ELECTROMAGNETIC FIELD (EMF) RADIATION AND ITS IMPACT ON OUR HEALTH AND ECO-SYSTEM

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Abstract - Electromagnetic Field (EMF) radiation is a wave of the electromagnetic field. The radiation from mobile phones, cordless phones, mobile antennas, and many other devices pose health threats, especially when they are close to the body for extended period. In humans and animals, bioelectrical signals regulate many processes. Therefore, EMF radiations can interfere with the natural way of how our body works; it affects our body at celllevel. Moreover, the impact of EMF radiation on our eco-system is serious due to growing number of broadcasting antennas, mobile communications base stations etc. World Health Organization (WHO) says the EMF radiations produced by mobile phone is classified by the International Agency for Research on Cancer (IARC) as possible carcinogento humans. The aim of this research paper is to survey on mobile phone usage and EMF radiation awareness. Our results from analyzing the survey data shows that 86.2% people keep their mobile phones near their ears while receiving calls, 77.7% people keepmobile phones in their bedroom before going to bed. Based on the results and considering the major impact of EMF radiations, we propose innovative house design called Radiation Reduced Dwelling (RRD) by which the EMF radiation exposure can be minimized at home. Moreover, we propose an Environment Friendly Link (EFL) by which mobile base stations case be avoidedin forests andhilly areas.

Keywords - Electromagnetic Field (EMF), Radiation, Health, Ecosystem.

I. INTRODUCTION

Electromagnetic Field radiation refers to the wave of the electromagnetic field, propagating through a space carrying electromagnetic energy. Existing researches [1] showed that EMF radiation have biological effects, thus the radiation is a harmful energy in disguise, it comes from electronic devices such as mobile phones, laptops TV's etc. Fig 1. shows a typical EMF radiations at home and outdoor. Humanbodies are not suited to take-in this type of radiation. As technology develops, people tend to have their life surrounded by more and more electronic devices. Studies linked radiation exposure to higher rate of depression, anxiety, headaches, sleep deprivation and worst of all brain cancer and brain tumors among humans [6]. Now, as more children start using mobile phones it may result in reduced brain development and many more early life complexities [1]. Baby monitors and related gadgets too may have impact on the development of children.

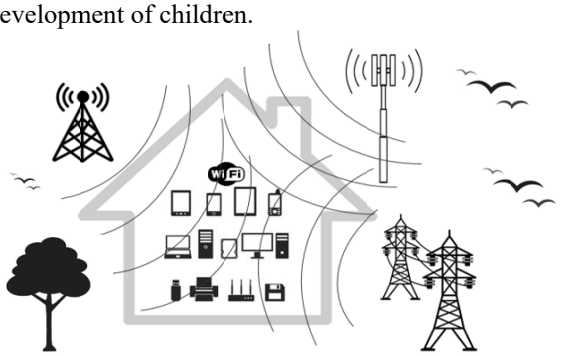


Fig.1 Typical EMF Radiations at home and outdoor

EMF radiations affects not only the people but also the plants and animals around us especially birds, bats, butterfly are more affected [18], as they are not used to this type of radiation. This has resulted in sudden decrease in flying birds. Moreover, birds avoid making nest in cities and towns [2]. When birds are affected, it has an impact on the eco-system in many ways as birds act as predators, pollinators, scavengers, seed dispersers etc.

The impact is going to be very serious with the arrival of 5G mobile towers; in near future we may not be able to see any birds [3]. EMF radiation has long-term effect on humans;it was recently reportedby Dr. Martin Pall [4], from Washington State University that electromagnetic field has biological effects, andthe current EMF safety guidelines are inadequate because they do not take into consideration of its non-thermal effects [4]. Humanbodies are one of the best absorbers of EMF radiations; the proteins in our blood absorb radiations and this prevents our body from performing its normal activities [20]. Studies have compared the effect of the usage of mobile phones to the use of cigarettes [5]. Very recently, 5G cellular towers have been banned at California city bay in view of health risks [7][15].

Considering the advantages posed by the gadgets we use daily and as the devices are part of our life, discarding them completely is not a solution. However, there are possibilities to reduce the exposure of EMF radiation while using the electronic devices. Our houseneeds to be safe from EMF radiations and particularly our bedroom, as we spend around eight hours sleeping. In this project, we propose an innovative EMF free house solution called Radiation Reduced Dwelling (RRD) by which the exposure to EMF radiation can be minimized. We also propose a

novel Environment Friendly Link (EFL) bywhich mobile cellular towers are removed from forests and hill area such that the outdoor radiation is reduced and thereby plants, animals and our ecosystem are safeguarded.

The rest of this paper is organized as follows: Section II presents the problem definition, Section IIIstates the objectives of the research, and SectionIVpresents the EMF Survey.The proposed solution is presented inSection V and finally, our conclusionand future work is presented in Section VI.

II. PROBLEM DEFINITION

Effect of EMF radiations on people

This EMF radiation causes many types of illnesses insomnia, headaches, ears ringing, fatigue, cognitive disturbance, stress and in the worst cases reduced brain development in children [12][19]. Additionally, indirectly attributed infertility, nausea, anxiety, bloody nose, vertigo, memory loss, depression, ADHD, damage in DNA, and then eventually cancer [8]. World Health Organization (WHO) says the EMF radiations produced by mobile phones are classified by the International Agency for Research on Cancer (IARC) as possiblecarcinogento humans [9].

Today, with baby monitors at home, the radiation emitted by these devices have been linked with an intense reduction in melatonin an important hormone for sleep and cancer prevention [10]. The disruption of melatonin due to exposure to EMF has long-term health effects in humans [11]. Electromagnetic fields affect childhood development [12].

Effect of EMF radiations on animals

EMF radiation also affects animals, such as migratory birds, bats, certain fish, rats[16] and insects. It affects the animals with weak defense systems and due to this, birds and other weak animals are moving away from cities. It is becoming difficult to find birds in cities when compared to earlier decade. Moreover, many migratory birds rely on magnetic fields to migrate and due to EMF radiation, the magnetic fields are interrupted thereby they are unable to navigate properly [13]. A recent research[2] correlated the substantial decrease in birds with increase in the number of mobile towers.

A most recent research published in the journal of “Environmental Research” by Ramazzini Institute [14] showed thecarcinogenic (having the potential to cause cancer) effects of EMF radiations generated by 1.8 GHz GSM mobile phone antenna on Sprague-Dawley rats. This was the largest long-term study ever performed with 2448 animals. Male and female rats were exposed from prenatal life until natural death to a 1.8 GHz GSM far field with a whole-body exposure for 19 hour/day. The research concluded an increase in the incidence of tumors in brain and heart in rats and further stated that these tumors are of the same type of those observed in some epidemiological studies on cell phone users. These experimental studies provided sufficient evidence for acall to re-evaluatethe carcinogenic potential of EMF radiation in humans [14].

Our research methodology consists of the two stages

a) Conduct anonymous survey using seven questions on mobile phone usage and Electromagnetic Field (EMF) radiation awareness. Perform data analysis on the survey data

b) Design solution to minimize EMF radiations for both indoor and outdoor

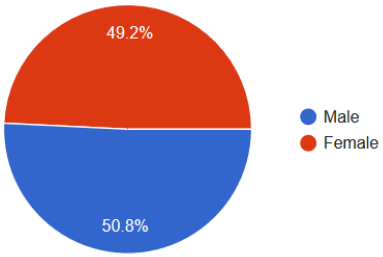
III. OBJECTIVE

The aim of this research is to reduce EMF radiation on people and the ecosystem, raise awareness about EMF radiation. The main objectives of our research isstated below.

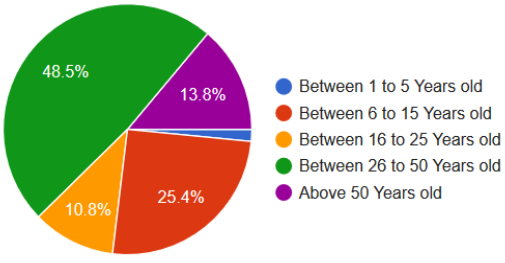
- Survey and study on the mobile phone usage and EMF radiation awareness
- Minimize EMF radiation exposure at home
- Minimize EMF radiation outdoors, hill stations, forest to safeguard eco-system

IV. EMF SURVEY

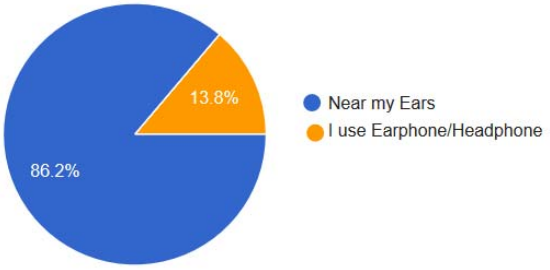
We conducted an online survey with 130 participants using Google forms. We had 66 male (50.8%) and 64female(49.2%) participate in the survey. The survey questionnaire consisted of seven questions, which includes the gender, age and questions on mobile phone usage.



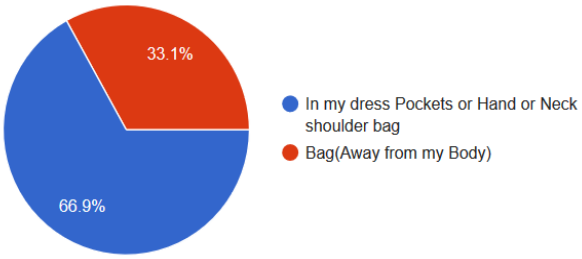
a) Genderof the participants



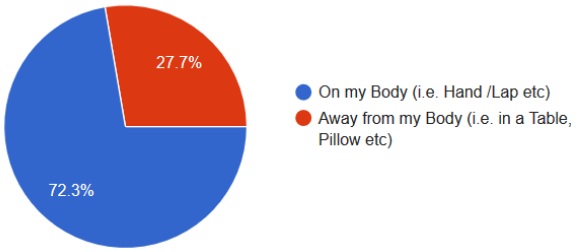
b) Age group of the participants



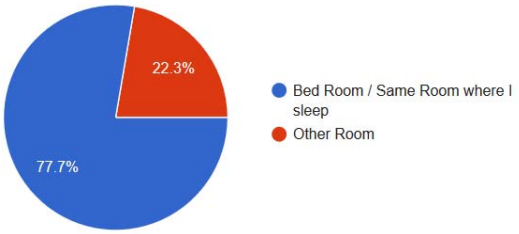
c) Mobile phone placement while receiving calls



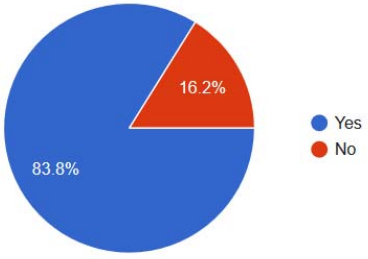
d) How is Mobile phone is carried



e) Placing mobile while texting, browsing online



f) Placing mobile before going to bed



g) Aware of the EMF Radiations

Fig.2. Result of the Survey

1. My Gender *: Male, Female
2. My Age Group * : Between 1 to 5 Years old, Between 6 to 15 Years old, Between 16 to 25 Years old, Between 26 to 50 Years old, Above 50 Years old
3. While receiving calls I keep my Mobile phone * : Near my Ears, I use Earphone/Headphone
4. While walking I carry my Mobile phone * : In my dress Pockets or Hand or Neck shoulder bag, Bag(Away from my Body)
5. While Texting, Browsing online I keep my Mobile phone *: on my Body (i.e. Hand /Lap etc.), Away from my Body (i.e. in a Table, Pillow etc.)
6. Usually at Night before going to bed I keep my Mobile Phone in * : Bed Room / Same room where I sleep, Other room
7. I am aware of the Electromagnetic Field (EMF) Radiations emitted from Mobile phones / electronic devices * : Yes, No

Our results from analyzing the survey data shows that 86.2% people keep their mobile phones near their ears while receiving calls, 66.9.% carry their mobile in their hand or dress pockets. While texting, browsing online 72.3% keep their phones on their body. Moreover, 77.7% keep mobile phone in their bedroom before going to bed. Despite 83.8% of people said that they are aware of EMF radiations.

V. PROPOSED SOLUTION

A. Radiation Reduced Dwelling (RRD)

EMF radiation is something we just cannot avoid in the modern world. Today, everything around us is connected in one way or another, for example televisions, toys, kitchenware, cars etc. and every time devices are connected we eventually increase radiations. One of the best way of reducing EMF radiation is by controlling the devices that emit radiation. Fig 3. Shows a modern house with many devices.

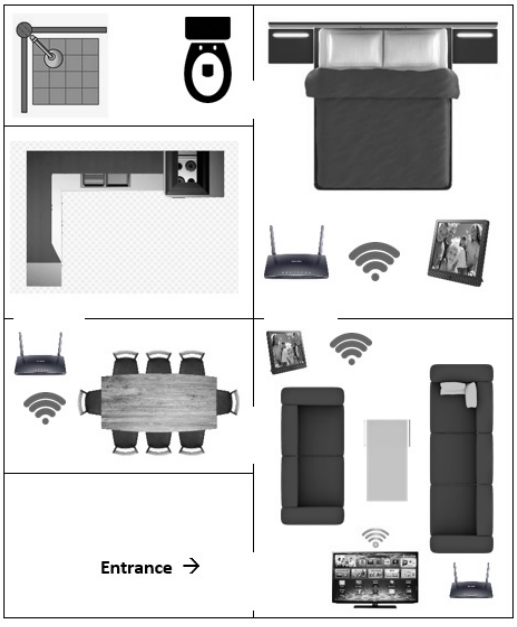


Fig. 3. Modern home with EMF

In the proposed Radiation Reduced Dwelling (RRD) as shown in Fig 4. EMF radiation is controlled as every device in the home is connected using fiber optics cables. There is a separate room called the EMF zone where all the devices that emit EMF radiation are kept. Devices in all other rooms (EMF Free Zone) are connected through cable.Moreover, mobile phones are connected via cable and display panels are placed in every room, if a call comes, it will appear on the screen and enables the recipient to attend and talk.

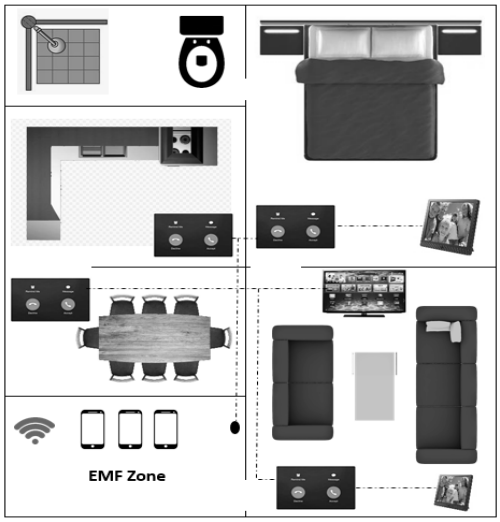
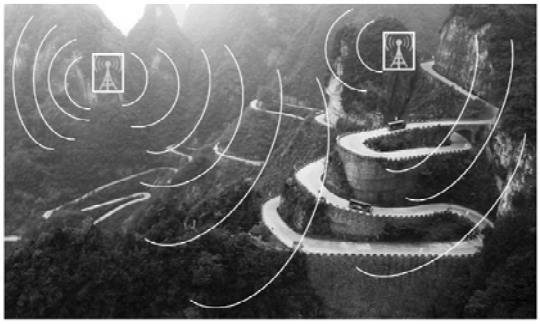


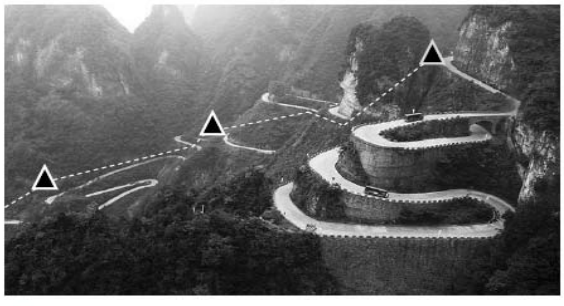
Fig. 4. Modern home with EMF Zone

This emit less radiation and is less harmful to the people in the house. Additionally, radiations absorbing special sheets are placed in the wall to give further protection to EMF free zone.



Mobile phone tower radiating EMF

Fig. 5. Typical Hilly region with Mobile tower



(Environment Friendly Link) stations along the route
Optic fiber cable (underground)

Fig. 5. Proposed EFL (Environment Friendly Link) station

B. EFL (Environment Friendly Link)

Hill station roads are covered with cellular towers that emits EMF that affects the eco-system refer Fig. 5. To effectively reduce the impact of EMF radiations in forest, hill stations and conserve ecosystem, we recommend placing EFL (Environment Friendly Link) mobile network connectivity stations. As shown in Fig 6. EFL stations are linked using optic fiber cables. EFL stations are similar to “Smoking Cabins” in a “No Smoking” area of an Airport.

People interested in making a call or interested to get connected to internet, stops at EFL stations. EFL stations can also be placed at existing or new “fuel stations”, Hotels on the route thereby severing multiple purpose. This will tremendously reduce EMF radiation when compared to the mobile towers placed in forest and hill area. This has a direct impact on the wildlife and the ecosystem in the area covered.

C. Recommendations

Our general recommendation to reduce EMF radiations

Indoor radiations:

1. Mobile in Bedroom

a) Minimize radiations: Place mobile phones in airplane mode this cuts communication but allow us to set and hear the alarm.

b) Best option: Place mobile phone in other room and use a normal alarm clock operated by batteries.

2. Maximize the use of mobile phone speaker or headphones and avoid placing mobile phone near head.

3. Turn off home Wi-fi during night before going to sleep.

4. Maximize the use of wired connection.

Outdoor radiations:

1. Reduce cellular tower density such as to reduce EMF radiation

2. The power output norms for cellular towers should be reduced

3. Distance limit from cellular tower to schools, hospitals hould be increased such as to reduce the harmful effects of the radiation.

CONCLUSION AND FUTURE WORK

Today the radiations from cell phones, cordless phones, mobile antennas, broadcast towers, electrical security systems, and many more devices pose a serious health threat to society and environment. EMF radiations can interfere with the natural way of how body works; it affects our body at cellular level. Moreover, the impact of EMF radiation on our eco-system is serious due to various broadcasting antennas, mobile communications base stations etc. World Health Organization (WHO) says the EMF

radiations produced by mobile phone is classified by the International Agency for Research on Cancer (IARC) as possibly carcinogenic to humans.

Our data analysis on the survey shows that 86.2% people keep their mobile phones near their ears while receiving calls, 77.7% keep mobile phone in their bedroom before going to bed. Based on the results and considering the major impact of EMF radiations. We proposed innovative house design called Radiation Reduced Dwelling (RRD) by which the EMF radiation exposure can be minimized at home and Environment Friendly Link (EFL) by which impact of EMF radiations is reduced outdoor.

As a part of our ongoingwork, we are performing more experiments on indoor andoutdoor EMF radiations. Moreover, perform statistical analysis on the survey data.

REFERENCES

[1] Morgan, L. Lloyd, Anthony B. Miller, Annie Sasco, and Devra L.Davis. "Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A)." International journal of oncology 46, no. 5 (2015): 1865-1871.

[2] Kumar, Manish, and R. K. Singh. "Effect of Mobile Tower Radiation on Birds, Rural and Urban Area of Durg District ", World Journal of Pharmacy and Pharmaceutical Sciences, 7, no. 6 (2018): 1330-1338.

[3] Reynard Loki. “Our cellphone addiction is turning wireless tech into an invisible weapon that’s destroying wildlife”, https://www.salon.com/2018/07/13/our-cellphone-addiction-is-turning-wireless-tech-into-an-invisible-weapon-that-is-destroying-wildlife_partner/ Jul 14, 2018

[4] Pall, L. Martin. "Wi-Fi is an important threat to human health." Environmental research 164 (2018): 405-416.

[5] Andre Spicer. “What do smartphones and cigarettes have in common?” ,Jan, 9, 2018 https://edition.cnn.com/2018/01/09/opinions/smartphone-addiction-opinion-spicer/index.html

[6] Touitou, Yvan, Alain Reinberg, and David Touitou. "Association between light at night, melatonin secretion, sleep deprivation, and the internal clock: Health impacts and mechanisms of circadian disruption." Life sciences 173 (2017): 94-106.

[7] Karl Rode. 5G Wireless Rekindles Decades-Old Fight Over Cellular Health Risks, https://motherboard.vice.com/en_us/article/pa8bpk/5g-wireless-rekindles-fight-over-cellular-health-risks , Sep 17, 2018

[8] Scenihr."Potential health effects of exposure to electromagnetic fields (EMF)." Health effects of EMF Jan 20, 2015.

[9] Electromagnetic fields and public health: mobile phones, http://www.who.int/en/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones

[10] Miah, Tayaba, and Deepak Kamat. "Current understanding of the health effects of electromagnetic fields." Pediatric annals 46, no. 4 (2017): e172-e174.

[11] Halgamuge, Malka N. "Pineal melatonin level disruption in humans due to electromagnetic fields and ICNIRP limits." Radiation protection dosimetry 154, no. 4 (2012): 405-416.

[12] Sage, Cindy, and Ernesto Burgio. "Electromagnetic fields, pulsed radiofrequency radiation, and epigenetics: How wireless technologies may affect childhood development." Child development 89, no. 1 (2018): 129-136.

[13] Sivani, S, and D. Sudarsanam. "Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem-a review." Biology and Medicine 4, no. 4 (2012): 202-216.

[14] Falcioni, L., L. Bua, Eva Tibaldi, Michelina Lauriola, L. De Angelis, F. Gnudi, Daniele Mandrioli et al. "Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission." Environmental research 165 (2018): 496-503.

[15] Kaitlyn Mensing, Legal Intern and David Andrews “Despite Health Concerns, FCC and States Clear the Way for Next-Generation Wireless Networks”,https://www.ewg.org/news-and-analysis/2018/07/despite-health-concerns-fcc-and-states-clear-way-next-generation-wireless#.W2CzYbh9idU

[16] Gupta, Asheesh, Saurabh Verma, Kumar Vyonkesh Mani, Gaurav K. Keshri, Santanu Karmakar, Anju Yadav, and Manish Sharma. "Microwave frequency-electromagnetic field 10 GHz radiation exposure impact on rat skin: An oxidative stress insight." In Microwave and Photonics (ICMAP), 2018 3rd International Conference on, pp. 1-2. IEEE, 2018.

[17] Mishra, A. K., P. A. Kokate, S. K. Lokhande, A. Middey, and G. L. Bodhe. "Time-Dependent Study of Electromagnetic Field and Indoor Meteorological Parameters in Individual Working Environment." In Environmental Pollution, pp. 181-191. Springer, Singapore, 2018.

[18] Sutherland, William J., Stuart HM Butchart, Ben Connor, Caroline Culshaw, Lynn V. Dicks, Jason Dinsdale, Helen Doran et al. "A 2018 horizon scan of emerging issues for global conservation and biological diversity." Trends in ecology & evolution 33, no. 1 (2018): 47-58.

[19] Fernández, C., A. A. de Salles, M. E. Sears, R. D. Morris, and D. L. Davis. "Absorption of wireless radiation in the child versus adult brain and eye from cell phone conversation or virtual reality." Environmental research (2018) (in Press).

[20] Romanenko, Sergii, Ryan Begley, Alan R. Harvey, Livia Hool, and Vincent P. Wallace. "The interaction between electromagnetic fields at megahertz, gigahertz and terahertz frequencies with cells, tissues and organisms: risks and potential." Journal of the Royal Society Interface 14, no. 137 (2017): 20170585.

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