THE RADIATION OVERVIEW OF BANGLADESH: COMPARATIVE ANALYSIS OF ELECTROMAGNETIC RADIATION & INTEGRATION WITH GUI

BY

RASEL SHAHRIAR

ID: 171-19-1961

KAZI FAHIM

ID: 171-19-1941

JANNATUN NAYEM

ID: 171-19-1947

This thesis report is the partial fruition the requirement for the degree of

Bachelor of Science in Electronics & Telecommunication

Engineering

Supervised By

Md. Taslim Arefin

Associate Professor and Head, Department of ICE

Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

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APPROVAL

This thesis titled **"THE RADIATION OVERVIEW OF BANGLADESH: COMPARATIVE ANALYSIS OF ELECTROMAGNETIC RADIATION & INTEGRATION WITH GUI)"** submitted by Rasel Shahriar, Kazi Fahim and Jannatun Nayem to the department of Electronics and Telecommunication Engineering, Daffodil International University, has been accepted as satisfactory for the partial fruition of the requirements for the degree of Bachelor of Science in Electronics and Telecommunication Engineering and approved as to it is form and contents. The presentation will be held on MAY 2021.

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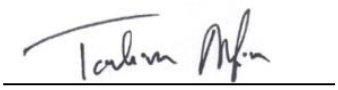

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Faculty of Engineering
Daffodil International University

(Prof. Dr. A.K.M. Fazlul Haque) **Internal Examiner**
Professor and Associate Dean
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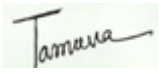
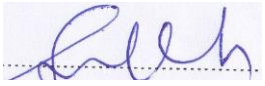


Ms. Tasnuva Ali
Assistant Professor
Department of ICE
Daffodil International University

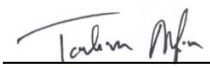


Dr.Saeed Mahmud Ullah **External Examiner**
Professor
Department of EEE,Dhaka University

DECLARATION

We hereby announce that we completed this study under the supervision of **Md.Taslim Arefin, Associate Professor, Daffodil International University's Department of ICE.** We further announce that neither this work nor any part of it has been sent to any other institution for the grant of a degree or diploma.

Supervised By:



Md. Taslim Arefin

Associate Professor and Head

Department of ICE

Daffodil International University

Submitted By:

Name: Rasel Shahriar

ID: 171-19-1961

Department of ICE

Daffodil International University

Name: Kazi Fahim

ID: 171-19-1941

Department of ICE

Daffodil International University

Name: Jannatun Nayem

ID: 171-19-1947

Department of ICE

Daffodil International University

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ABSTRACT

All the innovation of communication technology happened just after Michael Faraday's invention of electricity, which lists to the invention of the AC, Fan, Computer, tv, radio, radar, mobile, satellite etc. Devices are very important to us in everyday life, because these have made our lives easier and more prosperous but on the other hand, these devices are putting our health at risk through electromagnetic radiation emissions. None of us are out of this risk. Many people have confessed to having health issues as a result of electromagnetic fields (EMFs) and electromagnetic radiation (EMR). While some people have mild health problems and want to get as far away from the world as possible, others are so seriously affected that the survey is effective that they must change their whole lifestyle. In this paper, we have taken data from different types of electromagnetic sources and managed to store it through web based Graphical User Interface (GUI) for further survey purpose. We've got a lot of everyday equipment that emits a huge amount of electromagnetic radiation. But the most at risk are those who work in the magnetic field most of the time. This survey's findings may help the people take precautionary measurements for a long duration in the various electromagnetic field.

Keywords: Electricity, Electromagnetic Radiation, Electromagnetic Sources, Health effects, Survey, GUI

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CHAPTER 1

INTRODUCTION

1.1 Introduction

From the 60's of the last century, scientific and technological advancement in science and technology began. During this time, the first computer, the radiotelephone, was invented, and the first satellite communications were developed and launched. The number of familiar electromagnetic radiation sources increased in parallel with this invention, radar stations, radio relay stations, and television towers. Simultaneously, developed industrialized countries became interested in the effects of EMF on our health.

The number of devices and devices using electricity in the world has increased thousands of times in the last 20 years. Now electronics, without which we can do nothing else, stays with us both at work and on vacation. Televisions, microwave ovens, mobile phones, computers, on the one hand, help us. On the other hand, they have become an invisible but sure threat to our health - electromagnetic fumes - combining artificial devices and EM radiation from devices.

1.2 EMF Health Effect

The EMF has the potential to induce SIDS (sudden infant death syndrome). The EMF is also said to cause health effects such as inflammatory diseases, DNA disruption, responsive lymphocytes, and cellular breakdown.

Health risks refer to non-ionizing radiation (NIR) emitted from a variety of electromagnetic fields. Scientists and researchers are worried about EMF and they are working to find the right solution.

The public is becoming gradually concerned about the possible health hazards associated with the widespread use of EMR emits devices. Although skill in this field has vastly increased in the last 10 - 15 years, it is still inadequate to establish legal safety regulations.

Electromagnetic radiation (EMR) has a quit complex addition to the human body and it's depends on bodily posture, far-field versus near-field, frequency, polarization etc. But since research in this area has been minimal, most experiments have concentrated on subtle short-term expression levels.

Thus, it has health damage caused by electromagnetic fields and various electronics equipment. So, people should be aware of this. To reduce the risks of non-ionizing radiation or to find suitable solutions to control it, it is necessary to inform about the harmful effects of non-ionizing radiation on living systems and the environment.

1.3 Motivation

Electricity is very important for human lives and it is inextricably linked with our lives. And that's why we are constantly living in the field of electromagnetic radiation. All the electronic devices we use emit electromagnetic radiation. All the Household appliances like TV, Radio, Computer, Laptop, Cell Phone, AC, Power line etc. emit Radiation. Everyday almost 24hour we passed our time in the field of radiation whether it is home, University or Office. And while it may not harm us all at once, it can slowly affect our body. In this paper, we will collect radiation level from various electromagnetic sources like Household device, Devices which always close to the human body, Devices from study place & also from outdoor Electromagnetic fields. Then we'll save the data through Web based Graphical User Interface (GUI) for empirical study and Survey works

1.4 Aims and Objective

These are the objectives of this research:

- To assess the effect of various sources of electromagnetic radiation on leaving system.
- Calculate EMR from ICNIRP framework sources and compare it to ICNIRP/ITU approved MPD standard values.
- To Collect and store the data on a web-based GUI.
- To access the data from anywhere and anytime.
- To make a database on the effects of electromagnetic radiation particularly from ICNIRP applications source like Power Lines, Mobile phones, Household appliances, Base station, Wi-fi Zone, etc. in Dhaka city
- To prepare a survey report about effect of Electromagnetic Radiation from Daffodil International University permanent Campus Ashulia, study place & lab equipment.
- To calculate the magnetic field, electric field and SAR value.

1.5 Thesis Formation

The rest of the thesis paper is created as follows:

Chapter 2 talks about the Literature reviews of Electromagnetic Radiation. In this Chapter, it discusses the effect of EMR on Human Body and past researches about EMR. We have talked about the overall health effect and how it affects with some of research main outline.

In chapter 3 we have briefly explained the theoretical model of EMR and we have talked about electric field, magnetic field and electromagnetic radiation.

Chapter 4 discusses about the Effect of EMF on Environment & Biological System. It talks about bio-hazard of electromagnetic radiation.

In Chapter 5, we have discussed about the technique we used for measure the radiation from various devices and place and we have also talked about the devices we used for measuring the Magnetic field, Electric Field and power.

Chapter 6 discusses about the procedure of data collection and rules.

In Chapter 7, we have shown the Web based Graphical User Interface and how it can process data for survey purpose.

In chapter 8, It shown the data table from GUI and survey analysis.

In chapter 9, This chapter discusses and analysis the performance of Survey report and theoretical report. Later in chapter 10, we have discussed our result. Finally in chapter 11, We discussed the conclusion and future work.

CHAPTER 2

BACKGROUND OF WORK

2.1 Introduction

There are several health issues because of Electromagnetic Radiation, and in this chapter, we will discuss them. Several research on the impact of EMR on our daily lives have been published. We will consider a few critical points of the study.

2.2 Research on Electromagnetic field

As a result of the experiments, the scientists found that the electromagnetic waves could communicate with living beings and transmit their energy to them. Scientists have suggested that electromagnetic fields on human health be the most dangerous factor and have called for more stringent measures to protect the world's population.

Carl Blackman's study found that the low electromagnetic field secretes calcium ions from the cell membrane. Today, many researchers say that long-term, weak but electromagnetic radiation is enough to stimulate serious diseases such as Alzheimer's or Parkinson's, cancer, erectile dysfunction, as well as all kinds of sleep and memory disorders.

Electromagnetic induction also works on the other side, so that a moving electric charge can create a magnetic field. Basically, a conventional therapeutic magnet is the result of the separate motion of the electrons in the individual atoms of the magnet, so that the marginal field is on the same side so that it is peripheral. The threat of exposure to electromagnetic field radiation in the human body the scientifically proven fact has a number of diseases associated with the effects of electromagnetic field in the human body.

The electromagnetic field is that part of space which contains and surrounds bodies in electric or magnetic condition. [1]

A study comparing personal and residential area measurements of children in the United Kingdom also demonstrated that a 90-min measurement within the child’s home could classify children into the lowest 90% of exposure with acceptable sensitivity and specificity. [2]

Long-term effects such as cancer, which may arise year after year or even decades later, are also a possibility. These kinds of results aren't always visible, but their likelihood is proportional to the radiation dose. Since children and teenagers are substantially more vulnerable to radiation than adults, they are at greater risk.

In Iran, a report on the effects of electromagnetic radiation from high-voltage transmission lines was performed. This demonstrated that living under a transmission line was riskier than standing next to one (Ahmadi HL Al, 2010).

In France, fatigue has been observed in people living within 300 meters, with sleep disturbances, discomfort, and within 200 meters increased with restlessness, depression, dizziness, memory loss, within 100 meters from the base station (Santini et al., 2002).

Residents of BTS who use local mobile phones are at risk for neuropsychiatric symptoms such as tingling, headaches, altered reflexes, body aches, tremors, memory loss, numbness, dizziness, leg / leg pain, muscle and joint pain, and memory loss (Abdel-Rasul et al.).

There is a link between exposure to electromagnetic fields for Alzheimer's disease, motor neurone disease and Parkinson's disease (WHO, 2007).

Electric fields induce high blood pressure, changes in white and red blood cells, immune system dysfunction, chronic stress symptoms, increased metabolism, chronic fatigue disorders, and headaches, according to Russian scientists who have studied EMFs for decades. (2007.).

People who were exposed to very low frequency electric fields from high voltage substations had a detrimental impact on those who lived near the substation and had sleep issues (Taibeh et al. 2012).

Auditory effects: An audible sound (e.g. buzz, click, chirp or knocking sensation) is heard when human head is exposed to pulsed radiation (Elder, 1984), (Chou, 1982). [3]

According to Tice and his team's study, human lymphocytes can be damaged by specific absorption rate (SAR) of at least 5.0 w/kg on average, under extended exposure conditions. An electromagnetic pollution survey was conducted in the town of Kakuta, which includes sports and amusement parks. There are several mobile phone base stations in the area.

Radiofrequency electromagnetic fields have been listed as potentially carcinogenic to humans by the World Health Organization (2013). Staff in the mechanical, electronic, and telecommunications industry have a higher prevalence of leukemia, according to two epidemiological surveys conducted in the United States and Sweden.

CHAPTER 3

THEORETICAL MODEL OF RADIATION

3.1 Introduction

This chapter explains what electric and magnetic fields are and how they operate. Electromagnetic radiation from electronic devices and sources is also discussed.

3.2 Radiation Theory

Radiation the process by which heat is transmitted from a warm object to a cool object in the form of electromagnetic waves without the aid of an inert medium is called radiation. As light travels from one place to another in the form of electromagnetic waves, the radiation system conducts heat in much the same way. Electromagnetic radiation in the form of waves emits energy called electromagnetic waves or light. According to quantum mechanics, light is both a particle and a wave. When it is being considered as a particle, it is called a photon. When it is considered a wave, it is called an electromagnetic wave or a light wave. The fields are defined as electromagnetic waves when the instantaneous value of the field is compared to the transverse sinusoidal electric and magnetic field equation. The presence of electromagnetic waves with speeds equal to the speed of light is predicted by Maxwell's equations. To verify the validity of the theory, Hertz had to create a detector device that would allow him to find data that could calculate the speed of electromagnetic radio waves combined with wavelength and frequency, the speed of light.

Terahertz radiation (also known as sub-millimeter radiation, terahertz waves, massive high-quality waves, T-rays, T-waves, T-light, T-Lux or T-hertz) is composed of electromagnetic waves located in bands of 0.3 to 3 terahertz ITU.

(1-Hz = 1012 Hz) The radiation wavelength of the terahertz band can range from 1 mm to 0.1 mm (100 micro-mm). Since the wavelength of the terahertz band starts from 1 mm and goes down, it is also called submillimeter band and its radiation is called submillimeter wave, especially in astronomy.

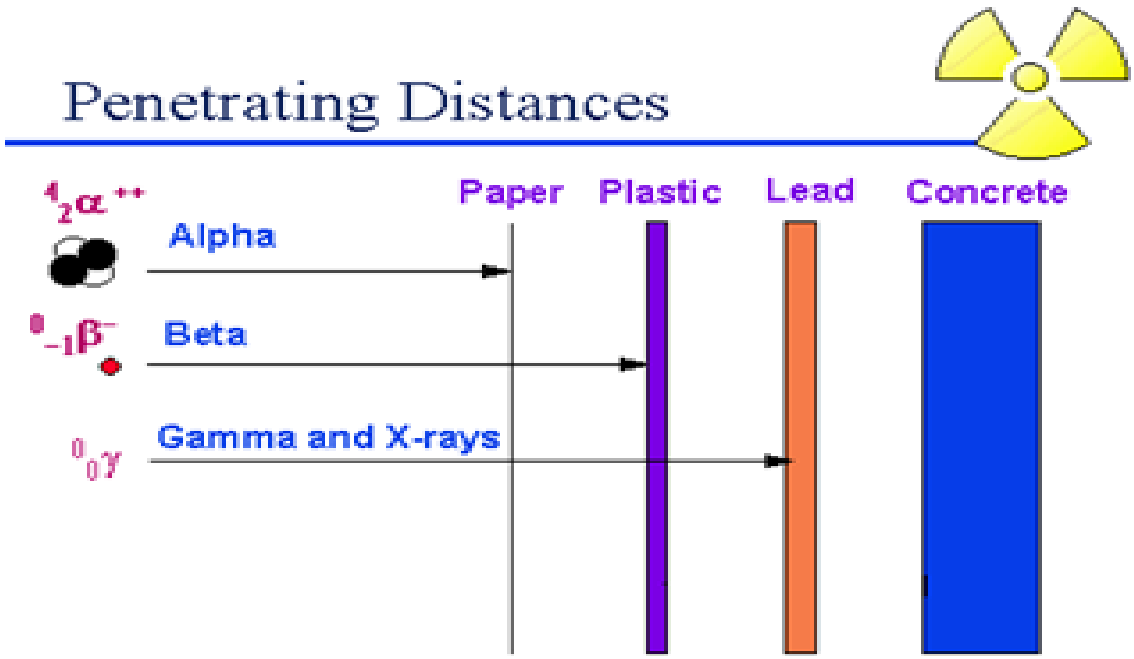


Figure 3.1: Alpha, Beta, and Gamma rays provide penetrating ability.

3.2 About Static Electric Field

We have to charge everything we encounter on a daily basis. This charge is almost always in balance. When some charge is taken from a neutral object, the object becomes a charged object. Stable electricity is produced when excess electrons in an electrically charged body enter another body. It happens through the expression of energy. There is no way to balance this charge by taking charge from outside, the object remains a charged object. These charges are known as permanent and static charges. The electric field created by this charge is known as static electricity. Charge is a scalar quantity. Since the introduction of a static electric field can also break the inversion and reflection symmetry of a laser field, this provides an asymmetric field scenario in which the strong laser field process may show abundant new features, and thus more complex mechanisms may be found. [4]

In turn, the body that receives the discharge of electrons is charged statically through the process of electronic induction. This discharge and energy charge - from one body to another, respectively - can be caused by sparks or some kind of mechanical discharge.

Here the balance of energy is proved, since the body with higher electron count gives this charge to the body with a lower electron count.

Even if a body has a very high electrical charge, the electrons can "jump" directly towards the object of discharge, creating an electric pressure due to the dielectric separation of the air.

In short, the transfer of electrons from one body to another is due to the basic interaction between the charges: opposite electric charges attract and repel each other like electric charges.

This makes it possible for electric charges to be transferred from one atom to another and move toward the surface of the body, depending on the response conducted by the other body.

As a result, the transfer of electrons from the body occurs with a lower negative charge with a larger negative charge in the body that raises the electronic phenomenon.

The most common way to understand static electricity is to rub two electrically charged bodies with opposite charges.

Static electricity is a very useful method of obtaining very high voltages.

The gold leaf electroscope is the most common and simplest method for detecting and

measuring static electricity.

Static electricity is not able to create a magnetic field.

Static electricity usually forms a page of an object.

One such issue is laser detachment of an electron bound by a short-range, -model potential in the presence of a heavy static electric field, as discussed in this study. Despite the fact that this issue has a long history, most recent therapies required large sums of money or were restricted to particular regions of low static field, field geometry, and/or special cases of laser polarization. For other importance cases (called quasi static) the spatial distribution is nearly the same as for the static field (do not change with time) even though may vary rapidly with time. [5]

3.4 Characteristics of EMF

Magnets have the property of attracting the opposite poles of other compounds and some magnets and then throwing them backwards like the poles of some magnets. Pushing the two north (or south) poles of two permanent bar magnets together produces a disruptive force, which is amplified as the two ends are joined together. There is an interesting force between two opposing poles (one north and one south) as they are brought together. The more you combine them, the more powerful this force becomes.

And if they do not generate their own magnetic field, alloys containing ferromagnetic materials such as iron, nickel, and cobalt - or these (such as steel) - are drawn to permanent magnets. They're just drawn to magnets, and they won't be repelled until they start producing their own magnetic field. Magnets are not drawn to such materials such as aluminum, wood, or ceramics.

Electromagnetic currents accelerate at the speed of light and disperse as vibrations (C). The frequency is proportional to the wavelength.

$$\lambda \text{ (wavelength)} = \frac{c(speed\ of light)}{f(frequency)}$$

The closest field is used if the distance to the field source is less than three wavelengths. The difference between long-distance fields is greater than three wavelengths. Since the ratio of electric field energy (E) to magnetic field energy (H) is not constant in the short term, each must be measured separately. In the long run, however, measuring the sum of one area and comparing it to the other is adequate.

The fundamental properties of electromagnets and magnets are the same. The distinction between a permanent magnet and an artificial magnet is in the way the field is shaped, not in the field itself. Electromagnets, for example, have two poles that absorb ferromagnetic material and poles that repel other poles while attracting opposite poles. The distinction is that in permanent magnets, the charge is generated by the interaction of electrons in the atoms, while in electromagnets, the charge is created by the movement of electrons as part of the electric current.

CHAPTER 4

THE IMPACT OF EMF ON BIOLOGICAL SYSTEMS AND THE ENVIRONMENT AND ITS ADEQUECY

4.1 Introduction

This chapter discusses the biological mechanism of EMR, which is a threat to human civilization.

4.2 Variety of Health Threats of EMF:

Since EMFs are practically everywhere, most people are exposed to them on a regular basis.

EMFs from manufactured sources, such as microwaves, do not damage human health at the levels of radiation that people are exposed to on a daily basis, according to scientists.

Some important information about the effects of Non-Ionizing Radiation:

1. Results in a Scandinavian residential study indicate a double leukemia risk above 0.2 μT, usually with exposure levels relative to those encountered within 50 to 100 meters of the overhead power line.

2. The International Non-Ionizing Radiation Defense Commission or ICAIRP speaks of the greatest risk to the human body if the ear or brain tumors from this radiation. The company's website also mentions a number of problems, including headaches, heart disease, insomnia, and insomnia.

3. A few studies have attempted to estimate EMF exposures in broad categories (69–71, 81), but none of these found increased cancer risks related to EMF exposure. [6]

4. There is still a risk of long-term effects like CANCER, which can occur year after year or even decades later. These types of effects are not always seen, but their probability is proportional to the dose of radiation.

5. Since children and teenagers are slightly more vulnerable to radiation than adults, they are at greater risk.

6. Radiation-exposed populations, such as patients who survived an atomic bomb or radiotherapy patients, saw a substantial rise in cancer risk above 100 MSV, according to epidemiological reports.

7. A steady increase in the prevalence of allergic/ asthmatic diseases globally has occurred, with about 30%–40% of the world population now being affected by one or more allergic/asthmatic conditions. [7]

8. A very special disease called repetitive stress injuries (RST) have reported to attack and estimated 185000 US office and factory workers a year due to personal computer (PC) use. [8]

9. Prenatal exposure to ionizing radiation exceeds 100 M SV at 8-15-15 weeks of gestation and can cause brain damage in fetuses after an acute dose of 200 MSV at 16-25 weeks of gestation.

10. Radiation can impair tissue and organ function and cause extreme side effects such as skin redness, hair loss, radiation burns, and acute radiation syndrome outside of those strains.

11. At greater doses and higher dosage frequencies, these symptoms become more pronounced. The dosage level for acute radiation syndrome, for example, is around 1 sv (1000 MSV).

12. From the calculations based on the qualitative risks discovered in a Swedish study, about 20 cases of leukemia and 20 cases of brain tumors per year can be attributed to magnetic fields. These figures are comparable to the 40,000 annual cancer cases in Sweden, of which 600 are considered occupational sources.

13. The Power Development Board of Canada, the New York State Power Line, and nine other states, as well as the United States, New Zealand, and Sweden, have made Right of Way (ROW) a statute banning the construction of homes within 30-90 meters of high-voltage power lines. Other nations, such as Russia, Poland, China, and India, have special security rules.

14. Bio-Electromagnetism, Bio-Electronics, Electro-medicine, Electro-healing, and other new fields of research have been coined.

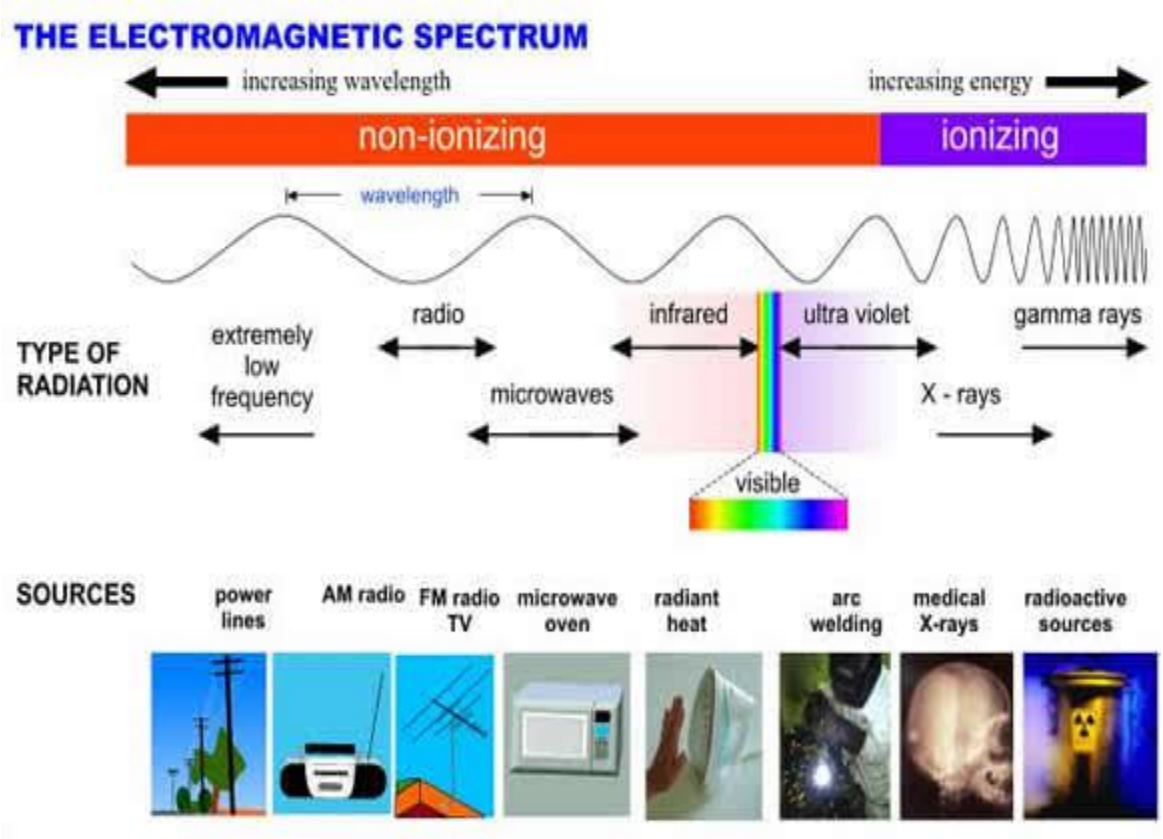


Figure 4.1: Spectrum of Electromagnetics

15. More recently, several epidemiological findings of people who received care as an infant (pediatric CT) have shown that cancer risk could be reduced as well (between 50-100 MSV).

16. Depending on the dosage to radiation-damaged tissues and/or organs, as well as the absorbed dose, which is measured in grays (X). The type of radiation and the susceptibility of various tissues and organs determine the possible damage from an absorbed dose.

17. Radiation is harmful to everyone. External radiation greatly interferes with the way cells in the human body communicate with each other. It also increases the risk of diseases such as cancer.

18. Dr. Golam Mohammad Bhuiyan said that there is a risk of radiation in children with autism. Apart from this, radiation can also create a risk of genetic changes, fatigue, leukemia and some other diseases in anyone.

19. The confusion resulting from IARC's recent classification once again demonstrates the difficulties in assessing evidence and the manifold pitfalls in communicating risk. The problem starts with defining the risk factor. [9]Dr. Golam Mohammad Bhuiyan said that there is a risk of radiation in children with autism. Apart from this, radiation can also create a risk of genetic changes, fatigue, leukemia and some other diseases in anyone.

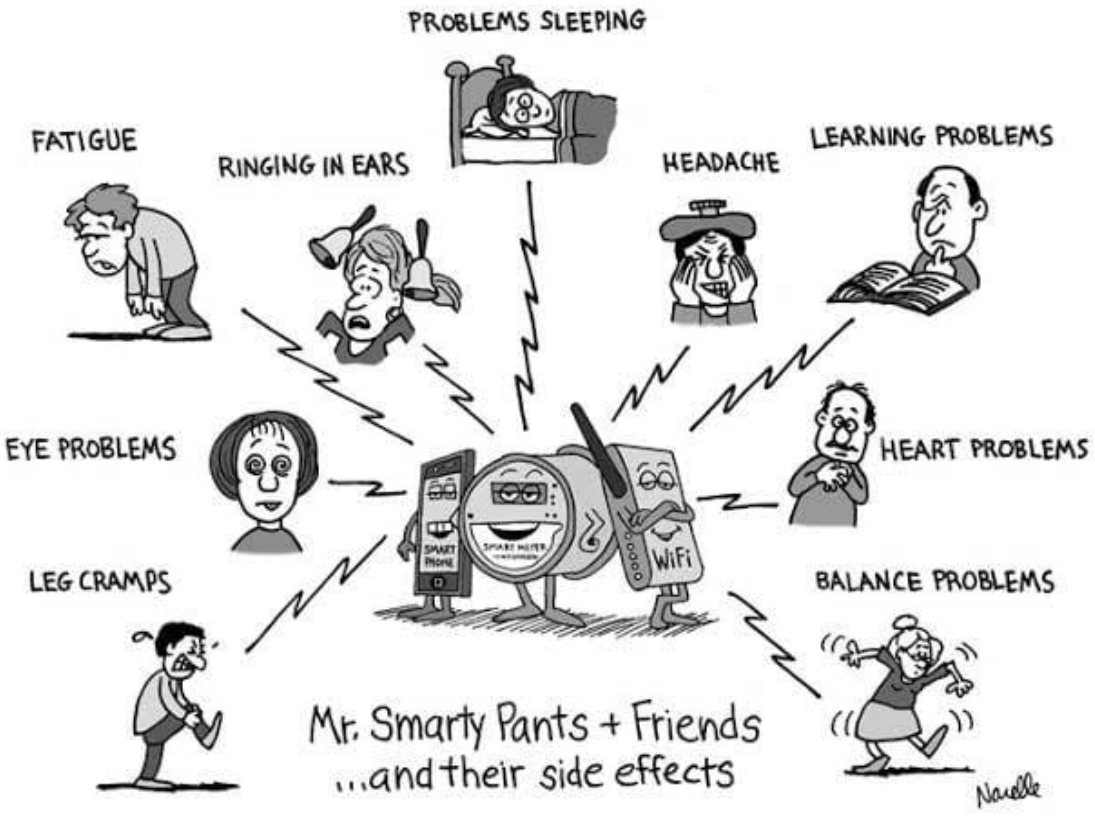


Figure 4.2: Radiation from a variety of household products.

CHAPTER 5

METHODOLOGY

5.1 Introduction

The experiment was measured from different regions of the electromagnetic field. We follow the ICNIRP application list like MRI, power line, mobile phone, LED, base station etc., also from various brands of home appliances. We have collect electric fields, magnetic fields and power.

Where we spend most of our time every day various household appliances are measured. Measurements were taken around the device (front, back, left, right, top and bottom).

Multi-Field EMF Meters We have found magnetic fields, electric fields and radio frequencies including meters.

5.2 Overview of Instrument :

(A) Electrosmog Meter

The Electrosmog Meter is a three-mode instrument that measures the strength/power density of high frequency (RF) electromagnetic waves, low frequency (LF) magnetic fields (Gauss, Tesla), and low frequency (ELF) electric fields (v/m) in living environments. This is an excellent product for persons or organisations dealing with the safety of electrical magnetic waves. It has a 100MHz to 8GHz RF bandwidth with high sensitivity (0.5uw/m2 to 1.8w/m2) and a 50Hz to 10KHz LF bandwidth (or 50Hz to 1KHz) 8GHz, 0.1T to 60T (1mG - 600mG) or 0.01T to 1T (0.1mG to 10mG) sensitivity, and E-field bandwidth of 50Hz-50kHz, sensitivity of 10v/m to 1000v/m. Electrosmog Meter used to detect the magnetic component of the electromagnetic fields in the frequency range 20 Hz – 100 kHz. [10] Electrosmog-meter-detector such as Gauss meter, Telemeter, ELF-meter, are needed to measure the level of ELF-EMF produced by power lines, computers, TVs, kitchen appliances, enabling to find hidden sources of ELF frequency magnetic fields, and determining the effectiveness of eventual electric shielding devices. [11] A broadband survey Meter (Cornet Electrosmog Radiofrequency Meter) with the following specifications was used to measure the power density, electric and magnetic field strength around the BSA. [12]. A handheld three-axis RF meter (electrosmog meter) was used for the measurement of the power density of electromagnetic radiation from the mobile base stations. [13]

(Radiation from BTS Antenna)

(Wi-Fi Router)

(We using Directional ELECTROSMOG meter at Power Substation)

Figure 5.1: Electrosmog Meter

Applications :

• Electromagnetic wave field intensity, power density, and frequency measurement at high frequencies.

• Magnetic field analysis at low frequencies (LF) (Gauss meter function).

• Electric field calculation at low frequencies (ELF) (E-field meter function).

• Antenna radiation power density test for mobile phone base stations.

• Analog and digital RF wireless communications (AM/FM, TDMA, GSM, DECT, CDMA, 3G, 4G, 5G(Sub-6GHz)).

• Wireless LAN (Wi-Fi), Bluetooth, tracking, installation, and optimization of Ultra-Wide-Band.

• Calculation of radio frequency (RF) power for transmitters.

• Spy camera, portable bug finder, and Internet of Things (IoT) gadgets

• SMART METER radiation level, cellular/cordless handset radiation level, Electrical Utilities SMART METER radiation level

• EMF from AC power lines, transformers, generators, and small appliances.

• Detection of leaks in microwave ovens.

• EMF protection assessment of one's personal living space.

(B) RF Field Strength Meter with 3 Axis

The energy of Radio-Frequency Electromagnetic Fields is measured and observed with this meter. Above the frequency scale of 10MHz to 8GHz, the meter is accurately tuned. The meter is precisely calibrated above the frequency range of 10MHz-8GHz. Measurements were collected at a distance of 1 m (m) and 2 m from the gantry for SMFs when the brain, cervical spine and extremities were scanned. [14]A calibrated THM1176 3-Axis hall magnetometer will be used to collect measurements for static magnetic fields from both 1.5 and 3.0 MRI scanners. [15]

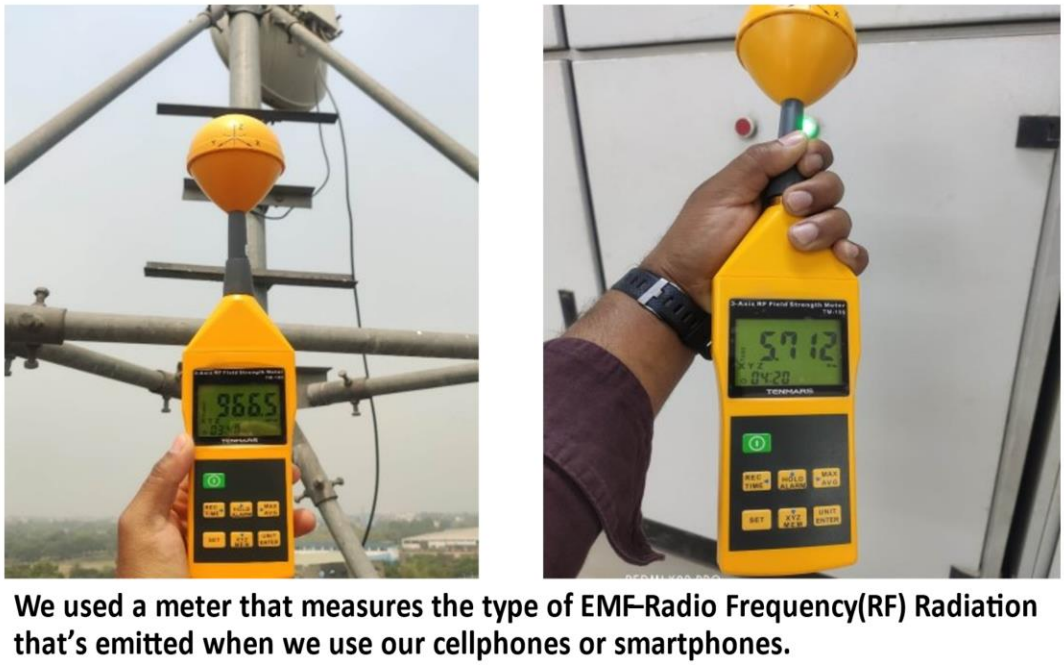


Figure 5.2: RF Field Strength Meter with 3 - Axis

Applications:

• In environments where active electromagnetic fields are present, such as radio stations, regular maintenance and service work is often required.

Some workers may also be vulnerable to electromagnetic radiation. Personnel must not be exposed to harmful amounts of electromagnetic radiation in such situations, such as:

• Electromagnetic wave field penetration calculation at high frequencies (RF).
• Antenna radiation power density test for mobile phone base stations.
• Applications for wireless networking (CW, TDMA, GSM, DECT).
• Transmitter RF power estimation.
• Identification and implementation of wireless LAN (Wi-Fi).
• Wireless bug finder and spy camera
• Radiation protection from cell phones and cordless phones.

Features:

• The meter is a broadband instrument for measuring high-frequency radiation in the 10MHz to 8GHz range, as well as measures of electric field intensity in TEM cells and absorber spaces, thanks to the non-directional electric field antenna and high sensitivity.
• The unit of measurement and measurement forms have been chosen to express electrical and magnetic field strength and power density in units of electrical and magnetic field strength and power density.
• The power density is especially important at high frequencies. It gives a measurement of how much power an individual exposed to the field absorbs. At high frequencies, the power output must be kept as low as possible.
• Three-channel measuring tracker for isotropic electromagnetic field measurements and non-directional (isotropic) measurements.
• Three-channel optical results analysis has a wide dynamic range.
• Warning threshold and memory feature can be customized.
• It's easy and safe to use.
• Detector for low battery.

(C) Multi-Field EMF Meter

This meter simultaneously displays the magnetic field, electric field, and RF power. To express measurement units and types, electrical and magnetic field resistance and power density units are used. This meter will measure power lines, electrical machines, industrial devices, cell phones, base stations, and microwave leakage emf. This unit is carefully tested and calibrated before distribution, and reliable service is provided year after year of proper use. In the operating frequency range of the system, f=1Hz÷100kHz (including both the processes in the charging and discharging circuits) the effects over the human body are nonthermal, expressed in sensory, nerve and muscle stimulations (Non-binding guide to good practice for implementing Directive 2013/35/EU, 2013). [16] ELF-EMF was generated by a system including autotransformer, multi-meter, solenoid coils, teslameter and its probe. [17]

(Power Substation)

(Wi-Fi Router)

Figure 5.3: Multi-Field EMF Meter

Features:

• Data storage (HOLD)

• OL (overload) view

• Brightness levels: mild, medium, and moderate

• Customizable Auto-shutdown (APO) 1 hour, 3 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes

• Pressing the keys On/Off with programmable tone parts for sounds/alarm sounds

• The program version is shown on the information panel.

• English, Traditional Chinese, Simplified Chinese, Japanese, and Spanish are the available languages.

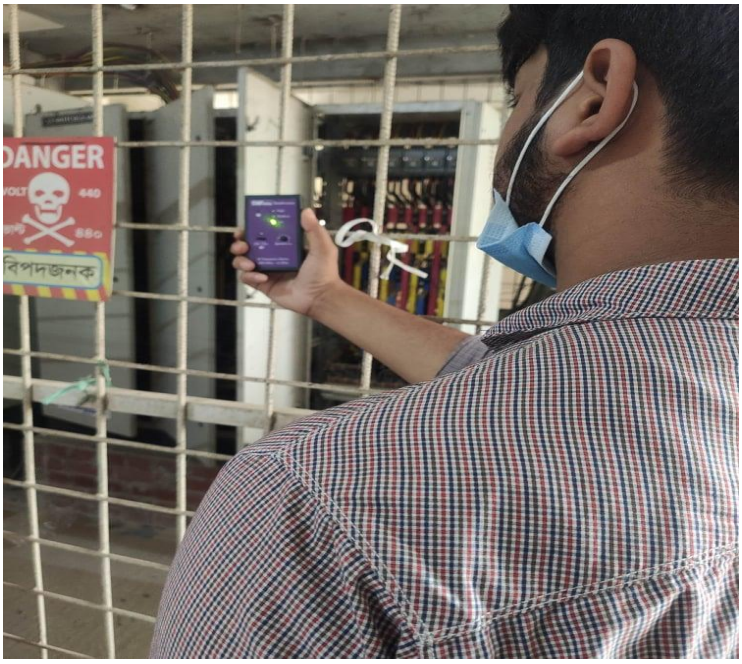
• Gauss(mg) or Tesla(T) as magnetic units

• EMF readings with a high frequency.

• Up to 20 classes of RF historical records

(D) EMF Fields (RadAware)

The RadAware warning detects and responds to signals in the frequency range used by most electronic communication systems (200 Mhz to over 6 Ghz, with an average dB of 6 dB). Exposure levels are shown on three LED lights and are also indicated by six different audible alarm sounds which can be switched off. Electric and magnetic fields (EMF) are ubiquitous in the modern society. [18]



(We using Directional EMF fields at Power Substation)

(wi-Fi Router)

(Radiation from BTS Antenna)

Figure 5.4: EMF Fields (RadAware)

Applications

- Since the instrument is not waterproof, it should be protected from the rain with a transparent plastic container.
- The RadAware runs off a standard 9V PP3 battery.
- A separate green blinking LED above the ON-OFF Switch signals that the RadAware is operating by measuring the peak RF/microwave frequency 128 times per second.
- Detects hidden microwave and RF radiation sources you may not be aware of, monitors personal exposure.
- The large color display shows all three parameters (EMF, electric, and RF) simultaneously, including readings, bar graphs, and a trend graph.
- Compact enough to fit in a pocket or a purse. It's meant to be left on all the time, but it'll let you know if it gets too far.
- This versatile meter measures fields surrounding something as small as a cell phone all the way up to cellular phone base stations and power lines.
- Extra sensitive adjustable detector: 0.015 to 3 V/m, 0.6 to 24000 uW/m2. Wide frequency range: 200 MHz to over 6 GHz.
- No need to navigate menus – all three parameters display simultaneously stay safe - audible alarm and color-coded bar graph alert you to dangerous conditions large, high-visibility color TFT display with adjustable brightness is viewable in any lighting electric field: 50 to 2000 V/m radio frequency strength (50 MHz to 3.5 GHz): –51 to 16 dBm.
- This broadens the use of non-pharmacological, non-invasive EMF therapy to the treatment of postoperative pain and edema to enhance surgical recovery. [19]
- In WEVC applications, since a significant amount of power is transmitted over a large airgap, these systems may produce a large amount of electromagnetic field (EMF) emissions in and around the vehicle. [20]

CHAPTER 6

COLLECTION OF INFORMATION

6.1 Introduction

The method for gathering data was addressed in this chapter.

6.2 Data Collection procedure

The latest study specifically includes the calculation of magnetic field (MF), electric field (EF) and signal strength from cell phone, Base transceiver station (BTS), Home Apliances, Wi-fi Zone as well as various electronics instruments in Permanent Campus of Daffodil International University's (DIU) laboratories.

1. For cell phones: Random users have taken data from different branded cell phones to measure electronic fields, magnetic fields, signal strength.
2. Home appliances: The data has collected from various branded home appliances like Light, Fan, Router, Fridge, laptop, AC, etc. Also, measurement the nearest distance radiation for highest value. From all side measurement has taken. [21]
3. University equipment: The following information was gathered from Daffodil International University's different equipment.

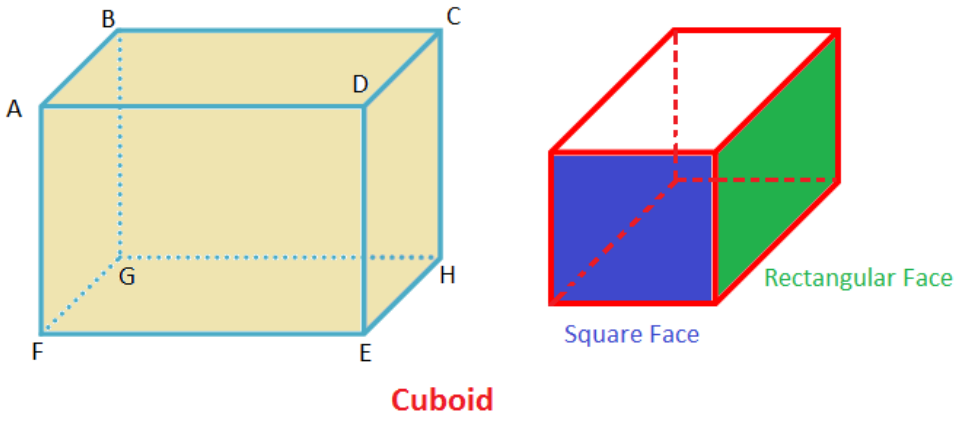


Figure 6.1: Indications of measured side.

4. Compare all side compact hints to compare with electronic / electrical equipment ABCD roof side, EFGH ground side, ADFE side section, BGCH rear side, ABFG left side, CDEH compare all side compact hints to compare with electronic / electrical equipment.

CHAPTER 7
INTEGRATION WITH GRAPHICAL USER INTERFACE (GUI)

7.1 Introduction

In this chapter, we developed a web based graphical user Interface (GUI) for store our measured data from various sources and Survey purpose. We will prepare a monthly survey report from the stored data. There are two different Interfaces for Admin and viewers. Admin can login by his credentials and control the data server and Viewers can easily see the data and survey report from web address. We hosted the web data to pythonanywhere.com for educational and test purpose and the name of our web address given radiationinfo.pythonanywhere.com.

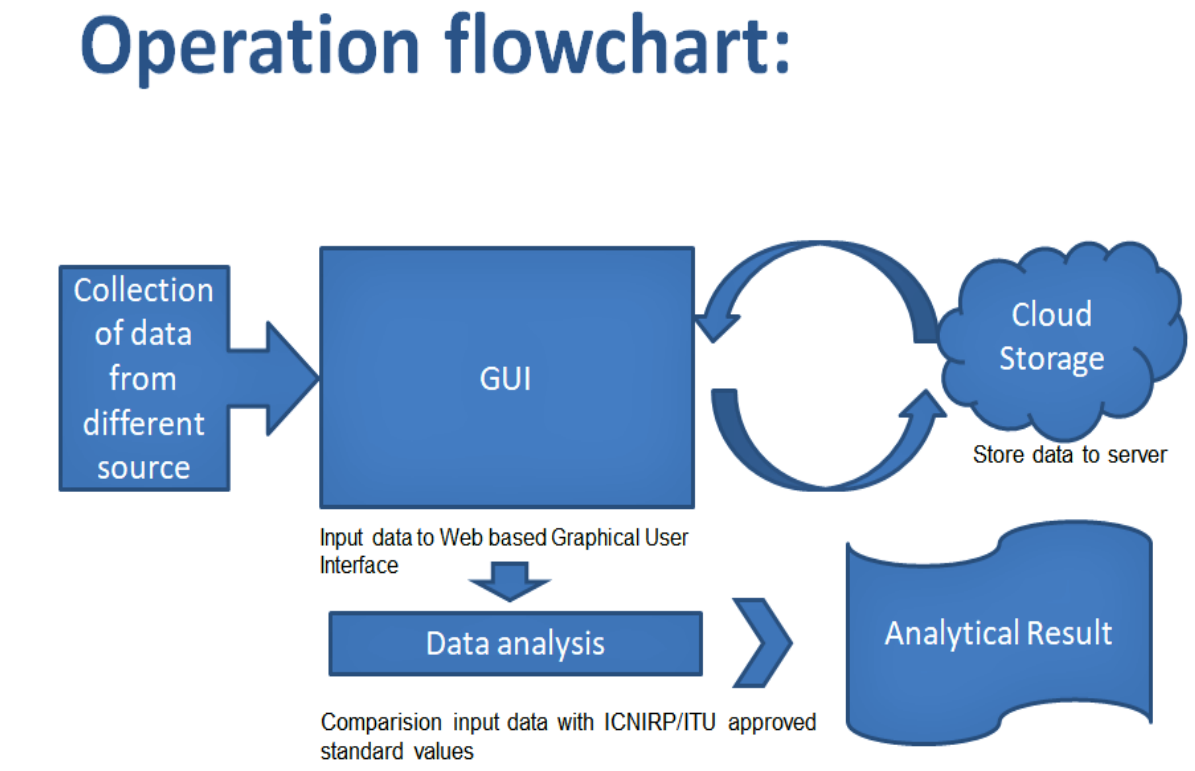


Figure 7.1: Operation Flow-chart of GUI

7.2 GUI model-Admin Panel

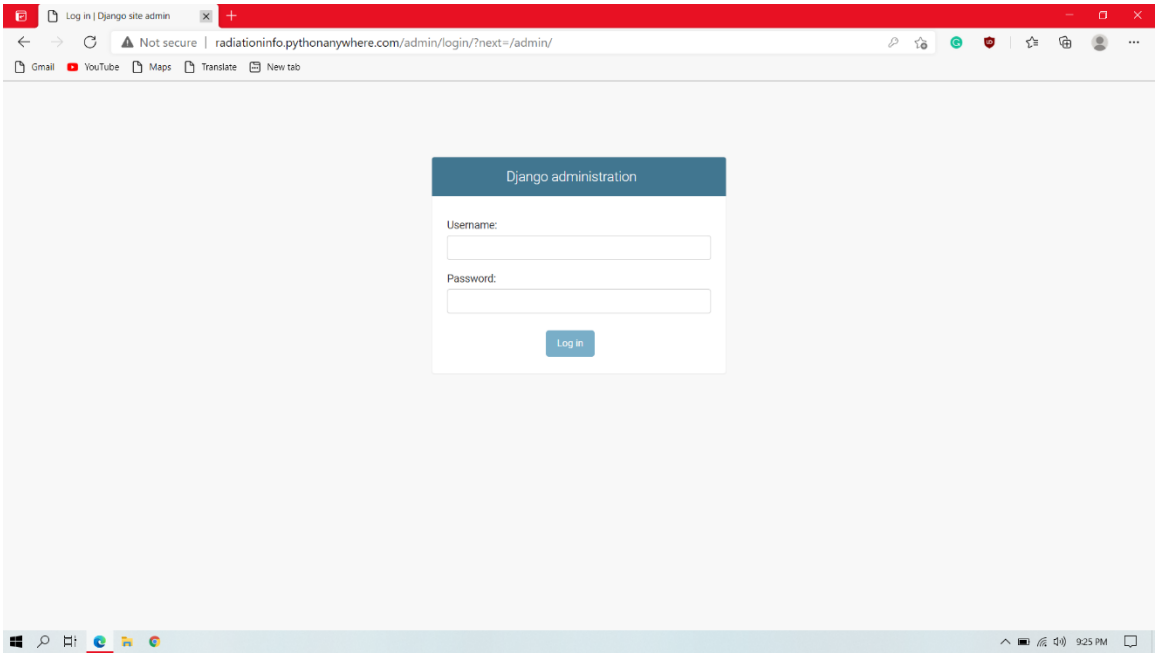


Figure **7.2:** Admin login panel

An admin will input the data from the various Radio-active devices by measured the value with specified machine. Admin will log in to the panel by his desired credentials. After log in to the server, there will be some different data entry field for input the data.

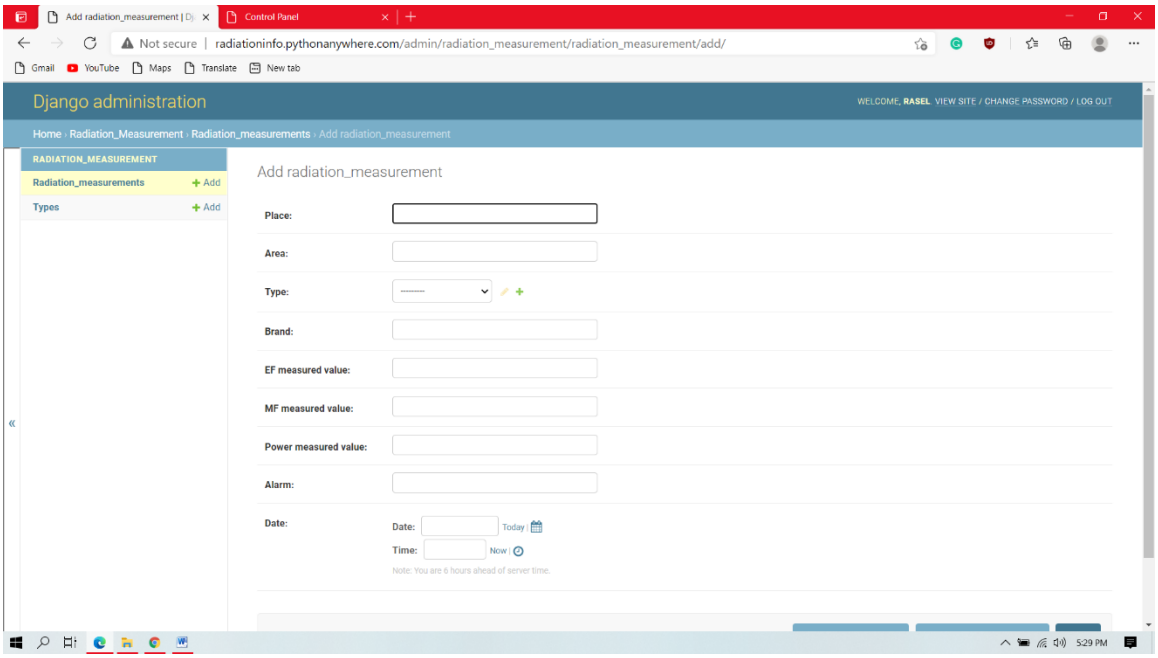


Figure **7.3:** Data field for Admin

7.3 GUI model-Viewers Side

Anybody from anywhere can access the site by taping the web address and he can see the data.

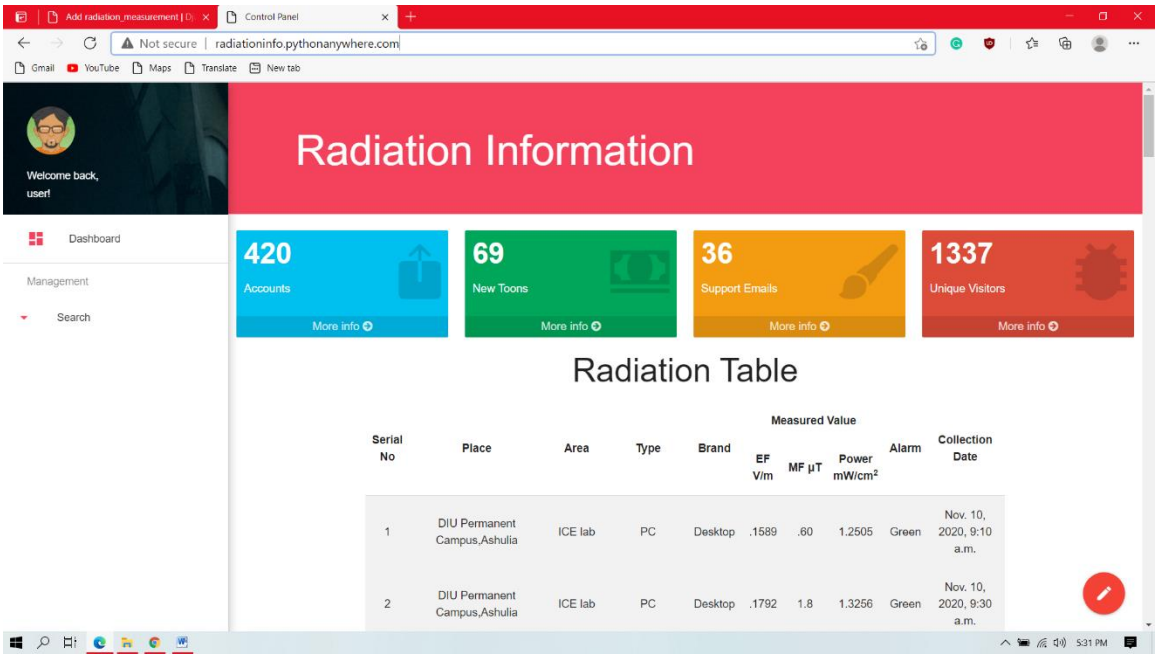
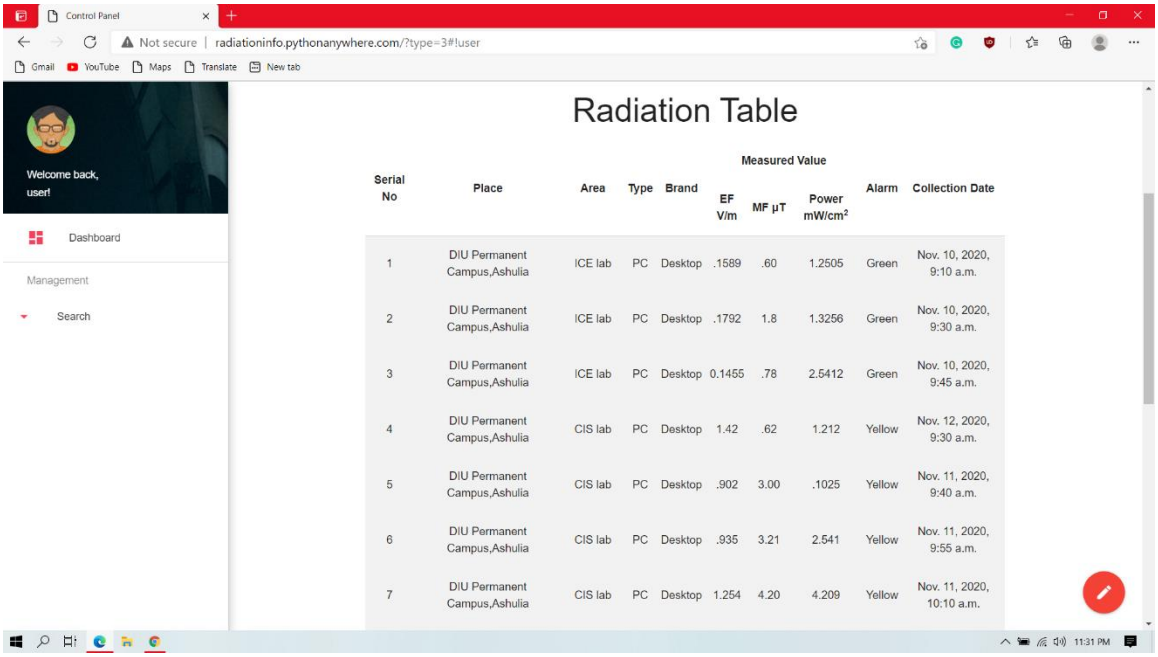


Figure **7.4:** User view

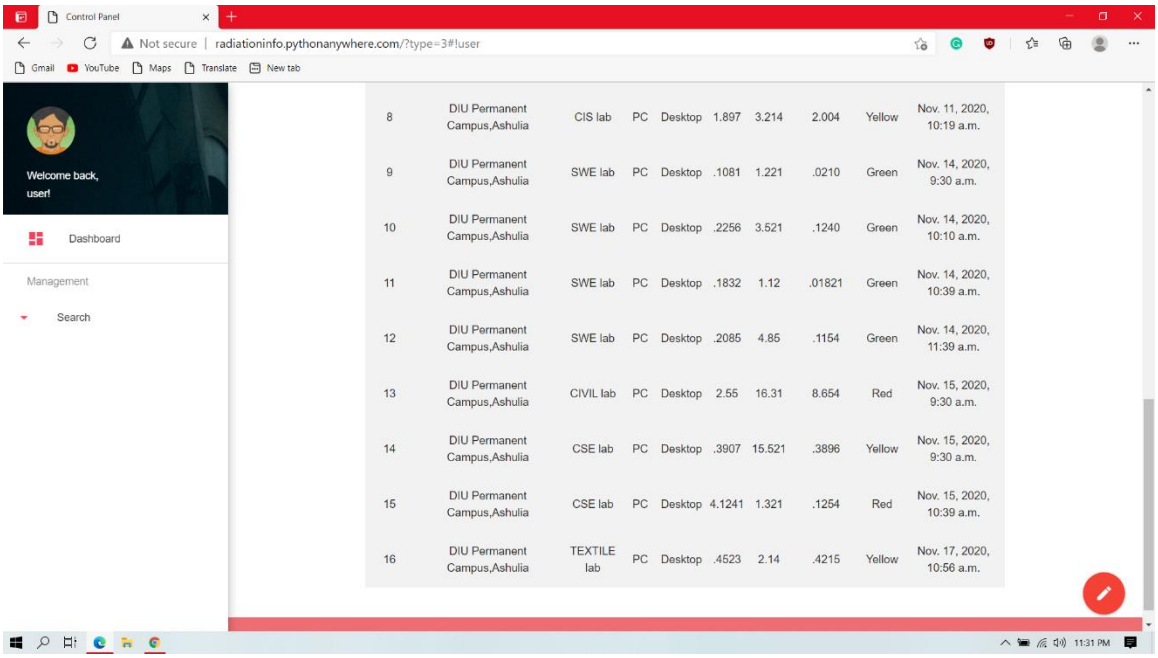
CHAPTER 8

RESULT

Table8.1: Results for PC from Various lab of DIU

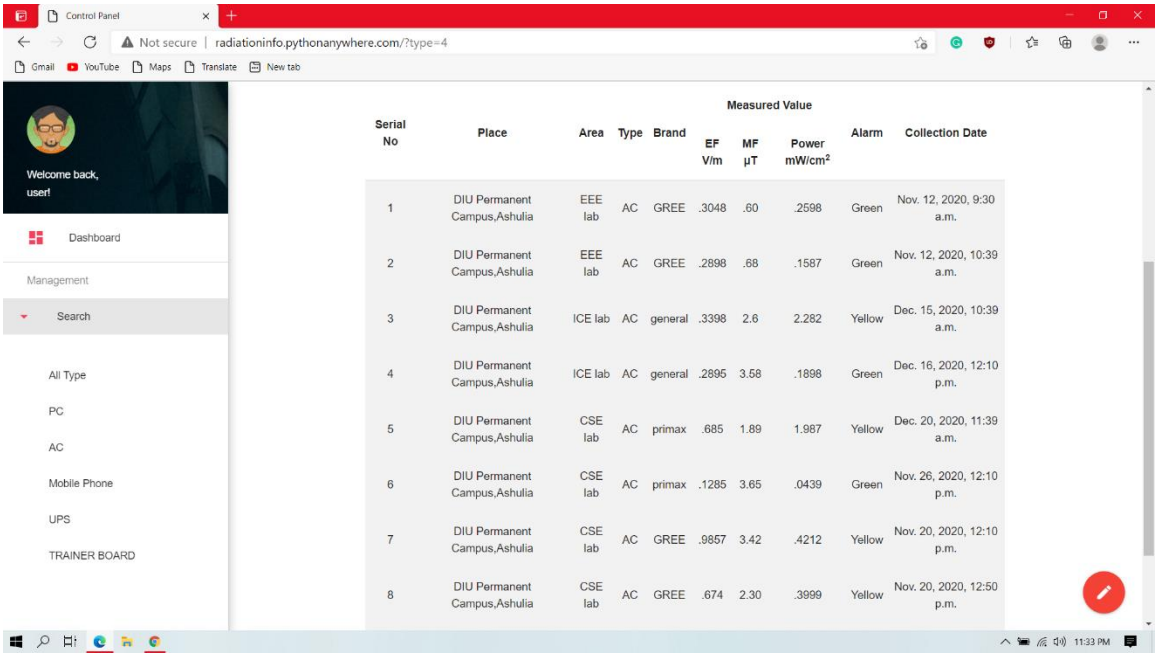


Serial No	Place	Area	Type	Brand	Measured Value EF V/m	MF µT	Power mW/cm²	Alarm	Collection Date
1	DIU Permanent Campus,Ashulia	ICE lab	PC	Desktop	.1589	.60	1.2505	Green	Nov. 10, 2020, 9:10 a.m.
2	DIU Permanent Campus,Ashulia	ICE lab	PC	Desktop	.1792	1.8	1.3256	Green	Nov. 10, 2020, 9:30 a.m.
3	DIU Permanent Campus,Ashulia	ICE lab	PC	Desktop	0.1455	.78	2.5412	Green	Nov. 10, 2020, 9:45 a.m.
4	DIU Permanent Campus,Ashulia	CIS lab	PC	Desktop	1.42	.62	1.212	Yellow	Nov. 12, 2020, 9:30 a.m.
5	DIU Permanent Campus,Ashulia	CIS lab	PC	Desktop	.902	3.00	.1025	Yellow	Nov. 11, 2020, 9:40 a.m.
6	DIU Permanent Campus,Ashulia	CIS lab	PC	Desktop	.935	3.21	2.541	Yellow	Nov. 11, 2020, 9:55 a.m.
7	DIU Permanent Campus,Ashulia	CIS lab	PC	Desktop	1.254	4.20	4.209	Yellow	Nov. 11, 2020, 10:10 a.m.



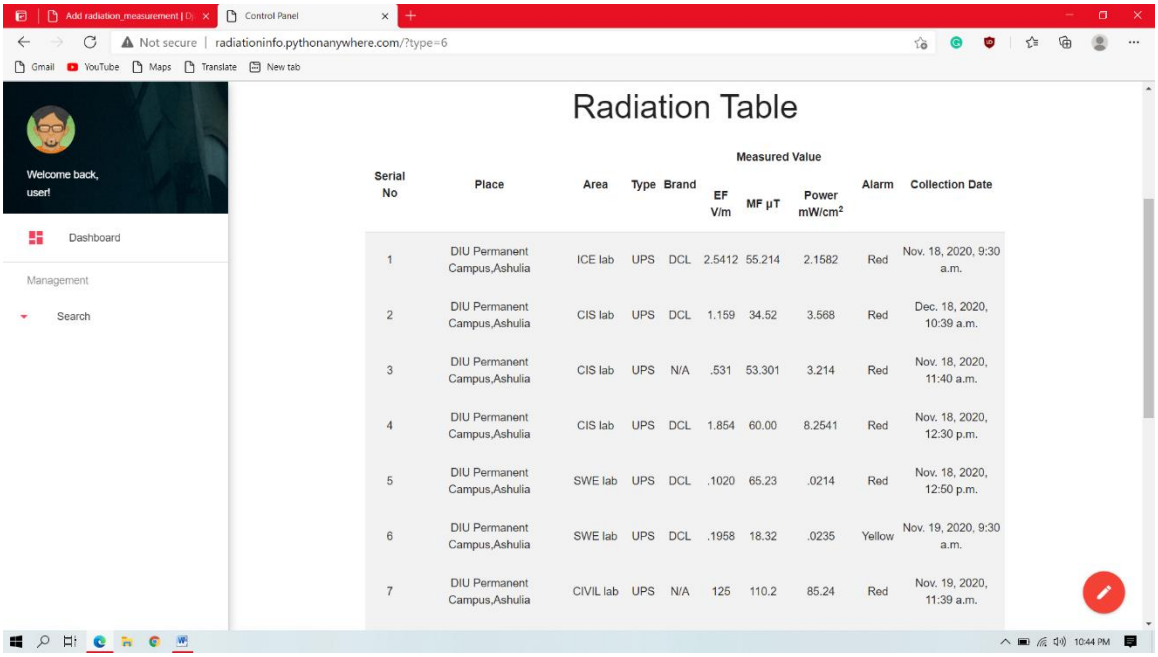
8	DIU Permanent Campus,Ashulia	CIS lab	PC	Desktop	1.897	3.214	2.004	Yellow	Nov. 11, 2020, 10:19 a.m.
9	DIU Permanent Campus,Ashulia	SWE lab	PC	Desktop	.1081	1.221	.0210	Green	Nov. 14, 2020, 9:30 a.m.
10	DIU Permanent Campus,Ashulia	SWE lab	PC	Desktop	.2256	3.521	.1240	Green	Nov. 14, 2020, 10:10 a.m.
11	DIU Permanent Campus,Ashulia	SWE lab	PC	Desktop	.1832	1.12	.01821	Green	Nov. 14, 2020, 10:39 a.m.
12	DIU Permanent Campus,Ashulia	SWE lab	PC	Desktop	.2085	4.85	.1154	Green	Nov. 14, 2020, 11:39 a.m.
13	DIU Permanent Campus,Ashulia	CIVIL lab	PC	Desktop	2.55	16.31	8.654	Red	Nov. 15, 2020, 9:30 a.m.
14	DIU Permanent Campus,Ashulia	CSE lab	PC	Desktop	.3907	15.521	.3896	Yellow	Nov. 15, 2020, 9:30 a.m.
15	DIU Permanent Campus,Ashulia	CSE lab	PC	Desktop	4.1241	1.321	.1254	Red	Nov. 15, 2020, 10:39 a.m.
16	DIU Permanent Campus,Ashulia	TEXTILE lab	PC	Desktop	.4523	2.14	.4215	Yellow	Nov. 17, 2020, 10:56 a.m.

Table8.2: Results for AC from different LAB of DIU**.**



Serial No	Place	Area	Type	Brand	Measured Value EF V/m	MF µT	Power mW/cm²	Alarm	Collection Date
1	DIU Permanent Campus,Ashulia	EEE lab	AC	GREE	.3048	.60	.2598	Green	Nov. 12, 2020, 9:30 a.m.
2	DIU Permanent Campus,Ashulia	EEE lab	AC	GREE	.2898	.68	.1587	Green	Nov. 12, 2020, 10:39 a.m.
3	DIU Permanent Campus,Ashulia	ICE lab	AC	general	.3398	2.6	2.282	Yellow	Dec. 15, 2020, 10:39 a.m.
4	DIU Permanent Campus,Ashulia	ICE lab	AC	general	.2895	3.58	.1898	Green	Dec. 16, 2020, 12:10 p.m.
5	DIU Permanent Campus,Ashulia	CSE lab	AC	primax	.685	1.89	1.987	Yellow	Dec. 20, 2020, 11:39 a.m.
6	DIU Permanent Campus,Ashulia	CSE lab	AC	primax	.1285	3.65	.0439	Green	Nov. 26, 2020, 12:10 p.m.
7	DIU Permanent Campus,Ashulia	CSE lab	AC	GREE	.9857	3.42	.4212	Yellow	Nov. 20, 2020, 12:10 p.m.
8	DIU Permanent Campus,Ashulia	CSE lab	AC	GREE	.674	2.30	.3999	Yellow	Nov. 20, 2020, 12:50 p.m.

Table8.3: Results from UPS used in Various Department of DIU.



Serial No	Place	Area	Type	Brand	Measured Value EF V/m	MF µT	Power mW/cm²	Alarm	Collection Date
1	DIU Permanent Campus,Ashulia	ICE lab	UPS	DCL	2.5412	55.214	2.1582	Red	Nov. 18, 2020, 9:30 a.m.
2	DIU Permanent Campus,Ashulia	CIS lab	UPS	DCL	1.159	34.52	3.568	Red	Dec. 18, 2020, 10:39 a.m.
3	DIU Permanent Campus,Ashulia	CIS lab	UPS	N/A	.531	53.301	3.214	Red	Nov. 18, 2020, 11:40 a.m.
4	DIU Permanent Campus,Ashulia	CIS lab	UPS	DCL	1.854	60.00	8.2541	Red	Nov. 18, 2020, 12:30 p.m.
5	DIU Permanent Campus,Ashulia	SWE lab	UPS	DCL	.1020	65.23	.0214	Red	Nov. 18, 2020, 12:50 p.m.
6	DIU Permanent Campus,Ashulia	SWE lab	UPS	DCL	.1958	18.32	.0235	Yellow	Nov. 19, 2020, 9:30 a.m.
7	DIU Permanent Campus,Ashulia	CIVIL lab	UPS	N/A	125	110.2	85.24	Red	Nov. 19, 2020, 11:39 a.m.

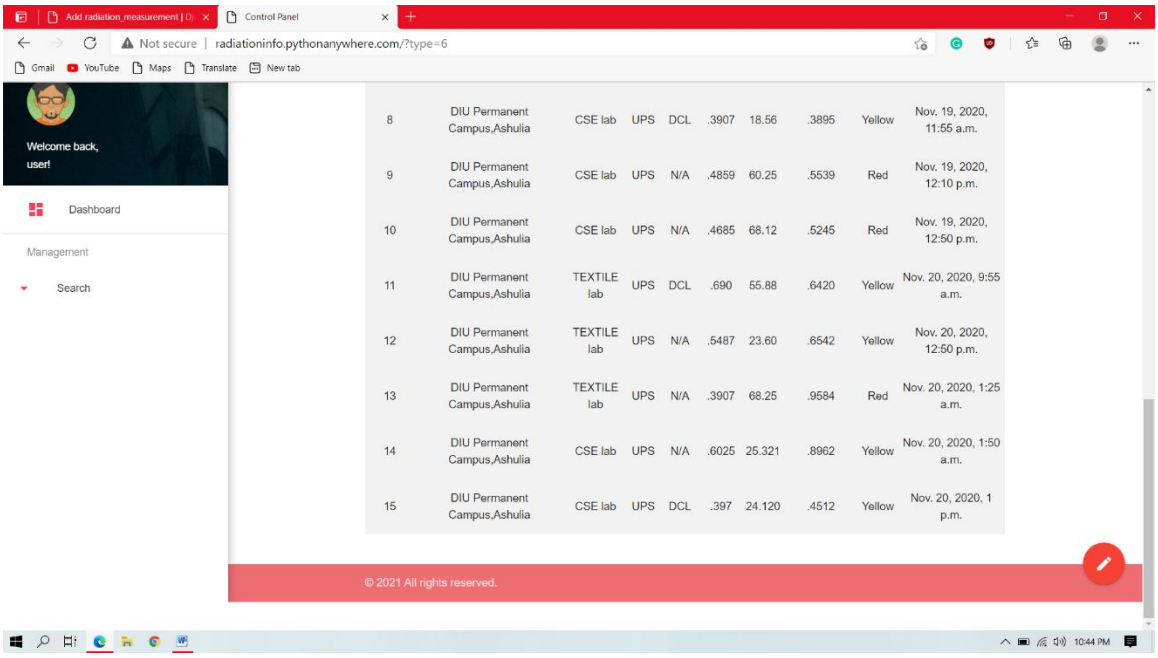


Table8.4: Results for TRAINER BOARD from different LAB of DIU**.**

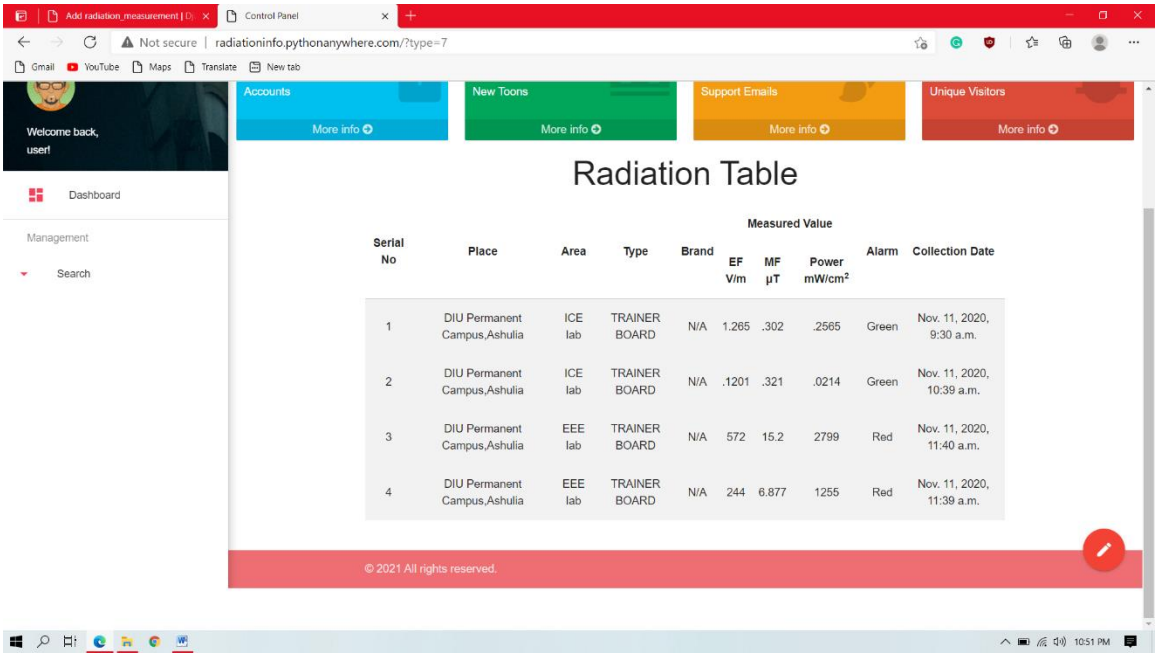
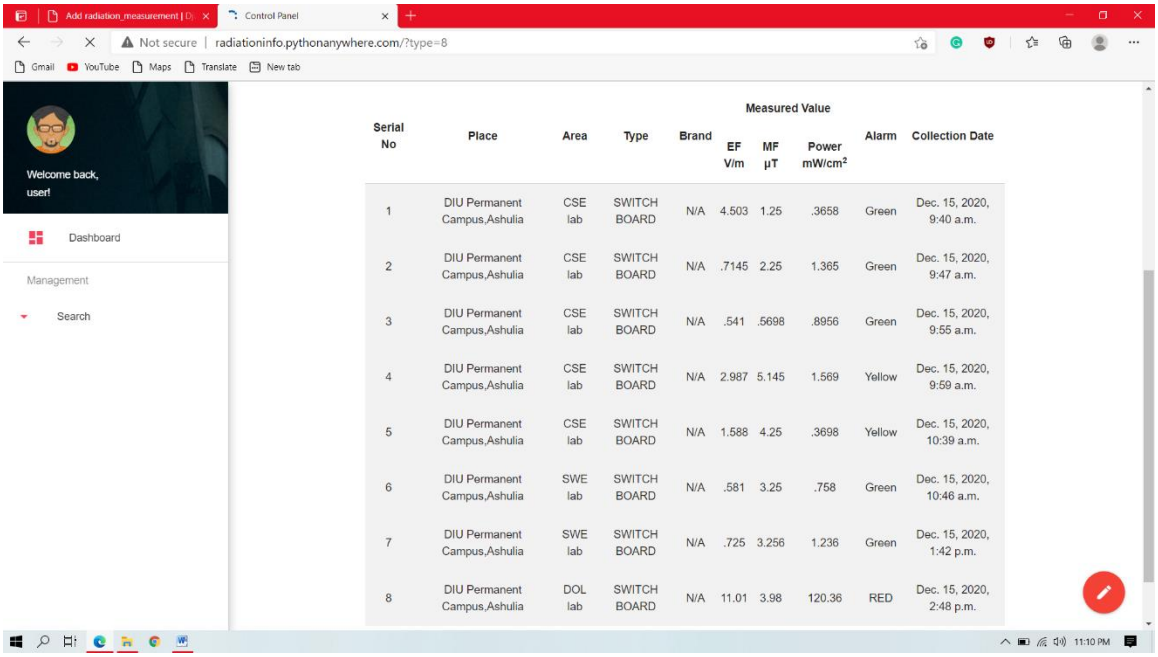
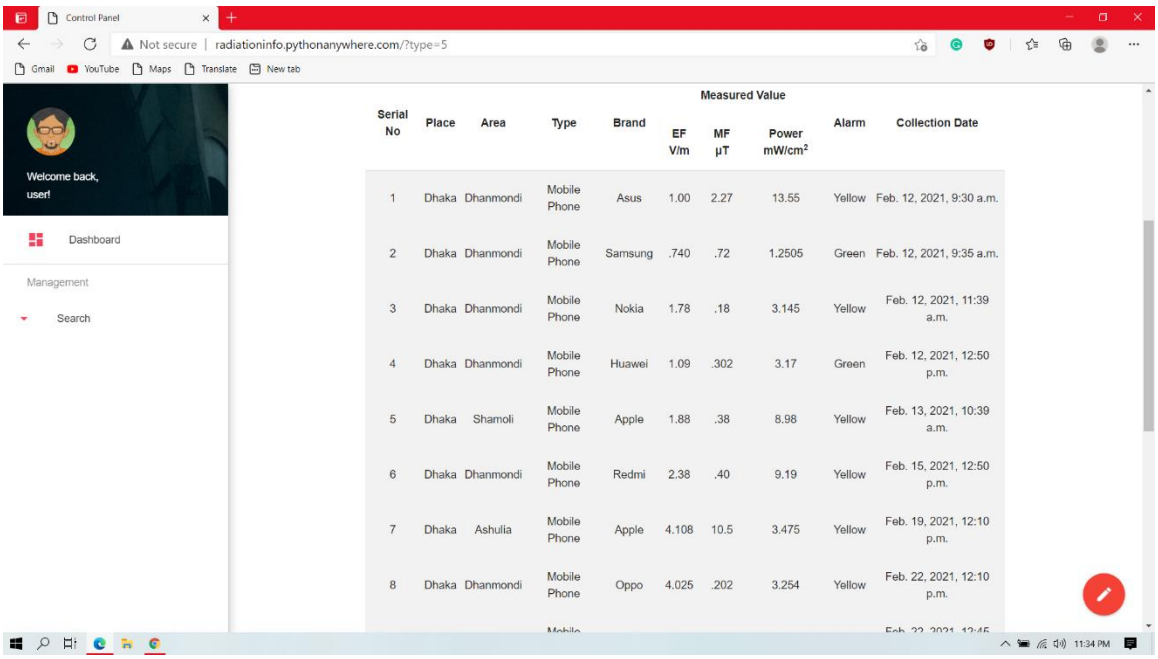


Table8.5: Results for SWITCH BOARD from different LAB of DIU.

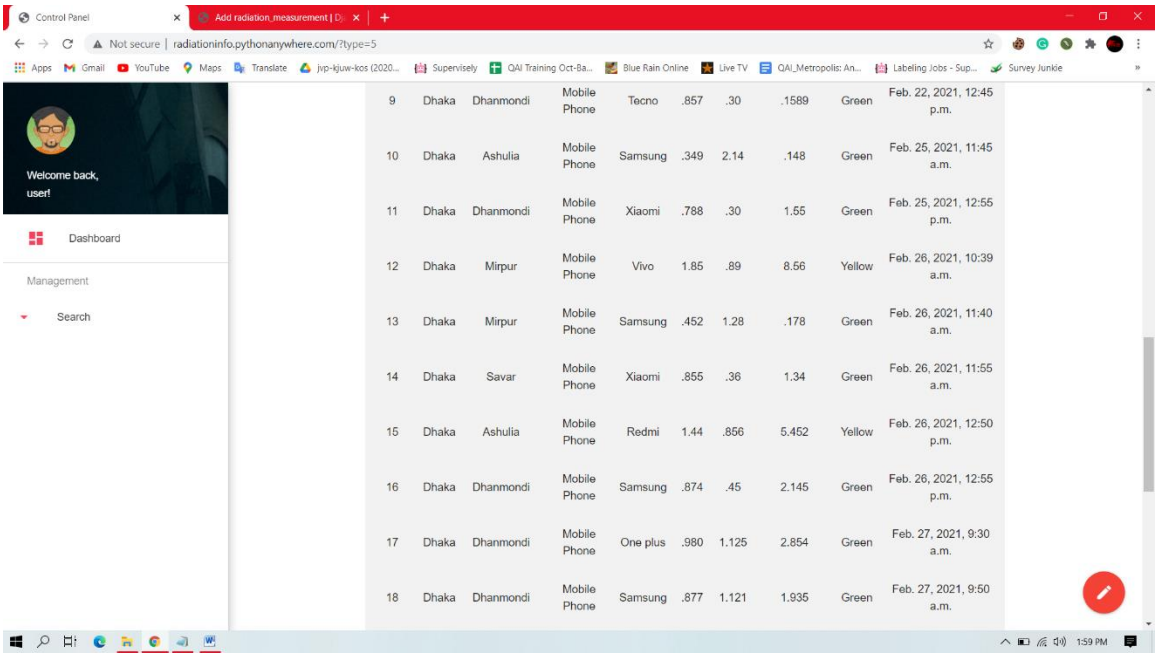


Serial No	Place	Area	Type	Brand	Measured Value EF V/m	MF µT	Power mW/cm²	Alarm	Collection Date
1	DIU Permanent Campus,Ashulia	CSE lab	SWITCH BOARD	N/A	4.503	1.25	.3658	Green	Dec. 15, 2020, 9:40 a.m.
2	DIU Permanent Campus,Ashulia	CSE lab	SWITCH BOARD	N/A	.7145	2.25	1.365	Green	Dec. 15, 2020, 9:47 a.m.
3	DIU Permanent Campus,Ashulia	CSE lab	SWITCH BOARD	N/A	.541	.5698	.8956	Green	Dec. 15, 2020, 9:55 a.m.
4	DIU Permanent Campus,Ashulia	CSE lab	SWITCH BOARD	N/A	2.987	5.145	1.569	Yellow	Dec. 15, 2020, 9:59 a.m.
5	DIU Permanent Campus,Ashulia	CSE lab	SWITCH BOARD	N/A	1.588	4.25	.3698	Yellow	Dec. 15, 2020, 10:39 a.m.
6	DIU Permanent Campus,Ashulia	SWE lab	SWITCH BOARD	N/A	.581	3.25	.758	Green	Dec. 15, 2020, 10:46 a.m.
7	DIU Permanent Campus,Ashulia	SWE lab	SWITCH BOARD	N/A	.725	3.256	1.236	Green	Dec. 15, 2020, 1:42 p.m.
8	DIU Permanent Campus,Ashulia	DOL lab	SWITCH BOARD	N/A	11.01	3.98	120.36	RED	Dec. 15, 2020, 2:48 p.m.

Table8.6: Results for Mobile phone from Random users of Dhaka City.



Serial No	Place	Area	Type	Brand	Measured Value EF V/m	MF µT	Power mW/cm²	Alarm	Collection Date
1	Dhaka	Dhanmondi	Mobile Phone	Asus	1.00	2.27	13.55	Yellow	Feb. 12, 2021, 9:30 a.m.
2	Dhaka	Dhanmondi	Mobile Phone	Samsung	.740	.72	1.2505	Green	Feb. 12, 2021, 9:35 a.m.
3	Dhaka	Dhanmondi	Mobile Phone	Nokia	1.78	.18	3.145	Yellow	Feb. 12, 2021, 11:39 a.m.
4	Dhaka	Dhanmondi	Mobile Phone	Huawei	1.09	.302	3.17	Green	Feb. 12, 2021, 12:50 p.m.
5	Dhaka	Shamoli	Mobile Phone	Apple	1.88	.38	8.98	Yellow	Feb. 13, 2021, 10:39 a.m.
6	Dhaka	Dhanmondi	Mobile Phone	Redmi	2.38	.40	9.19	Yellow	Feb. 15, 2021, 12:50 p.m.
7	Dhaka	Ashulia	Mobile Phone	Apple	4.108	10.5	3.475	Yellow	Feb. 19, 2021, 12:10 p.m.
8	Dhaka	Dhanmondi	Mobile Phone	Oppo	4.025	.202	3.254	Yellow	Feb. 22, 2021, 12:10 p.m.


Control Panel
Add radiation_measurement | D
Not secure | radiationinfo.pythonanywhere.com/?type=5
Welcome back, user!
Dashboard
Management
Search
9 Dhaka Dhanmondi Mobile Phone Tecno .857 .30 .1589 Green Feb. 22, 2021, 12:45 p.m.
10 Dhaka Ashulia Mobile Phone Samsung .349 2.14 .148 Green Feb. 25, 2021, 11:45 a.m.
11 Dhaka Dhanmondi Mobile Phone Xiaomi .788 .30 1.55 Green Feb. 25, 2021, 12:55 p.m.
12 Dhaka Mirpur Mobile Phone Vivo 1.85 .89 8.56 Yellow Feb. 26, 2021, 10:39 a.m.
13 Dhaka Mirpur Mobile Phone Samsung .452 1.28 .178 Green Feb. 26, 2021, 11:40 a.m.
14 Dhaka Savar Mobile Phone Xiaomi .855 .36 1.34 Green Feb. 26, 2021, 11:55 a.m.
15 Dhaka Ashulia Mobile Phone Redmi 1.44 .856 5.452 Yellow Feb. 26, 2021, 12:50 p.m.
16 Dhaka Dhanmondi Mobile Phone Samsung .874 .45 2.145 Green Feb. 26, 2021, 12:55 p.m.
17 Dhaka Dhanmondi Mobile Phone One plus .980 1.125 2.854 Green Feb. 27, 2021, 9:30 a.m.
18 Dhaka Dhanmondi Mobile Phone Samsung .877 1.121 1.935 Green Feb. 27, 2021, 9:50 a.m.
1:59 PM

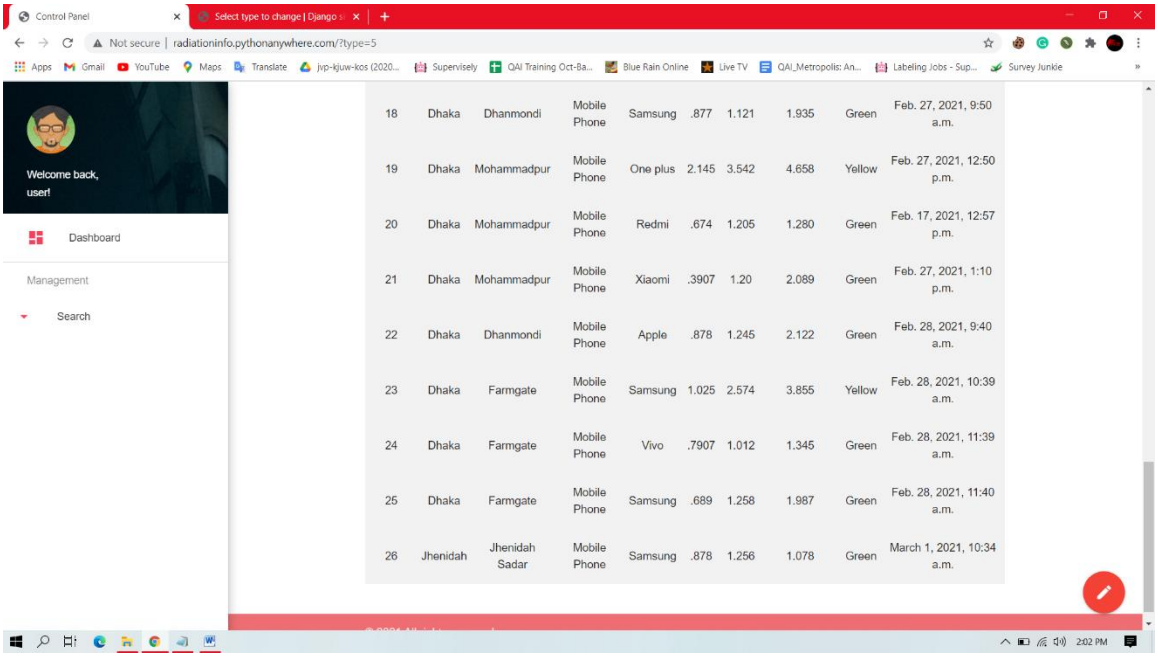
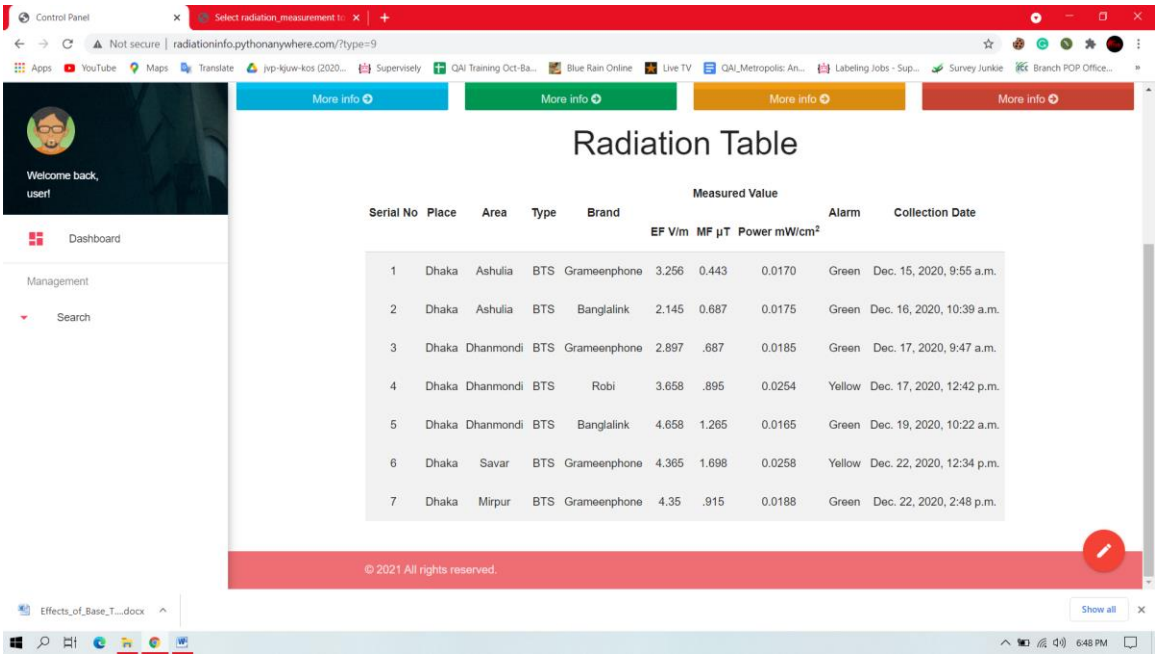
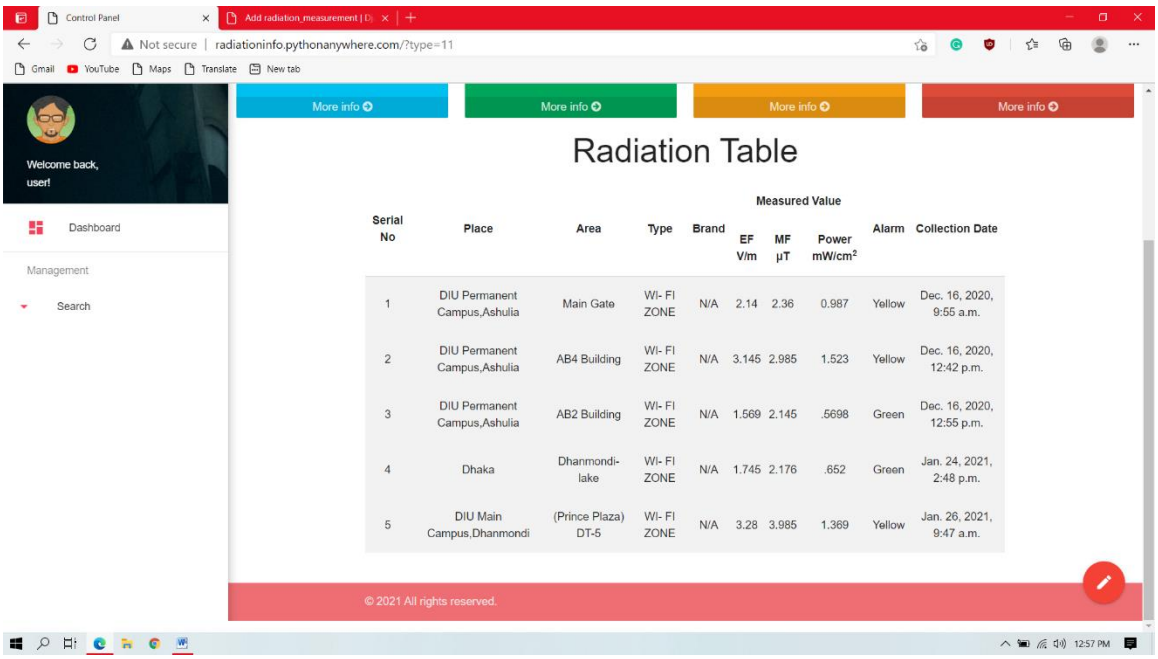

Control Panel
Select type to change | Django
Not secure | radiationinfo.pythonanywhere.com/?type=5
Welcome back, user!
Dashboard
Management
Search
18 Dhaka Dhanmondi Mobile Phone Samsung .877 1.121 1.935 Green Feb. 27, 2021, 9:50 a.m.
19 Dhaka Mohammadpur Mobile Phone One plus 2.145 3.542 4.658 Yellow Feb. 27, 2021, 12:50 p.m.
20 Dhaka Mohammadpur Mobile Phone Redmi .674 1.205 1.280 Green Feb. 17, 2021, 12:57 p.m.
21 Dhaka Mohammadpur Mobile Phone Xiaomi .3907 1.20 2.089 Green Feb. 27, 2021, 1:10 p.m.
22 Dhaka Dhanmondi Mobile Phone Apple .878 1.245 2.122 Green Feb. 28, 2021, 9:40 a.m.
23 Dhaka Farmgate Mobile Phone Samsung 1.025 2.574 3.855 Yellow Feb. 28, 2021, 10:39 a.m.
24 Dhaka Farmgate Mobile Phone Vivo .7907 1.012 1.345 Green Feb. 28, 2021, 11:39 a.m.
25 Dhaka Farmgate Mobile Phone Samsung .689 1.258 1.987 Green Feb. 28, 2021, 11:40 a.m.
26 Jhenidah Jhenidah Sadar Mobile Phone Samsung .878 1.256 1.078 Green March 1, 2021, 10:34 a.m.
2:02 PM

Table8.7: Results for BTS from Random places of Dhaka City.



Serial No	Place	Area	Type	Brand	Measured Value			Alarm	Collection Date
					EF V/m	MF μT	Power mW/cm²		
1	Dhaka	Ashulia	BTS	Grameenphone	3.256	0.443	0.0170	Green	Dec. 15, 2020, 9:55 a.m.
2	Dhaka	Ashulia	BTS	Banglalink	2.145	0.687	0.0175	Green	Dec. 16, 2020, 10:39 a.m.
3	Dhaka	Dhanmondi	BTS	Grameenphone	2.897	.687	0.0185	Green	Dec. 17, 2020, 9:47 a.m.
4	Dhaka	Dhanmondi	BTS	Robi	3.658	.895	0.0254	Yellow	Dec. 17, 2020, 12:42 p.m.
5	Dhaka	Dhanmondi	BTS	Banglalink	4.658	1.265	0.0165	Green	Dec. 19, 2020, 10:22 a.m.
6	Dhaka	Savar	BTS	Grameenphone	4.365	1.698	0.0258	Yellow	Dec. 22, 2020, 12:34 p.m.
7	Dhaka	Mirpur	BTS	Grameenphone	4.35	.915	0.0188	Green	Dec. 22, 2020, 2:48 p.m.

Table8.8: Results for WI-FI Zone from Random places of Dhaka City & DIU.



Serial No	Place	Area	Type	Brand	Measured Value			Alarm	Collection Date
					EF V/m	MF μT	Power mW/cm²		
1	DIU Permanent Campus,Ashulia	Main Gate	WI-FI ZONE	N/A	2.14	2.36	0.987	Yellow	Dec. 16, 2020, 9:55 a.m.
2	DIU Permanent Campus,Ashulia	AB4 Building	WI-FI ZONE	N/A	3.145	2.985	1.523	Yellow	Dec. 16, 2020, 12:42 p.m.
3	DIU Permanent Campus,Ashulia	AB2 Building	WI-FI ZONE	N/A	1.569	2.145	.5698	Green	Dec. 16, 2020, 12:55 p.m.
4	Dhaka	Dhanmondi-lake	WI-FI ZONE	N/A	1.745	2.176	.652	Green	Jan. 24, 2021, 2:48 p.m.
5	DIU Main Campus,Dhanmondi	(Prince Plaza) DT-5	WI-FI ZONE	N/A	3.28	3.985	1.369	Yellow	Jan. 26, 2021, 9:47 a.m.

CHAPTER 9

PERFOMANCE ANLAYSIS

9.1 Introduction

This chapter discusses and analyzes the comparison between the measured value and theoretical study. Data has been collected from Cellphone, BTS, Wi-Fi zone, Ac, Computer and various lab instruments from Permanent campus of DIU.

9.2 Analysis of Measured Data

From table 8.1 to 8.8, near about 100 samples of measured data has been collected from 8 different radioactive sources. Different data has been collected by different types of devices like, 3- axis field strength meter, EMF fields(Radaware), Multi-field EMF meter.

The average data result from various sources given bellow:

Table 9.1: Average data

SL NO	Types	Electric Field (**V/m**)	Magnetic Field (**μT**)	Power (**mW/cm²**)
1	PC	0.70(approx.)	3.00 (approx.)	1.20 (approx)
2	AC	0.50(approx.)	2.50 (approx.)	0.75 (approx.)
3	Mobile Phone	1.30(approx.)	1.50 (approx.)	3.50 (approx.)
4	UPS	0.80(approx.)	50.00(approx.)	9.50 (approx.)
5	TRAINER BOARD	0.55(approx.)	11.40(approx.)	0.18 (approx.)
6	SWITCH BOARD	2.85(approx.)	3.00(approx.)	1.00 (approx.)
7	BTS	3.60(approx.)	0.85(approx.)	0.019(approx.)
8	WI- FI ZONE	1.70(approx.)	1.95(approx.)	0.70(approx.)

9.3 Accuracy

Accuracy refers to the closeness of computations to the threshold value. From table 8.1 to 8.8 all types of data have been taken by various devices and all devices gives real time output data.

Our Graphical User Interface (GUI) has the option that we can remotely access to the server by admin anytime and anywhere from the world, that's why we have been able to input data at any time with time stamp (shown in table-8.1 to 8.8).

As this server has virtual hosting with enough data space, there is no chance of losing data. Each time we collected the data from the source and input it to the server through GUI.

The accuracy of our data collection devices is almost 99%.

9.4 Analysis of Results

(A) Performance Analysis of Household Appliances Lab Instrument

Most of the household appliances produce Electromagnetic field like LED,TV,WI-fi eouter, AC, Computer etc and most of them lies between the frequency level of 50KHz to 5MHz. Heat Transfer is the only known biological effect. It mainly occurs when the energy absorbed by the body, which is measured by SAR value and when SAR is greater than 4W/kg for the body & 100 W/kg for the Head.

The threshold emission value of 100KHz appliances (LED) is 87 V/m.

For 100Mhz to GHz the threshold emission value is 28 V/m to 61 V/m.

Tv and computer screens have a typical maximum public exposure of 10 V/m, while TV and radio transmitters have a typical maximum public exposure of 0.1W/m2.The magnetic field strength across all household equipment is quickly dwindling, forcing us to move farther away from them. The majority of domestic appliances are not handled in close proximity to the body. According to our study, the magnetic fields covering most household appliances and lab instruments are more than 50 times smaller than the given guideline limit of 100 T at 50 Hz (83 T at 60 Hz) for the general public at a distance of 30 cm.

Green=pc, Orange=Ac, Yellow=UPS;

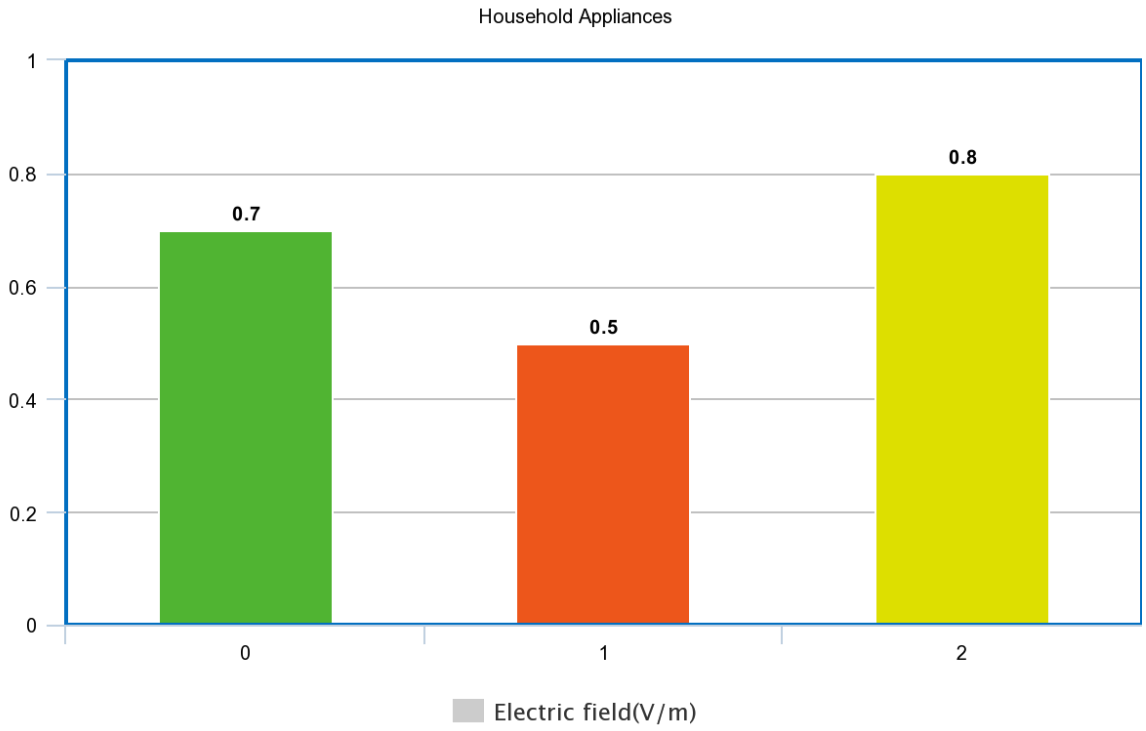


Figure 9.1: Electric field Comparison of household appliances.

(B) Performance Analysis of Mobile phone and BTS

According to BTRC, there are currently four cell phone companies in Bangladesh serving 16.26 crore active mobile subscribers with 26,000 towers and a total of 9.24 crore people are using mobile data among these active subscribers. Among six mobile phone operators, under the naming of Airtel, Banglalink, Citycell, Grameenphone, Robi and TeleTalk, five of them are major carriers in Bangladesh. [22]

Specific Absorption Rate (SAR) testing is the radiofrequency (RF) dosimetry quantification of the magnitude and distribution of absorbed electromagnetic energy within biological objects that are exposed to RF fields. [23]

ORGANIZATION	SAR LIMIT	REGULATION
IEEE	1.6W/Kg	Mandatory
ICNIRP	2.0 W/Kg	Mandatory

By doing a survey study on mobile phone, we got huge sensational SAR value. All the values have been taken from cellphone which has 4G network Carriers . We got an average of 5 mW/cm² SAR values that is extremely harmful for continuous use. i.e It's indicates the amount of radiation energy arriving at a surface. Temperature of ear lobes increases by 1 degree Celsius when cell phone is used for approximately 20 minutes. And it causes,

Irreversible Warm Sensation >Pain >Tinnitus Hearing failure

Finally, both of these factors combine to cause Ear Tumor.

As a result, a person's mobile phone use can be limited to 20-30 minutes per day.

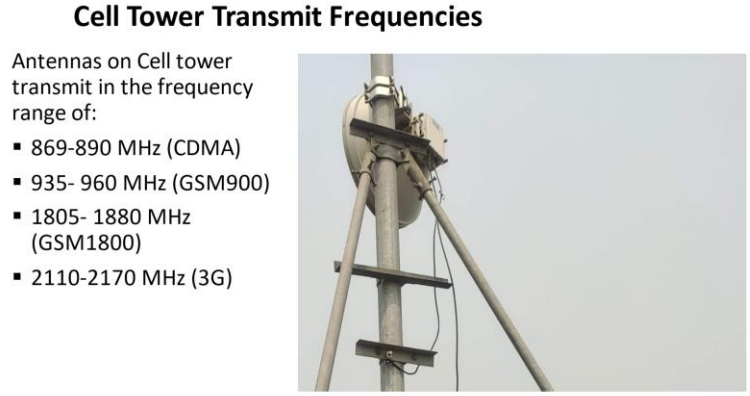


Figure 9.2: BTS Antennas on Cell Tower

Power Density Calculation:

Power density $P_d = \frac{1}{2} Re[\overline{E} \times \overline{H}]$…….(1)

$$P_d = \frac{|E_{rms}|^2}{Z_O} = Z_O . |H_{rms}|^2$$ ……(2)

Where, $\overline{E}$ and $\overline{H}$ are the electric and magnetic field intensity of the electromagnetic wa

$Z_O = \sqrt{\frac{\mu_0}{\epsilon_0}}$ves……..(3)

$\mu_0 = 4\pi \times 10^{-7} \frac{H}{m}$.....(4)

$\epsilon_0 = \frac{10^{-9}}{36\pi} \; F/m$.....(5)

Then,

$Z_O = 120\pi \approx 377\Omega$……(6)

The total electric field intensity due to the base station antenna is:

$E_{rms} = \frac{\sqrt{30 N P_{rad} G}}{R}$ ……(7)

Where,

N is the number of carriers (antennas),
P_{rad} is the radiated power
G is the radiation gain for a pattern antenna
R is the distance from the base station.

Then substituting Equation (7) in Equation (2) we get :

$P_d = \frac{30 N P_{rad} G}{R^2 Z_O}$ ……(8)

The following formula enables the calculation of equivalent power density (P_d) to be made and assumes field impedance:

$$P_d = 0.0796N\frac{P_{rad}}{R^2} \times 10^{\frac{G}{10}} \quad \text{.....(9)}$$

Where,

G is the gain of base station antenna in dB.

The simplest case of application is the one when human is exposed to a single base station antenna, (N=1).

Then, $P_d = 0.0796\frac{P_{rad}}{R^2} \times 10^{\frac{G}{10}}$ .....(10)

Where,

P_{rad} is the radiated power (in Watts) emitted by the base station antenna,

Distance from base station (Metres)	Power Density At, G= 5dB P=65W (W/m^2)	
	Calculated	Measured
10	0.168	0.199

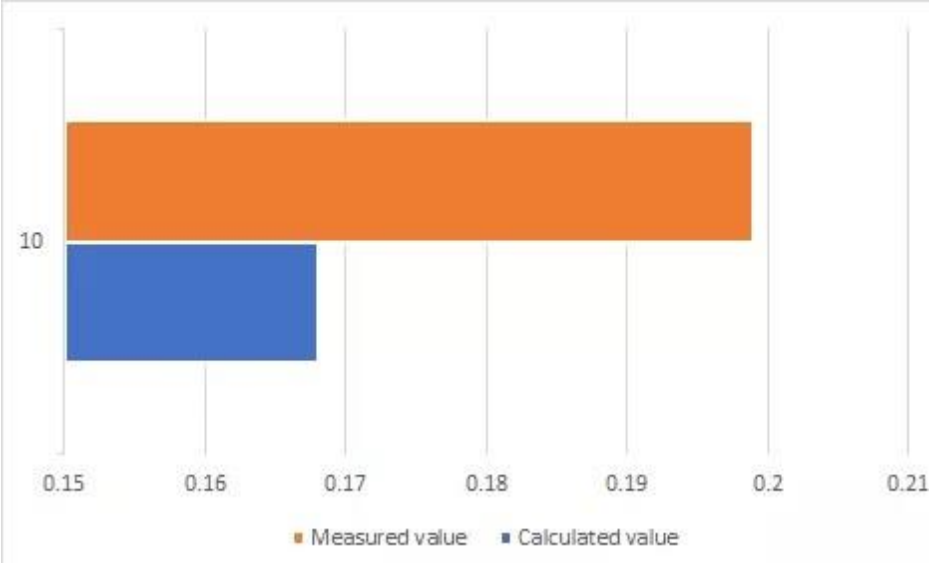


Figure 9.3: Calculated and measured Power density with respect to Distance

Here, measured value is higher than the theoretically calculated result, because there were no concrete walls and buildings that provided significance and this information was collected directly in terms of the maximum radiation transmitted by the antenna.

9.5 Alarm state analysis

We used 3 different devices for collect data from various sources and the device has an option that is Alarm indication. We have taken the Alarm indication from EMF field device.

The radAware measures the peak RF / Microwave level 128 times every second.

The Sensitivity of the device can be adjusted to suit personal requirements by adjusting knob.

The sensitivity scale is:

Very sensitive:

0.015 V/m [Green] to 0.15 V/m [RED]

(0.6 µW/m2 to 60 µW/m2)

Least Sensitive:

0.3V/m [Green] to 3 V/m [RED]

(240 µW/m2 to 24000 µW/m2)

Here, presenting Average Alarm state for every Application from where we have taken data.

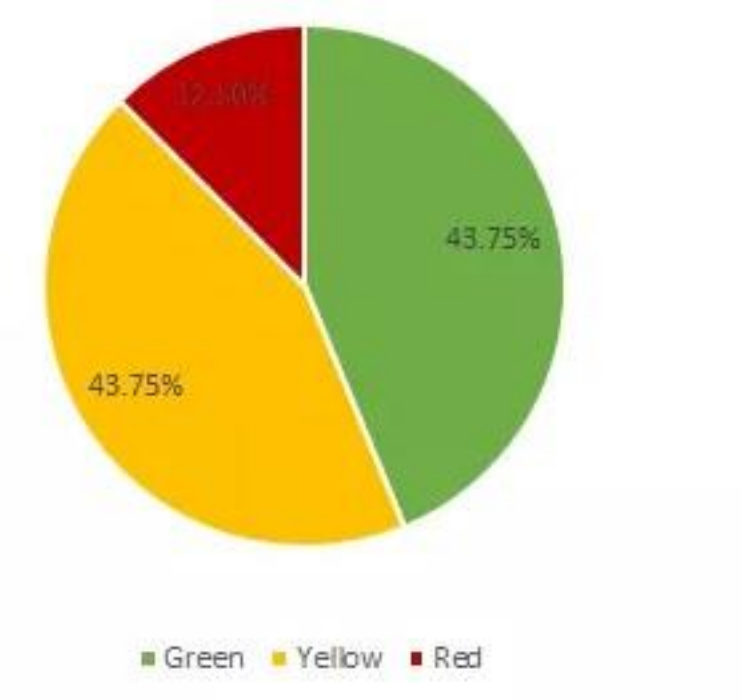


Figure 9.4 : Alarm state for PC

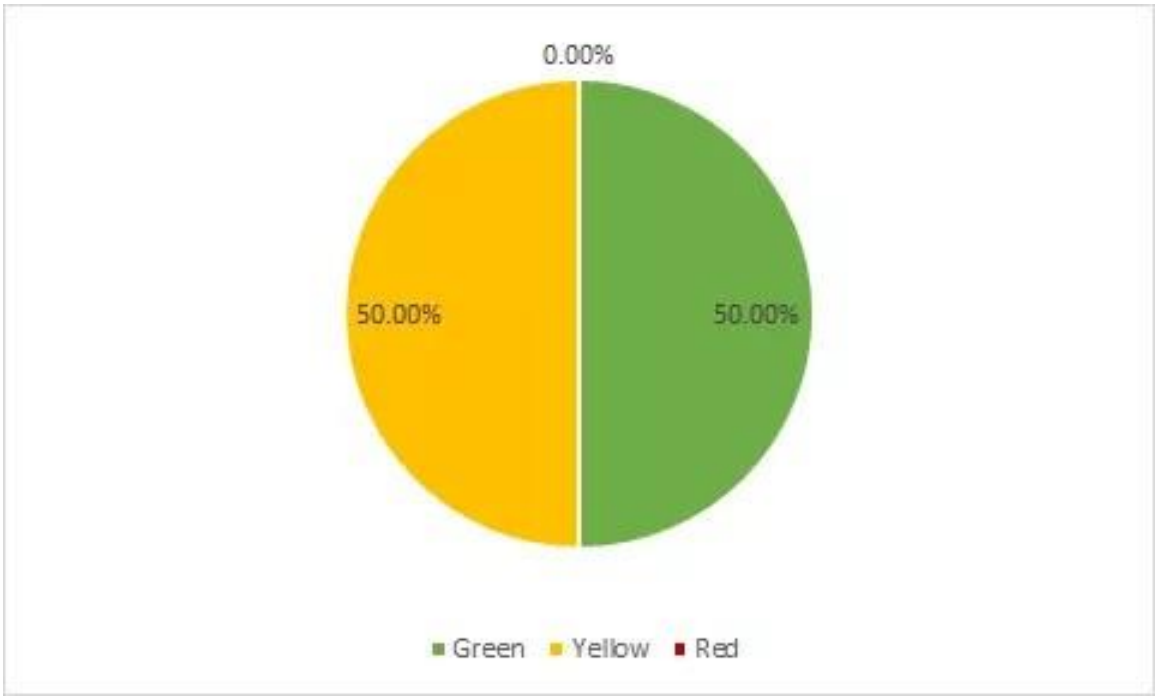


Figure9.5 : Alarm state for AC

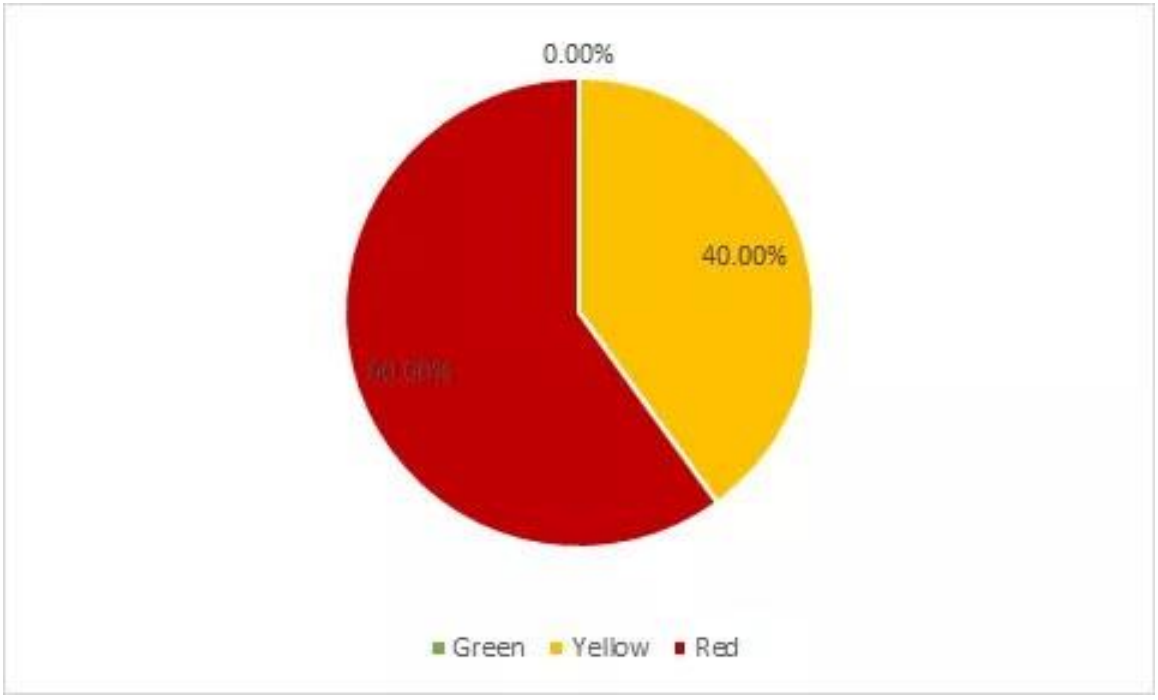


Figure9.6 : Alarm state for UPS

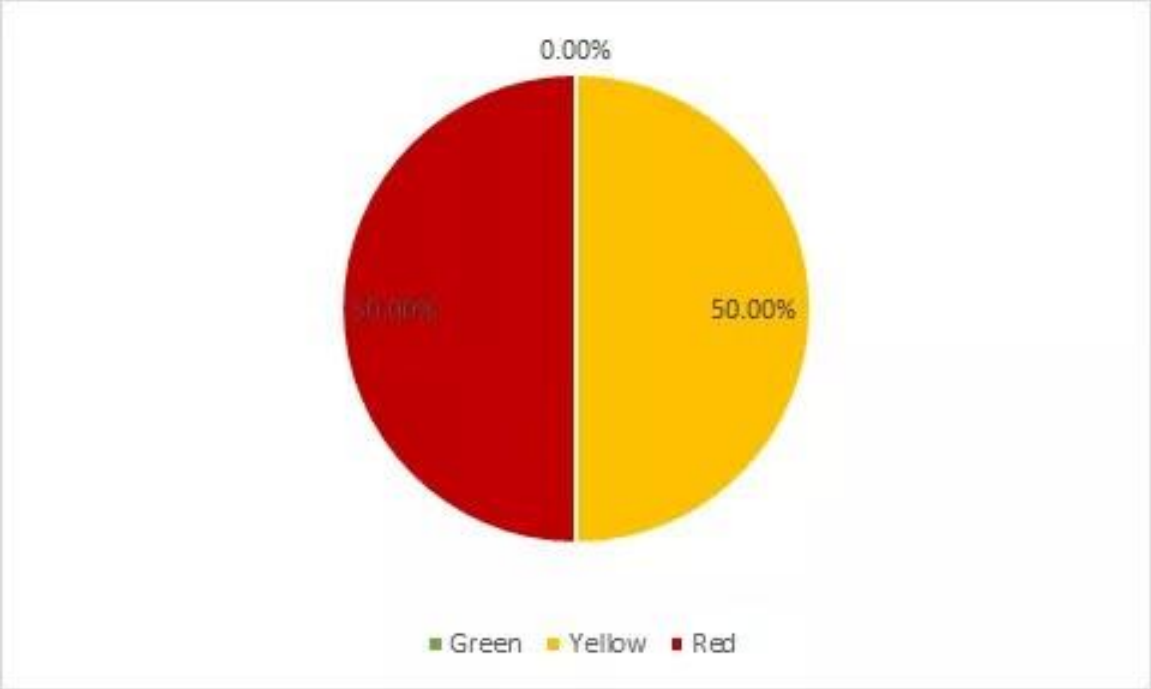


Figure9.7: Alarm state for Analog Trainer Board

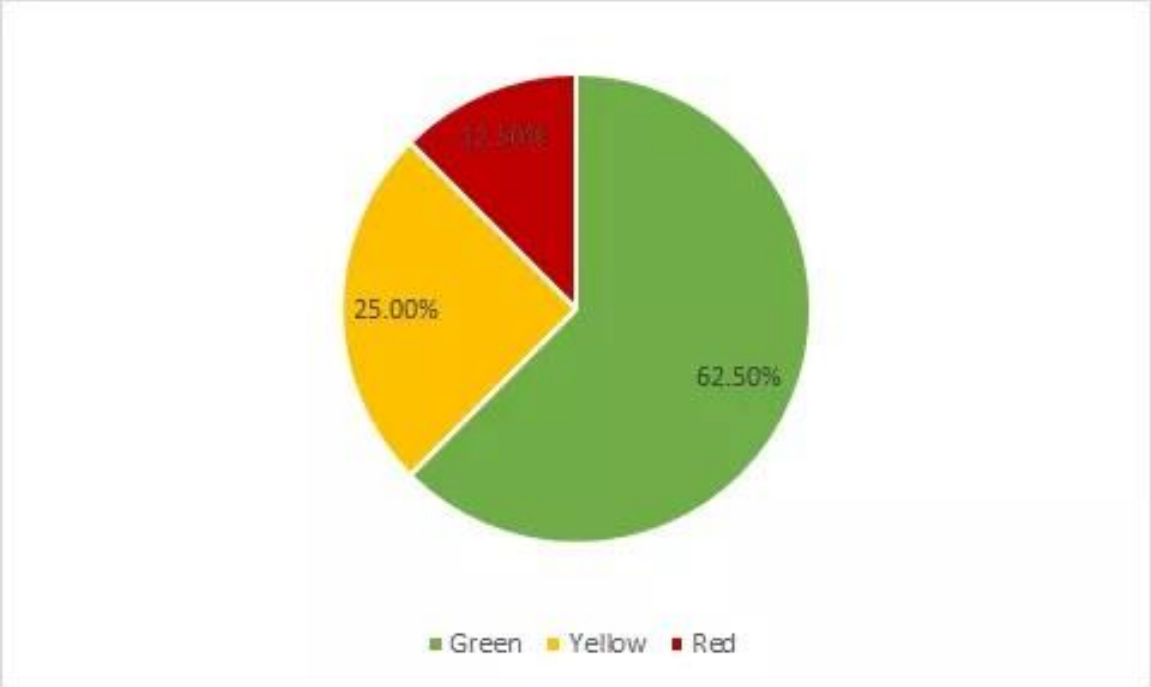


Figure9.8: Alarm state for Switch Board

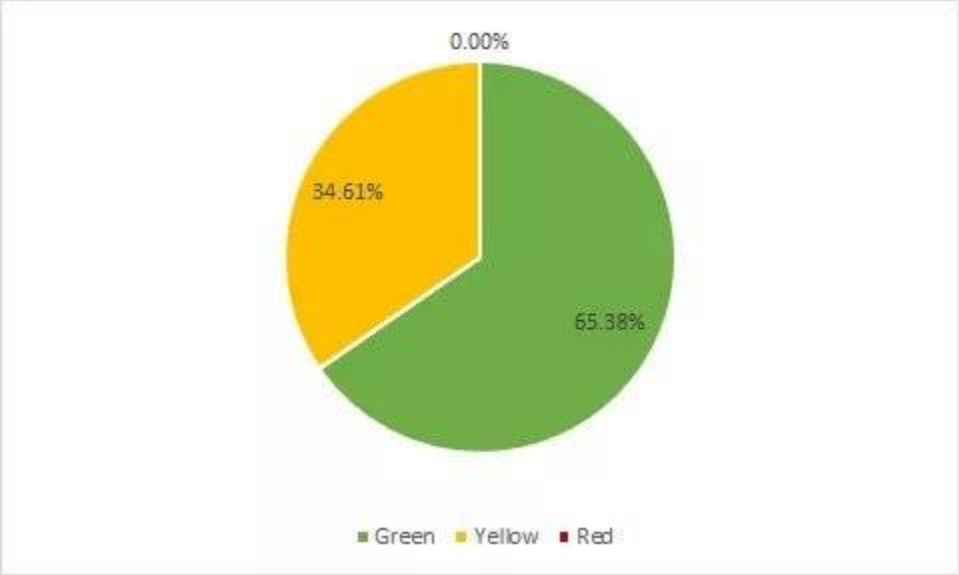


Figure9.9: Alarm state for Mobile Phone

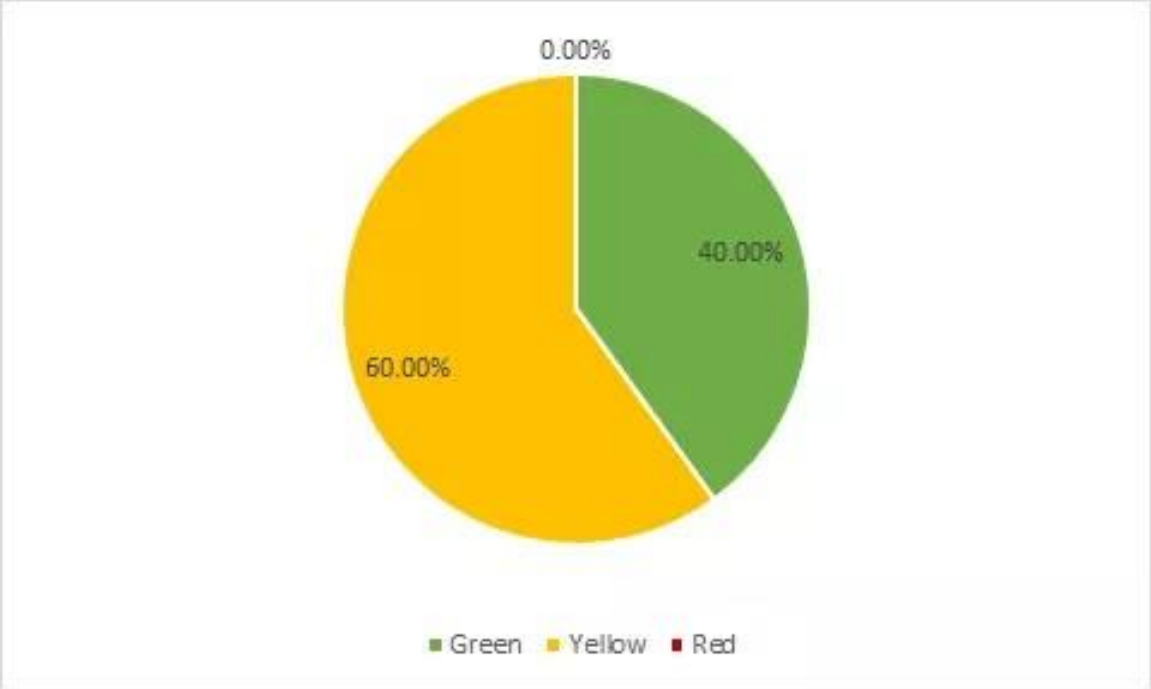


Figure9.10: Alarm state for WI-FI zone

CHAPTER 10

DISCUSSION

From the above survey result given in table 8.1-8.8, It was very much clear that, the measured values are crossed the threshold level most of the cases. Our Teachers and students spend an average 2-5hours a day in Laboratories. However, as can be seen from the survey paper, the magnetic field values are greater than the threshold value. The design of the wiring in the floor and ceiling may be the primary cause. We all need to be aware of this.

From the survey of mobile phone users living random places in Dhaka city, they keep their mobile phones close to their bodies most of the day. Electromagnetic Radiation radiated from mobile phone has huge effect on human body. Many users suffering from various disease like Headache, Insomnia, Sickness, Vomiting etc. On the other hand, researcher proved that, longer exposer time causes serious health issue like Cancer, Cardiovascular disease etc.

We developed a magnetic-Nano sensor platform based on the GMR effect to quantify the concentration of various radiation-reactive proteins in peripheral blood, and then we tested two radiation biomarkers using small quantities of blood samples obtained from in vivo mouse radiation.

Any sensors were sealed with epoxy or coated with BSA or Biotin-BSA in the experiment. The electrical reference sensor is the epoxy cover sensor. By subtracting the average signal of the epoxy-cover sensors from all other signals, the electrical background noise was suppressed. The negative control sensors were bovine serum albumin (BSA)-like sensors, which were blocked and directly prevented the capturing of magnetic nanoparticles with antigen or streptavidin tags. The detection signals obtained from the capture antibody-coated sensors are obviously not the product of complex binding of analyzers or magnetic nanoparticles, as shown by the very small signals present in the BSA-coated sensors. Due to their ability to trap striptavidin-tagged magnetic nanoparticles in particular, biotin-coated sensors were used as positive functional controls, and they displayed very large signals as predicted.

There were some inconsistencies between the magneto-nanocensor chips and the ELISA in calculating concentrations, which may be attributable to variations in the antibody surface interaction or the signal generation mechanism.

We found that, the household devices also radiate electromagnetic radiation that has effect on us for long time working or living near/under this environment.

EMR may have an effect on biological systems. In daily life, everybody is subjected to different types of EMR, but it is not possible to control it alone. Certain regulations are required for the application and distribution of EMR for research, lab, medical, commercial, industrial, telecommunication and household purposes, as well as the diversity of radiation emitting devices and installations.

CHAPTER 11

CONCLUSION

Here, it's very much clear that the result we found from various electronics devices, Household appliances, Mobile phone from random users, and different laboratories equipment most cases the magnetic field somewhere electric field and power crossed the threshold level. Maximum exposer also crossed many cases. From our survey report, we can easily say that, most of the time we are staying in magnetic field, and that is very much harmful for our health. The general people, the students, the teachers and the workers everybody is in health risk.

We carrying mobile phone and other electronics device very near to our body, students and teachers working all day long in the laboratories, Workers doing their duty in company and day after night we are sleeping our sweet home that's also a magnetic field.

The electromagnetic radiation causes Insomnia, Vomiting, Headache, Cancer, Sickness, Cardiovascular disease etc.

The MF strength at the Earth's surface ranges from less than 30 μT in an area including most of South America and South Africa (the so called south Atlantic anomaly) to almost 70 μT around the magnetic poles in northern Canada and south of Australia, and in part of Siberia (Occhipinti et al., 2014). [24]

Since magnetic fields are more dangerous than electric fields, a range of 0.2 to 0.3T is needed at both the residential and technical level. This value is widely accepted as the international minimum maximum in many countries.

In all of these applications they have specific experimental and theoretical characteristics. Also, the techniques applied to study magnetokinetic phenomena span a large variety, ranging from magnetic resonance detection of spin polarization (CIDNP, CIDEP, ODMR) through "simple" detection of magnetic field-dependent reaction yields and magnetic isotope effects (MIE) to reaction-yield-detected magnetic resonance (RYDMR). [25]

The International Committee for Non-Ionized Radiation Protection (ICNIRP) was established by the World Health Organization (WHO) in 1996, with representatives from 54 countries. Bangladesh's Ionizing Radiation Protection Act, which is enforced by the Bangladesh Atomic Energy Commission, has been in effect since 1994. (BAEC). However, Bangladesh also lacks an NIR administrative rule, which should be enacted as soon as possible.

Citizens should be mindful of the health risks posed by all those system, and precautionary steps should be taken accordingly.

More experiments and long-term analyses are needed to obtain a broader knowledge in the field, which might help to finding an optimal solution to the specific challenges induced by EMF

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Appendix

Abbreviation

EMF: Electromagnetic Field

NIR: Non-Ionizing Radiation

ELF: Extended Low Frequency

SIDS: Sudden Infant Death Syndrome

EMI: Electromagnetic Interference

EMR: Electromagnetic Radiation

GUI : Graphical User Interface

ICNIRP: International Commission on Non-Ionizing Radiation Protection

MPD: Maximum Permissible Dose

BTS: Base Transceiver Station

SAR: Specific Absorption Rate

RSt: Repetitive Stress

PC: Personal Computer

ROW: Right of Way

IARC: International Agency for Research on Cancer

BSA: Body Surface Area

AM: Amplitude Modulation

FM: Frequency Modulation

TDMA: Time-Division Multiple Access

GSM : Global System for Mobile Communications

DECT: Digital Enhanced Cordless Telecommunications

CDMA: Code-division multiple access

LAN: Local Area Network

RF: Radio frequency

IOT: Internet of Things

MRI: Magnetic Resonance Imaging

CW: Content Warning

TEM: Transmission Electron Microscopy

APO: Auto Power Off

LED: Light-Emitting Diode

TFT: Thin Film Transistor

WEVC: Watt Electric Vehicle Company

MF: Magnetic Field

EF: Electric Field

GMR: Global Medical Relief

ELISA: Enzyme-Linked Immunosorbent Assay

CIDNP: Chemically Induced Dynamic Nuclear Polarization

ODMR: Optically Detected Magnetic Resonance

MIE: Magnetic Isotope Effects

RYDMR: Reaction-Yield-Detected Magnetic Resonance

WHO: World Health Organization

BAEC: Bangladesh Atomic Energy Commission

BTRC: Bangladesh Telecommunication Regulatory Commission

NOC: No Objection Certificate