Wireless Communication Without Internet Connection

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***Abstract*—The Internet is a technology that has dramatically improved its utilization and found its way into our life. It has evolved into one of the world's leading technologies, with people relying on it to complete the majority of their daily tasks. Nevertheless, not every location is lucky enough to have the requisite network infrastructure. As a result, their ability to communicate with others both locally and globally is severely limited (like North Korea). Given this, providing individuals with a way to communicate even when there is no internet would be quite advantageous. One way for people to communicate with one another is through the use of an application. The best line of action is to develop an app that meets our criteria (i.e., a communication app that does not require Internet access). When surfing the Internet for already finished works, we realized that the bulk of the applications accessible have only one feature (either calls only or file sharing only). We have developed a messaging application that can be utilized for a variety of applications. Messaging, file sharing, screen sharing, audio and video conversations, and other activities are all features of our app.**

***Index Terms*—Bluetooth, IoT D2D, Mobile Adhoc Network, IoT, Wi-Fi, Wi-Fi Direct, Wireless Communication, Wireless, Network, and ZigBee.**

I. INTRODUCTION

From instant messaging to video conferencing, the Internet is an essential element of our daily communication. We can save a lot of money thanks to the Internet. However, there are several disadvantages to using the Internet. Access to technology and the Internet is essential for communication, education, and economic development in the modern world. However, a sizable portion of the world's population, especially those living in developing nations, lacks access to these resources. The creation of mobile applications that offer affordable, dependable communication services has grown in popularity as a solution to this problem

As technology advances, the need for seamless communication has expanded in recent years. While the internet has provided a solid platform for connecting people all over the world, there are instances when access to the internet is limited or unavailable. In such instances, technologies such as Wi-Fi Direct have emerged as viable solutions for communicating without the need for internet connectivity.

Wi-Fi Direct is a wireless communication method that enables device-to-device communication without the need for an intermediary access point or an internet connection. It enables seamless and quick device connections, making it ideal for file sharing, multimedia streaming, gaming, and collaboration. Wi-Fi Direct eliminates the need for internet connectivity, allowing devices to communicate locally even in areas where internet access is limited or non existent. Wi-Fi Direct is a versatile and effective wireless communication solution that improves user experiences in a variety of scenarios and domains due to its simple setup, faster speed, and secure connections.

These applications take advantage of mobile technology's potential to create user-friendly and reasonably priced voice and text messaging solutions. They can also be developed to function offline, enabling users to remain connected even when Internet access is limited or nonexistent. Through the provision of alternative channels of communication, particularly in settings where traditional communication methods are impractical, these applications have the potential to fundamentally alter how people interact with one another.

An additional challenge is an Internet outage, which is a complete or partial failure of Internet services that can occur as a result of censorship, hacking, natural disasters, actions taken by the police or security services, or mistakes. Disruption of undersea

communications cables may cause widespread blackouts or slowdowns.

After analyzing some of the efforts (i.e., mobile application projects) to handle the problem at hand, we observed that their functionality was limited, data transfer was slow, and they missed key essential features of instant messaging software. There have been attempts to address these issues with mobile application projects, however, they have lacked important instant messaging software elements and had poor functionality and slow data transfer. Therefore, there is a need to develop a mobile application that provides a cheap and efficient means of communication for individuals who cannot afford Internet based communication and a backup mode of communication in the event of an Internet outage.

A. Objectives

The purpose of this project is to develop a mobile application that provides a cheap and efficient means of communication for individuals who cannot afford Internet based communication, as well as a backup mode of communication in the event that the Internet goes down. In addition to bridging the digital gap, our application will guarantee that individuals have access to dependable communication tools in times of crisis or when Internet connectivity is not available.

II. LITERATURE SURVEY

We read a range of academic works to have a full understanding of the topic area for this proposed application. The goal of this project is to create an application that does not require an Internet connection. In order to connect to a network, we studied the best techniques for connecting devices and discovered that WiFi direct is the best alternative. Following that, we discovered that we could overcome WiFi Direct's constraints and came up with two options: employing WiFi extenders or a concept known as Mesh Technology. We looked at the WiFi Direct Multi Group communication paradigm.

According to Xu Junwei's study on the matter, Wi-Fi Direct Multi-Group Communication is presently not viable to implement by using the Android operating system's Wi-Fi Direct API. In this paper, a new Wi-Fi Direct Multi-Group communication topology is suggested. A new gadget called an Access Point is also introduced in order to connect numerous Wi-Fi Direct Groups. The results of building a bidirectional, Multi-Group communication on Android devices that implement the most recent Wi-Fi Direct protocol are described in this study. If various groups of Wi-Fi Direct can connect to one another, the communication range of Wi-Fi Direct might be substantially expanded. To conclude, Multi-Group communication enables Wi-Fi Direct to successfully cover a larger range. [1]

According to another research report, Wi-Fi direct is the best option for device-to-device communication over the other modes that have been mentioned. This document contains an experimental evaluation that illustrates expected performance in real world circumstances, as well as a comprehensive discussion of the novel functionalities specified with Wi-Fi direct.[2]

Based on a paper on Wi-Fi-Direct Based Mobile Ad-hoc Network, the two main disadvantages of Wi-Fi Direct technology are multi-hop communication and support for interaction between two groups of client devices. It presents a routing layer that allows multi hop communication among group devices as well as Wi-Fi Direct connection among group devices. The suggested system is simply adaptable to accommodate device connectivity via a variety of protocols, such as Bluetooth and ZigBee. The proposed system was implemented using four Samsung mobile devices that enable Wi-Fi Direct.[3]

Khan, Muhammad Asif, Wael Cherif, Fethi Filali, and Ridha Hamila published the Group Formation strategy in the literature, with the goal of improving the performance of Wi-Fi Direct networks. In this paper's technical review of Wi-Fi Direct, the network architecture, node functionality, including Device and Service Discovery, Group Formation, power-saving measures, and security features are all addressed in detail.[4]

One of the biggest issues of using Wi-Fi direct as a network of communication is security. Without a safe way to connect to and make use of our system, people will lose confidence in our system. We don’t blame them for being concerned about this issue as data breaches happen very often. One of the study we looked at was the standards for security for IoT D2D (Device to Device) connectivity. It presented Secure Key Exchange with QR Code (SeKeQ) as a specific authentication mechanism to validate the user's identity by guaranteeing an automatic key comparison and supplying a shared secret key utilizing Diffie-

Hellman key agreement with a SHA-256 hash.[5] This will put a smile on our customers face since they won't have to worry about being hacked. Moreover, the study by M. M. Al Qathrady and N. K. Noordin (2019) provides a comprehensive review of the security threats and solutions in WiFi Direct networks. The authors discuss the vulnerabilities of WiFi Direct and analyze the existing security mechanisms, including authentication, encryption, and key management. The paper suggests enhancing the security of WiFi Direct by incorporating advanced cryptographic techniques and intrusion detection systems. WiFi Direct can provide advantages for mobile applications, including high data transfer rates, low power consumption, and multi-hop communication, compared to other wireless communication technologies [6].

III. DISCUSSION

The examination of literature delves into the various components of developing an application that does not require an internet connection. This study focuses on Wi-Fi Direct, which has been selected as the best choice for connecting devices that do not have an internet connection. To bypass Wi-Fi Direct's limitations, two methods are presented: using Wi-Fi extenders or Mesh Technology. The research investigates the Wi-Fi Direct Multi Group communication paradigm, which may be used to connect numerous groups to extend the communication range of Wi-Fi Direct.

According to Xu Junwei's research, the review shows the limits of Wi-Fi Direct Multi-Group Communication, implying that using the Wi-Fi Direct API directly on the Android operating system is no longer practicable. A novel topology for Wi-Fi Direct Multi-Group communication is proposed, as well as a new device called an Access Point that can connect several Wi-Fi Direct Groups. On Android devices that implement the most recent Wi-Fi Direct protocol, the study presents a bidirectional, multi-Group connection. Wi-Fi Direct can successfully cover a wider range thanks to multi-group communication, making it a feasible alternative for device to device communication.

The assessment also delves into the proposed design of a routing layer that permits multi hop interaction among group devices as well as Wi-Fi Direct communication among group devices. This design is easily adaptable to accommodate device connectivity via a variety of protocols, including Bluetooth and ZigBee. Another study focuses on the Group Formation strategy, which intends to improve the performance of Wi-Fi Direct networks by discussing network design, node functionality such as Device and Service Discovery, Group Formation, power-saving measures, and security features. Finally, the study continues by delving into the security needs for IoT D2D (Device to Device) connectivity and introducing the Secure Key Exchange with QR Code (SeKeQ) as a specialized authentication technique for certifying user identity.

A. Conceptional Block Diagram

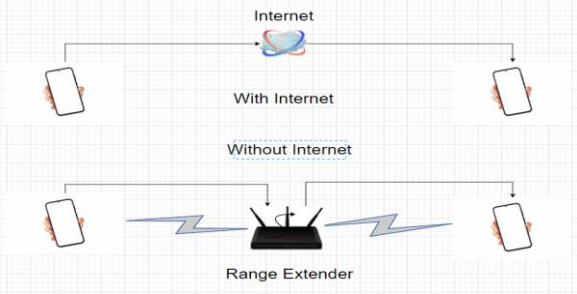

Fig.1. Conceptual Block Diagram

Fig. 1 The upper part shows how communication between users occurs, as can be seen in the diagram above. It depicts how two phones get connected. The caller first connects to the nearby phone tower, which then connects the caller to the person they are trying to reach.

The bottom part illustrates how a link between two users functions in the absence of the internet or phone towers. The two gadgets can be connected in two different ways. One makes use of the mesh network, and the other WiFi repeaters.

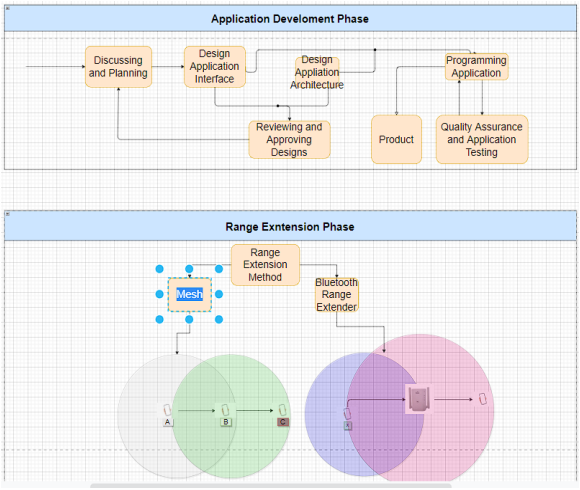

Fig.2. Software life cycle of our project

The WiFi-Repeater is a tool that can increase a device's range so that other users can access it and establish connections. Two devices, for instance, are outside of range as shown in the diagram. Therefore, the device can increase the range and connect by using a Wi-Fi repeater.

According to the mesh concept, devices can send data to their target addresses by using other devices as a conduit. For instance, suppose there are three users at points A, B, and C. Data is being sent from Point A to Point C. They are further apart, though. Both users are able to reach Point B. The shared data will initially travel to point B using the mesh principle and then redirects to point C.

IV. IMPLEMENTATION

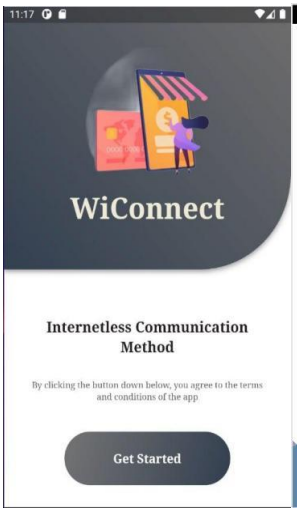

Fig.3.1. Landing Page

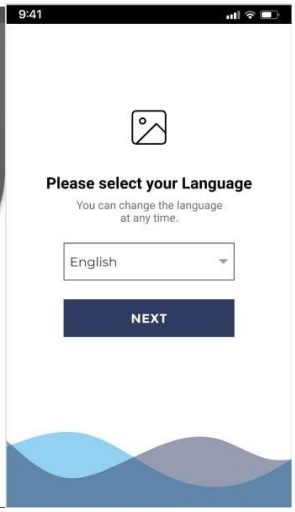

Fig.3.2. Select Language Page

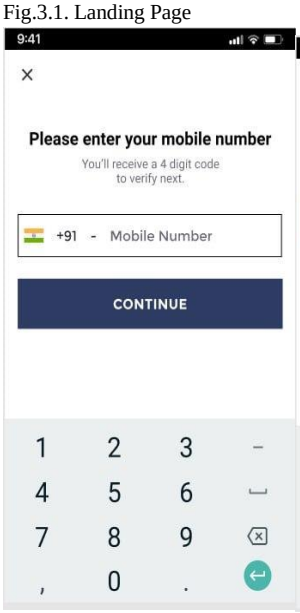

Fig.3.3. Enter Your Number

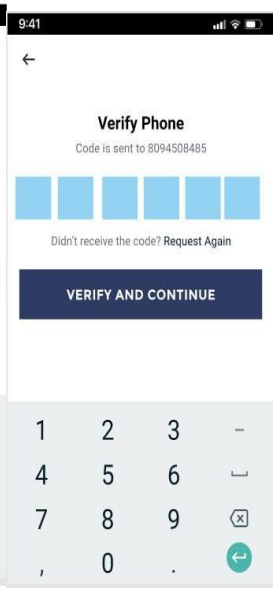

Fig.3.4 Verify Phone

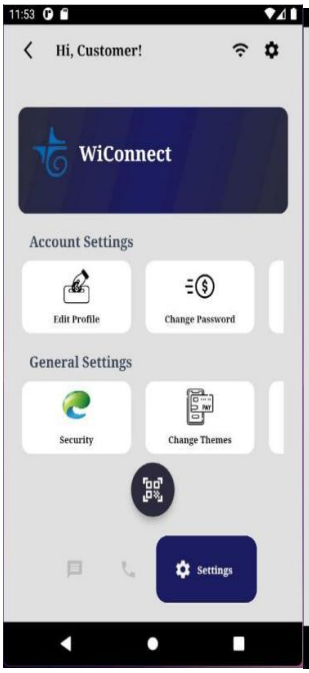

Fig.3.5. Home Page

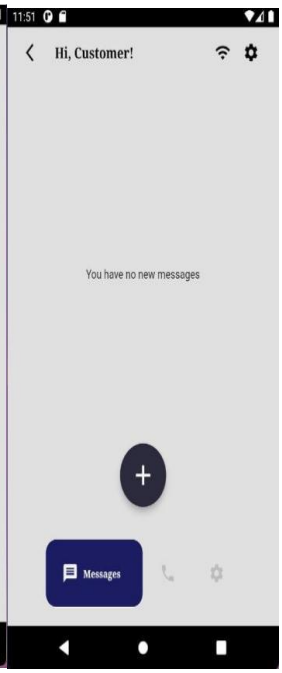

Fig.3.6. Messages Screen

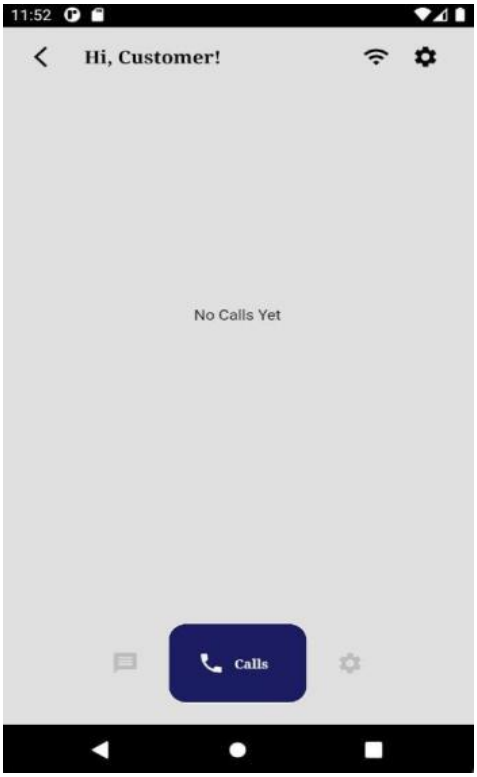

Fig.3.7. Calls Page

V.SYSTEM ARCHITECTURE

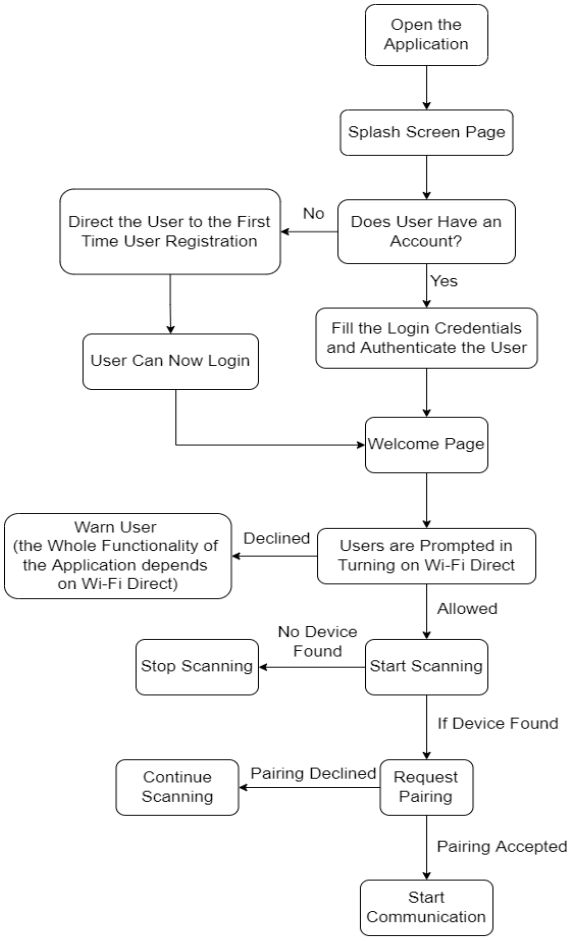

Fig.4. The operational flow of the work

The figure above (Fig. 4.) illustrates the flow in which user follows to interact with our user interface.

V. METHODOLOGY

A. Testing Previous Work

Developers have attempted to provide a similar solution throughout the years. They have created software that does not require Internet connectivity to function. These applications use WiFi Direct technology to connect the host device to other devices. Furthermore, they are intended to perform a certain job, such as texting or exchanging files. The major goal of our project was to merge these functions into a single application. It is a comprehensive messaging platform that allows users to exchange files, conduct video conversations, and communicate via text and images.

The first application function to be attempted was file sharing. Using Wi-Fi Direct, devices were able to establish a direct connection and send files to one another. The testing revealed that Wi-Fi Direct could handle file transfers quickly and reliably, making it an effective tool for data sharing across devices.

Additionally, communication tools such as text messages and voice calls were tried. Wi-Fi Direct provided direct device-to-device connections, allowing messaging and phone calls to take place without the need for cellular network coverage or internet access.

B. Researching

Research was conducted to fill the gaps in our project. Thus, security issues have been the main concern. One of the disadvantages of WiFi Direct is that it is particularly open to assaults. Because users place a great importance on security, several researches have been conducted to establish the best techniques, algorithms, and tactics for improving our application's security. Because of this, users will feel more confident knowing that their data is protected.

C. Proposing our idea to reviewers

The project's core idea was frequently presented while it was being worked on. Eventually, various recommendations for improving our project were obtained. These evaluations also contained feature upgrade suggestions, which aided us in our search.

D. Advice from Our Mentors

A seasoned Android developer has been hired to serve as a mentor for our project. The mentor has provided our team with advice and assistance throughout the project to ensure its success. He has reviewed, commented, and offered suggestions for improvement.

E. Taking Courses

Our team is made up of individuals with varying levels of technical knowledge. To be on the same page, we needed to enroll in classes and explore a range of study resources. Our aim is to provide a mobile application that does not require Internet access, we first looked for a network connection that could be found in many locations. As a result, we began reading papers and discovered that WiFi Direct is the better alternative because it is present in practically all devices and is a secure solution for our project. Following that, we examined some limitations of WiFi Direct and reviewed a research paper on how to overcome these drawbacks. The limits being range, we have looked at numerous approaches to improve the connectivity's range. After applying these strategies to solve our limits, we moved on to the application's implementation. We used Figma to design our application's UI and Android Studio to produce the

native application, which employed the programming languages Java, Xml, and MySQL to create the app's database. We also used Firebase for user login authentication.

VI.CONCLUSION

People's daily lives are becoming increasingly dependent on the internet, and their jobs cannot be done without it. However, all the times and all the places we won't have access to the internet, therefore we devised a solution by giving a wireless method of communication via WiFi-direct. We have implemented a messaging app using WiFi-Direct to overcome this situation.

WiFi Direct is a feasible solution for file sharing among a small number of devices with high throughput and low delay. WiFi Direct outperforms Bluetooth in terms of data transfer rate and throughput, especially in multi-hop communication. Therefore, WiFi-direct would be a perfect fit for the odd situation.

FUTURE SCOPE

Due to limitations of wifi network the proposed system won't be used for communicating with the for distance devices and transmission speed is also limited to - Efforts should be made to extend the Wifi Direct transmission speed and its coverage range.

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