International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 10 | Oct - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

Mobile Detector in Exam Halls

N Yashaswi[1], Bussa Sri Sagar[1], N Varshini[1] , K Ashish Agrawal[1], Sudhamani Chilakala[1]

1 Department of ECE, CMR Technical Campus, Hyderabad, Telangana, India;

Email: 247r1a0461@cmrtc.ac.in, 247r1a0412@cmrtc.ac.in, 247r1a0437@cmrtc.ac.in, 247r1a0425@cmrtc.ac.in, sudhamani.ece@cmrtc.ac.in

Abstract:

Mobiles are widely used in the world. While people have to be connected to one another, there are situations or places where their usage is to be prohibited either due to security reasons or it may cause health hazards. Mobile detection has been on investigation for a long time. There are techniques which have been formulated or proposed on how mobiles can be detected. Most of them use the features such as audio system, RF system and common materials of the phones and try to look into how they can be used as basis to detect mobiles. This paper utilizes the RF system of the cell phone as the feature to be used to detect its presence. A circuit that detects signals of the range 0.9GHz to 3GHz is used to detect a cell phone when in use. When the signal is detected, an LED blinks to indicate the usage of a mobile within a radius of 1.5metres.

Keywords: Mobile Phone Detection, RF Signal Detection, Electromagnetic Signals, Wireless Communication, LED Indicator, Security System, Signal Detection Range, RF Sensor, GSM.

I. INTRODUCTION

What is radio frequency?

Radio frequency (RF) is a measurement representing the oscillation rate of electromagnetic radiation spectrum, or electromagnetic radio waves, from frequencies ranging from 300 gigahertz (GHz) to as low as 9 kilohertz (kHz). With the use of antennas and transmitters, an RF field can be used for various types of wireless broadcasting and communications.

How radio frequency works?

Radio frequency is measured in units called hertz (Hz), which represent the number of cycles per second when a radio wave is transmitted. One hertz equals one cycle per second; radio waves range from thousands (kilohertz) to millions (megahertz) to billions (gigahertz) of cycles per second. In a radio wave, the wavelength is inversely proportional to the frequency. Radio frequencies are not visible to the human eye. As the frequency is increased beyond that of the RF spectrum, electromagnetic energy takes the form of microwaves, infrared radiation (IR), visible, ultraviolet, X-rays and gamma rays.

RF technology

Many types of wireless devices make use of RF fields. Cordless and cellphones, radio and television broadcast stations, Wi-Fi and Bluetooth, satellite communications systems and two-way radios all operate in the RF spectrum

In addition, other appliances outside of communications, including microwave ovens and garage door openers, operate at radio frequencies. Some wireless devices, like TV remote controls, computer keyboards and computer mice, operate at IR frequencies, which have shorter electromagnetic wavelengths.

How the radio frequency spectrum is used

The radio frequency spectrum includes the set of frequencies of the electromagnetic framework ranging from 30 Hz to 300 GHz. It is divided into several ranges, or bands, and given labels, such as low frequency (LF), medium frequency (MF) and high frequency (HF), for easier identification.

With the exception of the lowest-frequency segment, each band represents an increase of frequency corresponding to an order of magnitude (power of 10). The following table depicts the eight bands in the RF spectrum, showing frequency and bandwidth ranges. The super high frequency (SHF) and extremely high frequency (EHF) bands are often referred to as the microwave spectrum.

RF congestion and interference

In the United States, radio frequencies are divided into licensed and unlicensed bands. The Federal Communications Commission (FCC) issues licenses that permit commercial entities to have exclusive use of a frequency band in a given location. Entities include frequency modulation (FM) radio, cellular networks, television, military and satellite communications. Unlicensed frequencies are free for public use but remain a shared medium.

The competition for bandwidth and channels from internet users has increased dramatically in recent years, leading to signal issues. In addition, distribution across frequencies is not equitable. In many locations, it is possible to find broadcasters --radio and TV stations--with their own individual frequencies, while a multitude of sources compete for space on the unlicensed frequencies.

Heightened demand has led to a number of innovations geared toward improved spectrum efficiency, including dynamic spectrum management, trunked radio, frequency pooling, spread spectrum, cognitive radio and ultra-wideband.

How cellular networks use RF

A cellular network typically covers a specific geographical area divided into cells. Every cell is allocated a set of frequencies that have radio base stations assigned to them. When a communication such as a cellular phone call is initiated, the device searches for the closest base station to establish a radio link.

When receiving the call, the base station antenna establishes a connection with the phone. Phones are designed to periodically check in with the network, making it easier for them to receive a radio signal of substantial quality from a nearby base station antenna.

RF technology allows a set of frequencies to be used in other cells, as long as the cells aren't bordering each other. It is possible for numerous callers in one area to use the same frequency because calls can be switched to the closest base station with that particular frequency. This increases the capacity of the cellular network. However, the frequency reuse works only for unrelated transmissions. Users can still experience some interference from signals coming from other cells using the same frequency. This is why wireless networks use a system of frequency-division multiple access (FDMA), in which there must be at least one cell in between cells reusing the same frequency.

FDMA enables numerous users to send and receive data through the same communication channel. Cellular network users can also move from one cell to another while calling, without calls being dropped. Through the handover process, the mobile device remains aware of signal quality and the nearest antenna with the least congestion. When need be, the mobile device switches to a new and more convenient channel.

How 5G uses RF

Wireless 5G-enabled devices connect to the internet and telephone networks using radio waves that go through a nearby antenna. As the upcoming iteration of wireless broadband network technology, 5G provides peak speeds as high as 10 gigabits per second (Gbps) for downloads.

5G can operate on low frequencies (below 6 GHz), as well as HF ranges, commonly known as millimeter waves, or MM waves (higher than 6 GHz). The higher the frequency, the more likely the user is to experience higher data transfer speeds.

5G networks will, therefore, provide more capacity and will serve as a channel for internet service providers (ISPs) that can compete with wired internet services. 5G networks may also facilitate greater connectivity for the internet of things (IoT), smart cities and advanced manufacturing processes, to name a few.

5G achieves its increased capacity by using up to three different types of cells – macro cell, small cell and femtocell -- each with unique antenna designs. Some of these antennas will provide higher speeds, while others will cover longer distances. Because 5G operates in LF, MF and HF bands, the appropriate hardware depends on the best possible route for users and their data.

5G networks are also capable of reducing latency to achieve faster response. They are expected to provide a more consistent user experience (UX), even when users move around frequently. The advent of 5G new radio (5G NR) standards is also expected to increase coverage areas and improve connection quality, as well as speed and data rates.

A radio frequency (RF) system is a complex setup used for wireless communication, radar systems, remote control devices, and many other applications. Here's a more detailed overview of the components and characteristics:

Antennas: Antennas are essential for transmitting and receiving RF signals. They convert electrical signals into electromagnetic waves for transmission and vice versa for reception.

Transmitters: Transmitters generate RF signals at a specific frequency and power level. They modulate the signal with the information to be transmitted, such as voice, data, or video.

Receivers: Receivers capture RF signals and demodulate them to extract the original information. They often include amplifiers and filters to improve signal quality and reject interference.

Amplifiers: RF amplifiers boost the power of signals to enhance transmission range or compensate for losses in the transmission medium.

Filters: RF filters are used to select or reject specific frequencies. They help in reducing interference from other signals and improving the signal-to-noise ratio.

Modulation/Demodulation Circuits: These circuits are used to modulate the information onto the RF carrier signal during transmission and demodulate it to recover the original information at the receiver.

Frequency Range: RF systems operate within a specific frequency range, typically from a few kilohertz (kHz) to several gigahertz (GHz), depending on the application.

Bandwidth: The bandwidth of an RF system determines the range of frequencies it can handle. It's crucial for determining the data transmission capacity of the system.

Power Output: The power output of a transmitter determines the signal strength and transmission range. It's typically measured in watts or decibels relative to a reference power level.

Modulation Techniques: Various modulation techniques, such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM), are used to encode information onto the RF carrier signal.

Sensitivity: Sensitivity refers to the ability of a receiver to detect weak signals. It's a critical parameter for ensuring reliable communication over long distances or in noisy environments.

Selectivity: Selectivity is the ability of a receiver to separate desired signals from unwanted signals or interference. It's essential for maintaining signal integrity and minimizing distortion.

RF systems are designed to meet specific performance requirements, such as range, data rate, and reliability, depending on the intended application. They play a crucial role in modern wireless communication networks, including cellular networks, Wi-Fi, Bluetooth, and satellite communication systems.

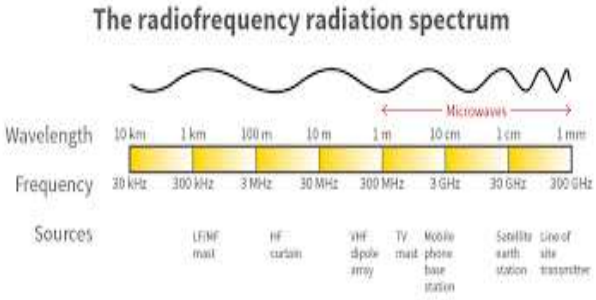


Fig 1. Radio frequency spectrum

Radio frequency (RF) systems find applications across various industries and technologies. Here are some common applications:

Wireless Communication:

RF systems are the backbone of wireless communication technologies such as cellular networks, Wi-Fi, Bluetooth, and Zigbee. They enable voice, data, and multimedia transmission over long distances without the need for physical cables.

Broadcasting:

Radio and television broadcasting rely on RF systems to transmit audio and video signals to a wide audience. AM (Amplitude Modulation) and FM (Frequency Modulation) radio broadcasting are classic examples of RF applications.

Radar Systems:

Radar (Radio Detection and Ranging) systems use RF waves to detect the presence, direction, distance, and speed of objects. They're used in aviation for air traffic control, weather forecasting, military defense, and automotive applications like collision avoidance systems.

Navigation Systems:

Global Navigation Satellite Systems (GNSS) like GPS (Global Positioning System), Galileo, and GLONASS utilize RF signals transmitted by satellites to determine the precise location, velocity, and time information for navigation purposes.

RF Identification (RFID):

RFID technology employs RF systems for identifying and tracking objects using RFID tags. These tags contain electronically stored information that can be read remotely by RFID readers, facilitating applications such as inventory management, access control, and contactless payment systems.

Wireless Sensing:

RF systems are used in wireless sensor networks for monitoring and collecting data from remote locations. They're employed in various fields such as environmental monitoring, industrial automation, healthcare (e.g., remote patient monitoring), and agriculture (e.g., precision farming).

Remote Control Systems:

RF-based remote control devices are commonly used for operating electronic appliances, home automation systems, garage door openers, and automotive keyless entry systems.

Satellite Communication:

RF systems play a vital role in satellite communication for transmitting television signals, internet data, telephone calls, and other telecommunications services globally.

Medical Devices:

RF technology is utilized in medical devices for applications like wireless patient monitoring, implantable medical devices (e.g., pacemakers, neurostimulators), and medical imaging systems (e.g., MRI, CT scanners).

Security Systems:

RF-based security systems, such as wireless alarm systems, surveillance cameras, and access control systems, provide protection for homes, businesses, and public facilities.

II. LITERATURE SURVEY

This section reviews previous research and existing work related to mobile phone detection systems, focusing on radio frequency (RF) signal detection techniques. Various studies have explored methods for detecting mobile phones using audio signals, RF signals, and other phone-related features. Among these methods, RF-based detection is widely used to identify mobile phone activity by detecting signals within a specific frequency range. The proposed system uses an RF detection circuit operating between 0.9 GHz and 3 GHz to detect mobile phone signals within a distance of approximately 1.5 metres. When a signal is detected, an LED blinks to indicate the presence of an active mobile phone nearby.

Datta and Ghatak (2021) present a study on the design of a cell phone detector that focuses on identifying mobile phone activity in restricted areas [1]. The study explains how radio frequency (RF) signals emitted by mobile phones can be detected, even when the phones are in silent mode. When an active mobile phone transmits signals during calls, SMS messages, or video transmission, the detector identifies the RF signals and alerts the user through a buzzer and a blinking LED. The study highlights the importance of mobile phone detection in areas where phone usage is restricted for security and safety reasons. [2] Ajasa and Adenowo, present a study on the design and development of a mobile phone signal detector capable of identifying incoming and outgoing signals from active mobile phones. The study describes a compact detection system that can detect mobile phone signals within a distance of approximately 1.5 metres. The system uses radio frequency (RF) signals to identify mobile phone activity, even when the phone is in silent mode. When an RF signal is detected, the circuit activates a buzzer and blinks an LED to alert

the user. The authors highlight its potential applications in examination halls, confidential rooms, and other restricted areas where mobile phone usage and unauthorized video transmission need to be controlled.

Armin Esmaeilzadeh and Yoohwan Kim (2022) present a study on mobile malware detection methods, focusing on identifying malicious activities in smartphones and mobile applications [3]. The study highlights the growing security risks associated with the widespread use of mobile devices and high-speed internet, as mobile applications often handle sensitive and confidential information. The authors discuss various techniques for detecting malware before installation, during application execution, and through network traffic analysis. The study also classifies recent research methods for detecting mobile malware by analyzing network traffic, emphasizing the importance of effective detection techniques in improving mobile security. [4] Edwin Ataro presents a study on the design and testing of mobile phone detection systems, focusing on preventing unauthorized phone usage in examination halls and other restricted areas. The study highlights how mobile phones can be misused for academic cheating and privacy violations. The author proposes two detection methods: an RF-based mobile detector with a range of approximately 1 metre, capable of detecting calls, text messages, and video transmission even when the phone is in silent mode, and a Reed switch-based scanning system that can detect mobile phones that are switched off or placed in flight mode. The study demonstrates the potential of these systems to improve security in restricted areas and provides a foundation for further research and development of mobile phone detection techniques.

Ayan Karajagi and Rohit Lawand present a study on the design of a cell phone detector, focusing on identifying mobile phone activity in restricted areas [5] . The study discusses different techniques for detecting mobile phones using audio signals, radio frequency (RF) signals, and other phone-related features. The proposed system uses an RF detection circuit that operates within the frequency range of 0.9 GHz to 3 GHz to identify signals transmitted by active mobile phones. When a signal is detected within a range of approximately 1.5 metres, an LED blinks to indicate the presence of mobile phone activity. The study highlights the usefulness of RF-based detection systems in improving security and preventing unauthorized mobile phone usage in places such as examination halls and other restricted areas.

III. PROPOSED SYSTEM

The proposed system is designed to detect the presence of mobile phones by identifying the radio frequency (RF) signals emitted by them during communication. The system uses an RF detection circuit that operates within the frequency range of 0.9 GHz to 3 GHz to detect signals from mobile phones.

When a mobile phone is used to make a call, send a message, or transmit data, it emits RF signals that can be detected by the circuit. Upon detecting these signals, the system activates an LED indicator that blinks to alert the presence of a mobile phone within a range of approximately 1.5 metres.

The proposed system is simple, cost-effective, portable, and easy to operate. It can be used in examination halls, hospitals, conference rooms, and other restricted areas where mobile phone usage is prohibited. It helps improve security and maintain discipline by providing a visual indication of mobile phone activity without requiring direct contact with the device.

3.1. Modelling and Analysis

Input Stage is shown in Fig 2.



Fig 2: Input Stage

Fig 2 shows the input stage is an important part of the mobile phone detection system. It receives radio frequency (RF) signals emitted by mobile phones and processes them before sending them to the next stage. The input stage consists of an antenna, RF band-pass filter, RF amplifier, envelope detector, signal-conditioning circuit, and output stage. Each block performs a specific function in detecting possible mobile phone activity.

1. Antenna

The antenna is the first block of the input stage. Its primary function is to receive electromagnetic waves from the surrounding environment. When a mobile phone communicates with a cellular network, it transmits radio frequency signals that may be captured by the antenna.

The antenna converts the received electromagnetic energy into a small electrical signal. The strength of this signal depends on the distance between the mobile phone and the detector, the phone's transmission power, antenna characteristics, and surrounding obstacles. The received signal is then passed to the RF band-pass filter for further processing.

2. RF Band-Pass Filter

The RF band-pass filter allows signals within a selected frequency range to pass through while attenuating signals outside that range. In this project, the intended frequency range is approximately 0.9 GHz to 3 GHz.

The filter helps reduce unwanted signals and interference from other sources. It improves the selectivity of the input stage by limiting the frequencies passed to the next block. The filter can be designed using suitable inductors, capacitors, or specialised RF filter components. The actual component values depend on the required bandwidth and circuit design.

3. RF Amplifier

The RF amplifier increases the amplitude of weak radio frequency signals received by the antenna. Mobile phone signals may be very weak when they reach the detector, particularly when the phone is far away.

The amplifier boosts the received signal to a level suitable for the following detection stage. A low-noise amplifier (LNA) is commonly used in RF systems because it increases the signal strength while introducing as little additional noise as possible. The amplifier must be designed to operate at the intended frequencies. Its gain, noise performance, and input/output impedance affect the overall sensitivity of the detector.

4. Envelope Detector

The envelope detector converts the amplified RF signal into a lower-frequency electrical signal that can be processed by ordinary electronic circuits.

It commonly uses a diode and an RC network. The diode rectifies the RF signal, while the capacitor and resistor help follow changes in the signal's amplitude. The resulting output represents variations in the strength of the received signal. This makes it easier for the next stage to determine whether the received RF activity is strong enough to trigger an indication.

5. Signal-Conditioning Circuit

The signal-conditioning circuit prepares the output of the envelope detector for further processing. The detected signal may be weak, noisy, or variable, so it may require additional amplification or filtering. This block can include an operational amplifier, a low-pass filter, or other suitable electronic components. These components help adjust the signal level and reduce unwanted variations. Proper signal conditioning improves the reliability of the detection process and helps prevent unwanted triggering caused by small fluctuations in the signal.

6. Output to the Next Stage

The final block transfers the conditioned signal to the next stage of the mobile phone detector. This stage may contain a comparator or microcontroller, depending on the circuit design. A comparator compares the detected signal with a predefined reference voltage. If the signal exceeds the selected threshold, the comparator changes its output state. The output can then be used to activate an LED indicator. When the detection condition is satisfied, the LED blinks to alert the user to possible mobile phone activity. A microcontroller-based design may also process the signal and control additional indicators or alarms.

Overall Working Principle

The antenna receives RF signals from the surrounding environment. The band-pass filter selects the desired frequency range, and the RF amplifier increases the strength of weak signals. The envelope detector converts the RF signal into a lower-frequency electrical signal. The signal-conditioning circuit prepares this signal for further processing, and the final stage checks whether it exceeds the detection threshold. When the threshold is exceeded, the system activates the LED indicator to provide a visual alert. The proposed frequency range of 0.9–3 GHz covers several mobile communication bands, but a single circuit will not necessarily detect all signals across this entire range. The actual detection range and sensitivity depend on the antenna, RF components, circuit design, and surrounding conditions. The detector responds to RF activity and cannot identify a mobile phone with certainty based on frequency alone.

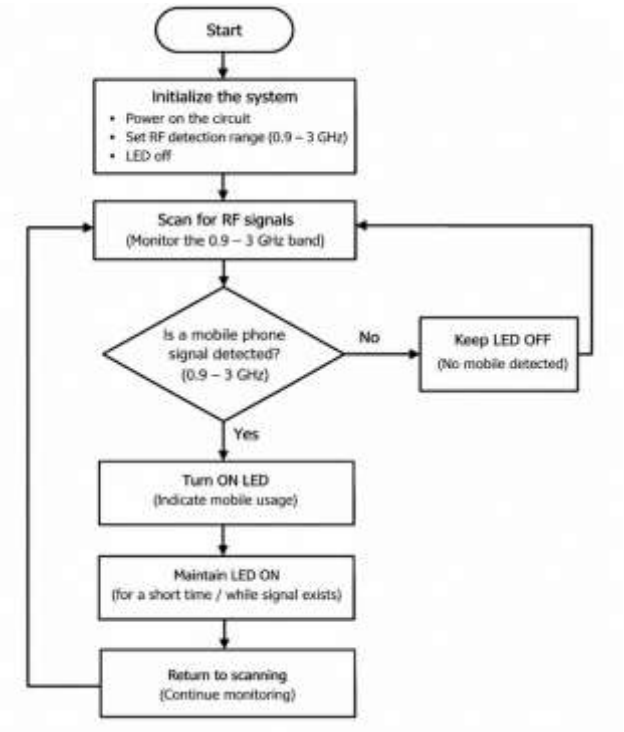


Fig. 3. Flow chart

IV. RESULTS & DISCUSSION

Case 1: When mobile is detected (RF signals are detected)this in turn glows the red led and turns on the buzzer.

.



Fig. 4.: mobile is detected

Case 2: When mobile is Not-detected (RF signals are not detected) Then the led is turned and buzzer is in off condition.



Fig : 5 Mobile not detected

The Mobile Phone Detection System was designed to detect the presence of a mobile phone by identifying radio frequency (RF) signals emitted during mobile communication. The system uses an RF detection circuit that responds to signals within the frequency range of approximately 0.9 GHz to 3 GHz. An LED is used as an indicator to show the detection of a mobile phone signal.

When the circuit is switched ON, the detector continuously monitors the surrounding area for RF signals. When a suitable signal is detected within the effective detection range of the circuit, the LED blinks to indicate the possible presence or use of a mobile phone. According to the project design, the detection range is approximately 1.5 metres under suitable conditions. When no detectable signal is present, the LED remains OFF or returns to its normal state, depending on the circuit configuration.

The system demonstrates how electromagnetic signals can be used to identify possible mobile phone activity without directly connecting to the mobile device. It provides a simple and economical method of detecting RF activity and can be useful for demonstrating mobile phone detection in classrooms, examination halls, meeting rooms, laboratories, and other restricted areas. The project also helps in understanding the practical applications of radio frequency detection, electromagnetic radiation, electronic circuits, and indicator systems. The LED provides a simple visual indication, allowing users to identify the detection event without requiring a complex display or computer interface.

The performance of the system depends on several factors, including the strength of the transmitted RF signal, the distance between the mobile phone and the detector, the antenna and sensitivity of the circuit, and interference from other electronic devices. The detector may not respond when a mobile phone is idle or when its RF transmission is too weak to be detected. Similarly, other RF sources operating within the circuit's response range may sometimes trigger the indicator.

It is important to note that the system detects RF activity rather than identifying a mobile phone with complete certainty. Therefore, the LED indication should be interpreted as evidence of a potentially detectable RF signal, not definitive proof that a mobile phone is present. The stated detection range of 1.5 metres should also be verified through practical testing under the intended operating conditions.

In conclusion, the project demonstrates the basic working principle of an RF-based Mobile Phone Detection System. It successfully illustrates how a suitable RF detection circuit and an LED indicator can be combined to provide a simple visual warning when detectable RF activity occurs nearby. The system offers a foundation for developing more advanced detection systems with improved sensitivity, greater reliability, and additional indication feature

V.CONCLUSION

The Mobile Phone Detection System is an electronic system designed to detect the presence of mobile phone-related radio frequency (RF) signals in its surrounding environment. The main objective of this project is to develop a simple, cost-effective, and efficient method of identifying detectable RF activity without requiring any direct physical connection to the mobile phone. The system operates by detecting RF signals within an approximate frequency range of 0.9 GHz to 3 GHz and uses an LED indicator to provide a visual alert whenever. The working principle of this project is based on the radio frequency signals generated by mobile phones during communication activities such as making calls, sending messages, and transmitting or receiving data. When the RF detection circuit receives a signal within its effective detection range, the circuit responds by activating the LED. The blinking LED indicates the possible presence of mobile phone-related RF activity in the surrounding area. The system is designed for an approximate detection distance of 1.5 metres, although the actual range depends on the circuit's sensitivity, signal strength, antenna characteristics, and environmental conditions.

This project demonstrates the practical application of electronic circuits and RF signal detection technology. It provides a basic understanding of electromagnetic signals, wireless communication, signal detection, and electronic indication systems. The use of an LED makes the system simple to operate because it provides a visible indication without requiring a complicated display or additional monitoring equipment. Its relatively simple design also makes it suitable for educational demonstrations and basic security-related applications. The proposed system may be useful in places where unauthorized mobile phone usage is restricted, such as examination halls, classrooms, meeting rooms, laboratories, and certain security-sensitive areas. It can help alert users to detectable RF activity in the monitored area. However, the detector does not identify a mobile phone with complete certainty, as other RF sources may also activate the circuit. Furthermore, a mobile phone that is not transmitting detectable RF signals may not be detected. Therefore, the system should be considered a supplementary detection aid rather than a complete mobile phone monitoring or security solution.

In conclusion, the Mobile Phone Detection System

demonstrates how RF signal detection technology can be used to provide a simple visual warning of detectable wireless activity. The project achieves its educational objective of explaining the relationship between mobile communication signals and electronic detection circuits. It also provides a foundation for developing more advanced, reliable, and intelligent RF detection systems in the future. With suitable improvements in sensitivity, selectivity, and performance, this type of system may serve as a useful supplementary tool for applications that require awareness of nearby RF activity.

REFERENCE

[1] rimpi datta, trisha ghatak "cell phone detector and its design" International Journal of Advance research ideas and innovations in technology, ISSN: 2454-132X ,Volume: 7 ,2021

[2] Ajasa, adenowo, "design and development of a mobile phone signal detector", International Journal of Engineering Research& technology,ISSN: 2278-0181, Volume 3,2024

[3] Ayan karajagi, Rohit lawand , "cell phone detector" , International Journal of Research Publication and reviews, ISSN: 2582-7421,Volume: 5,pp.8663-8667,2024

[4] Armin esmaeilzadeh,yoohwan kim, "mobile malware detection method", IEEE, ISBN: 10.1109/CCWC54503.2022.9720753 ,2016

[5] Edwin ataro, " design and testing of mobile phones", Innovative systems design and engineering, ISSN: 2222-1727,Volume-7