sewage.
- Creation of degradable packaging materials.
- Creation of reliable food preservatives.
- Creation of a storage device to store gases.
- Creation of a device to test the various crude oil components.
- Creation of a crude oil separation device or instrument.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Petrochemical and Chemical Engineering.

Chemical Engineering

Chemical Test tubes

Chemical Engineering is a branch of engineering that applies physical sciences and life sciences together with mathematics and economics to produce, transform, transport, and properly use chemicals, materials and energy. It essentially deals with the engineering of chemicals, energy and the processes that create and convert them. Chemical engineers are concerned with processes that convert raw materials or chemicals into more useful or valuable forms.

Some Common Identified Problems In Chemical Engineering

- Lack of potable drinking water.
- Increased land pollution due to inadequate structures for recycling plastic and polythene materials.
- Lack of proper sewage treatment before injection into water bodies.
- The need for an alternate source of fuel.
- Lack of a proper cleansing agent such as soap to remove stains caused by hard water from clothing.
- Lack of alternate food preservation methods.
- Weakened bridges in the community due to rusting.
- Farm crops lacking the required nutrients.
- The need for synthetically produced chemicals to combat weed growth in local farms.
- The need for a proper sterilization device or method.
- The need to harness external energy.

Some Common And Known Solutions To The Respective Identified Problems

- Creating of water cleansing agents that make it safe for domestic purposes.
- Creation of degradable packaging materials.
- Creation of chemicals that nullify dangerous chemicals in sewage.
- Creation of an alternate source of fuel by extracting biodiesel from seeds.

- Creation of a cleansing agent for clothes.
- Creation of reliable food preservatives.
- Creation of an anti-rust agent.
- Creation of advanced chemicals through the extraction of nitrogenous compounds from organic matter to apply to crops.
- Creation of anti-growth agent for farm weeds.
- Creation of chemicals for sterilization.
- Creation of solar cells for solar panels to harness solar energy.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Petrochemical and Chemical Engineering.

Civil Engineering

Civil Engineering Drawings

Civil engineering is a discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings. Civil engineering takes place in the public sector from municipal through to national governments, and in the private sector from individual homeowners through to international companies.

Some Common Identified Problems In Civil Engineering

- Lack of a proper dumping site for refuse.
- Lack of roads in the society.
- Inadequate gutters and the lack of a proper drainage system.
- Lack of disaster resilient buildings leading to high cases of deaths during disasters.
- Lack of an overhead bridge leading to increased road accidents.
- Lack of a proper storage facility for local farmers.
- Lack of a proper water harvesting method for farmers during the raining season leading to low agricultural yield.
- Increased land degradation due to lack of erosion control measures in the society.
- The need for a dam construction to store water to ensure constant annual supply.

Some Common And Known Solutions To The Respective Identified Problems

- Construction of a proper dumping site for waste.
- Construction of good roads for easy transportation.
- Construction of underground drainage systems.
- Creation of new building designs to withstand disasters.
- Construction of bridges.

- Construction of storage structures.
- Construction of water harvesters for farms.
- Construction of erosion prevention structures.
- Construction of a dam.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Geological Engineering

Geological engineering is the application of the geological sciences to engineering study for the purpose of assuring that the geological factors regarding the location, design, construction, operation and maintenance of engineering works are recognized and accounted for. Engineering Geologists provide geological and geotechnical recommendations, analysis, and design associated with human development and various types of structures. The realm of the engineering geologist is essentially in the area of earth-structure interactions, or investigation on how the earth or earth process impacts human made structures and human activities.

Some Common Identified Problems In Geological Engineering

- Increased rate of erosion in the community.
- Increased rate of floods during rainy season.
- Local roads not lasting long due to poor site selection and constructing materials.
- The need for a reliable source of drinking water such as a borehole.
- The need for the construction of a waste disposal site in the community.
- The need for alternate building materials.
- Improper soil type selection for agricultural practices.

Some Common And Known Solutions To The Respective Identified Problems

- Construction of erosion prevention structures.
- Selection of proper sites for good drainage systems.
- Selection of good raw materials and land sites for the construction of roads.
- Selection good grounds where there's availability of underground water for the construction of boreholes.

- Selection of suitable grounds for the construction of a waste disposal site.
- Discovering alternate raw materials for building.
- Selection of good sites for agricultural activities.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Geomatic Engineering

Surveying A Landscape

Geomatic Engineering is an engineering discipline that focuses on spatial information. The location is the primary factor used to integrate a very wide range of data for spatial analysis and visualization. Geomatic engineers apply engineering principle to spatial information and implement relational data structures involving measurement sciences, thus using geomatics and acting as spatial information engineers. Geomatic Engineering also involves aspects of Computer Engineering, Software Engineering and Civil Engineering.

Some Common Identified Problems In Geomatic Engineering

- Lack of a proper navigation system.
- Increased mobile phone theft due to lack of a tracking system.
- The need for the installation underground pipes for fluid transportation.
- The need for a water treatment plant in the community.
- Lack of good roads in the community.
- The need for the construction of a proper drainage system.
- Improper selection of sites for infrastructure.
- The need for a dam construction to store water to ensure constant annual supply.
- The need for a reliable source of drinking water such as a borehole.
- The need for a GPS positioning and tracking system.
- The need for the construction of a waste disposal site in the community.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of a proper navigation system.
- Creation of a remote tracking system.
- Selection of good sites for laying underground pipes.
- Selection of good sites for building the plant.
- Selection of suitable grounds for road construction.
- Selection of good sites for the construction of good drainage systems.
- Selection of good sites per the requirements of the given infrastructure to be constructed.
- Selection of suitable grounds for the construction of a dam.
- Good surveying of a given area to identify areas with substantial underground water.
- Creation of a GPS tracking system.
- Selection of suitable grounds for the construction of a waste disposal site.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Mechanical Engineering

Mechanical Gears

Mechanical Engineering is a discipline that applies the principles of engineering, physics, and materials science for the design, analysis, manufacturing, and maintenance of mechanical systems. It is the branch of engineering that involves the design, production and operation of machinery. Mechanical engineers use core knowledge in mechanics, kinematics, thermodynamics, materials science, structural analysis, and electricity along with tools like computer-aided design to design and analyse manufacturing plants, industrial equipment and machinery, heating and cooling systems, transport systems, aircraft, watercraft, robotics, medical devices, weapons and others.

Some Common Identified Problems In Mechanical Engineering

- Patients at the hospital always have to be carried upstairs due to lack of a transportation device
- Lack of an automatic temperature recording device and cooling system in industrial machines leading to frequent breakdown.
- Lack of a proper irrigation system in local farms.
- Lack of an alternate power generation machine.
- Lack of automatic opening gates at hospitals.
- Lack of a remote controlled transportation device during disasters.
- Lack of an automatic waste type detection device in recycling companies.
- The need for a hydraulic lifting device to get heavy objects to higher heights.
- The need for an overspeeding indicator in vehicles.
- Lack of a device to help clear bushes in the community.
- Lack of an automatic fluid level indicator in reservoirs.
- The need for a device to detect cracks in walls of structures such as buildings, reservoirs and dams.
- The need for an automatic valve control device in reservoirs and dams to prevent overspill.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of a transportation device to transport patients in the hospital.
- Creation of an automatic temperature control device that records the temperature and performs a cooling action when temperature exceeds maximum tolerance.
- Creation of a mechanic irrigation system.
- Creation of a machine to generate alternate power.
- Creation of automatic gates.
- Creation of a remote controlled transportation device to transport relief items during disasters.
- Creation of a device that automatically detects waste types and separates them through different channels for recycling.
- Creation of a hydraulic device to lift heavy materials to higher heights.
- Creation of a device to alert drivers during overspeeding instances.
- Creation of a machine to weed bushy areas in the community.
- Creation of a device to automatically check fluid level in reservoirs.
- Creation of a crack determining device.
- Creation of automatically controlled valves that close when the reservoir's gauge indicates maximum and open when the gauge indicates empty.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Mechanical, Aerospace and Agricultural Engineering.

Aerospace Engineering

A Turbine

Aerospace engineering is the primary branch of engineering concerned with the research, design process, development, construction, testing, science and technology of aircraft and spacecraft. It is divided into two major and overlapping branches which are aeronautical engineering and astronautical engineering. Aeronautics deals with aircraft that operate in earth's atmosphere and astronautics deals with spacecraft that operate outside the earth's atmosphere.

Some Common Identified Problems In Aerospace Engineering

- The need for a better transportation device.
- The need for an airborne surveillance device or system.
- Lack of a proper irrigation system.
- Lack of an alternate power generation device.
- The need for a lifting device to get heavy objects to higher heights.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of an engine-powered remote transportation device.
- Creation of an airborne surveillance device or system.
- Creation of a mechanic irrigation system.
- Creation of a turbine to produce power.
- Creation of a device to lift heavy materials to higher heights.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Mechanical, Aerospace and Agricultural Engineering.

Agricultural Engineering

A Plough

Agricultural Engineering is a discipline in engineering that applies engineering science and technology to agricultural production and processing. Agricultural engineering combines the disciplines of mechanical, civil, electrical and chemical engineering principles with knowledge of agricultural principles.

Some Common Identified Problems In Agricultural Engineering

- Lack of a fast harvesting device or method leading to birds and other animals consuming majority of the farm produce hence decreasing the harvest.
- Lack of a proper irrigation system.
- The need for a source of power to power other instruments.
- Lack of a water pumping system.
- Lack of a better and faster method for planting on the field.
- Lack of a better and faster spraying system on the farm.
- The need for a proper storage system or device for farm produce.
- The need for soil type detection methods for agricultural practices.
- Lack of a device to help clear bushes and weeds.
- The need for a valve-controlling device for irrigation systems.
- The need for better and secure feeding containers in farms.
- The need for an egg-incubating device.
- Lack of proper housing units for farm animals.
- Lack of proper alternative food preservation methods.
- Plants' inability to grow properly due to lack of particular soil nutrients.

Some Common And Known Solutions To The Respective Identified Problems

- Creation of a harvesting machine to harvest farm produce.
- Creation of an automatic irrigation system.
- Creation of a machine or device to generate alternate power.
- Creation of a water pumping system.
- Creation of a planting machine.
- Creation of a spraying machine.
- Creation of a storage device to keep farm produce.
- Creation of a soil type detection device.
- Creation of a device to help clear bushes before planting.
- Creation of an automatic valve-controlling device that closes after a given set time has elapsed in irrigation systems.
- Creation of better feeding containers for farm animals.
- Creation of an incubator.
- Construction of proper housing units for farm animals.
- Creation of reliable food preservatives.
- Creation of chemicals to be applied to soil to cater for nutrient deficiencies.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Mechanical, Aerospace and Agricultural Engineering.

Materials Engineering

Lab Testing Of New Materials

Materials Engineers design, produce and evaluate materials and their uses. They bring valuable expertise in materials to just about every industry, often working closely with other engineers, to make a real difference in our world. They make things like metal, plastic and ceramics work for us. They develop, change and use different processes to turn raw materials into useful substances with desirable properties.

Some Common Identified Problems In Materials Engineering

- Land degradation due to waste materials not being recycled.
- Regular leakage of water reservoirs.
- Regular damage of bridges in the society.
- The need for alternate and reliable building materials.
- Iron-made water reservoirs causing infections in people who drink water from them.
- Lack of a proper dumping site for refuse.
- Regular power outage due to the use of non-recommended wire types.
- The need for corrosion preventive measures to be applied to metallic infrastructure.
- The need for an underground pipe transportation system for water in the community.

Some Common And Known Solutions To The Respective Identified Problems

- Recycling waste materials into other useful building materials.
- Selection of good and durable materials for reservoir construction.
- Selection of good and durable materials for bridge construction.
- Selection of alternate building materials.
- Selection of non-reactive materials for reservoir construction.
- Selection of appropriate wire types for wiring.
- Creation of anti-corrosion alloys or materials for construction.
- Selection of good materials for the construction of an underground pipe transportation system.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Materials and Metallurgical Engineering.

Metallurgical Engineering

Metal sheet creation

Metallurgical engineering is a branch of engineering that studies the physical and chemical behaviour of metallic elements, their intermetallic compounds, and their mixtures, which are called alloys. Metallurgical engineers extract, refine and recycle metals. They solve problems such as reducing corrosion, maintaining heat levels, and increasing the strength of a product. They help develop or improve metals that are used in the healthcare, in transportation, in defense, and in the entertainment industry. Their work impacts most of the other engineering fields as they develop core materials that can enhance the function of many products and systems.

Some Common Identified Problems In Metallurgical Engineering

- The need for alternate and reliable building materials.
- Regular damage of bridges in the society.
- Iron-made water reservoirs causing infections to people who drink water from them.
- Corrosion of underwater pipes.
- Regular power outage due to the use of non-recommended wire types.
- The need for the repair of railway tracks.

Some Common And Known Solutions To The Respective Identified Problems

- Selection of alternate and reliable building materials.
- Creation of bridges with strong and durable metals.
- Creation of reservoirs with materials which do not react with water to form harmful substances.
- Creation of anti-corrosive agents to reduce the effects of corrosion on metals.
- Selection of appropriate metals with beneficial resistances for the manufacture of wires.
- Selection of good and strong metals for railway tracks.

All the above outlined common solutions to their respective identified problems are not the only solutions available for the respective problem. You should not therefore restrict yourself to just these ones. Any other good solution derived with the intention of solving the same identified problem would be suitable. You are therefore expected to explore.

Note that some of these common problems and solutions might repeat for similar engineering fields such as Materials and Metallurgical Engineering.

External Links

It is very important to have prior knowledge about a project you are doing or about to do before you actually commence it. It becomes very easy and time-saving especially when people have already worked on projects that are similar or related to what you want to do. However, you cannot receive vital information unless you get the exposure on how they solved that similar problem they identified and how they identified problems using the same criteria you would adopt.

This book provides external links to a number of projects and problems related to all the engineering fields discussed above. This is meant to expose readers to the similar problems and projects to give them a fair idea of how best they can go about their projects with respect to problem identification and finding good solutions to the identified problem.

All external links are in the appendix section.

All external links are in the appendix section of this book.
Click here to jump to that section.

All external links are clickable. Just click or tap on them if you are on a mobile device to send you to the designated URL online.

Materials And Methods Needed (Day Two)

At this stage, you should have been able to identify a problem and at least proposed a solution for it. Successfully identifying a problem and generating a proposed solution to solve the given problem does not actually solve the problem unless the solution becomes a fully-fledged establishment. For a proposed solution to become an actual one, one has to go through a number of required stages and after each stage, the proposal edges closer to becoming actual.

This book covers the necessary required stages only and explains the need for each step. These steps include:

- Materials and methods needed
- Fieldwork
- Analysis of results obtained
- Discussing the solution
- Writing the report
- The PowerPoint presentation

In this chapter, we will talk more about the materials and methods needed for fieldwork.

Materials, What Are They?

Materials are physical devices and instruments that would be used for collection, processing and storing of data as well as fieldwork. These materials come in a wide range and are dependent on the requirements of the project and its final report document.

The following constitute the most common materials that the CENG Project requires for fieldwork:

- A pen and a book for recording observations.
- A computer for data processing and storage.
- A camera for taking pictures of sites.
- A measuring instrument for taking measurements and readings.
- A questionnaire if your method involves its use.
- A recorder to record interview sessions with locals.
- A permit if the place is a highly restricted area.
- A copy of the letter of introduction given to you by the school to prove your credibility.

Methods, What Are They?

Methods describe the various means and ways that would be employed to make research and inquiries during fieldwork.
The following constitute the most common methods that the CENG Project requires for fieldwork:

- The use of a questionnaire to make the necessary inquiries.
- The use of a recorder to make the necessary inquiries.
- Performing one-on-one interviews with locals to affirm whether the problem is really a drawback.

We would discuss the use of questionnaires and how to conduct a good interview in the next section.

What Is A Questionnaire?

A questionnaire is a set of printed or written questions with a choice of answers, devised for the purpose of a survey or statistical study.

Qualities Of A Good Questionnaire

- It should be short and precise.
- It should consist of an easy and a simple language.
- It should be interactive.
- It should consist of questions and answers that are in line with the answers you are looking for.
- It should have understandable answers if provided.
- It should have questions that are arranged in a proper way. (Questions about a particular topic should be grouped together before questions from another topic are asked).

You can find a sample questionnaire in the Appendix section of the sample report. Click here to jump to that section.

What Is An Interview?

An interview is a conversation between two or more people where questions are asked by the interviewer to gain facts about a person or a problem.

How To Conduct A Good Interview

- Ask questions one at a time and do not rush the interviewee to respond.
- Speak clearly so that the interviewee can easily hear and understand you.
- Listen carefully and ask follow up questions.
- Do not try to correct your interviewee and keep your personal opinions to yourself as much as possible.

There may be other materials and methods that were not discussed that might come in handy. You are at liberty to use them.

Why Is It Important To Know The Materials And Methods You Will Need For Fieldwork?

I trust you do not want to find yourself in a place very far from home doing some fieldwork and you realize you would need a tool you left behind. Well, these are some of the situations you might find yourself in if you do not take this stage of identifying the necessary materials and methods you will need for fieldwork very seriously.

These summarize a few benefits you will receive if you take this stage seriously:

- It saves time.
- It gives an assurance of collecting correct and accurate data.
- It makes fieldwork easier.

Fieldwork (Day Three)

Creating or proposing a solution for a problem that exists without personally visiting the site to perform the necessary analysis and research might not end up solving the problem adequately. It always becomes a prerequisite for one to visit a site where he or she has identified the existence of a problem. The process of undertaking this exercise is what is termed fieldwork and we would cover it in more detail.

Definition Of Fieldwork

Fieldwork basically means going to the site where the problem exists or the site where the construction of the solution is going to be done, to make the necessary research, inquiries and analysis to enhance the process of modifying and creating a solution to solve the problem adequately.
The main prerequisite for fieldwork is getting the materials and methods needed ready. We have already discussed that in the previous chapter so we are good to go.

Fieldwork In Stages

Fieldwork could be very demanding. At times you need to use more than a single day in order to obtain the desired results. However, it is considered good practice if all activities are broken down and executed in stages. Let us discuss these stages.

Introductory Stage (Stage One)

The Introductory Stage is the stage where initial analysis and research is performed on the field. It requires the use of some materials and methods discussed already in this book.
The following may occur during this stage of fieldwork:

- Analysing and recording of the effects of the problem on the community and the environment as a whole.
- Seeking relevant information through the use of interviews and questionnaires or any suitable method.

Data Collection Stage (Stage Two)

The Data Collection Stage is the stage where measurement and reading of relevant data is done. Just like Stage One, it requires the use of some materials and methods discussed already in this book.
The following may occur during this stage of fieldwork:

- Taking the necessary recordings or measurement and storing their values.
- Taking pictures of the site and any given occurrence of interest.

Conclusion Stage (Stage Three)

The Conclusion Stage is the stage which sums up the entire fieldwork activity. It entails making a complete visualization of how the solution may be constructed and stating clearly any challenges that might be faced during construction.

These identified and discussed stages are the standard ones available. Sometimes there might be a need to add a few more stages depending on the project you are embarking on. However these should be enough for your CENG Project.

Why Is It Important To Perform Fieldwork?

Of course you cannot find a perfect solution to a problem or one that is close to perfection if you do not have certain vital information about the problem itself to be able to model that perfect solution. Fieldwork may be fun at times and very involving at other times, but whether it is very interesting or not, it is still very important and must be performed regardless.

These summarize a few benefits you will receive if you take this stage seriously:

- It gives you relevant information concerning how best to create or modify the solution.
- It prevents extra time and work in finding another solution since it gives you relevant information to find a good solution to the existing problem.
- It gives more insight about the problem.
- It kickstarts the creation of the actual solution.

Analysis Of Data Obtained (Day Four)

At this point, you have been able to identify a problem and proposed a solution for it. You have also been able to outline materials and methods you need and done the necessary fieldwork. Fieldwork presents one with records of the effects of a problem on a given area or community, information obtained through interviews and questionnaires, values obtained from measurements and pictures of sections of the site. All these resources, though very useful, might prove to be redundant if proper analysis is not performed on them to yield proper conclusions.

Analysis In Stages

Just like in Fieldwork, it is considered good practice if all activities are broken down and executed in stages. This categorizes the analysis stage into three main stages:

- Analysis of data obtained from measurements and recordings.
- Analysis of data obtained from observations.
- Analysis of data obtained from questionnaires and interviews.

Analysis during each stage is performed by using data received from Fieldwork to answer some predefined questions. We will take these stages one after the other for discussion.

Analysis Of Data Obtained From Measurements And Recordings

With the data obtained from Fieldwork, answer the following questions:

- Why was there a need for taking the measurement?
- Was the measured value normal or unexpected? e.g. (voltage)
- What can be done to solve the problem if the measured value is the cause of the problem?
- What are the causes of the unexpected measured value?

Analysis Of Data Obtained From Observations

With the data obtained from Fieldwork, answer the following questions:

- What are the causes of your observations?
- What are the effects of your observations?
- What are the possible solutions to solve the problem that arises from your observations?

Analysis Of Data Obtained From Questionnaires And Interviews.

With the data obtained from Fieldwork, answer the following questions:

- What was the most consistent response?
- What was the most consistent plea, proposal or recommendation?

Why Is It Important To Analyse Your Data?

How useful is data if you do not analyse it to see how best it can be used? Data analysis forms one of the essential tools that one needs to arrive at a final solution which solves a problem adequately.

These summarize a few benefits you will receive if you take this stage seriously:

- It gives more insight about the problem.
- It directs you on how to solve the problem.
- It validates proposed solutions or it helps you get a better modified version.

Make sure you have proper documentation of all analysis made in each category. This is because the report is mainly a composition of the conclusions drawn from the analysis of the data obtained from your observations in the field.

Discussing The Solution (Day Five)

Obtaining a good and working solution is the ultimate stage for every project that seeks to identify and solve a given problem. On that note, the CENG Project also has the solution finding stage as one of the ultimate stages since in this case the report and defense of the project carry equal importance as the solution. In this chapter, we would discuss the CENG Project's solution and how it should be modeled.

The CENG Project's Solution

The CENG Project's Solution is a virtual model of a solution that an individual obtains through the use of knowledge from his field of engineering study, after going through a list of predefined stages. All of these predefined stages have been discussed above in previous chapters.

Virtual Model, What is it?

A virtual model is a visualized and imaginary version of the real model irrespective of whether it exists or not. Which means providing a virtual model of a solution does not require you to actually construct it. All it requires is visualizing how it would be created or designed.

Requirements Of A Virtual Model

Though a virtual model is not physically created, it should be able to represent the physical or real model in the imaginary state. Also any individual should be capable of transforming it into the real model with information received form the virtual model. Therefore every virtual model should be able to meet a given requirement for it to be considered as one.

These are the basic and key requirements of a virtual model:

- It should have a sketch or a graphical representation of how the actual design should look like.
- It should state or show the materials needed for construction and the role of each material in the real model.
- It should state or show the various operations in the real model.

Application Of Knowledge From Your Field Of Engineering Study To Solve The Problem.

Aside the fact that the CENG Project's solution should be a virtual model, it should strictly be based on knowledge from one's field of engineering study. This is because engineers are not the only people in the world who solve societal problems. Scientists, Advanced Researchers, Mathematicians, Physicists, and Health Care personnel are among other people aside engineers who help to mitigate and solve problems. Any problem that one identifies could be solved by other non-engineering means but since this project is an engineering based project, knowledge from engineering, more specifically knowledge from one's field of engineering study is required.

To help you understand this concept better, we will take a sample problem for illustration.

Sample Problem

There has been an outbreak of malaria causing an increase in the mortality rate lately in my community due to stagnant waters in gutters.

Solving The Problem Using Knowledge From Science

The scientist will probably be thinking of how to manufacture chemicals which could combat the mosquitoes in the community.

Solving The Problem Using Healthcare Knowledge

The health care personnel will probably be thinking of how to manufacture drugs that could combat the malaria parasite within infected people.

Solving The Problem Using Knowledge From Physics

The physicist will probably be thinking of how to identify the physical basis of how the mosquito larvae survives in water and how to reverse these mechanisms.

Solving The Problem Using Knowledge From Different Fields Of Study In Engineering

- The Civil engineer will be thinking about how to construct better gutters that can remain choke-free to prevent stagnant waters.
- The Mechanical engineer will be thinking about how to manufacture equipment that could be used to spray mosquitoes in a large scale.
- The Biomedical engineer will be looking at how to reduce the mortality rate by designing and building machines which could easily identify and diagnose malaria in a patient by measurement of temperature or by analysis of any of the malaria symptoms.
- The Chemical engineer will also be looking at how to manufacture chemicals to combat the mosquitoes and the larvae in a large scale.

Make sure your solution is based on knowledge from your field of engineering.

In order to make this very easy for you, sample solutions have been provided for each sample problem in Chapter 2 (Problem Identification). Those should guide you in selecting yours.

Summary: The CENG Project's Solution

These sum up the nature of the CENG Project's Solution:

- It should be a virtual model.
- It should be based on knowledge from your field of engineering study.

Writing The Report (Day Six)

The Report is a formal documentation of the total project starting from the problem identification stage to the stage of providing the solution. In the CENG Project, the report forms part of the most important aspects of the entire project. It is through this document that an individual can properly justify himself as to whether he really pursued the project to the fullest.

Preparing Yourself For The Writing Of The Report

In order to ensure that you have a standard report to present, you really have to prepare yourself before writing. Preparation should be as easy as it should be if you have already sailed through the previous stages we have discussed throughout this book. All you actually have to do is make the required materials available to aid the report writing process.

The following describes materials you will need to write the CENG Project's report:

- A picture of the map of your community.
- A picture of the site where the problem exists.
- A picture or a sketch of the solution.
- A copy of your questionnaire.
- A copy of the letter of introduction.
- All analysis made from the analysis of data obtained stage (day four).
- A documentation of how you intend to solve the problem with knowledge from your field of engineering as discussed in the discussion of the solution stage (day five).

Structure Of The Report

The CENG Project's report has a required structure that must be followed. Each year, the components of the required structure is made known to students via the CENG clinic or prepared document by the College. In this book, we are only going to discuss the most crucial aspect of the structure of CENG Project's Report.

The following outlines aspects of the CENG Project's report we will be discussing:

- Cover page
- Acknowledgements
- Table of Contents

- Abstract or Summary
- Introduction
- Materials and Methods
- Results and Discussion
- Conclusion and Recommendations
- References
- Appendix

Cover Page

The Cover page is the very front page of the report document. It shows the following details:

- University name
- College
- Department
- Logos (Optional)
- Title of report
- Name
- Index number
- Month and year of submission

Acknowledgement

The Acknowledgement consists of appreciation and recognition of contributors and supporters of the project. It should be short and precise. It should not be more than one paragraph.

Table Of Contents

Table of contents consists of a structured guide to the various sections and titles of the report.

Abstract Or Summary

The Abstract is a summary of the report. It includes purpose, methods, results, conclusion and recommendations. It highlights essential points of the report and strictly follows the chronology of the report. The Abstract should be kept as short as possible about half a page long.

Introduction

The introduction is a brief background to the course and your specific project. It identifies the aims and objectives of the CENG Project and the components of the report.

Materials And Methods

Materials and methods mostly referred to as methodology describes the following:

- How you identified the problem.
- How you prepared the map.
- How you went about collecting the data.
- The materials used in any of the above processes.

Results And Discussion

Results and discussion gives an account of the following:

- A description of your community (this is where the map is placed).
- A description of the nature and characteristics of the problem.
- A description of your field of engineering study and the different branches.
- A description of how the problem may be solved using knowledge from your field of study in engineering.

Conclusion And Recommendations

Conclusion states the key findings from your study in a summary. It specifically addresses the objectives you set out to achieve.

Recommendations indicate what should be the follow up to your work to solve the problem completely.

References

References serve as a guide to any reader who wants to refer to previous work on the same subject. It is also meant to show appreciation and credit to the invaluable work of the other researches who researched on the same subject. Failure to credit the work of others is regarded as plagiarism, carelessness or lack of courtesy.

Appendix

The appendix consist of the following:

- Copies of your questionnaire.
- Any additional maps.
- Copies of letters of Introduction.

Other Important Aspects Of The CENG Project's Report Document

The following outlines other important aspects of the CENG Project's report document:

- Text font size should be 12
- Text font type should be Times New Roman.
- Line spacing should be about 1.5.
- All texts should be justified.
- Page numbers should be centered about 0.5 inches from the bottom.
- Captions for figures should be placed below the figure.
- Captions for tables should be placed on top of the table.
- For a major heading, skip three carriage returns from the top margin (or previous section) and place the heading. Use a font larger than the text (preferably 14 or 18 points). The fonts should have initial capitals and should be bold.
- For a subheading, skip two carriage returns before and one after. Use a font larger than the text (preferably 12 or 14 points). The fonts should have initial capitals and should be bold.

A sample CENG standard report is in the appendix section of this book.
Click here to jump to that section.

Please note that the font size of the sample report has been changed to 11 instead of 12 for compatibility sake.

The PowerPoint Presentation (Day Seven)

Preparing the PowerPoint presentation for your CENG Project is the easiest task you can ever find in your CENG Project journey. It can also be the most confusing aspect if proper care is not taken because of how short and precise it is supposed to be.

The PowerPoint Presentation, What Is It?

The PowerPoint Presentation is a summary of your entire CENG Project's report. It consists of excerpts of essential points and facts in the main report. It is short (about 7 slides long) and should be able to represent the entire report.

Aspects Of The PowerPoint Presentation

The following are the aspects of interest with respect to the PowerPoint Presentation for the CENG Project:

- Outline
- Structure
- Fonts
- Colour
- Background
- Graphs
- Conclusions

Let's discuss the various aspects briefly.

Outline

- Make your first or second slide an outline of the presentation.
- Follow the order of your outline for the rest of the presentation.
- Only place main points in the outline slide.

Structure

- Use one to two slides per minute of your presentation.
- Write in point form and not complete sentences.
- Include four to five points per slide.
- Avoid the use of too many words: use key words and phrases only.
- Show one point at a time to have audience concentration throughout.

Fonts

- Use at least 18-point font.
- Use different size fonts for main points and secondary points.
- Use a standard font like Times New Roman or Arial.

Colour

- Use a colour of font that contrasts sharply with the background.
- Use colour to reinforce the logic of your structure.
- Use colour to occasionally emphasize a point.

Background

- Use backgrounds that are simple and attractive.
- Use backgrounds with light colours.
- Use the same background consistently throughout your presentation.

Graphs

- Use graphs rather than charts and words.
- Always give titles to your graphs.

Conclusion

- Use an effective and a strong closing.
- Use a conclusion slide to summarize the main points of your presentation and suggest avenues of research.

Wrapping up

Finally, you have successfully completed this project. I believe it has been a thrilling experience for you and I hope by now you fully appreciate the fact that society needs you to solve her problems.

Make sure you make the necessary forwarding to your project supervisors before the deadline is reached. And keep reading through your report document to find and correct any mistakes before submission.

I must say that it has been a pleasure helping you these past days.
If you have any further inquiries concerning the project, you can contact me personally. I will be glad to help you out in any way possible.

To conclude, I would like to say these few words.

Believe and when you believe, work hard towards what you believe in. We have always believed in change and this might be the only opportunity for us to work hard towards it. But the fact is change is impossible without you because **GESA NEEDS YOU FOR CHANGE!**

Contribute to change GESA today for a better tomorrow.

Thank you.

God Bless You.

Benjamin Asane Asante
[Alaska McKroney]
0276774440
alaskamckroney18@gmail.com

Appendix: External Links Reference

Computer Engineering
http://digitalcommons.calpoly.edu/cpesp/
http://1000projects.org/mini-projects-for-computer-engineering.html
http://www.collegelib.com/t-499-projects-topics-for-computer-science-and-engineering-cse-list-1.html
wwwstudymaterial-studymaterials.blogspot.com/2012/10/min-project-topics-for-computer.html?m=1

Telecommunications Engineering
https://www.elprocus.com/electronics-and-communication-engineering-projects-ideas/
http://projectsqa.com/forum_posts.asap?TID=201

Biomedical Engineering
http://therohanaurora.com/mini-projects/
http://biomedikal.in/2011/07/636-biomedical-engineering-project-titles-form-discussion/
http://bmedesign.engr.wisc.edu/
http://etechsystems.blogspot.com/2012/06/biomedical-engineering-projects-list.html?m=1
http://projects.spogel.com/forum_posts.asp?TID=65

Electrical Engineering
http://www.electronicshub.org/top-electrical-mini-projects/
https://www.elprocus.com/list-of-72-simple-mini-projects-for-eee-students/
http://1000projects.org/electrical-mini-projects.html
http://www.crazyengineers.com/threads/electrical-engineering-mini-project-ideas.61675/
https://www.elprocus.com/top-electrical-project-ideas-for-engineering-students/

Petroleum Engineering
http://everydaylife.globalpost.com/types-projects-petroleum-engineers-deal-12566.html
http://entrance-exam.net/btech-in-petroleum-engineering-project-names-and-ideas/#ixzz2JZYOXghM
http://work.chron.com/petroleum-engineering-projects-20839.html
http://www.hw.ac.uk/schools/petroleum-engineering/research/research-projects.htm
http://petroleum.louisiana.edu/research-innovation/current-projects

Petrochemical Engineering
http://finalprojects2030.net/category/chemical-engineering-projects/
https://sites.google.com/site/ethiograd123/my-calendar/200-project-ideas
http://www.nairaland.com/1164200/final-year-project-topic-petroleum
http://work.chron.com/petroleum-engineering-projects-20839.html

Chemical Engineering
http://finalprojects2030.net/category/chemical-engineering-projects/
https://sites.google.com/site/ethiograd123/my-calendar/200-project-ideas
http://m.mtu.edu/chemical/research/current/
http://www.che.iitb.ac.in/online/education/ug-programme/ug-curriculum/undergraduate-projects?page=1
http://cbee.oregonstate.edu/student_projects

Geological Engineering
http://m.mtu.edu/geo/research/current/
http://www.env.auckland.ac.nz/en/about/notices/notices-2013/2013/08/23/Potential-Geology-Research-Projects.html

Geomatic Engineering
http://www.berchagroup.com/projects/proj_goe_all.htm
http://www.rmofspringfield.ca/_municipal_services/geomatics-engineering-department

Civil Engineering
http://www.aboutcivil.org/civil-engineering-final-year-projects-topic-list.html
http://www.iamcivilengineer.com/2013/11/80-final-year-project-ideas-for-civil.html?m=0
http://www.crazyengineers.com/threads/civil-engineering-project-ideas-for-third-final-year-students-2012.55385/

Mechanical Engineering
http://m.mtu.edu/mechanical/undergraduate/senior-design/spring-2012/
http://mechanical.final-year-projects.in/
http://projectsqa.com/forum_posts.asp?TID=16
https://capstone.me.ucsb.edu/past-projects
http://m.projecttopics.info/?url=http%3A%2F%2Fwww.projecttopics.info%2FMechanical%2FMechanical-Engineering-Project-Ideas-List-PPT.php
http://technosoft9.blogspot.com/p/mechanical-engineering-projects.html?m=1

Materials Engineering
http://digitalcommons.calpoly.edu/matesp/
http://sci.waikato.ac.nz/study/qualifications/be/projects/mape
http://materials.iisc.ernet.in/web/2014/07/ug-final-year-projects-for-2014-15/

Metallurgical Engineering
http://entrance-exam.net/btech-in-metallurgical-engineering-project-names-and-ideas/
http://mme.utep.edu/research.htm

Agricultural Engineering
http://www.crazyengineers.com/threads/agriculture-engineering-project-ideas-for-third-final-year-students.55560/
http://afribary.com/topics/80/agricultural-engineering
http://digitalcommons.calpoly.edu/braesp/
http://www.egerton.ac.ke/index.php/Agricultural-Engineering/research-projects.html

Aerospace Engineering

http://aerospace.technion.ac.il/studies/ug-studies/student-projects/
http://www.engin.umich.edu/aero/info/student/projects
http://www.projecttitles4free.com/2011/11/final-year-aeronautical-engineering.html?m=1
http://www.darcorp.com/Aeronautical_Engineering/Projects/

Appendix: Sample Report

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

CENG 291

COLLEGE OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

LACK OF ROAD TRAFFIC CONTROL SYSTEM AT NII OKAI COMMUNITY ONE LEADING TO INCREASED ROAD ACCIDENTS

BY: ALASKA MCKRONEY

9234019

AUGUST 2015

ACKNOWLEDGEMENT

First and foremost, I will like to thank God for granting me the strength and ideas to undertake this project. I will also like to thank my supervisor Mr. Kwakye Bernard for his guidance and support throughout this project.

I will also like to acknowledge and appreciate the efforts and contributions I received from the Ghana Highway Authority and the National Road Safety Commission (NRSC).

Finally, thank you to all those who supported this project in one way or the other.

God richly bless you.

SUMMARY

This project was pursued to tackle the lack of a road traffic control system in the Nii Okai Community One which has led to the increase in the amount of road accidents in recent times.

The main methods for data acquisition were the use of a questionnaire and verbal interviews. The main sources of information was the Ghana Highway Authority and the National Road Safety Commission (NRSC).

All information received from these organizations proved that the lack of a road traffic control system in the community was the prime factor for the increased rate of road accidents in recent times.

The proposed solution was the mounting of solar-powered LED traffic lights at all junctions and accident prone areas.

CONTENT

In order to prevent conflict, the report numbering has been omitted. Please make sure you have your report document properly numbered when creating yours.

INTRODUCTION

BACKGROUND OF THE COURSE

Science is the method of obtaining knowledge through experimentation, observation and research.

Engineering is the application of the scientific knowledge to design and build materials, devices and structures that will make work easier and faster or solve problems in society.

Engineering in society is a course that bridges the gap between the knowledge obtained from the various fields of engineering and the prevailing problems in the society.
It encourages students to exhibit their learnt skills through researching, fact finding and virtually solving societal problems by providing appropriate remedies.

OBJECTIVES OF THE COURSE

It is very clear that engineers have a major role to play in terms of making the world a better place to live in. The construction of infrastructure and the invention of devices that tend to speed up work at a very high efficiency are all ways engineers contribute to making work easier and faster and also the development of a country. However the solution generation process is highly dependent on project embarking and the making of reports on the analysis of research and findings in the problem solving process.
Embarking on projects and the writing of reports on analysis is therefore a vital tool engineers use to solve most problems in the society.
With respect to the above statements, the engineering in society (CENG 291) project is aimed at tasking engineering students to remedy problems in their various societies by applying knowledge based on their field of study to cause an improvement in the lives of the inhabitants of the society and to bring about development.
It also seeks to ensure that students appreciate their programme of study by providing a virtual platform for them to begin the problem identification and solving process as this will be their main engagement in the near future as fully actualized engineers.

COMPONENTS OF THE REPORT

The report is basically a formal documentation of all the research, facts and methods used in information acquisition and the general analysis of the data and information gathered from the field and the total information gathering process.

METHODOLOGY

IDENTIFICATION OF THE PROBLEM

I conducted a research exercise in my community and I happened to make a very great discovery. Almost all the major roads in the community had no road traffic control system to ensure smooth movement of vehicles. These major roads are highly characterized by huge vehicular traffic at every point in time. Due to the lack of a control system to direct these vehicles, there are frequent occurrences of road accidents which claim lots of lives each year.

PERPARATION OF THE MAP OF THE COMMUNITY

I obtained the map of my community from Google Maps on the internet.

THE DATA AND INFORMATION ACQUISITION PROCESS

In my quest to obtain data and information connected to the increased road accidents problem in Nii Okai Community One which is my community, I decided to use these three main processes:

i. The use of questionnaires to seek information from the students in the various schools
ii. Conducting verbal investigations
iii. Research using the internet

THE USE OF QUESTIONNAIRES

I used the questionnaire to obtain information from students in the society. This was because most students have to cross some of these roads to and from school.
You will find a copy of the questionnaire I used in the appendices section.

CONDUCTING VERBAL INVESTIGATIONS

I used verbal investigations to obtain information form the Ghana High Way Authority and the National Road Safety Commission (NRSC). All interactions were recorded on a voice recorder and will later be analysed during the data analysis stage of problem solving.

RESEARCH USING THE INTERNET

I used the internet extensively to research on similar problems faced by other communities in the country and how they went about to solve that problem.
Facts and findings from this research will also be analysed during the data analyses stage of problem solving.

METHODS USED TO ANALYSE DATA OBTAINED

Data consistency was the main method I used in analyzing the data obtained. This was to ensure accuracy in whatever data or information I received from the various people and avenues where I made the necessary inquiries.

I also conducted further confirmatory research where necessary in order to diligently analyse some of the data I received.

FINDINGS AND DISCUSSION OF RESULTS

DISCRIPTION OF THE COMMUNITY OF STUDY

Figure 1. A picture of Nii Okai Community One of The Nii Okai District

Nii Okai Community One is the name of my community. It can be located in the Nii Okai District in Accra. Some of the surrounding communities are North Pole Estates, Marina Residential Area and Nii Okai Community Four. The community takes its name from Chief Nii Okai Kwe I, who was the first Chief to ever rule in the district.

The community is dominated by the youth and teenagers with an appreciable number of them schooling. The community has an average age of about 25 years. Most of the women in the community have trading as their main occupation. A few of the men are also into masonry and carpentry with most of them having white collar jobs.

The community is endowed with many schools, hospitals, a better drainage system, good roads and other infrastructure which makes it one of the best communities in the district.

However, there are a few confronting problems which need immediate addressing in the community. Paramount among those problems is the unavailability of a road traffic control system on the roads which results in huge traffic and also claiming lots of lives in recent years.

Robbery and improper disposal of solid waste are the two other main problems in the community.

DISCRIPTION OF THE NATURE AND CHARACTERISTICS OF THE PROBLEM

The main roads in my community are the Adoley road, the Okai Kwe highway and the Nii Lamptey highway. All of these roads link the community to other communities. These roads were all constructed in the early two thousands and have since stood the test of time. Commuters of these roads are mostly commercial drivers and workers.
None of these roads however have a proper road traffic control system to provide easy movement of vehicles from one place to another. This always causes huge vehicular traffic and leads to many road accidents.
Every year, the mortality rate of the community increases by not less than 1% of that of the previous year. Research shows that road accidents constitute the greater part of the annual percentage increase. Therefore, there is the need for a road traffic control system to help curb this problem and thereby reducing the mortality rate substantially.

ANALYSIS OF DATA COLLECTED

After an interview with the National Road Safety Commission (NRSC) public relations officer, it was recorded that, last year the community experienced an unprecedented percentage increase in the mortality rate. Further research from the NRSC proves that there will be a possible increase in the percentage increase in deaths from next year.

An interview with a Ghana Highway Authority employee also made it clear that, there have not been any efforts to help solve this problem. Also, the only proposed method that would efficiently solve this problem will be the mounting of traffic lights along the roads, junctions and all accident prone areas.

Data obtained from the questionnaire made it clear that students sometimes become victimized by this confronting problem.
Zebra crossings which have to serve a purpose of providing a secure crossing section for people have lost their purpose since drivers are in a hurry to beat the immense traffic.
This has put pedestrians' lives at risk.

A report from the National Road Safety Commission shows that, in the last two years, more than two hundred people have died through road accidents.

As proposed by the National Road Safety Commission, the most efficient method to solve this problem will be to mount traffic lights along the roads. However, these traffic lights should have an alternate source of power since recent load shedding will render them inactive in times of power outage.

From the research made, the most reliable and cheapest alternate source of power will be solar energy.

THE COMPUTER ENGINEERING PROGRAMME ITS CAREERS AND ASPECTS

Computer Engineering, or fully known as Computer Hardware Engineering, is a discipline that integrates several fields of electrical engineering and computer science required to develop computer hardware and software.
Tasks involving computer engineers include writing software and firmware for embedded microcontrollers, designing VLSI chips, designing analog sensors, designing mixed signal circuit boards, and designing operating systems. Computer engineers are also suited for robotics research, which relies heavily on using digital systems to control and monitor electrical systems like motors, communications, and sensors.
Some careers one can pursue as a computer engineer are; computer programmer, electrical engineer, software developer and systems analyst among others.

SOLVING THE PROBLEM USING COMPUTER ENGINEERING BASED KNOWLEDGE

Before stating clearly how computer engineering can be used to solve the problem of the lack of a road traffic control system at Nii Okai community one leading to increased road accidents, the following terms need to be explicitly explained.

LED

Light Emitting Diode is a two-lead semiconductor light source. It is a p-n junction diode which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light is determined by the energy band gap of the semiconductor.

TIMER

Timer is an electronic component that allows current to flow or cuts current supply within specific time intervals.

INTEGRATED CIRCUIT

Integrated circuit is a set of electronic circuits on one small plate of semiconductor material, normally silicon. This can be made much smaller than a discrete circuit made from independent electronic components. ICs can be made very compact, having up to several billion transistors and other electronic components in a very small area.

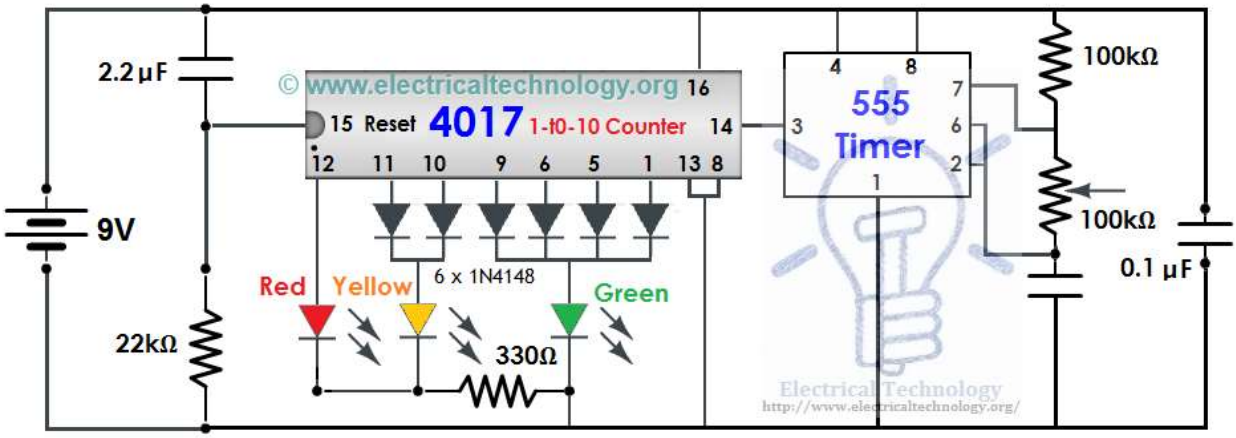


Figure 2. A typical traffic light circuit

Applying knowledge from computer engineering to solve this problem will basically involve the use electronic timers and light emitting diodes which will give the various indications.
Traffic light operation simply entails the controlling of current through LED using timers.

The main components that will be used will be:

- A source of power
- 100k, 22k and 330 ohm resistors
- 1uf, 10uf and 2.2mF capacitors
- Six 1N4148 diodes
- 555 timer IC (which would be used as a pulse generator)
- 4017 IC counter (which would be the main IC of the circuit)
- 1M Potentiometer (which would control the timing of the pulse generated by the 555 timer)
- Red, yellow and green LEDs (which would be the indicators)

The traffic light would be made with the help of a counter IC, which is mainly used for Sequential Circuits. The main IC in the traffic light circuit will be the 4017 counter IC which will be used to glow the red, yellow and green LED respectively. The 555 timer will act as a pulse generator providing an input to the 4017 counter IC.
Timing of the glow of the LEDs totally depends on the 555 timer's pulse, which can be controlled via the potentiometer by varying it.
This will allow us to set the time interval as desired.
The LEDs however will not be connected directly with the 4017 counter because this will cause a slight instability in the glowing of the LEDs.
A combination of the 1N4148 diodes and the LEDs will produce a rather stable output.

The alternate power source will be solar power. This is to provide an uninterrupted supply of power to the traffic lights to ensure that there is a control system to control the vehicles at all times.

Below are some advantages of solar powered traffic lights.

- They work during power outages
- No electricity bills
- They consume less power.

In the appendices is a picture of a solar powered traffic light (figure 3).

CONCLUSIONS

CONCLUSIONS ON KEY FINDINGS FROM THE COMMUNITY

After thorough research, it can be concluded that the incidence of road accidents was the most confronting problem at Nii Okai community one.

The lack of a control system to direct these vehicles was the main cause of this problem.
Annually, the mortality rate of the community increases not less than 1% of that of the previous year and this percentage is expected to increase in the near future.

As proposed by the National Road Safety Commission, the most efficient method to solve this problem will be to mount traffic lights along the roads. However, these traffic lights should have an alternate source of power since recent load shedding will render them inactive in times of power outage.

The major conclusion that can be drawn is that the provision of solar powered traffic lights will help reduce the occurrences of road accidents in the community.

RECOMMENDATIONS

I highly recommend that the traffic lights should be regularly checked and maintained as failure to do so will revive the increment in the mortality rate once again.

In order to check if a particular traffic light is working, there should be regular checks or better still there should be a communicating device attached to the traffic lights to ensure regular communication with the main stations.

All faulty traffic lights should be reported to the authorities and immediate actions should be taken.

APPENDICES

QUESTIONNAIRE

1. Do you think the lack of a proper traffic control system on the roads is a major problem in this community?

Yes ☐ No ☐

2. If yes, why?
……
……
……

3. Why do you think this problem still persists?
……
……
…….....

4. What do you think are some of the adverse effects this problem poses to the inhabitants?
……
……
……

5. What do you think is the main cause of the increase in the mortality rate in the community?
……
……
……

6. Do you think the recent increase in the cases of road accidents is the fault of pedestrians?

Yes ☐ No ☐

7. If no, explain?
……
……
……

8. If you answered yes in question 1,
Propose a likely remedy to this problem.
……
……
……

LETTER OF INTRODUCTION

COLLEGE OF ENGINEERING
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
Office of the Provost
Kumasi, Ghana. West Africa
Tel: +233 03220 60317 / 60240 Fax: +233 03220 60317
E-mail: provost.coe@knust.edu.gh

Our Ref: Coe-PO/CENG 291/ Date: May 15, 2015

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION

The bearer of this note is a first year engineering student of the College of Engineering conducting a project in a course titled "Engineering in Society".

The overall aim of the course is to inculcate in students an appreciation of the fact that the purpose of engineering is to solve societal problems. This course is aimed at encouraging students early in their programmes of study to draw a link between their chosen field of engineering and the application of this field to the issues that confront the day to day lives of people.

We should therefore be most grateful if you could facilitate his data collection and provide any other assistance that he may need.

Counting on your usual cooperation in such matters.

Yours sincerely,

ING. PROF. S.I.K. AMPADU, *FGHIE*
Provost, CoE

A SOLAR TRAFFIC LIGHT

Figure 3. A solar traffic light

REFERENCES

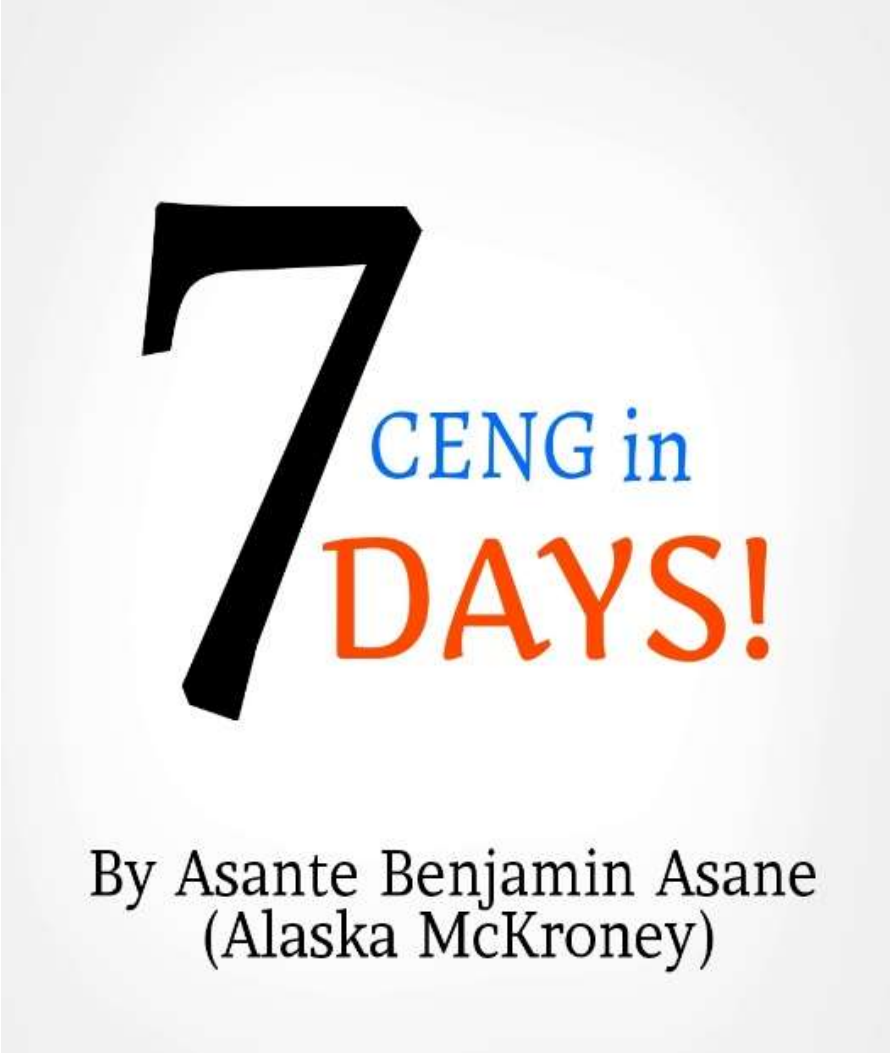
District Assemblies Demographic report (2015). Ghana District Assemblies. Provided by: Emmanuella Sekyi Yawson, Assistant Secretary, Ghana District Assemblies.

Road Safety report (2015). National Road Safety Commission (NRSC). Provided by Bediako K. Ebenezer, The NRSC PRO.

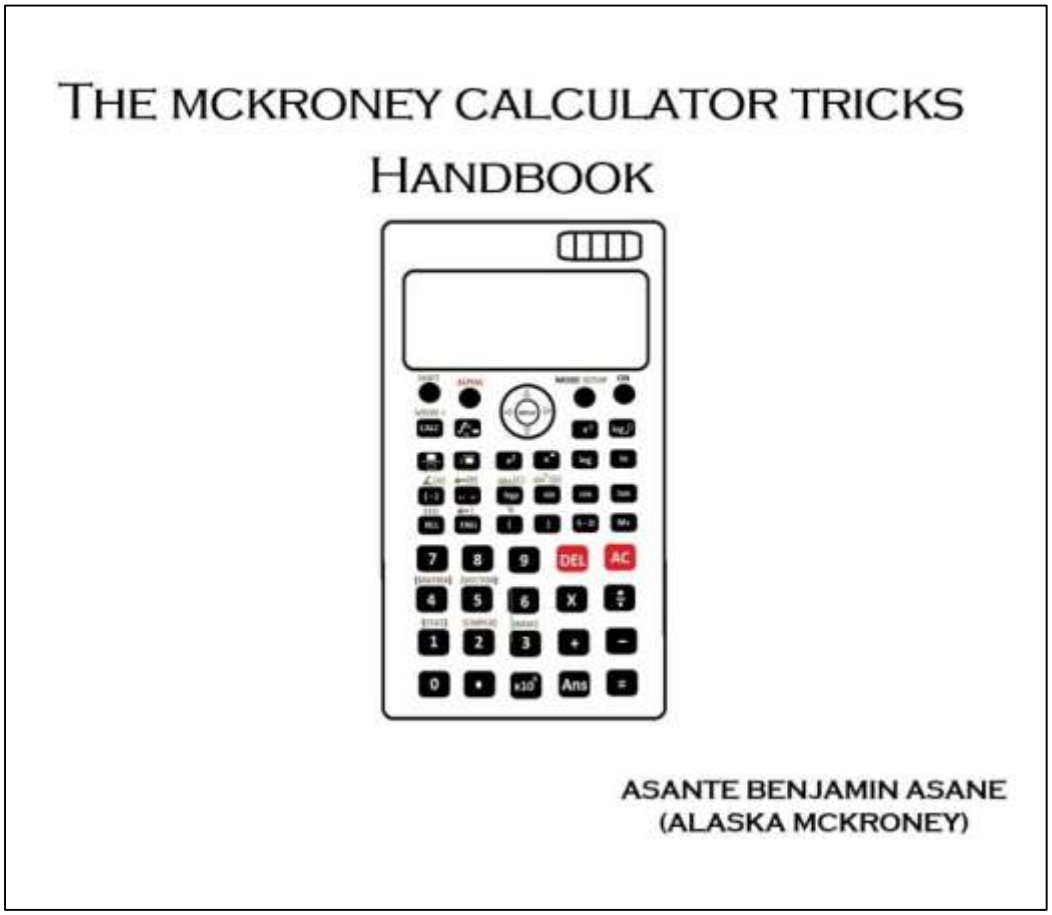
Figure 2. A typical traffic light circuit: Electrical Technology. Website: www.electricaltechnology.org

Figure 3. A solar traffic light: Efftronics. Website: www.efftronics.com/traffic-lights/solar-wireless-traffic-light-control-system.php

Other Books By The Same Author



CENG In 7 Days First Edition



The McKroney Calculator Tricks Handbook First Edition

References

- **Cover page:** cropped view of engineer holding helmet image by www.photo.elsoar.com
- **Major research**: www.wikipedia.com
- Structure Of The Project Report, CENG Clinic (2015)
- Structure Of The Project Report 1, CENG Clinic (2015)
- CENG291-Preparing PowerPoint, CENG Clinic (2015).