

Vidyalankar Polytechnic

Vision

To achieve excellence in imparting technical education so as to meet the professional and societal needs.

Mission

- Developing technical skills by imparting knowledge and providing hands on experience.
- Creating an environment that nurtures ethics, leadership and team building.
- Providing industrial exposure for minimizing the gap between academics & industry.

Program

Vision

To produce Electronics and Telecommunication engineers capable of effectively using technical knowledge and interpersonal skills to benefit the industry and society.

Mission

- Providing state of the art facilities and conducive environment enabling the students to sustain the challenges in the field of Electronics and Telecommunication.
- Educating the students to face the competitive world develop leadership skills and to instill discipline and ethics.
- Promoting industry institute interaction.

Diploma Program in Electronics and Telecommunication Engineering

I – Scheme

Programme Structure

Programme Educational Objectives (PEO) (*What s/he will continue to do even after 3-5 Years of working in the industry*)

PEO 1. Provide socially responsible, environment friendly solutions to Electronics and Telecommunication engineering related broad-based problems adapting professional ethics.

PEO 2. Adapt state-of-the-art Electronics and Telecommunication engineering broad-based Technologies to work in multi-disciplinary work environments.

PEO 3. Solve broad-based problems individually and as a team member communicating effectively in the world of work.

Program Outcomes (PO) given by NBA. (*What s/he will be able to do at the entry point of industry soon after diploma programme*)

PO 1. Basic knowledge: Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electronics and Telecommunication engineering problems.

PO 2. Discipline knowledge: Apply Electronics and Telecommunication engineering knowledge to solve broad-based Electronics and Telecommunications engineering related problems.

PO 3. Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Electronics and Telecommunication engineering problems.

PO 4. Engineering tools: Apply relevant Electronics and Telecommunications technologies and tools with an understanding of the limitations.

PO 5. The engineer and society: Assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in field of Electronics and Telecommunication engineering.

PO 6. Environment and sustainability: Apply Electronics and Telecommunication engineering solutions also for sustainable development practices in societal and environmental contexts.

PO 7. Ethics: Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Electronics and Telecommunication engineering.

PO 8. Individual and team work: Function effectively as a leader and team member in diverse/ multidisciplinary teams. **PO 9.** Communication: Communicate effectively in oral and written form.

PO 10. Life-long learning: Engage in independent and life-long learning activities in the context of technological changes also in the Electronics and Telecommunication engineering and allied industry.

Program Specific Outcomes (PSO) (*What s/he will be able to do in the Electronics and Telecommunication engineering specific industry soon after the diploma programme*)

PSO 1. Electronics and Telecommunication Systems: Maintain various types of Electronics and Telecommunication systems.

PSO 2. EDA Tools Usage: Use EDA tools to develop simple Electronics and Telecommunication engineering related circuits.

SUMMER INTERNSHIP REPORT

AT

NCC TELECOM PVT. LTD.

Submitted in partial fulfillment of the requirement for
the award of Diploma in Electronics &
Telecommunication Engineering

MAY 2019-JUNE 2019

SUBMITTED BY

Nilay Pushkar Puranik

Enrollment No – 1710900111

SUBMITTED TO

Department of Electronics & Telecommunication
Engineering

VIDYALANKAR POLYTECHNIC
WADALA(E), MUMBAI-400037



TITLE PAGE

NAME OF THE STUDENT: Nilay Pushkar Puranik

ROLL NO: 17201C0014

STARTING DATE: 15th May, 2019

COMPLETION DATE: 25th June, 2019

TOTAL WORKING DAYS: 36

NAME OF THE INDUSTRY: NCC Telecom Pvt. Ltd.

ADDRESS OF THE INDUSTRY WITH PINCODE: 329/A, Virwani Industrial
Virwani Industrial Estate, Western Express Highway, Goregaon (East),
Mumbai - 400063.

DEPARTMENT: Research & Development Department

**Maharashtra State Board of Technical Education,
Mumbai**



Certificate

This is to certify that Mr./~~Ms.~~ Nilay Pushkar Puranik With Enrollment No. 1710900111 has successfully completed Industrial Training (22049) in NCC Telecom Pvt. Ltd. from 15th May 2019 to 25th June 2019 for partial fulfillment towards completion of Diploma in Electronics.....& Telecommunication.....Engineering..... from Vidyalankar Polytechnic (0568/1090)

External Examiner

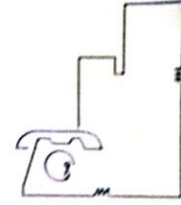
Er. Anjum Mujawar
(Head of Department)

Name of the Mentor
(Helina Tandel)

Prof. Ashish Ukidve
(Principal)



Certificate



Ncc
Telecom
Pvt. Ltd.

Date: 25/06/2019

TO WHOMSOEVER IT MAY CONCERN


This is to certify that **NILAY PUSHKAR PURANIK**,
student of **VIDYALANKAR POLYTECHNIC**
has completed his **INTERNSHIP TRAINING** during **15th MAY 2019 to 25th JUNE**
2019 commenced in our organization.

We found him sincere, hard-working and dedicated
during the course of training for all the tasks provided to him.
He has successfully completed the tasks within the time limit.

We wish him a bright and prosperous future.

Date :- 03rd July, 2019

Yours Faithfully,
For NCC Telecom Private Limited


Mr. Mayur Mehta
(Director)



H.O.

329/A, Virwani Industrial Estate,
Western Express Highway,
Goregaon (E), Mumbai-400 063.

Tel. : +91-22-29271396/98/39
Fax : +91-22-29271397
E-mail : info@ncc.co.in
Website : www.ncc.co.in

Abstract

The training has helped me a lot in many ways to bring in comprehensive improvement in my overall personality and attitude.

I hereby conclude my Implant Training report. There is always some difference between theoretical knowledge and practical knowledge. Knowledge can't be useful in life unless we have some practical experience. Education is incomplete if learning is not implemented into practical work. Training gives us that chance to implement our learning. Training is an attempt to develop basic skills regarding electronics and it is the developments that aid us for the future up gradation.

In these six weeks of tenure, I have learnt the practical aspects associated with building of a complete product like R&D, laying of proper specifications for productions, maintaining the quality of a product, etc. The training familiarized me with various materials, processes, products & their applications with the relevant aspect of organizational management. It gave an opportunity to enhance my knowledge in problem solving & project assignments. This training period made me familiarized with different technologies used in the field of electronics.

This Semester training has acted as a catalyst, a constant illuminating factor, an incandescent spirit, a torch bearer in gathering of knowledge, practice and understanding about our specific field. I believe I have achieved a lot of experience which will surely help me in my future.

ACKNOWLEDGEMENT

It is my pleasure to be indebted to various people, who directly or indirectly contributed in the development of this work and who influenced my thinking, behavior, and acts during the course of study.

I express my sincere gratitude to Mr. Mayur Mehta (Director of NCC), & his team for providing me an opportunity to undergo summer training.

I am thankful to Mr Ashish Ukidve, Principal Vidyalankar Polytechnic and Mr. Anjum Mujawar, HOD Electronics & Telecommunication Engineering department for all the support rendered to me during the entire internship.

I also extend my sincere appreciation to ~~Mr~~/Ms. Helina Tandel, Faculty mentor who consistently provided me all the required valuable suggestions with his precious time in accomplishing my training.

Lastly, I would like to thank the almighty God and my parents for their moral support and my friends with whom I shared my day-to-day experience and received lots of suggestions that improved my quality of work.

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CHAPTER 1

1.0 INTRODUCTION

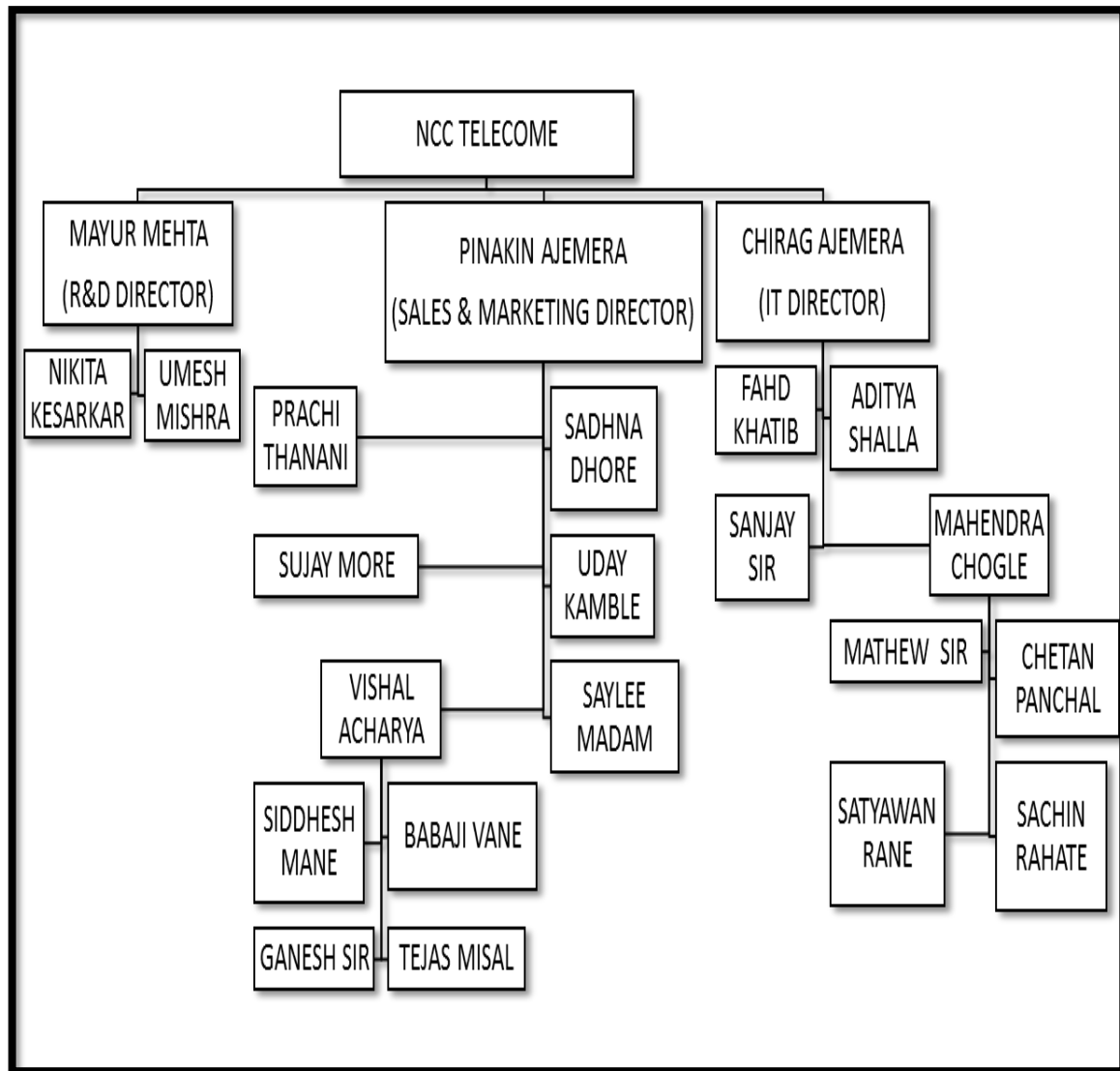
1 COMPANY LOGO AND PROFILE



The corporate slogan of **NATIONAL COMMUNICATION AND CONTROL** nicknamed as **NCC** says it all. The very purpose of the company is reflected in its name. Ever since its establishment in 1989 by Mr. Mayur Mehta and Mr. Pinakin Ajmera, it has continued to grow by leaps and bounds, leaving several competitors way behind. It is a technology driven company with leading-edge capabilities in the field of intercom, security systems and Home Automation. Its reputation is based on a strong customer orientation, the technological sophistication that characterizes its products, and an impressive record of achievements over last twenty-five years.

1.1 Organizational Structure of Industry/ Organization and General Layout.

1.1 VARIOUS DEPARTMENTS OF NCC



CHAPTER 2

2.0. Introduction of Industry/ Organization

The corporate slogan of **NATIONAL COMMUNICATION AND CONTROL** nicknamed as **NCC** says it all. The very purpose of the company is reflected in its name. Ever since its establishment in 1989 by Mr. Mayur Mehta and Mr. Pinakin Ajmera, it has continued to grow by leaps and bounds, leaving several competitors way behind. It is a technology driven company with leading-edge capabilities in the field of intercom, security systems and Home Automation. Its reputation is based on a strong customer orientation, the technological sophistication that characterizes its products, and an impressive record of achievements over last twenty-five years.

The young technocrats with excellent skills and abilities are engaged to conduct research and development thereby resulting in the up-gradation of the products. Thus the R&D team is always in the process of development to create systems to meet the future requirement with the co-ordination of market feedback team. As they are the creator and master of their own art, analytical assurance of the products reliability is exclusively possible. The products are greatly flexible and easily upgradeable so as to meet the optimum consumer satisfaction level, in present and the future.

Multiple numbers of our satisfied customers includes more than four thousand customers in Mumbai. Their products are approved by TELECOMMUNICATION ENGINEERING CENTRE (TEC) and notably sold at a reasonable price taking the customer satisfaction into consideration. The future prospects of the company can be easily viewed by the fact that, the R&D team is lead by Mr. Mayur Mehta himself.

2.1 Types of product and services

Services:

NCC's primary service includes home automation solutions based on client's needs and demands. It also offers services like repair and maintenance to its valuable customers.

Depending on the contract, NCC also offers routine annual maintenance and repair. For this, it dedicates a team which stays on-site all through its tenure.

Product range:

TOUCH SWITCHES

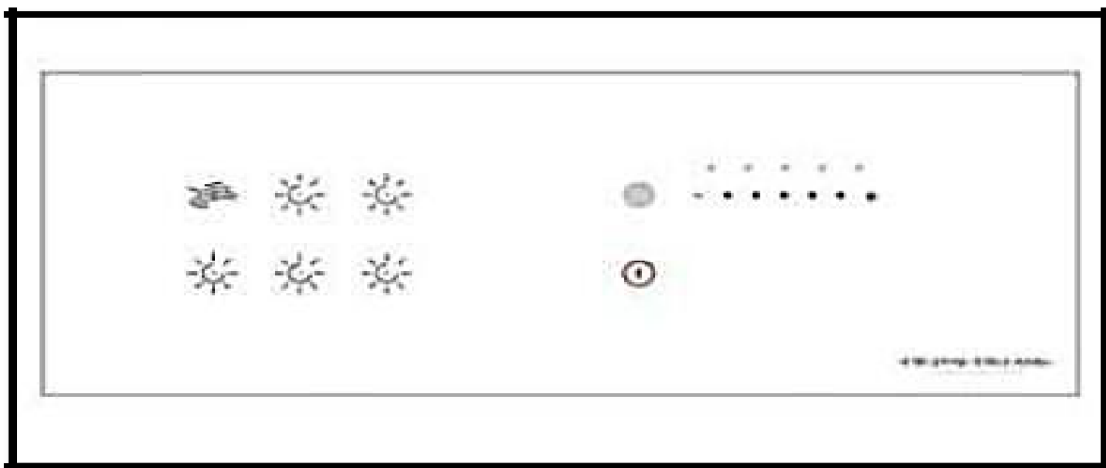


TOUCH SWITCHES VARIANTS

1DOT3

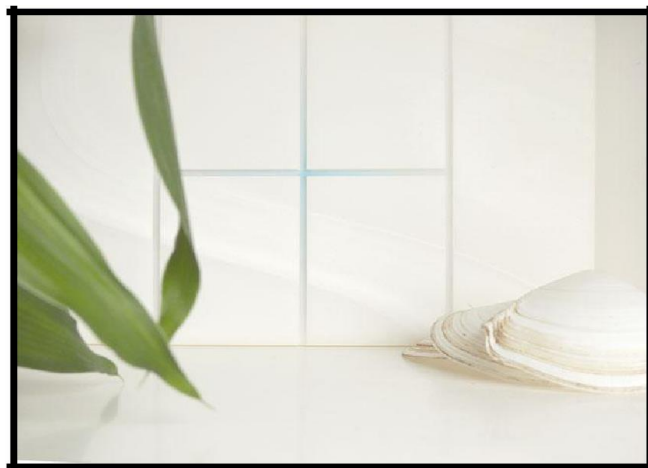


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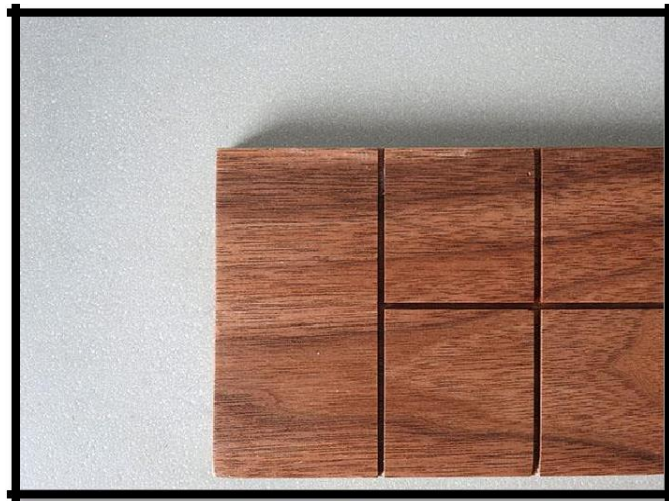


INFINITY SWITCHES

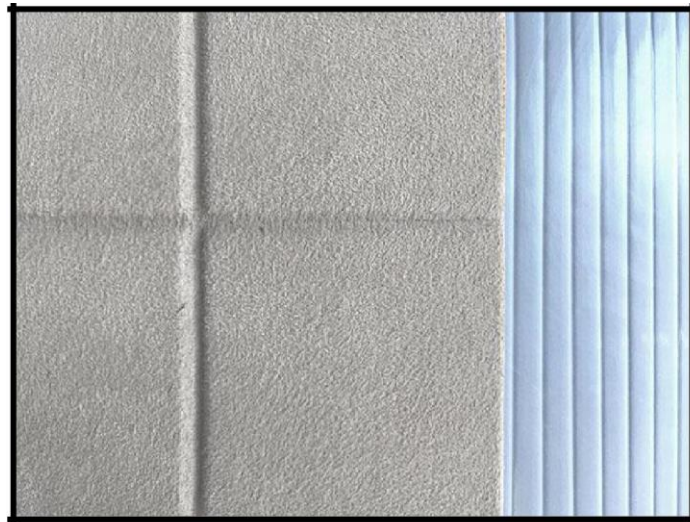
INFINITY STONE:



INFINITY WOOD:



INFINITY CANVAS:



CHAPTER 3

3.0 Types of major equipment/Instruments/Machine used in industry with Specification and approximate cost of equipment/Instruments.

TOUCH SWITCHES

In simple terms, they are touch-sensitive control Pads. Or in other words Intelligent-Switches. That means the most basic models are the modern substitute for conventional switches and switch boards. Moreover, they are always at an easy reach, even in the dark, thanks to a soft lit-up display. In addition, they come in sleek and stylish designs that can take the luxury quotient of your home a notch higher.

APPLICATION

1. Residential complexes.
2. Educational facilities.
3. Hospitality.
4. Government institutions.

FEATURES

1. Capacitive Fan Dimming Technology.
2. No more fan noise at low speed!
3. Feather Touch Buttons.
4. Hybrid Module Bluetooth & Wi-Fi Control Smartphone / Tablet controlled.

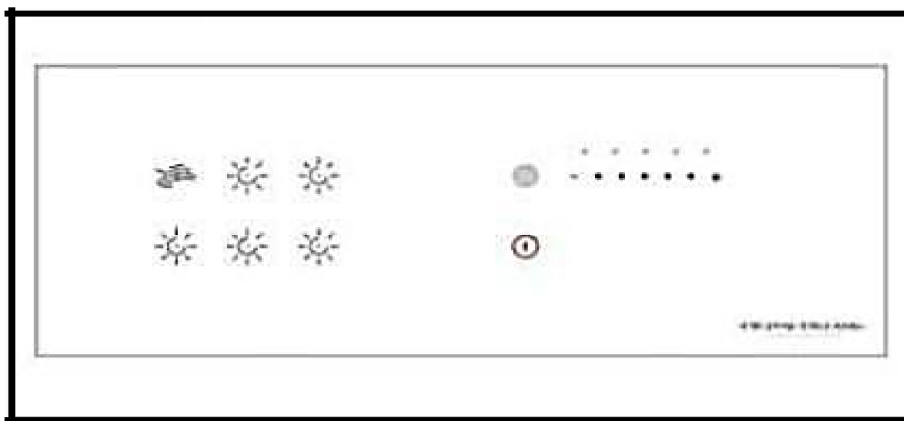


TOUCH SWITCHES VARIANTS

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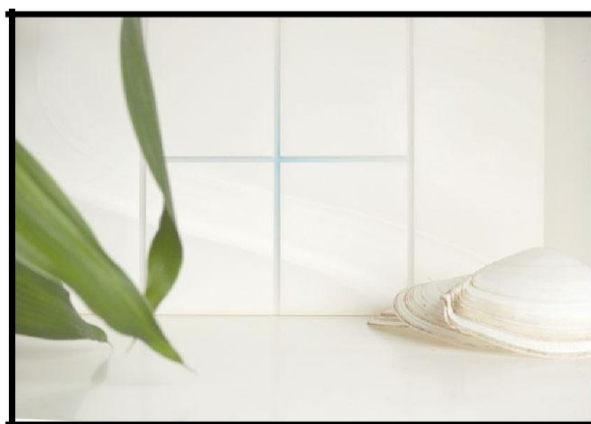
1DOT5



INFINITY SWITCHES

INFINITY STONE:

The Infinity collection of switches rewrites the rules of design, making your home stand out from the pack. Inspired from the natural stones, these switches are innovatively designed to enhance user experience and a design you proudly want to own! The entire surface of the 'Infinity Switch' is touching sensitive, creating a seamless user experience.



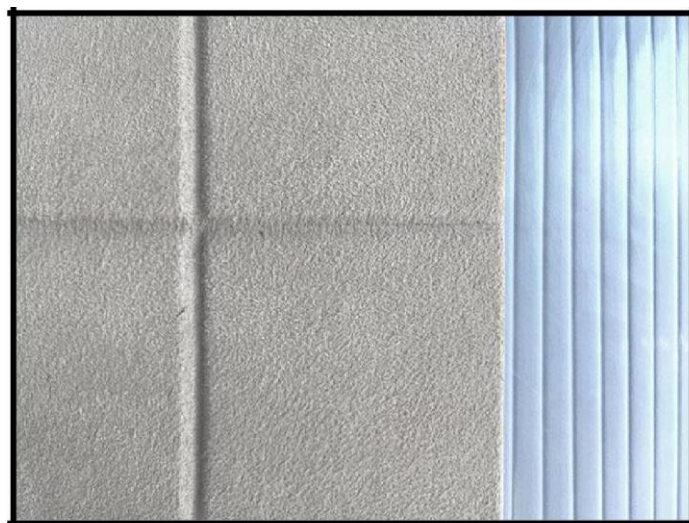
INFINITY WOOD:

The Infinity collection of switches rewrites the rules of design, making your home stand out from the pack. Crafted using natural wood, these switches are innovatively designed to enhance user experience and a design you proudly want to own! The entire surface of the 'Infinity Switch' is touching sensitive, creating a seamless user experience. With our wide variety of wood palette, these switches can blend into your furniture coherently!



INFINITY CANVAS:

The Infinity collection of switches rewrites the rules of design, making your home stand out from the pack. Crafted using some of the most plush fabrics, these switches are innovatively designed to enhance user experience and a design you proudly want to own! The entire surface of the 'Infinity Switch' is touching sensitive, creating a seamless user experience. Fabric used is an avant-garde material with aesthetic, technical and sensory qualities that no other material can equal.



3.1 Routine Maintenance.

11.0 REFERENCES

Should be numbered consecutively (in square [] brackets, throughout the text and should be collected together in the reference list at the end of your report. The references should be numbered in the order they are used in the text. The following format should be used:

[1] J.K. Author, "Name of paper," *Abbrev. Title of Periodical*, vol. *x*, no. *x*, pp. *xxx-xxx*,
Abbrev. Month, year

CHAPTER 5

5.0 Testing Procedures and Quality Assurance Procedure

1. Testing Procedures:

Following are the testing procedures for the products. Testing is done at NCC as a part of a maintenance routine or as per customer feedback.

1.2 Hardware Testing methodologies for the electrical & electronic aspects of your product

Common methods for testing the various electrical or electronic components of your products include:

1.2.1 Cable/interconnect testing

The goal with this testing is to verify proper connectivity from one cable/board to another cable/board. Errors may be caused by problems such as shorts, disconnects, crosstalk, or impedance issues. Some potential tests for consideration:

1. Continuity check
2. send/receive walking 1s/0s
3. send/receive counting patterns of data
4. send/receive pseudorandom data

1.2.2 Communication interface testing

The goal with this testing is to verify the ability to communicate to all applicable points, sometimes at a particular response rate or bandwidth if that's a critical parameter. Depending on the type and criticality of the communication interface, the testing here may vary significantly. Some potential tests for consideration:

1. Continuity check
2. Point to point addressability check
3. Pseudorandom data payload check
4. Full rate bandwidth check

You'll generally want to perform board level testing for verifying the basic functionality (e.g., power supply checks, processor checks, communication chip checks) of circuit boards, when board-level test points are more accessible.

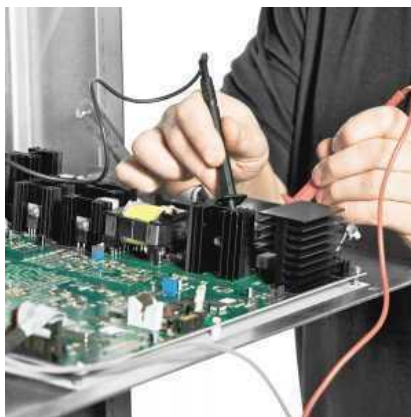


Figure 1: Measuring the output voltages and checking connectivity

2. Quality assurance procedure

Quality assurance (QA) is any systematic process of determining whether a product or service meets specified requirements.

QA establishes and maintains set requirements for developing or manufacturing reliable products. A quality assurance system is meant to increase customer confidence and a company's credibility, while also improving work processes and efficiency, and it enables a company to better compete with others.

1.2.3 Quality Assurance in Electronics Industry

There are a number of key tests that should be carried out on electronic products. They include functionality checks, reliability testing, safety tests and verification (certification may be required depending upon the product and the country that product will be sold in).

a. Functional checks: it is essential that the product manufactured meets the product specification in order to satisfy the customer's expectations. The functional checks should be carried out against the product specification document.

b. Reliability testing: this is generally carried out on random samples taken from the production line and subjected to various tests. A common method of testing electronic products is HASS (Highly Accelerated Stress Screening). HASS is implemented at the production stage – production samples are subjected to stress testing beyond the product specification limits.

Early product failures on a new product are often attributed to variability within a manufacturing process. Therefore, identifying these potential production failure modes as early as possible is paramount to the success of a product launch and this is where HASS comes into play.

c. Safety Tests and Certification: different countries have different regulations that must be met in order to sell a product within that country. For most consumer electronic products there would be a minimum requirement from a safety testing point of view. A few examples of the other regulations you should consider are: UL Certification for the US market – Product Safety Testing.

- UL Certification for the US market – Product Safety Testing.
- FCC for the US market – All commercial electronic devices (unintentional radio-frequency radiators) are regulated by the Federal Communications Commission (FCC). This includes almost every product that contains a microprocessor.
- CE Mark for the European Union – The CE-marking is the manufacturer's statement that his product complies with all relevant CE-marking directives. (And make sure not to put this mark on products to which it does not apply.)
- C-Tick for Australia – The Australian Communications Authority introduced an EMC protection framework requiring EMC compliance for electronic products.

If you are not sure what to do, China Importal can help you identify which regulations you MUST comply.

11.0 REFERENCES

[1] <https://www.chinainportal.com/blog/electronic-products-quality-control/>

CHAPTER 6

6.0 Product/ Equipment Handling Procedure and Troubleshooting procedures, debugging, work handled

1. Product/Equipment Handling Procedure

Following are the guidelines for product handling:

Electrostatic Discharge (ESD)

Certain components used in electronic assemblies are sensitive to static electricity and can be damaged by its discharge. Static charges are created when non-conductive materials are separated, such as when plastic bags are picked up or opened, when friction occurs between articles of synthetic clothing, when plastic tapes are dispensed and many other causes.

Handling and Storage Methods

1. Circuit board assemblies must always be handled at properly designated work areas.
2. Designated work areas must be checked periodically to ensure their continued protection. Areas of main concern include:
 - a) Proper grounding methods.
 - b) Static dissipation of work surfaces.
 - c) Static dissipation of floor surfaces.
 - d) Operation of ion blowers and ion air guns.
3. Designated work areas must be kept free of static generating materials including Styrofoam, vinyl, plastic, fabrics and other static generating materials.
4. Work areas must be kept clean and neat. To prevent contamination of circuit board assemblies, there must be no eating or smoking in the work area.
5. When not being worked on, sensitive components and circuit boards must be enclosed in shielded bags or boxes. There are three types of ESD protective enclosure materials including:

Static Shielding - Prevents static electricity from passing through the package.
Antistatic - Provides antistatic cushioning for electronic assemblies.
Static Dissipative - An "over-package" that has enough conductivity to dissipate any static buildup.
6. Whenever handling a circuit board assembly the operator must be properly grounded by one of the following:
 - a) Wearing a wrist strap connected to earth ground.
 - b) Wearing 2 heel grounders and have both feet on a static dissipative floor surface.
7. Circuit board assemblies should be handled by the edges. Avoid touching the circuits or components. (See Figure 1)
8. Components should be handled by the edges when possible. Avoid touching the component leads.
9. Hand creams and lotions containing silicone must not be used since they can cause solderability and epoxy adhesion problems. Lotions specifically formulated to prevent contamination of circuit boards are available.
10. Stacking of circuit boards and assemblies should be avoided to prevent physical damage. Special racks and trays are available for handling.



Figure 1: Always handle circuit boards by the edges.

2. Troubleshooting procedures, debugging, work handled

1.2.4 Some Rules of Troubleshooting

1. Safety first - know the hazards associated with the equipment you are troubleshooting. Take all safety precautions. Expect the unexpected. Take your time.
2. Always think 'what if'. This applies both to the analytic procedures as well as to precautions with respect to probing the equipment. When probing, insulate all but the last 1/8" of the probe tip to prevent costly shorts. (If I had a nickel for every time I have been screwed not following this advice...)
3. Learn from your mistakes. We all make mistakes - some of them can be quite costly. A simple problem can turn into an expensive one due to a slip of the probe or being over eager to try something before thinking it through. While stating that your experience in these endeavors is measured by the number of scars you have may be stretching the point, expect to screw up - we all can point to that disaster due to inexperience or carelessness. Just make it a point not to make the same mistake again.

11.0 REFERENCES

[1] <http://www.circuitrework.com/guides/2-1.html>

[2] <https://www.repairfaq.org/sam/tshoot.htm#tshbtr>

CHAPTER 7

7.0 Safety Procedures

1.2.4.1 Circuit Board Safety Tips

Below include a number of precautions with printed circuit board safety:

1. Wearing safety goggles – Protective eyewear is essential (and mandatory)!
2. Wearing gloves
3. Handle solder diligently with care
4. Clutter free workstations
5. Appropriate temperatures
6. Utilize ventilation system
7. Acceptable lighting
8. Do not put cookies or food through reflow oven (just checking if you are reading this)
9. Proper tools
10. Check all connections
11. Testing
12. Proper cleanup

When working with or testing any electronic equipment, it's always important to be cautious. Whatever type of equipment you're handling, whether simple or complex, it's important to take the right safety precautions.

Working with electricity comes with huge risks that should never be taken lightly. If you're a hobbyist who loves working with electronic components or an electronics professional at your workplace, safety should always come first.

To avoid personal injury, possible damage to equipment or danger of fire, all work on electronic equipment should be conducted following these safety procedures.

General Safety

Before working on any electronics, consider following these basic safety precautions to help reduce any hazards.

- Remove any electronic equipment you're testing or working on from the power source.
- Never assume the power circuit is off. Test and test again with a voltmeter to confirm.
- Remove fuses and replace them only after the power to the circuit is disconnected.
- Don't connect power to a circuit until you're done working on it and rechecked the work.
- Always ensure that all electronics equipment is properly grounded
- If it's damaged, replace it. For instance, replace cables instead of repairing with insulating tape.
- Always use the right electronics repair and maintenance tools.
- Always return covers after removing them to reduce the risk of electric shock.
- Make sure your circuit is not overloaded.
- Always have safety equipment like a fire extinguisher, a basic first aid kit and a mobile phone nearby.

- Avoid damp and wet areas when working with electricity.
- Avoid wearing jewelry or baggy clothing.
- Assume circuits are on and check with voltmeter before handling wires.
- Broken or damaged tools should be labeled with DAMAGED DO NOT USED. The instructor should be notified so that the tool may be repaired or replaced.

11.0 REFERENCES

- [1] <http://www.blog4safety.com/2017/02/safety-precautions-to-take-when-working-with-electronic-equipment/>

CHAPTER 8

8.0 Particulars of Practical experiences in Industry/ Organization if any in Production/ Assembly/ Testing/ Maintenance.

- I've completed my six weeks' industrial training at NCC Telecom and have gained a treasure of practical. Being in the R&D department, the first thing I noticed there was the different skills my colleagues and seniors had. There I was introduced to a lot of different skill sets. Following are some platforms I came across at NCC.
 - KiCAD PCB designing software
 - DialogFlow
 - Google's action console
 - Advanced usage of Arduino board and IDE
 - Hardware modules like ESP 32, ESP 8266 WROOM, HC-12, HC-05
 - Methods of device testing
 - Hardware installation
 - Device set-up/configuration
 - C programming
 - Burning software in device memories
 - Basic troubleshooting hardware

Introduction to KiCad

KiCad is an open-source software tool for the creation of electronic schematic diagrams and PCB artwork. Beneath its singular surface, KiCad incorporates an elegant ensemble of the following stand-alone software tools:

Program name	Description	File extension
KiCad	Project manager	*.pro
Eeschema	Schematic and component editor	*.sch, *.lib, *.net
Pcbnew	Circuit board and footprint editor	*.kicad_pcb, *.kicad_mod
GerbView	Gerber and drill file viewer	*.g*, *.drl, etc.
Bitmap2Component	Convert bitmap images to components or footprints	*.lib, *.kicad_mod, *.kicad_wks
PCB Calculator	Calculator for components, track width, electrical spacing, color codes, and more...	None
Pl Editor	Page layout editor	*.kicad_wks

KiCad can be considered mature enough to be used for the successful development and maintenance of complex electronic boards.

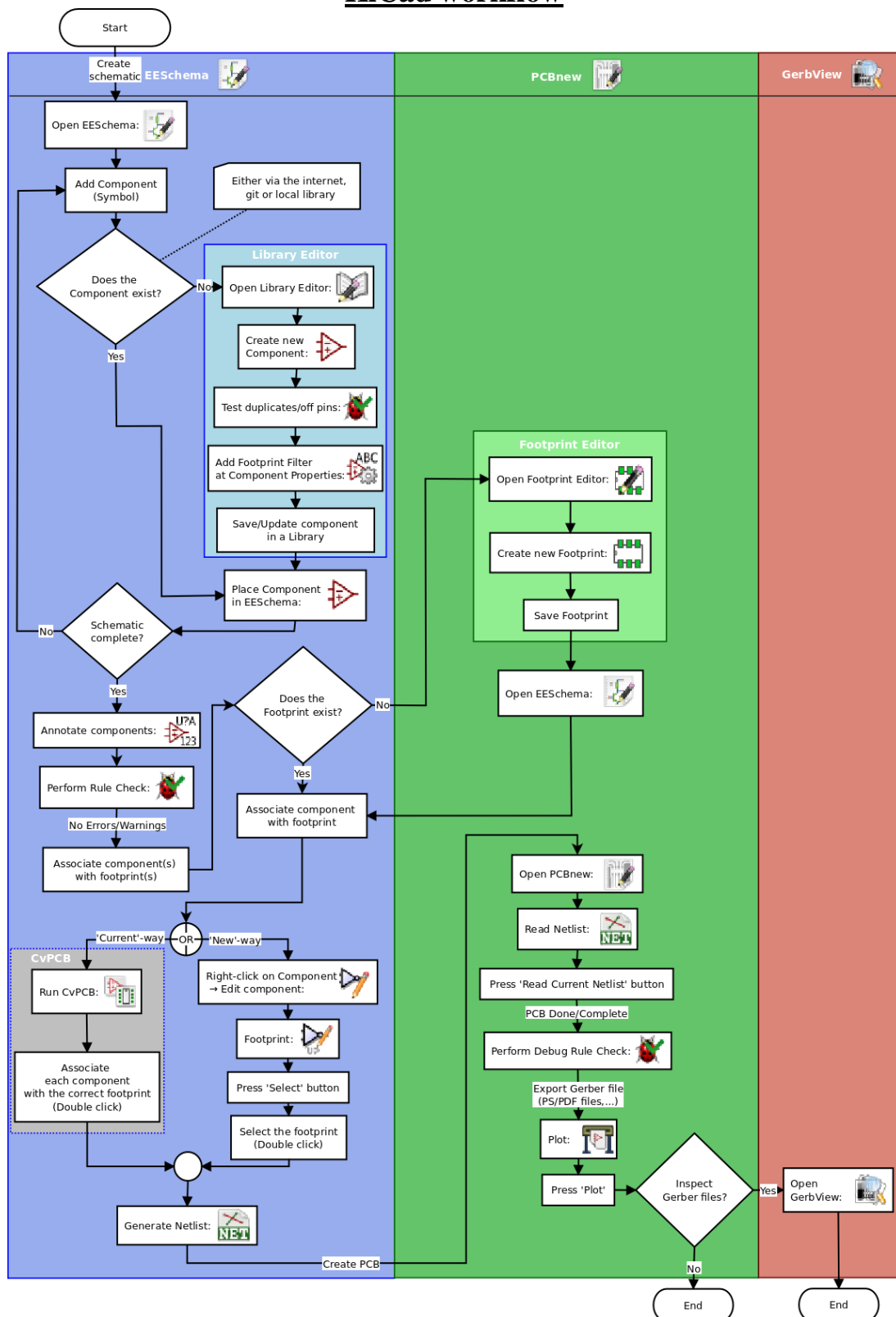
KiCad does not present any board-size limitation and it can easily handle up to 32 copper layers, up to 14 technical layers and up to 4 auxiliary layers. KiCad can create all the files necessary for building printed boards, Gerber files for photo-plotters, drilling files, component location files and a lot more.

The KiCad workflow is comprised of two main tasks: drawing the schematic and laying out the board. Both a schematic component library and a PCB footprint library are necessary for

these two tasks. KiCad includes many components and footprints, and also has the tools to create new ones.

In the picture below, you see a flowchart representing the KiCad workflow. The flowchart explains which steps you need to take, and in which order. When applicable, the icon is added for convenience.

KiCad workflow



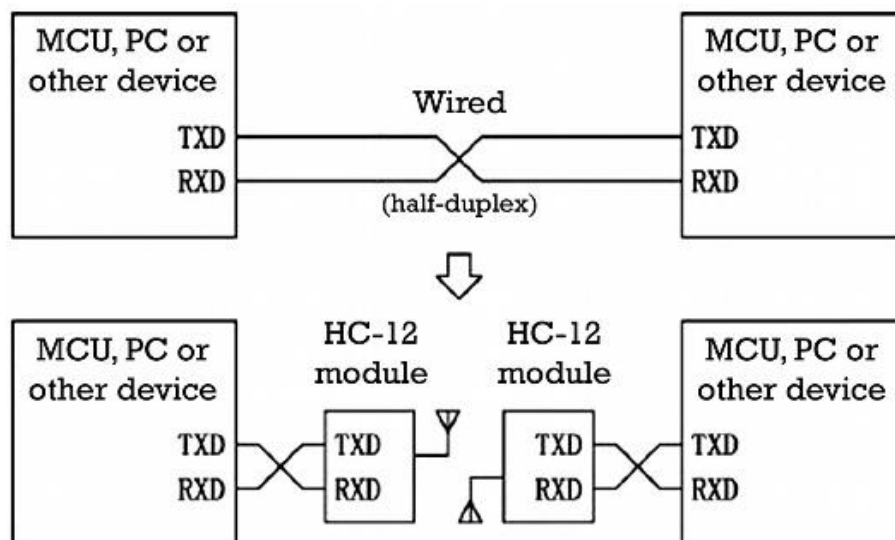
Introduced with basics of 'KiCAD' software, with the help of KiCAD software we designed the any Circuit Diagram, Components symbols and footprints. I learned how to design the Schematic circuit diagram, assign footprints and PCB Layout of Astable Multivibrator using IC 555, Power supply and Dual power supply using IC 7805 and IC 7905.

HC-12

Introduction

The HC-12 wireless serial port communication module is a new generation of multi-channel embedded wireless data transmission module. Its wireless working frequency band is 433.4-473.0MHz. Multiple channels can be set, with a channel stepping of 400kHz and a total of 100 channels. The maximum transmitting power of the module is 100mW (20dBm), the receiving sensitivity is -117dBm at a baud rate of 5000bps in the air. Communication distance is 1000m (FU3 mode at 4800bps serial speed) in open space, 1800m in FU4 mode at reduced baud rate and volume of data.

The module has an onboard MCU, eliminating the need for user to program the radio section separately, with transparent half-duplex serial transmission provided for receiving and sending serial port data. This making the HC-12 very easy to interface with. The module adopts multiple serial port transparent transmission modes that are user selected by AT commands according to usage requirements. The average working current of the four modes FU1, FU2, FU3, and FU4 in idle state are: 3.6mA, 80uA, 16mA, and 16mA respectively, while the maximum working current in any mode is 100mA (in the transmitting state).

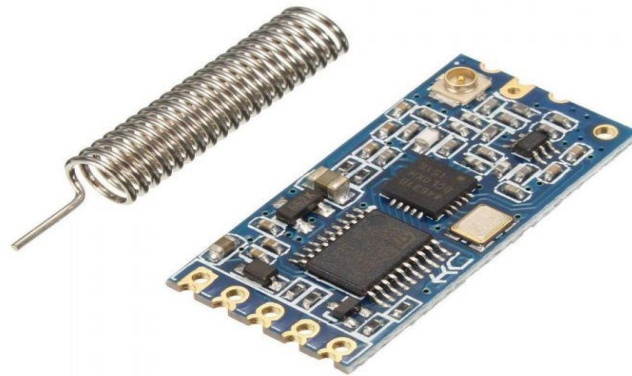


Features

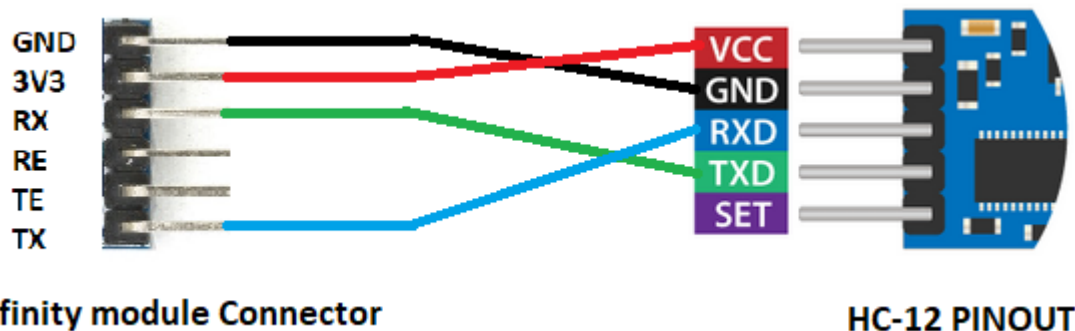
- Long-distance wireless transmission (FU3: 1000m in open space, baud rate 5000bps in the air. FU4: 1800m in open space, baud rate 500bps in the air)
- Working frequency range (433.4-473.0MHz, with 100 communication channels)
- Maximum 100mW (20dBm) transmitting power (8 levels of power can be set)
- Four working modes, adapted to different application situations
- Built-in MCU performs communication with external device through serial port, no programming or configuration required for basic use
- The number of bytes transmitted continuously is unlimited (FU1 and FU3 modes only)

- Update software version through the serial port

HC-12



Connection with Infinity modules.



Individual HC-12 is connected with the connector (SAM20J18 Controller pins are mapped onto the connector) as shown in the above figure. Pair HC-12 communicate with each other using UART protocol.

Working.

AT commands is use to change setting of the HC-12 module. Some of the AT commands are listed below.

AT Commands

•AT

Test command. Send command “AT” to the module, and the module returns “OK”.

•AT+Bxxxx

Change the serial port baud rate. The baud rate can be set to 1200bps, 2400bps, 4800bps, 9600bps, 19,200bps, 38,400bps, 57,600bps, or 115,200bps. The default value is 9600bps.e.g: To set the serial port baud rate of the module to 19,200bps, send command “AT+B19200” to the module, and the module will return “OK+B19200”. After exiting from command mode, the module will begin to communicate at 19,200bps.

•AT+Cxxx

Change wireless communication channel, selectable from 001 to 127 (for wireless channels exceeding 100, the communication distance cannot be guaranteed). The default value for the wireless channel is 001, with a working frequency of 433.4MHz. The channel stepping is 400KHz, and the working frequency of channel

100 is 473.0MHz.

•AT+FUx

Change the serial port transparent transmission mode of the module. Four modes are available, namely FU1, FU2, FU3, and FU4. Only when the serial port speed, channel, and transparent transmission mode of two modules is set to be the same, can normal wireless communications occur.

HC-12 is connected to our two infinity modules programmed with two serial software. Whenever a touch is sensed in one of the module it sends a packet of data to the other module over Radio frequency.

Applications

- Wireless sensor
- Community building security
- Robot wireless control
- Industrial remote control and telemetry
- Automatic data acquisition
- Container information management
- POS system
- Wireless acquisition of gas meter data
- Vehicle keyless entry system
- PC wireless networking

CHAPTER 9

9.0 Short report/Description of project:

At NCC I was not assigned with a particular project. Instead I was assigned a number of tasks which were assigned to me by my experienced colleagues or my seniors over the course of industrial training. Following are the tasks given to me:

- **Design Basic PCB Circuits in KiCAD:** As a part of our training we were taught the KiCAD software. Our senior had assigned some of our experienced colleagues to guide us. We started with designing the circuit schematics, then assigning component values and footprints, then designing the PCB layout, laying tracks on PCB, learned concept of design rule to adjust track width as per voltage requirement, creating components, creating footprints and finally generating Gerber files. We then made PCB for dual power supply using IC 7805 and IC 7905, astable multivibrators using IC 555 and dual stage amplifiers using NPN transistors.
- **Arduino project test:** To test my knowledge of arduino, I was asked to first produce red, green, blue, yellow, magenta, cyan and white colour in a pattern using an RGB LED. Once done, I was asked to add Bluetooth control to it using an HC-05.
- **HC-12 module:** My experienced colleagues gave me the basics of the HC-12, an RF wireless UART communication module, and asked me to learn about and experiment with it. I then learned about its parameters and came to know a lot of its parameters can be reconfigured using the AT commands. When the set pin of HC-12 is grounded and all other connections are made normally, it enters the AT mode or command mode. Its channel, transmission power, power utilisation mode and baud rate. Then we were asked to debug two infinity modules connected to each other in master and slave configuration.
- **Testing/programming/debugging:** often we were given some modules to test, program or debug. These ranged from 2 or 3 to 20. If we fail to figure it out, the module was marked as “not OK” or our seniors would help us, which seldom occurred.
- **Field Work:** When we were sent out to field in Andheri, at Rustomjee Elements, we were trained and guided to help and provide assistance when the installations, repairing or debugging is done. Soon we started doing the given tasks ourselves as we learned through the process. Once the instructor was confident in our work. He dispatched us as a team to proceed with the work. Coordination and timing was valued there.
- **Solder work:** At NCC office, our senior tested our soldering skills. They gave us old circuit boards. Once I was able to meet her expectations at THT soldering and desoldering. I moved to SMD soldering which was a challenge for me as I had never encountered it before. Soon I learned soldering and desoldering SMD components. I helped with the soldering, both THT and SMD, whenever needed.

CHAPTER 10

10.0 Special/ Challenging experiences encountered during training.

- My special experience started as soon as I entered NCC. After going through the company's website and brochure I had a brief idea of it. Never before was I able to learn a completely new software in little time. My experienced colleagues at NCC taught me PCB designing in KiCAD.
- At the end of training I was able to design multi-stage amplifier circuits using NPN, astable multivibrator using IC 555, power supply using IC 7805 and IC 7905.
- In KiCAD, designing basic circuit is not that difficult. But making precise PCBs needs knowledge of the components, their available packages and variations, their exact dimensions, etc.
- Another experience was SMD soldering. I had never tried SMD soldering before. It needed a lot of concentration and focus. We were given old and used PCB boards that made it perfect to practice SMD and THT soldering.
- I was also given HC-12 RF communication module to work with. I already had experience with HC-05 module with Arduino, so learning HC-12 was easy. Challenging thing was using it with the infinity touch modules such that buttons toggled on the slave module should be accurately represented on the master module and vice versa. Troubleshooting the set-up was also a part of the challenge.
- On-field work was also a different challenge for me. This was my first time doing hardware installation.
- We had to go to different flats as per requirement and aid our colleagues or seniors as required. Working in team coordination was essential. Many a times, one or two of us had to repair or troubleshoot hardware in time for the installation team which was decided on the spot.
- Understanding the process of home automations was intriguing yet difficult. DialogFlow was used for this purpose. It lets you process the user's input and converts the user's commands or instructions into code.

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