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SECTORAL DIGITALIZATION IN VIETNAM

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ABSTRACT

This study uses the concept of digital spillover to examine the sectoral digitalization in Vietnam. The calculations and analysis give two main results. Firstly, the degree of digitization varies among economic sectors in Vietnam.The leading sectors in terms of digital technology adoption are the technological, scientific and service oriented. Second, although sectoral digitalization has been improving over the last 15 years, but the improvement is not significant.This result on one hand reflects the limited spillover effect of Vietnamese ICT sector in other economic sectors.On the other hand, this result also inndicates the current situation of limited digital technology application in Vietnamese enterprises.This study suggests that Vietnam needs policies to develop the information and communication sector and especially promote the digital transformation process to achieve the national digitalized economy goal of 20% of GDP by 2025 and 30% by 2030, respectively.

Keywords - Digital Economy, Measurement, Core Digital Economy, Digitalized Economy, Vietnam.

I. INTRODUCTION

In Vietnam, information and communication technology has been officially considered a key for socio-economic development. In June 2020, the government issued Decision no.749/QD-TTg approving the national digital transformation program. The goal set by the program states that the digitalized economy accounts for 20% of the national GDP by 2025 and 30% of the national GDP by 2030,the proportion of the digital economy in each economic sector GDP is of at least 10%(Vietnam Prime Minister, 2020). The Vietnamese government considers digital transformation across the entire economy crucial for continued growth and prosperity.Therefore, analyzing and measuring the level of sectoral digitalization is extremely important to achieve the set goal.

The paper's objective is to analyze the sectoral digitalization in Vietnam. The study uses theHuawei and Oxford Economics (2017)digital spillover concept for estimation. On the one hand, the research results contribute to the challenging topic of measuring the digital economy. On the other hand, ithelps visualize digital transformation in developing countries and suggests policies to build digital economies in these countries.

The paper is organized as follows. After the introduction, section 2 describes the research model and data and presents the calculation of the model parameters. Section 3 discusses the research results, and finally, the conclusion is presented in section 4.

II. MODELAND DATA

2.1. Model

According toKotarba (2017), to look at the digital transformation perspective, studies are often based on three factors: 1) assets, 2) usage and 3) labor of businesses or economic sectors.Due to data constraints, this effect analysis is based on the production function-based reduced regression model proposed by Vu (2013) which uses sectoral data as follows:

$$GDP\_gr_{it} = \beta_0 + \beta_1 lnGDP\_0_{it} + \beta_2 EMP_{gr_{it}} + \beta_3 ICT_{it} + e_i + f_t + \varepsilon_{it} \quad (1)$$

Where i is the economic sector and t is the time, GDP_gr is the average GDP growth rate of the economic sectors, lnGDP_0 is the log of GDP growth rate at the beginning of the period, EMP_gr is the growth rate average labor growth, ICT is the industry's average ICT usage (share of ICT spending in sector's total intermediate consumption), *e* and *f* represent the impact by sector and time phase.

The coefficient β3 estimated from (1) shows the impact of ICT use on the GDP growth of economic sectors. The study uses this coefficient to determine the contribution of ICT to each economic sector - which can be understood as the digitization level of each economic sector in Vietnam. The size of digital economy in the sectoral GDP can be determined as follows:

$$Sectoral\ digital\ share_{it} = \frac{\beta_3 ICT_{it}}{GDP\_gr_{it}} \quad (2)$$

And the size of digitalized economy can be calculated by the following formular:

$$Digitalized\ economy\ share_t = \sum Sectoral\ digital\ share_{it} \times GDP_{it} \quad (3)$$

Where GDP_{it} is the output value of the sector i in year t.

2.2. Model estimation

Because the model uses panel data, the model form is tested. Two models RE (random effect) and FE (fixed effect) are often considered to be used. The Hausman test results show that the conditions for the RE model are not suitable. Therefore, the study uses the FE model.

Next, the study performed a test of heteroskedasticity. The test generates a small p-value = 0.0000, which proves that the model has a heteroskedasticity problem. The heteroskedasticity and the autocorrelation problem are solved by the cluster(e) command by industry.

The model estimation results in Table 1 show that the explanatory variables all affect the independent variable with statistical significance of 5% and 1%.The signs of the parameters are as expected in theory.

Z_gr	Coef.	Std. Err.	t	P>|t|
lnZ0	-8.7558	7.7309	-1.13	0.071
EMP_gr	.08561	.04520	1.89	0.074
ICT_avr	.09106	.03784	2.41	0.026
f				
2	3.9735	2.4627	1.61	0.123
3	6.0154	4.7163	1.28	0.218
Cons	98.473	82.222	1.20	0.246
Sigma_u	11.0007			
Sigma_e	2.1907			
rho	.9619			
F(5,19)	4.89			
Prob>F	0.0048			
R-sq	0.2747			

Table 1. Model of ICT usage impact on Vietnam sectoral GDP growth

The coefficient of ICT usage is 0.0911.Therefore a 1% increase in the share of ICT spending in an economic sector's total input spending could generate 0.0911% of that sector's GDP growth.Comparing this estimate with Vu's (2013) estimate for Singapore for the period 1995-2005, it can be seen that the coefficient of Vietnam is lower.Specifically, the coefficient estimated by the corresponding FE model in Vu (2013) is 0.179.This can be explained by the fact that Singapore's digital economy is much better than Vietnam's, even in the past.

III. RESULTS AND DISCUSSION

The calculation results in Figure 1indicate the sectors with the highest and lowest digitization level (ICT based GDP growth).For the highest digitalized sectors, in addition to sector Information and Communication (ICT digital content-services industry) (N10), sectors that achieve growth based on digital technology include Professional activities, science and technology (N13), Communist Party activities, socio-political organizations (N15), Art, play and entertainment (N18), and other Service activities (N19). The lowest digitalized sectors include Agriculture, Forestry, Fisheries (N1), Construction (N6), Transportation and warehousing(N8), Accommodation and food services(N9).

The results show that the majority of sectors using ICT are service activities. Sectors such as Agriculture, Forestry, Fisheries (N1), and Manufacturing and Processing (N3) have low usage of ICT products and services.This may not be in line with the strategic goals of Vietnam's economic development.In the socio-economic development strategy for the period 2021-2030, Vietnam sets a target that by 2030, Vietnam's manufacturing industry to be accountable for 30% of GDP and the digital economy about 30% of GDP. These two contents are placed side by side and support each other sinceIndustry 4.0 is expected to enhance labor productivity in general and support economic restructuring from the low-productivity sectors to the high-productivity sectors.

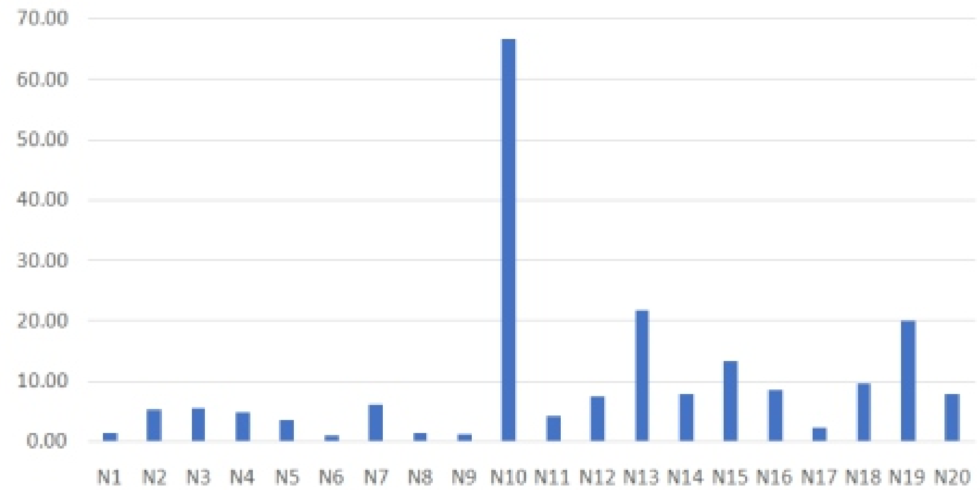

Figure 1: Share of sectoral digitalization in Vietnam 2007-2019 (%)

Table 2 shows the share of the digitalized economy in Vietnam's GDP in the period 2007-2019.The share of the digitalized economy in Vietnam's total GDP has gradually increased over time. In the 2007-2011 period, the digitalized economy accounted for 7.17%. This number increased to 8.03% between 2016 and 2019. On average, for the whole period, the digitalized economy accounted for 7.60% of Vietnam's GDP.

Period	Share of digitalized economy in national GDP* (%)
2007-2011	6.17
2012-2015	7.66
2016-2019	8.03
2007-2019	7.60

Table 2. Share of digitalized economy in Vietnam GDP 2007-2020

Although there are development steps, the growth of the digitalized economy is quite small compared to the development of the ICT industry in Vietnam. Specifically, in the period 2007-2019, Duc, Linh, Hong, and Hieu (2021) pointed out that the ICT industry expanded from 1.5% to 8.0% of national GDP. In other words, the spillover effect of digital technology in the Vietnamese economy has not changed much while the ICT sector has grown remarkably over the past years. The result is consistent with some previous studies.For example, Duc and Linh (2020) examined the spillover effect of the ICT industry by IO analysis and showed that although the impact of the domestic ICT sectors in the Vietnam economy increased over time, it is generally not outstanding in comparison with other sectors.The ICT manufacturing sector is rather self-sufficient, stimulating import rather than added value for the domestic economy.The ICT service-content sector reveals their significant diffusion but due to its small size, the effect is modest.In other words, Vietnam's ICT sector is growing fast, but its services for domestic production are limited.In principle, if the domestic ICT industry cannot meet the domestic demand for ICT products and services, imports can substitute and businesses can still perform a digital transformation. However, Vietnam seems not to be this case. The level of ICT application in Vietnamese enterprises is low which predicts the low level and impact of digital transformation.Most enterprises apply basic ICT services such as computers, email, networks, and websites.Only 6% of enterprises use a sophisticated software system to support production and business(Duc & Linh, 2020).Most Vietnamese firms have not yet applied new digital technologies such as cloud computing, IoT, and 3D printing technology(MOIT-UNDP, 2019).In the socioeconomic conditions of a low-middle-income country, Vietnamese firmsface many difficulties in ICT adoption, such as lack of capital, technology, and human resource. Moreover, awareness of ICT impact is also a challenge for ICT adoption in the country.

IV. CONCLUSION

This study uses the concept of digital spillover to measure the GDP contribution of the core digital economy and digitalized economy of Vietnam.The calculations and analysis give two main results.Firstly, the degree of digitization varies among economic sectors in Vietnam.The leading sectors in terms of digital technology adoption are the technological, scientific and service oriented.Second, although sectoral digitalization has been improving over the last 15 years, but the improvement is not significant.This result on one hand reflect the limited spillover effect of Vietnamese ICT sector in other economic sectors.On the other hand, this result reflects the current situation of limited digital technology application in Vietnamese enterprises.This study shows that to achieve the digitalized economy's national goal to account for 20% of GDP by 2025 and 30% by 2030, Vietnam needs to have continue strengthening the ICT sector because digital technology is a prerequisite fordeveloping the digitalized economy. At the same time, Vietnam needs to promote the digital transformation process in socio-economic activities, accelerating the digital spillover. The digital transformation of Vietnamese firms is still limited, and firms' attitude toward digital transformation is still cautious. Therefore, to promote the digitalized economy, the government first needs to raise awareness of digital transformation among businesses. Furthermore, the training and retraining of human resources for digital transformation should be considered the key to supplying digital labor. The government also needs to pay attention to creating sandbox policies for new products and services associated with digital economy innovations so that businesses can boldly experiment.When it comes to the impact of digital technology and digital transformation on the economy, authors emphasize the spillover effect, that is, the size of the digitalized economy.The core digital economy is just one sector and is predicted to have a limit in size.If ICT as a general-purpose technology (GPT), can penetrate economic activities, it can increase labor productivity, improve operational efficiency, and create new business models with enhanced added value,then its impact can create continuous economic growth.

REFERENCE

[1] Duc, D. T. V., & Linh, D. H. (2020). Analysing ICT Economic Impact in Vietnam. Research in World Economy, 11(5), 14. doi:https://doi.org/10.5430/rwe.v11n5p34

[2] Duc, D. T. V., Linh, D. H., Hong, D. T. T., & Hieu, D. (2021). GDP contribution of sectoral digitalization in Vietnam. Retrieved from

[3] Huawei, & Economics, O. (2017). Digital Spillover: Measuring the true impact of the digital economy. Retrieved from https://www.huawei.com/minisite/gci/en/digital spillover/files/gci_digital_spillover.pdf

[4] Kotarba, M. (2017). Measuring digitalization: Key metrics. Foundations of Management, 9(1), 123-138.

[5] MOIT-UNDP. (2019). Industry 4.0 readiness of industry enterprises in Vietnam. Retrieved from Hanoi:

[6] Vietnam Prime Minister. (2020). National digital transformation program to the year 2025, with orientation to the year 2030. (Decision No. 749/QD-TTg). Hanoi: Government of Vietnam

[7] Vu, K. M. (2013). Information and Communication Technology (ICT) and Singapore's economic growth. Information Economics and Policy, 25(4), 284-300. doi:https://doi.org/10.1016/j.infoecopol.2013.08.002

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PERFORMANCE OPTIMIZATION OF RECTANGULAR MICROSTRIP PATCH ANTENNAS

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ABSTRACT

In this research paper, the performance of Rectangular Micro strip Patch Antennas is improved, which are the most used in Wi-Fi and wireless local area networks (WLAN) applications, due to their ease of manufacture and low cost with their light weight and small size to be placed inside wireless communication devices with some disadvantages, the most important of which is narrow bandwidth. This design focuses on increasing the bandwidth to achieve great performance over a broad frequency range at the frequency of 2.45 GHz. This Rectangular Micro strip Patch Antennas design is presented using a Coaxial-line feed with a dielectric substrate type (Rogers RT5870, εr =2.33, tangent delta=0.0012) with the Use of additional microstrip resonators or extra patch introduction and a modification in the design parameters (Dielectric height=1.5 mm, width patch= 38.08 mm, length patch = 29.9 mm) to get better results in Rectangular Micro strip Patch Antennas performance compared to the actual design parameters in terms of Directivity of the radiation pattern, Gain, bandwidth, VSWR, and return loss. Utilizing computer simulation technologies (CST STUDIO 2021), MATLAB software was used to construct and simulate the suggested rectangular micro strip patch antennas, The proposed antenna appears to match the specifications and exhibit outstanding characteristics for various frequency bands, as well as good radiation patterns and characteristics in pertinent WLAN connections, according to the developed antenna simulation results.

Keywords - Bandwidth, Frequency, Insulating Substrate, Wireless Communication.

I. INTRODUCTION

Antennas are one of the most important parts in the formation of any wireless communication device and the development of low-cost and small-sized antennas to work efficiently within a wide frequency range in communication devices is an important topic that requires a lot of research and study.

In the past few years, the issue of inventing microwave antennas using Micro strip Patch Antennas has attracted increasing attention, this antenna is one of the modern antennas since it was originally applie din the1970s. Researchers have been interested in this type of antenna due to its good specifications and wide use in the field of communications, the development of high-efficiency, low-cost, compact, multiband, and broadband antennas that can be incorporated into wireless products is in high demand. Micro strip Patch Antennas in a Rectangular Shape are one of the shapes and have become one of the most popular antennas for their ease of analysis and installation, as well as for their small size with several types of feeding methods [1].

This antenna usually uses frequencies in the level greater than 1 GHz and is used in many applications such as telephone and satellite devices as well as in aircraft and can operate WLAN with Rectangular Microstrip Patch Antennas WLAN is an IEEE 802.11b-compliant broadband wireless technology that operates at a frequency of 2.45 GHz. and provides a rich set of features with great flexibility in terms of Diffusion options and streaming services.

II. ANTENNA DESIGN

2.1. Antenna geometry design

The Rectangular Micro strip Patch Antennas are comprised of two layers of a well-conductive material, such as copper or gold, separated by an electrically insulating substrate layer, with the first layer acting as a patch and the second as a ground surface, as shown in Fig1, One of the most significant aspects affecting antenna performance Rectangular Micro strip Patch Antennas is the shape, area, and type of the patch material. The substrate also has an impact on the antenna's performance in terms of antenna size, radiation range, gain rate, and directivity. The size of the patch installed in the antenna is determined by the substrate's dielectric constant.

There are different shapes of the patch that have developed, such as hexagonal, circular, square, and rectangular. Antennas in mind and this antenna was designed, to provide the rectangular shape of the patch a successful performance compared to other shapes, and it is the subject of this study, which aims to develop the antenna performance by choosing the best parameters in terms of the type and location of the appropriate feeding and calculating the dimensions of the patch and the type and thickness of the insulating substrate[2] and Add another patch with the same dimensions at a distance from the first patch to reach the required resonant frequency which is 2.45 GHz in a wide frequency bandwidth and overcoming the disadvantages such as low gain, narrow bandwidth, radiating from the edges and surface waves[3].

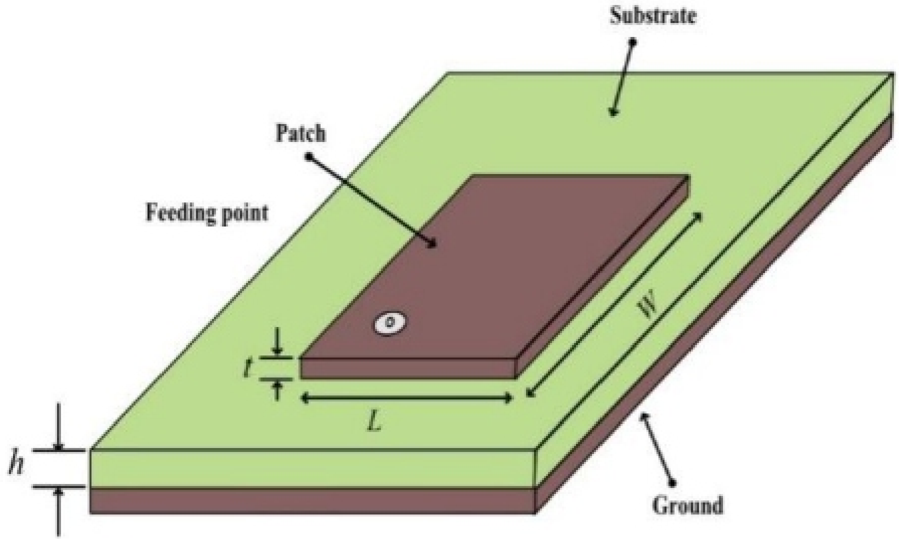

Fig.1. Micro strip Patch Antenna in a Rectangular Shape

2.2. Design parameter of the antenna

In this design, a micro strip antenna was adopted in its rectangular shape with a coaxial feed, and another radiant patch was added with a distance (D) from the base patch to increase the radiated power and frequency bandwidth, as shown in Fig 2, as well as choosing the best design parameters where there are three basic parameters for designing a coaxial feed rectangle micro strip antenna:

the resonant frequency (*fr*) It is the appropriate frequency at which the antenna operates within a specified range and in this design, the resonant frequency is 2.45 Ghz.

Insulation constant for substrate (*Er*) The antenna's size and efficiency are influenced by the substrate's dielectric constant., here the dielectric of material was (*Rogers RT5870*) with the dielectric constant (*Er*= 2.33) and the loss tangent is equal to (0.0012).

substrate thickness (h): The height of the dielectric substrate for an antenna was chosen with coaxial feed in this design to increase the radiated power hence, the height of the dielectric pillar used in the antenna design is (h = 1.5 mm).

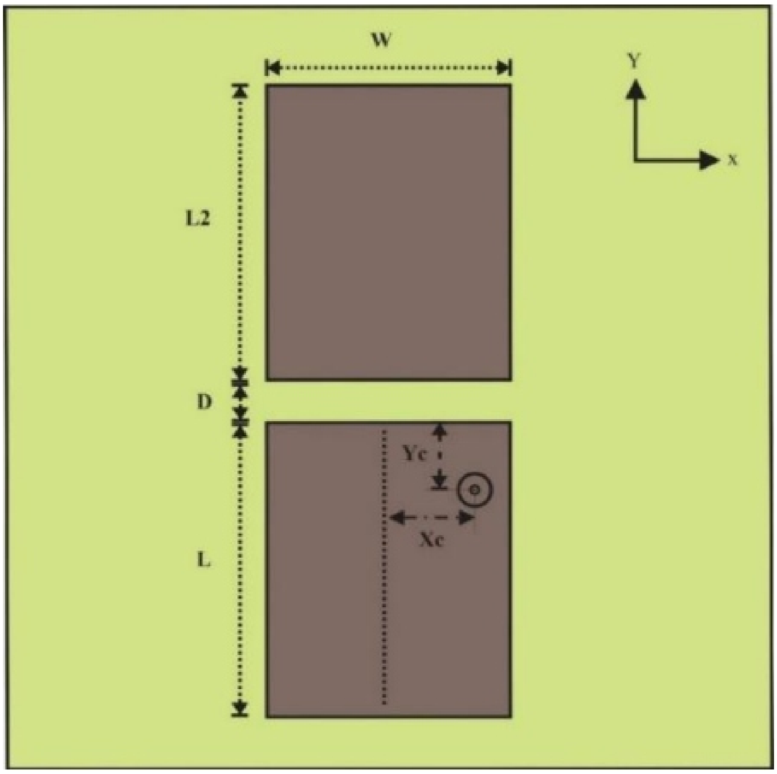

Fig.2. Micro strip Patch Antenna in a Rectangular Shape with the addition of another radioactive patch

2.3. Physical parameters calculation of antenna

The rectangular Micro strip Patch Antenna is built using Microwave Studio (CST) software as shown in the geometry in Fig 3 with a coaxial feed and operates in compliance with IEEE, 802.11/b, 802.11/a, 802.15.1 Bluetooth, and 802.15.4 Zig Bee applications and 802.15.3 UWB, Wi MAX, and 802.11/a/b/g Wi-Fi respectively. The design parameters and dimensions were calculated using MATLAB software to obtain the best impedance and the largest bandwidth according to the equations below by the transmission line method (Balanis, 2005), To ease our design process, the results of each parameter are shown in Table 1.

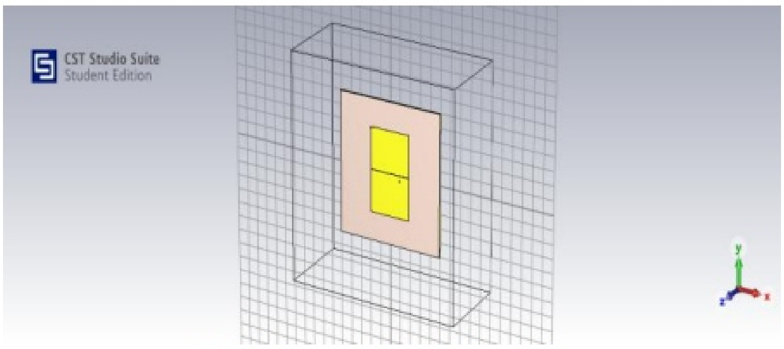

Fig.3. Geometrical Design View

According to (James et al. 1989), the antenna's width of the patch following calculation:

$$w = \frac{c\sqrt{2/\varepsilon_r + 1}}{2f_r} \quad (1)$$

where c represents the speed of light in empty space

According to (Pozar et al, 1995), the following formula can be used to determine the length of the Patch:

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{w}\right]^{-1/2} (2)$$

where εreff = Effective dielectric constant.
εr= Dielectric constant of the substrate.
h = Height of substrate.
w = Width of the patch
Due to the fringing field, the extension of patch length (ΔL) provided by (Ramesh et al, 2001):

$$\Delta L = 0.412h\frac{(\varepsilon_r + 0.3)*(\frac{w}{h} + 0.246)}{(\varepsilon_{reff} - 0.258)*(\frac{w}{h} + 0.8)} (3)$$

$$L_{eff} = L + 2\Delta L, L = \frac{\lambda_0}{2} - 2\Delta L (4)$$

For the construction of the substrate and ground plane, the antenna length and width were estimated by (Huang, 1983,) (Thomas, 2005):

$$L_g = LP + 6h (5)$$

$$W_g = wP + 6h (6)$$

where *Lg* is the ground plane's and the substrate's length, *Wg* the substrate, ground plane, and its width, in Table 1 shows the required design parameters with an impedance(50Ω) value, knowing that all measurements are in millimeters.

Parameters	Descriptions	Value (mm)
w	Width of the patch	29.85
L	the Patch's length	38.095
h	Height of substrate	1.5
D	Distance between patch	0.193
L_2	Width of the patch2	38.095
X_C	x - centre	10
y_c	y - centre	-4

Table 1: Design parameters

III. RESULTS AND DISCUSSION

3.1. Simulation and results

The results obtained from the simulation of the proposed design and according to the assumed parameters are shown in Fig. 4, Where the results were better than those obtained in a previous study (Nuraddeen Ado et al, 2016), which are as follows:

Return Loss(S1,1) = -55.98 dB.
Directivity = 8.218 dBi.
Gain = 7.833 dBi.
Bandwidth at (-10.0) dB=117.21 MHz

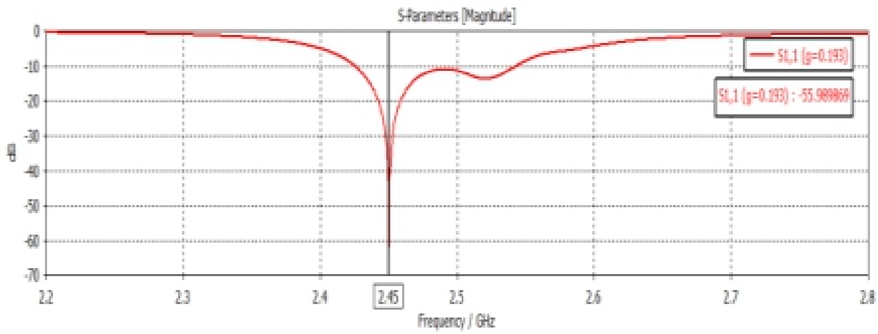

Fig.4. Micro strip patch reflection coefficients [S1, 1] at 2.45 Ghz

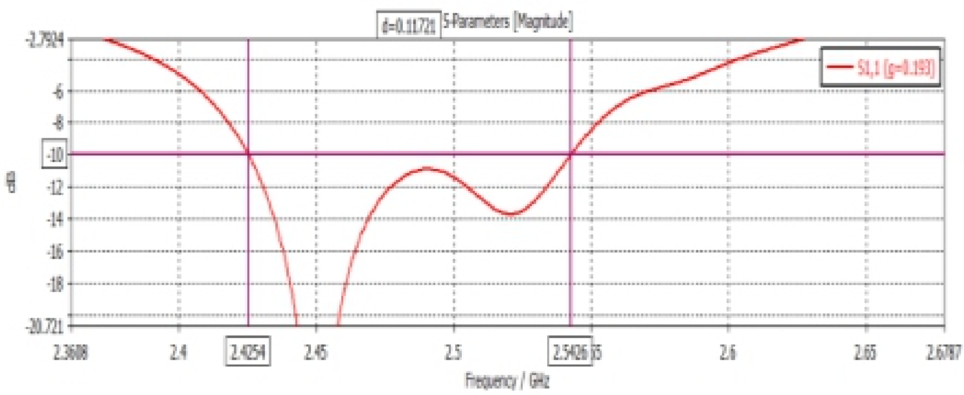

Fig.5. Plot of bandwidth at 2.45 GHz

The bandwidth of 117.21 MHz is accomplished as shown in Fig 4, the antenna covers the WLAN standard IEEE 802.11, and the return loss is equal to -10.0 dB at the resonating frequency of 2.45 GHz.

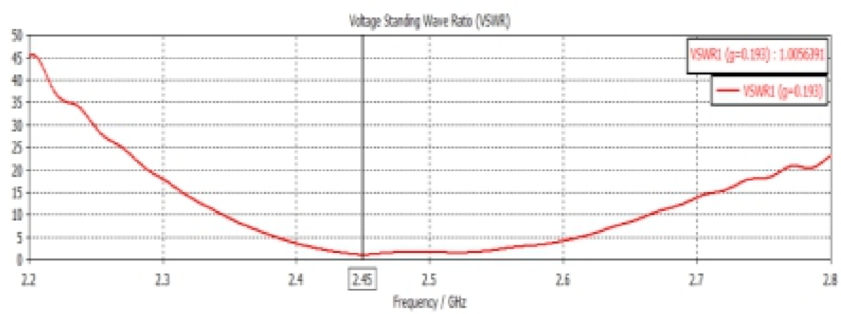

Fig.6. Curve Plot for VSWR

The voltage maxima to voltage minima ratio is known as voltage standing wave ratio (VSWR). The (VSWR) value should range from 1 to 2. The results obtained of coefficient (VSWR) was small enough at frequency 2.45 GHz and where it corresponds to close enough to specified frequencies bands for WLAN applications. Transmission line efficiency is measured using (VSWR) in Fig 5, The suggested micro strip patch antenna's (VSWR) value at the designated resonant frequency is 1.0056.

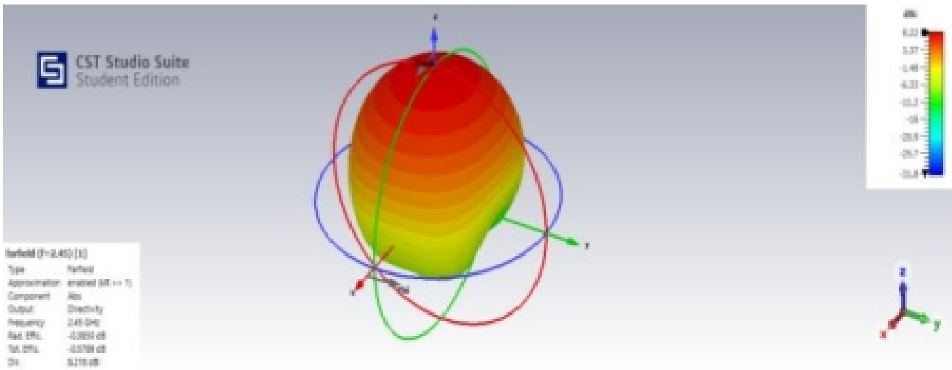

Fig.7. 3-D Patch Antenna Radiation Pattern Directivityat 2.45GHz

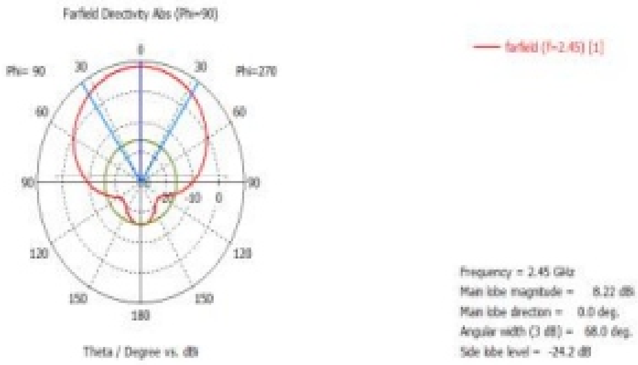

Fig.8. Directivity of the elevation radiation pattern at 2.45 Ghz

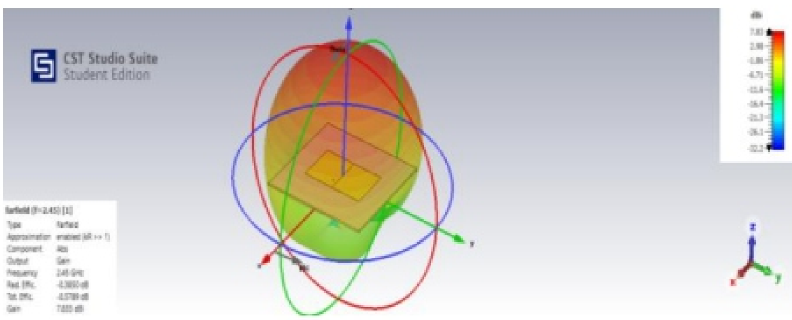

Fig. 9. At 2.45 GHz, the patch antenna's 3-D radiation pattern (gain)

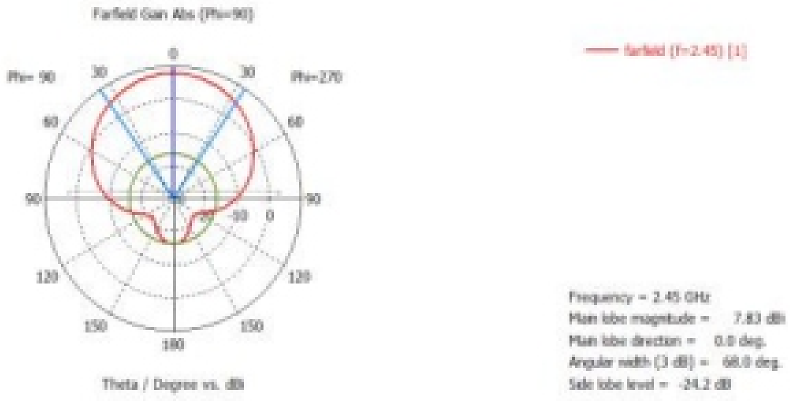

Fig.10. Gain at 2.45 GHz for the elevation radiation pattern

In Fig6, Fig7, Fig8, and Fig9 show the 3D dimensional radiation pattern obtained from the antenna simulation at a frequency of (2.45 GHz), where the radiation pattern that intended antenna has a consistent radiation pattern over the entire operational range with a Gain value is 7.833 dBi and the Directivity value is 8.012 dBi, for the antenna design that is suggested at 2.45 GHz is the resonant frequency.

IV. CONCLUSION

In this paper, a rectangular Micro strip Patch antenna was designed covering the 117.21 MHz frequencyspectrum with a gain 7.833dBi at the frequency of 2.45 GHz, with a fixed radiation pattern without side or back lobes within the bandwidth. It shows good results for the antenna design corresponding to optimal impedance at the central frequency of roughly 50 ohms. The thinness and tiny size of this antenna make it simple to construct on a substrate. This antenna is a solid option for WLAN applications using IEEE 802.11 Wi-Fi standards, IEEE 802.15.1 Bluetooth, and IEEE 802.15.4 ZigBee, thanks to the feed mechanism utilized in this design.

REFERENCE

[1] Constantine A. Balanis, "Antenna Theory Analysis and Design", 3rd Edition, Wiley, 2005.[2] E Aravindraj, K. Ayyappan, R. Kumar, "Performance analysis of rectangular mpa using different substrate materials for wlan application," ICTACT Journal on Communication Technology, Vol. 8, No. 1, pp. 1447-1452, March 2017.

[3] Muhammad Aamir Afridi, "Microstrip patch antenna -designing at 2.4 GHz frequency," Biological and chemical research, vol. 2015, pp. 128-132, March 2015.

[4] Pozar, D. M., Schaubert, D. H., Microstrip Antennas, the Analysis and Design of Microstrip Antennas and Arrays, IEEE Press, New York, USA.1995.

[5] J. R. James and P. S. Hall, "Handbook of Microstrip Antennas", " Vols. 1 and 2, Peter Peregrinus, London, UK, 1989.

[6] Ramesh G, Prakash B, Inder B, and Ittipiboon A, "Microstrip antenna design handbook," Artech House, 2001.

[7] Thomas A. Milligan, "Modern Antenna Design," IEEEInterscience Press, New York, 2nd edition, Ch. 2, 2005.

[8] J. Huang, "The Finite Ground Plane Effect on the Radiation Pattern of MPA". Journal of Antennas and Propagation, IEEE, vol. AP-31, no. 7, pp. 649–653, 1983.

[9] Nuraddeen Ado Muhammad, Yusuf Idris, "Design and analysis of rectangular microstrip patch

antenna for global WLAN applications using MatLab and CST microstudio software," International Journal of Engineering Science and Computing, vol. 6, no. 4, pp. 3732-3737, April 2016.
[10] Application Note Antenna and Propagation Simulation with CST Studio suite.
[11] Matlab 2021.

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BLOCKCHAIN WITHIN HEALTHCARE

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ABSTRACT

Blockchain technology makes it possible to have a distributed, decentralized ecosystem without the need for centralized power. Transactions are safe and reliable because of the application of cryptographic concepts. Blockchain technology has dominated several industries in recent years, largely because crypto currencies are so well-liked. Since it can help unify disjointed systems, enhance the quality of electronic medical data, and adopt an approach that focuses more on patients, the healthcare sector is one where blockchain technology has immense potential. Authentication, security, immutability, distributed ledger, and decentralized storage are just a few of the characteristics that come standard with blockchain. Due to strict regulatory requirements like the Portability of Health Insurance and Accountability Act of 1996, blockchain applications in the healthcare industry typically require stricter criteria for authentication, interoperability, and information sharing (HIPAA). Numerous facets of health and welfare might be improved by blockchain technology. These include medical insurance, medication tracking, clinical trial tracking, and device monitoring. In a blockchain infrastructure for device monitoring, hospitals may keep track of their assets over a gadget's entire lifecycle. The information acquired may then be applied to enhance patient safety and offer post-market analysis to optimize cost savings. Numerous healthcare applications based on blockchain are described in this article, such as supply chain transparency, smart contracts, credential verification, and electronic health records that are centered on the needs of the patient.

I. INTRODUCTION

Every facet of information and communications technology (ICT) is influenced by the blockchain network, and utilization has surged considerably in recent years. The primary factors influencing involvement in and the advancements of this technology have been the exponential growth in the worth of cryptos and sizable private equity holdings in start-ups. This technology industry is expected to grow through 2021.

The first digital currency was Bitcoin. It that transactions are carried out and distributed and does not require a reliable central authority. Since public keys are utilized, no one's identity needs to be disclosed. An integral component of the Bitcoin system is miners, who are compensated with bitcoins for completing computing chores to validate and store activity on the network. Bitcoin and other cryptocurrencies are only one use of blockchain technology. In a nutshell, the blockchain, the protocol, and the currency are the three ideas that need to be distinguished in a cryptocurrency. A coin can use the network of another coin, such as Ethereum or Bitcoin, while still creating its currency and system.

In the cryptocurrency space, it serves as a distributed ledger that keeps track of all coin activities. As a result, as additional blocks are added over time, such a blockchain continues to expand. The majority of well-known cryptocurrency blockchains are accessible to everyone, and you mayquery their transactions using websites like blockchain.com, which allows you to do so for the

Bitcoin blockchain.The early versions of blockchainbased cryptocurrencies like Bitcoin are included in the first generation of blockchain technology, sometimes referred to as blockchain 1.0. Another blockchain 1.0 technologies include Dash, Monero, and Litecoin, to name a few.

The two aspects of blockchain 2.0, the updated version of the technology, are smart properties and smart contracts. The smart properties are those digital assets or properties whose ownership may be handled via a blockchain-based platform, and the smart contracts are the software programs that store the rules that govern how they are monitored and maintained. Cryptocurrencies like Ethereum, Ethereum Classic, NEO, and QTUM are examples of blockchain 2.0. Proceeding from the above, blockchain 3.0, the third iteration of blockchain technology is currently oriented on non-financial applications.

To this purpose, attempts have been undertaken to expand the technology's potential applications outside of banking, allowing other sectors of the economy and use cases to gain from blockchain's intriguing qualities. As a result, blockchain is currently viewed as a multipurpose technology with applications in a number of different fields, including a few of which are supply chain management, identity management, dispute resolution, contract administration, insurance, and healthcare.

II. BACKGROUND

We discuss the basic concepts of blockchain technology in this portion so that you can grasp the remainder of the text.It was introduced simultaneously with Bitcoin and overcame the double-spend problem, a long-standing vulnerability. In the case of Bitcoin, this is executed by coming to an agreement with the greater part of the so-called mining nodes and adding genuine transactions to the blockchain. Blockchain technology was first used for cryptocurrencies. However, introducing a cryptocurrency is not necessary to use the system and create decentralized networks.The fundamental traits and constituent parts of the blockchain will be discussed in the following subsections[18].

III. BLOCKCHAIN—DISTRIBUTED LEDGER TECHNOLOGY

A series of blocks with timestamps connected by cryptographic hashes is referred to as a blockchain[17]. These blocks are securely and irreversibly sealed. Each subsequent block has a hash value reference to the information in the one before it, and as the chain lengthens, fresh blocks are regularly added to the end. The shareholders of the blockchain are also known as the nodes. Every node possesses two keys: a public key for message encryption delivered to it and a private key for decrypting communications and enabling a node to read them.Thus, a blockchain's consistency, irreversibility, and non-reputability are ensured via the public key encryption process. The messages encoded using the matching public key can only be decrypted with the correct private key. The term "asymmetric cryptography" refers to this idea. A more thorough explanation can be obtained in, as it is beyond the scope of this study to provide one.

The purported hash links each block in the chain by a unilateral cryptographic hash function (e.g., SHA256)[1]. A node signs each transaction it does before broadcasting it to the network for confirmation. Authentication and transaction integrity is provided via the digital signature of an exchange using the secret key. The second is caused by a data transmission issue that prohibits decryption from happening since only users with a certain private key may sign the transaction (i.e., verifying a specific digital mark)[9].

When the chain uses a particular consensus process, such as proof of work or stake, specific nodes, which are referred to as miners, organize and bundle the transactions that have been distributed and are deemed acceptable by the network into time-stamped blocks.The consensus method controls the choice of miners and the data that is included in the block. The validation nodes use the related hash to validate the blocks as they are broadcast to the chain to ensurethat the additional block contains valid transactions and correctly refers to the previous block in the network.

The purpose of network nodes is now at our fingertips. When a node begins to link and communicate with other nodes in the network, the proper word would be a peer node because of its similar type of network structure. We shall now refer to it as a "node" for the sake of clarity. A machine running a complete replica of the blockchain ledger and with the primary blockchain client installed is referred to as a full node[1].

A node is how a user connects to the blockchain network to interact with it. Since every miner must run a fully operating node, the miners stated earlier are a subset of nodes. As a result, every node is a miner, but not every miner is also a node. This scenario has been observed in a particular sort of public blockchain that uses the proof-of-work consensus. A different blockchain network, such as a proof-of-stake (PoS) network, which uses different decentralized consensus models, has no need for mining the basic duties of a peer node.

joining the blockchain network
Maintaining the latest ledger
keeping eye on transactions
transmitting valid transactions
keeping an ear out for freshly sealed blocks
verifying newly fresh blocks
validation of transactions
Generating and transmitting new blocks

IV. TYPES OF BLOCKCHAINS:

According to the controlled data, its accessibility, and the user operations that may be carried out, there are generally three sorts of blockchains.

These consist of

1. public (Open),
2. consortium,
3. private.

All of the data in the permissionless blockchain (sometimes known as just public) is visible to and accessible to the whole public. To protect a participant's anonymity, some portions of the blockchain may be encrypted. Anyone can join a public permissionless blockchain and participate as a simple node or a miner without needing to get permission (node). Blockchains of this type are typically provided as a financial incentive, such as in cryptocurrency networks. These blockchains come in the form of Bitcoin, Ethereum, or Litecoin[1].

Only a limited number of nodes can participate in the distributed consensus process on a blockchain of the consortium type[19]. It may be used in a single industry or in numerous. When a consortium blockchain is created inside a certain sector of the economy (like the financial sector), it is accessible to restricted public usage and is only partially centralized. Contrary to what is a consortium amongst industries (such as insurance firms, Investment banks, and governmental organizations) is made available or usage by the general public while yet maintaining a somewhat centralized trust.On a private blockchain, networks may only be joined by chosen nodes. As a result, the network is both scattered and centralized. Private blockchains are permissioned networks that limit which nodes can process transactions, carry out smart contracts, or take part in mining. They are all controlled by the same reliable organization. It is utilized for individual needs. Blockchain technologies that solely enable private blockchain networks are Ripple and Hyperledger Fabric. Be aware that these divisions are still up for debate and that various definitions may be found in the literature.

Depending on their use, blockchains can be divided into two categories: those used to track digital assets (like Bitcoin) and those used to execute specific logic (i.e., smart contracts).Tokens are used by some blockchains (such as Ripple, Bitcoin, and Ethereum), but not by others for example Hyperledger

Fabric[18].

V. DISTRIBUTED CONSENSUS PROTOCOLS:

The distributed ledger's state and the method for putting data into blocks must both be agreed upon by the peers of the blockchain network for it to continue operating. A distributed consensus system, which validates the chronological order of generated transactions, is what is known as such an agreement[19]. It ensures that the shared ledger's precise state and, consequently, the order in which new blocks are added are agreed upon by the majority of peers in the blockchain network[19].The method by which a network selects the peer who will prepare and seal the most recent block is described in a distributed consensus protocol, which contains data that has not yet been validated and formatted. The easiest method is to choose it at random, but this method is ineffective in terms of network durability and may potentially put the network at risk because peers could decide to launch an attack on the entire network. The principle underlying Proof of work, Proof of stake, and other similar protocols are that each miner makes a valuable contribution, and the best miner gets rewarded. The prize encourages rivals to verify each other's work and valuables in a competition that also reduces the likelihood of an attack[19].

The Bitcoin network employs the PoW consensus protocol. It chooses a peer by using processing power as a mechanism. Hashing unconfirmed transactions is the basis for peer competition. As a result, a peer's probability of selection is proportional to its processing capacity. A reward is given to a peer each time it succeeds and is selected. 12.5 freshly created bitcoins are credited to the chosen miner’s account as a current incentive in the Bitcoin network. The output of the hash must match a predetermined state to be valid. A miner broadcasts the freshly created block on the chain if it achieves the necessary value. Then, it isverified by other peers, and if accurate, it is duplicated throughout the network.

The Proof of stake algorithm is built on the resources that each peer has (i.e. a peer's share in the network value that is under their control.). The probability that a peer will be selected to confirm a fresh block is proportional to its stake. In actuality, this is accomplished by requiring a peer to freeze a threshold amount of stake. This grants an entry for the node. The winner is selected from a set of competitors who have tickets in a deterministic pseudo-random manner. Since the competition in this instance is not reliant on the processing capacity of the peers, it uses less energy than PoW. But this strategy resembles a shareholder business, where the wealthy have an edge. This works well because a peer is reluctant to attack the network since it would rather attack its stake. There are various iterations of the proof of stake algorithm, and each one offers a uniquemethod for selecting the peer to guarantee fairness.The Distributed PoS is one of these variations (DPoS).The nodes build the distributed consensus and afterward concur on specific rules since the system serves as an agreement procedure that keeps the nodes in sync.

VI. NEED FOR BLOCKCHAIN IN HEALTH CARE

Health care is among the areas where blockchain is regarded to have a lot of promise. Attempts to reform healthcare must focus on growing info that may profit from being able to link multiple systems and increase the precision of EHRs[1]. By using blockchain technology, it is possible to control access, share data, and maintain a record of all medical activities. Additionally, it can help with prescription medication management, pregnancy and risk data management, supply chain management, and access control. All aspects of healthcare that might benefit from blockchain technology include clinical trials, medical record exchange, provider credentialing, medical billing, and anti-counterfeiting drugs. To complement the patient-centric paradigm, healthcare service delivery is transforming. Since patients will have authority over their medical information, blockchainbased healthcare systems might improve the security and dependability of patient data. The aggregation of patient data using these technologies may make it easier for different healthcare institutions to share medical information. In the healthcare industry, it is crucial to store patient medical information.

Due to their extreme sensitivity, these data make for a lucrative target for online attacks. Securing all sensitive data is crucial. Control of data is another issue, which should ideally be handled by the patient[10]. A further application that can profit from cutting-edge contemporary technologies is the exchange and control of patient healthcare data. Blockchain technology offers a variety of access control strategies and is very resistant to attacks failures. Blockchain thus offers a useful platform for healthcare data.A private blockchain would be the most suitable sort of blockchain for confidential medical data. A blockchain may be used, according to the Würst and Gervais decision model, when numerous parties don't believe one another ought to interact and exchange similar data but do not wish to incorporate a reliable third party. When determining if a certain scenario calls for blockchain, their model outlines several characteristics that must be taken into account.Several elements (questions) need to be taken into account when it comes to storage:

Is it necessary to save information?

Is access to numerous writes needed?

Does there exist a trusted third party? Can you utilize one that is always online?

First, we must meet the demand for data storage. Then, a decision must be made on the need for several parties to have writing access. There is no need for a blockchain when there is simply one writer, and alternative solutions can be explored accordingly. It should be mentioned that a blockchain performs worse than conventional databases. There is no need for blockchain if a TTP is readily available, constantly accessible, and completely trustworthy.

What kind of blockchain should be utilized can also be determined using the Gervais - Würst model (e.g., public, private, or consortium). A public permissionless blockchain would be the only obvious option if the authors were unknown. If the TTP is inaccessible when it might perform as a certifying authority, and when the parties involved do not trust one another, a permissioned blockchain could be employed.

However, a shared-access database might be utilized in place of a blockchain provided all participants have mutual trust in one another. The first is used when public verifiability is required, and the second is used when it is not. Please be aware that these model components assume that the first three previously stated problems are satisfactorily addressed; otherwise, establishing a blockchain is not essential.Most of the present Healthcare system is based on trustworthy third parties. These can't always be completely trusted. A potential answer to this issue is the blockchain[1].

VII. POTENTIAL USES CASES IN THE HEALTHCARE SECTOR:

1. Supply chain transparency:

Healthcare and many other industries place a high priority on confirming the provenance of medical products in order to confirm their validity. Customers can have absolute visibility and transparency of the products they are receiving owing to the introduction of the system to monitor goods from the stage of building and at each step along the supply chain.

This is a significant issue for the business, particularly in developing countries where fake prescription drugs result in tens of thousands of fatalities annually. It is becoming increasingly crucial for medical equipment as well, which is rapidly expanding and attracting the attention of dishonest actors, as more remote health monitoring is introduced. Businesses in the prescription medicine supply chain may uphold the validity of prescriptions, as well as their expiration dates and other useful particulars, thanks to the leading blockchain platform MediLedger. Advantages of the blockchain (when used with Artificial Intelligence) Customer assurance: Each shipment may be tracked by the client from the beginning due to connection with manufacturers, wholesalers, shippers, etc.Compliance: In order to maintain patient safety, pharmaceutical companies and medical device makers must submit a lot of reports. By combining supply chain data into one system, compliance can be made easier. For instance, when an issue is found, FarmaTrust's blockchain-based technology automatically informs law enforcement.Supply Chain Optimization: Businesses utilize AI to more precisely forecast demand and modify supply when all the information is in one location.

2. Patient-centric electronic health records:Healthcare systems throughout the world are plagued by the issue of data silos, which only provide patients and their medical providers with a limited view of their medical history. According to data from Johns Hopkins University published in 2016, medical mistakes stemming from poorly coordinated treatment, such as actions not executed as anticipated or omissions in patient records, were the third biggest cause of mortality in the US.

Johns Hopkins study from 2016 on the percentage of US deaths attributable to medical errors One solution to this problem is to create a blockchain-oriented medical records system that would be connected using existing electronic systems and function as a thorough, single view of a patient's record. It is crucial to emphasize that every new product included in the blockchain, whether a prescription, a note from a doctor, or perhaps a test result, is transformed into a unique hash function, or a quick stream of letters and numbers. Real patient data is not, however, kept on the blockchain. Each hash function is distinct and can only be broken down with the approval of the data's owner.In this case, a transaction is logged on the blockchain every time a patient record is amended or they consent to share some of their medical information.

Medicalchain is a prime example of a company working alongside healthcare providers to create EMRs that are blockchain-enabled. These are the main advantages of blockchain-enabled EMRs:

A thorough, accurate, and centralized repository for patient medical records benefits both patients and healthcare professionals they provide patients the chance to see how often their records are amended and give their express approval to any disclosure of such particulars to others or to medical personnel. The patient may also set time limits on how long anybody outside the organization may view their medical records, who can also decide to disclose all or a portion of their medical records to researchers. Without the time and expense of a middleman, medical insurance can get rapid, verified confirmation of healthcare services from patients.Medicalchain is developing not only blockchain based medical records but also a platform on which other businesses may create digital health solutions. In order to promote the creation of digital health applications like population-level analytics solutions, these solutions involve a virtual counseling service and a data exchange where patients may elect to trade their anonymized medical data.The adoption of much more thorough, digitalized, and shared people's health records is going to have a substantial influence on the healthcare industry by enabling more advanced analytics. For instance, personalized medicine is a promising topic, but the scarcity of sufficient high-quality data seriously impairs its development. A considerably more robust segmentation and analysis of the outcomes of targeted treatment would be possible with access to dependable and widely disseminated population-level data.

3. Smart contracts for supply chain settlements and insurance

Companies like Chronicled and Curisium provide blockchain-based systems so that various stakeholders in the healthcare sector, can verify their organizational identities, record contract data, track exchanges of goods and services, and determine just how much paid for those goods and services. Beyond only managing the supply chain, this kind of environment also enables insurance companies andtrading partners to function in the healthcare industry under entirely digital and, in some circumstances, automatically generated contract conditions.They can significantly decrease disagreements over payment refund allegations for prescription meds and other commodities by having shared cloud-based agreements between makers, resellers, and healthcare institutions that are recorded on a blockchain network as opposed to every person having their own copy of contracts.

Due to the frequent changes in price structures, approximately 10 lacs chargeback claims aregenerated between these players each year, of which more than five % are challenged and require timeconsuming manual settlement.Similar to how shared smart contracts may be used to handle patient insurance contracts, 10% of which, per the Curisium, are under dispute. Insurance providers may apply more advanced analytics to improve healthcare outcomes and costs if this data has been digitized and is easily accessible, like in many other use cases.

4. Medical staff credential verification:

This technology may be used to monitor the competence of medical experts in a manner comparable to tracing the origin of a medical commodity. Reputable healthcare organizations and institutions have the ability to record the staff members' qualifications, which streamlines the hiring process for these organizations. Such a medical credential verification system was created by USbased ProCredEx using the R3 Corda blockchain protocol.

The blockchain system's main advantages include: Quicker credentialing throughout the recruiting process for healthcare organizations and A chance for healthcare organizations, insurance companies, and medical facilities to make money off of their current credentials and information on former and current employees. Transparency and assurance for partners, such as companies using locum tenens as a subcontractor or online digital health delivery models that let patients know about the qualifications of the medical personnel

VIII. FUTURE TRENDS

Researchers must create additional proofs-of-concept and prototypes because the use of Blockchain technology is currently in its youth in healthcare. It will give a better understanding of the technology as it relates to healthcare. According to current trends in blockchain research in healthcare, other uses of the technology, such as managing supply chains or managing prescription medicine orders, are much less common than data exchange, access control, and health records. Therefore, blockchain still has a lot of untapped potential. Most research uses blockchain technology in healthcare and proposes a new framework, design, or paradigm.

Additionally, technical information, such as the blockchain platform, consensus method, type of blockchain, or use of smart contracts, is frequently omitted. In particular, smart contracts might be employed more because they enable processes to be managed on a blockchain. Blockchain technology in medical care is still in its development. Thus there is still room for new applications and study. In conclusion, blockchain should continue to be utilized in circumstances where it makes sense and is required.

IX. CONCLUSION

The ability to modify the current healthcare systems from highly centralized to distributed, secure, decentralized systems that can aid in the improvement of healthcare as well as applicable services is provided by blockchain technology when blended with other modern technologies. First off, it helps in ensuring patient privacy while providing transparent data to all stakeholders. Vital medical records can no longer be altered by malicious attackers, and they are also protected from data theft and surveillance. Additionally, Healthcare solutions built on the blockchain can also offer affordable and secure services.

Blockchain may be applied to new processes or enhanced protocols, paying special consideration to risk management. As a result, we may conclude that blockchain technology plays an important role in the healthcare business.

REFERENCE

[1] A Systematic Review of the Use of Blockchain in Healthcare by Marko Hölbl, Marko Kompara, Aida KamišalićandLili Nemec Zlatolas

[2] Blockchain in healthcare applications: Research challenges and opportunities By Thomas McGhin, Kim-Kwang Raymond Choo, Charles Zhechao Liu, and Debiao He.

[3] Applications of Blockchain Within Healthcare By Liam Bell, William J Buchanan, Jonathan Cameron, and Owen Lo.

[4] Blockchain in healthcare By Maria Prokofieva, Shah J Miah

[5] Blockchain in Healthcare: Insights on COVID-19 by Antonio Fusco, Grazia Dicuonzo, Vittorio Dell'Atti, and Marco Catullo.

[6] Blockchain for Healthcare: The Next Generation of Medical Records? By Claude Pirtle & Jesse Ehrenfeld.

[7] Blockchain Technology in Healthcare: A Systematic Review by Cornelius C. Agbo, Qusay H. Mahmoud, and J. Mikael Eklund.

[8] Blockchain in Healthcare: A Patient-Centered Model By Hannah S Chen, Juliet T Jarrell, Kristy A Carpenter, David S Cohen, and Xudong Huang.

[9] Blockchain in Healthcare By Vikram Dhillon, David Metcalf & Max Hooper.

[10] A Systematic Review of Blockchain in Healthcare: Frameworks, Prototypes, and Implementations By EMEKA CHUKWU AND LALIT GARG.

[11] A Taxonomic Review of the Use of IoT and Blockchain in Healthcare Applications By K.Azbeg, O.Ouchetto, S.J.Andaloussi, L.Fetjah.

[12] The benefits and threats of blockchain technology in healthcare: A scoping review Israa Abu-elezz, Asthma Hassan, Anjanarani Nazeemudeen, Mowafa Househ, Alaa Abd-al Razzaq.

[13] Chapter One - Blockchain Technology Use Cases in Healthcare By Peng Zhang, Douglas C. Schmidt, Jules White, Gunther Lenz.

[14] Comparison of blockchain platforms: a systematic review and healthcare examples. By Tsung-Ting Kuo, Hugo Zavaleta Rojas, Lucila Ohno-Machado.

[15] S2HS- A blockchain-based approach for the smart healthcare system. By Gautami Tripathi, Mohd Abdul Ahad, Sara Paiva.

[16] A Blockchain-Based Smart Contract System for Healthcare Management by Asma Khatoon https://www.mdpi.com/2079-9292/9/1/94

[17] Aste, T.; Tasca, P.; Di Matteo, T. Blockchain Technologies: The Foreseeable Impact on Society and Industry. Computer 2017, 50, 18–28. [Google Scholar]

[18] Raval, S. Decentralized Applications: Harnessing Bitcoin's Blockchain Technology, 1st ed.; O'Reilly Media, Inc.: Sebastopol, CA, USA, 2016. [Google Scholar]

[19] Zheng, Z.; Xie, S.; Dai, H.; Chen, X.; Wang, H. An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends. In Proceedings of the 2017 IEEE International Congress on Big Data (BigData Congress), Boston, MA, USA, 11–14 December 2017; pp. 557–564. [Google Scholar]

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DIABETES PREDICTION USING DIFFERENT ML MODELS

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ABSTRACT

Diabetes is one of the biggest causes of mortality, disability, and economic loss worldwide. Type 2 diabetes is the most frequent type of diabetes (90–95 percent globally). However, it can be avoided or postponed by receiving competent treatment and therapies, which include an early diagnosis. There has been significant progress in the field of various machine learning methods, especially for diagnosis. Several computerized information systems for predicting and diagnosing diabetes were described, each utilizing a different classifier. Choosing valid classifiers clearly improves the system's precision and proficiency. During this study, we present an approach that mixes four classifiers (i.e., a random forest classifier, a decision tree classifier, a logistic regression model, and the K-nearest neighbor model) to diagnose diabetes. The accuracy obtained for the Random Forest Classifier is 90.47 percent, which is higher than that of Logistic Regression, K-Nearest Neighbor, and Decision Tree.

Keywords - Diabetes prediction, Hybridization, Decision Tree, Logistic Regression, K-Nearest Neighbor, Random Forest Classifier.

1 INTRODUCTION Changes in lifestyle and urbanization have resulted in tremendous changes in civilizations, political institutions, the environment, and human behaviorover the last five decades. [1] Due to this, the number of diabetics has significantly grown. Diabetes is a dangerous, chronic condition that arises when the pancreas fails to generate enough insulin (a hormone that regulates blood sugar levels or glucose) or when the body fails to utilize the insulin that is produced adequately. [2, 3]. Raised blood glucose, a typical side effect of untreated diabetes, can cause catastrophic damage to the heart, blood vessels, eyes, kidneys, and nerves over time. Diabetes affects over 400 million individuals worldwide. [3].

Type 2 diabetes mellitus (T2DM), generally known as adult-onset diabetes, can strike at any age, including children. However, it is more frequent in elderly, middle-aged, and overweight adults. Insulin resistance arises in adipose, muscle, and liver cells in T2DM, causing cells to be unable to utilize insulin to transport glucose into the body's cells for energy utilization. [4]Recent advancements in machine learning have dramatically increased computers' capacity to recognize and classify images, recognize interpret speech, play games requiring skills and a higher IQ, anticipate illnesses, and make better decisions based on data. The goal of these machine learning applications is often to teach a computer to perform as well as or better than humans.

Traditionally, supervised learning methods are used for training the model with labeled data, followed by testing data for assessment [5].As different machine learning algorithms are suitable for different sizes and kinds of data and have limitations [5].

By building predictive models using diagnostic medical datasets gathered from diabetes patients, machine learning approaches deliver efficient outcomes for extracting knowledge. Knowledge extracted from those kinds of datasets can be used to predict diabetes in individuals. Diabetes mellitus may be predicted using a variety of machine-learning approaches. [6]

However, selecting the appropriate approach to forecast based on such traits is quite challenging. To predict diabetes mellitus, in this paper we use four major machine learning methods, namely the random forest classifier (RF), the decision tree (DT) classifier, the logistic regression, and the K-nearest neighbor (KNN) classifier. [6]

This paper discusses predictive analytics in healthcare. For experimentation purposes, a large dataset of healthcare is obtained, and different machine learning algorithms are applied to the dataset. The performance and accuracy of the Applied algorithms are discussed according to the nature of the dataset.[5]

The study's goal is to offer readers a sufficient grasp of how the healthcare business might use big data analytics for better decision-making or illness prediction. Second, the performance of machine learning algorithms in predictive analytics for diabetic illness is evaluated.[5]

The body of the paper is structured as follows:Section II outlines the related work.Section III describes the machine learning methods employed.

Section IV describes the approach.

Section V shows the evaluation process.

Section VI discusses the findings.

Finally, Section VII brings this paper to a close.[5]

II. RELATED WORKS

Many scholars from across the world have conducted research and proposed numerous methods and algorithms for diabetes prediction. In this part, we will look at some research done by scientists to anticipate diabetes.

In [7] C. Kalaiselv et al. employed ANFIS with adaptive group-based KNN for diabetes diagnosis and cancer prediction. The accuracy achieved was about 80 percent.

The author of [8] employed a variety of algorithms to predict diabetes. In this research, logistic regression surpasses other computational intelligence approaches and has the greatest classification accuracy of 78 percent, while another algorithm, ANN, has the second-highest classification accuracy of 77 percent.

M. Nirmala Devi et al. in [9] proposed an amalgam KNN model for improved diabetes prediction.In [10], K. Deepika et al. used different algorithms to perform predictive analysis, including support vector machines (SVM), Nave Bayes, artificial neural networks, and decision trees, for the prediction of chronic disease diabetes, with the decision tree algorithm providing the highest efficiency of around 87.46 percent based on their experimental results.

In this research, we examine several variables in the dataset and use multiple machine-learning methods to predict diabetic sickness.

III. BACKGROUND STUDY

We employed four machine-learning methods in this paper. KNN, Logistic Regression, Decision Tree, and Random Forest are the four. Some brief information about the four of them is given below.

A. KNN

The K-Nearest Neighbors algorithm (or KNN) is one of the most widely used learning algorithms thanks to its simplicity. The KNN supervised learning algorithm is both a non-parametric and a lazy learning algorithm. For the prediction of the classification of the new sample point, it uses data from several classes. KNN doesn't make any assumptions about the information being studied and therefore is non-parametric; specifically, this model is distributed from the information. KNN will be employed in both regression and classification problems.

B. RANDOM FOREST

Random Forest is a supervised machine-learning algorithm that is commonly used in both regression and classification applications. It constructs decision trees from several samples, employing the majority of votes for classification as well as the average for regression. In the case of regression and classification, one of the most essential properties of the Random Forest algorithm is its ability to process datasets including both categorical and continuous variables. It produces better results for categorizing jobs. Random forests are created using data subsets. The outcome is determined by average or majority rating, which eliminates the issue of overfitting.

C. DECISION TREE

A decision tree is a supervised learning model that can be employed for both regression and classification problems. It is a classifier with a tree structure that is commonly used to resolve classification problems. Internal nodes represent dataset properties, whereas branches represent decision rules, and the result is represented by each leaf node. The two nodes in the decision tree are the decision node and the leaf node. Decision nodes are used to make decisions and always have several branches, whereas the decisions' outcomes are leaf nodes with no more branches. The decision tree derives its name from its resemblance to a tree. It starts with the root node and expands into branches, much like a tree. This entire structure is reminiscent of a tree.

D. LOGISTICS REGRESSION

One of the most commonly used ML algorithms is logistic regression. It is classified under" supervised learning." The method of logistic regression is used to predict the outcome of a category-dependent variable based on a set of independent variables. As a result, the output must be either categorized or discrete. That is, it can be 0 or 1, yes or no, and so on. Instead of an exact outcome, such as 0 or 1, it returns probable values ranging between zero and one. Apart from the method of application, logistic and linear regression are very similar. Logistic regression is applied to answer classification problems, whereas linear regression is used to address regression problems.

IV. METHODS AND MATERIALS

The following procedures must be taken in order to predict diabetes mellitus using machine learning.

1. Dataset Collection (DC)
2. Data Pre-processing (DP)
3. Clustering (CL)
4. Build Model (BM)
5. Evaluation (EVA)

Let us take a closer look at each phase.

A. Dataset Collection

This module contains data collection and information understanding to check trends and patterns that aid in forecasting and assessing results. Diabetes is a dataset with 253,680 entries and 22 characteristics.

B. Data Pre-processing

In this step, we deal with inconsistent data to obtain more precise and exact findings. There are some missing values in this dataset. Because several characteristics, such as glucose level, skin thickness, pressure, age, and BMI, cannot have zero values, we imputed the missing values. The dataset is then scaled to standardize all values.

C. Clustering

In this step, we used K-means clustering on the dataset tocategorize each patient as diabetic or non-diabetic. Prior to executing K-means clustering, significantly associated characteristics such as glucose and age were discovered. These two properties were clustered using K-means. We obtained class labels (0 or 1) for all of our records after implementing this clustering.

Algorithm:

• Select the number of clusters (K) and collect the data points.

• Randomly position the cluster centers(centroids) c1, c2,..... ck.

• Steps 4 and 5 should be performed until a set number of
iterations is reached. For each xi data point:

– Locate the closest centroid(c1, c2,..ck).

– Put the point in that cluster.

• for each cluster j = 1..k

• new centroid = the average of all the points allocated tothat cluster.

D. Model Building

This is the most significant step, which includes the development of diabetes prediction models. We applied multiple machine learning techniques for diabetes prediction in this. Random Forest Classifier, Decision Tree Classifier, Logistic Regression, and K Nearest Neighbor are among the algorithms used.Algorithm: Diabetes prediction using several machine learning algorithms. Randomly generate training and
test sets.

Specify the algorithms that will be utilized in the
model.

MN=[KNN( ), DTC( ), RandomForestClassifier(),
LogisticRegression()]
for(i=0; i¡15; i++) do
Model= MN[i];
Model.fit();
Model.Predict();
print(Confusion−Matrix, Accuracy(i),
Classification−Report);End

V. EVALUATION

This is the last step. In this section, we assess the prediction outcomes using several metrics, such as classification accuracy, confusion matrix, and f1-score.

A. Classification Accuracy

It refers to the fraction of accurate predictions compared to the overall number of samples used. It is expressed as follows:Accuracy = Number of Correct Predictions / Total Number of Predictions Made

B. Confusion Matrix

It produces a matrix for us to analyze as an output, which details the model's whole performance.

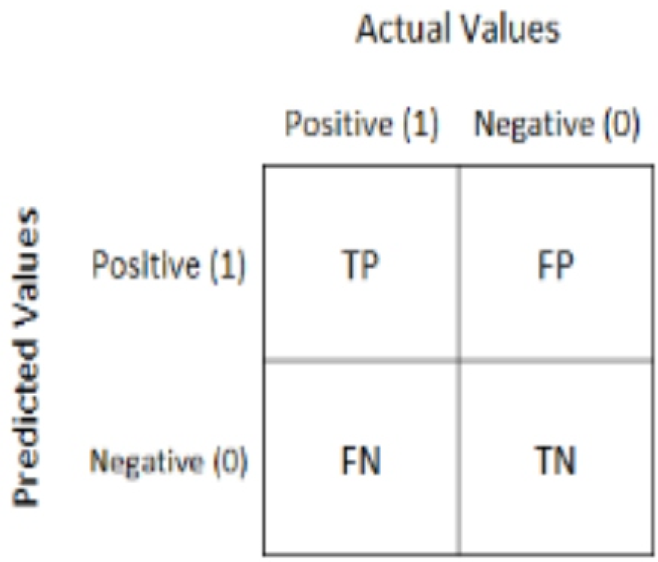

Fig. 1. Confusion Matrix

Where TP is True Positive, FP is False Positive, FN is False Negative, TN is True NegativeC. Accuracy

The matrix's accuracy could be measured by taking the average of all the values along the major diagonal.

It is written as follows:

Accuracy = T P + F N / N (2)

Where N = Total number of samples

D. F1 score

It is used to assess the precision of a test. The F1 score is the harmonic mean of recall and accuracy.

The F1 Score has a range of [0, 1]. It indicates the robustness and precision of your classifier. It is given mathematically as:

F 1 = 1 /((1/precision) + (1/recall)) (3)

F1 Score aims to maintain an equilibrium between precision and recall.

E. Precision

It is calculated by dividing the number of correct positive outcomes by the set of positive results predicted by the classifier. It is written as follows:Precision = T P / T P + F P (4)

F. Recall

This is derived by dividing the number of valid positive outcomes by the total number of relevant samples. In mathematical terms, it is as follows:Recall = T P / T P + F N (5)

VI. RESULTS

By implementing multiple algorithms for machine learning to the dataset, we obtained the accuracy values listed below, with the Random Forest Classifier providing the highest level of accuracy of 90.47 percent.

Algorithm	Accuracy
Random Forest Classifier	90.47%
Logistic Regression	72.78%
Decision Tree Classifier	70.06%
KNN	82.02%

Confusion Matrix for Random Forest Classifier is given below

	Diabetic	Non- Diabetic
Diabetic	32865 (0.85)	5840 (0.15)
Non- Diabetic	1571 (0.04)	37475 (0.96)

Accuracy, F1-Score, Precision, and Recall are the evaluation criteria being compared. The table shows the Confusion matrix for the said algorithm with the highest accuracy. Visualizing these accuracies allows us to easily comprehend the differences between them.

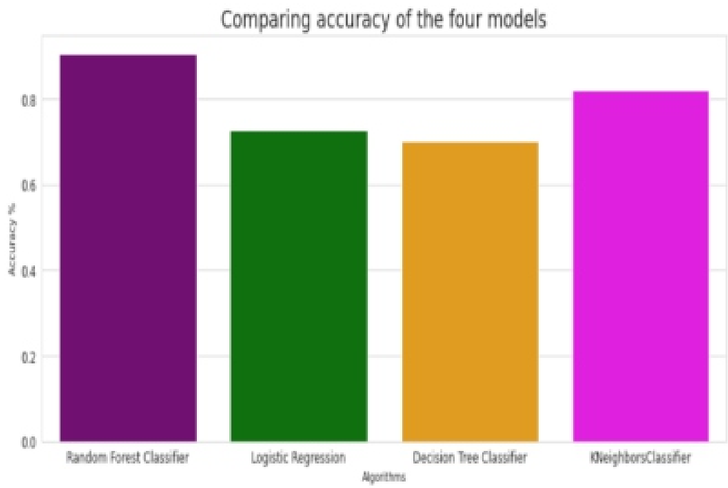

Fig. 2. Accuracy-based comparison of multiple machine learning algorithms

Algorithm	CDC Dataset	PIMA Dataset
Random Forest Classifier	90.47%	76.28%
Logistic Regression	72.78%	73.91%
Decision Tree Classifier	70.06%	74%
KNN	82.02%	76.67%

VII. CONCLUSION Multiple machine learning algorithms have been applied to the dataset under this study, and classification is performed using various methodologies, with the Random Forest Classifier yielding the highest accuracy of 90.47 percent. We've seen a comparison between machine learning method accuracies using two separate datasets. When compared to the existing dataset, the model clearly boosts diabetes prediction with both precision and accuracy. This research can be expanded to determine how likely nondiabetic persons are to develop diabetes in the coming years.

REFERENCE

[1] Zimmet, P. Z., Magliano, D. J., Herman, W. H., and Shaw, J. E.(2014). Diabetes: a 21st century challenge. The Lancet Diabetes and Endocrinology, 2(1), 56–64. doi:10.1016/s2213-8587(13)70112-8.

[2] Definition, Diagnosis and Classification of Diabetes Mellitus and its complications. Part 1: Diagnosis and Classification of Diabetes Mellitus (WHO/NCD/NCS/99.2). Geneva: World Health Organization; 1999.

[3] Roglic G. WHO Global report on diabetes: A summary. Int J Non-Commun Dis 2016;1:3-8.

[4] Dwivedi, A. K. (2018). Analysis of computational intelligence techniques for diabetes mellitus prediction. Neural Computing and Applications, 30(12), 3837-3845.

[5] Sarwar, M. A., Kamal, N., Hamid, W., and Shah, M. A. (2018,September). Prediction of diabetes using machine learning algorithms in healthcare. In 2018 24th international conference on automation and computing (ICAC) (pp. 1-6). IEEE.

[6] Faruque, M. F., and Sarker, I. H. (2019, February). Performance analysis of machine learning techniques to predict diabetes mellitus. In 2019 International Conference on Electrical, Computer and Communication Engineering (ECCE) (pp. 1-4). IEEE.

[7] C.kalaiselvi, G.M.Nasira, "A New Approach of Diagnosis of Diabetes and Prediction of Cancer using ANFIS", IEEE Computing and Communicating Technologies, pp 188-190, 2014.

[8] A. Kumar Dwivedi, "Analysis of computational intelligence techniques for diabetes mellitus prediction," Neural Comput. Appl., vol. 13, no. 3, pp. 1–9, 2017.

[9] M.NirmalaDevi, A.alias ,S.Balamurugan, and U.V.Swathi, "An amalgam KNN to predict Diabetes mellitus," IEEE International Conference on Emerging Trends in Computing, Communication and Nanotechnology, Tirunelveli India, 25-26 March, 2013,pp.691 – 695

[10] K.Deepika and S. Seema , "Predictive analytics to prevent and control chronic diseases," International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT),Banglore India, 21-23 July, 2016,pp. 381-386

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PRECISE INDOOR LOCATION SYSTEM USING ULTRA-WIDEBAND TECHNOLOGY

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ABSTRACT

This article discusses two ways of measuring distance with UWB technology, then identifies the advantages and disadvantages of the methods discussed. Measurement results for the measurement methods discussed are presented. The RSSI from which the distance can be calculated is also presented, as well as how to calculate the distance for the ToF method.

Keywords - Ultra-Wideband Technology, Navigation, Identity Management Systems, Indoor Localization

1 INTRODUCTION

Precise determination of the location of objects and people in confined spaces with high accuracy is in demand in the consumer and industrial markets. GPS technology, which correctly locates in open spaces, does not meet its objectives in enclosed objects. For simple indoor location, Bluetooth transmitters that calculate distance based on RSSI can be used, resulting in a measurement accuracy of one to two metres. Therefore, in indoor locations with a large number of objects to locate, where high accuracy of location measurement is required, technology that allows localization to a few centimetres should be used. The best solution to the problem of indoor location is to use UWB technology, which is additionally resistant to electromagnetic interference. Two localisation methods are distinguished in the UWB technology, namely RSSI and ToF. The RTLS (Real-Time Location System) is mainly based on UWB (Ultra-Wide Band) technology, which operates in high frequency radio technology with a wide signal band.[1]

II. RSSI MEASUREMENT

RSSI (Received Signal Strength Indication) signal strength measurement can be used to quickly estimate the distance between transmitter and receiver, this method provides very fast data acquisition. The disadvantage of this measurement method is the low accuracy in the range of 1m to 2m, making it unlikely to determine the position of several objects in close proximity.[2] The accuracy of signal strength measurement is affected by phenomena such as the reflection of electromagnetic waves from various surfaces, and absorption by some objects. These effects mean that the received signal strength does not behave in a linear manner. The following formula shows how signal strength is calculated by receiving and transmitting devices.[3]

$$\text{RSSI} = 10\log_{10}\left(\frac{\text{C}2^{17}}{\text{n}^2}\right) - \text{A[dBm]} \quad (1)$$

where: C -channel impulse response power, N - number of preamble accumulation, A - constant name of the transmission frequency.Signal power can be measured in two ways. The first way is to ask the receiver for the signal strength and then get a response, as shown in Figure 1. The second way is to measure the signal strength directly through the transmitter, as shown in Figure 2. The choice measurement method has no effect on the accuracy of the results, but has a large impact on the energy consumption when using an electrochemical cell in the transmitter, as continuous listening to the transmitting channels consumes more energy.

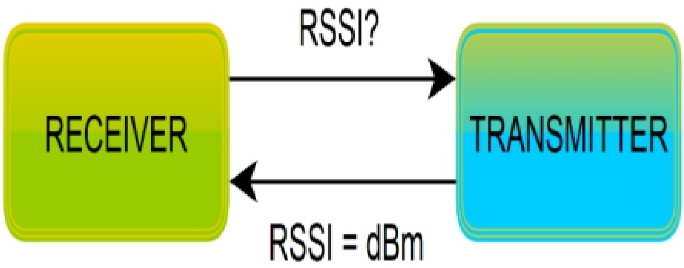

Figure 1: RSSI measurement with response.

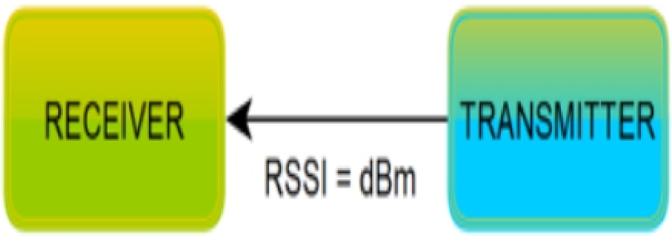

Figure 2: RSSI measurement without response.

III. TOF MEASUREMENT The ToF (Time of Flight) distance measurement method is shown in Figure 3. The operation of this method is based on determining the time of flight of a frame between the transmitting and receiving device.

Knowing the transmission time and the speed at which the radio waves travel (speed of light), it is possible to determine the distance with a high degree of accuracy.[4] This method allows multiple objects to be tracked simultaneously and makes it possible to locate them with an accuracy of several tens ofcentimetres. The method is characterized by high precision in determining the distance between transmitter and receiver.[5]

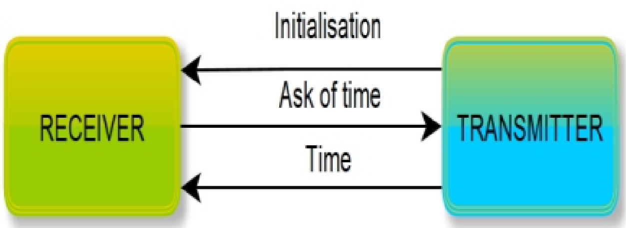

Figure 3: Method of measuring distance by measuring the response time.

The formula below shows how to calculate the distance between the anchor and the transmitter, the formulae in are simplified as the time t1 and t2 are fully dependent on the operating frequency of the microcontroller, the delay of the antenna used and the transmission channel chosen.[6]

$$tof = \frac{(t_1 - t_2)(1 - clk)}{2} \quad (2)$$

$$d = t_{of} \cdot c \cdot 100 \quad (3)$$

where: t1 - initialisation time, t2 - data reception time, clk - clock offset, tof – time of fly, c - speed of light.The high measurement accuracy makes it possible to determine the location of people and objects in the monitored room. The time-of-flight system used to determine distances can be used for indoor navigation, making it significantly easier to find a destination. Such a system can be used, for example, in large shopping centres, airports or warehouses.

Accurate localisation operating in less than 10 ms allows it to be used for access control management, e.g. the system recognises that a person is approaching a door and, if that person has access rights to the room, the door is opened without the need for objects to open it.[7] The very precise determination of the distance continuously results in higher power consumption.

IV. HARDWARE SOLUTION

The following assumptions were made in the design of the anchor electrical scheme:

- Small size,
- Power supply and data transmission via PoE power supply
- Anchor configuration via Bluetooth protocol
- Wide range of supply voltage

The use of UWB technology is enabled by the DW1000 module, which was configured via the SPI (serial peripheral interface) bus. The device's main microcontroller is the STM32F746IGK, which was responsible for communicating with an external server using the Ethernet standard and controlling the UWB module. The configuration of basic parameters such as the device name was done by the NRF52832 microcontroller with the Bluetooth wireless communication module. All circuits present on the board were powered by a DC/DC converter, which reduces the voltage supplied from the PoE power supply. The PoE power supplies provide a voltage range of 12 to 52 VDC, so the converter had to be adapted to this voltage range. The converter used was non-isolated to reduce the size of the PCB. The converter reduces the voltage to 5 VDC and then a stabiliser is used to stabilise the voltage from 3.3 VDC, which was used to power all the ICs on the PCB.

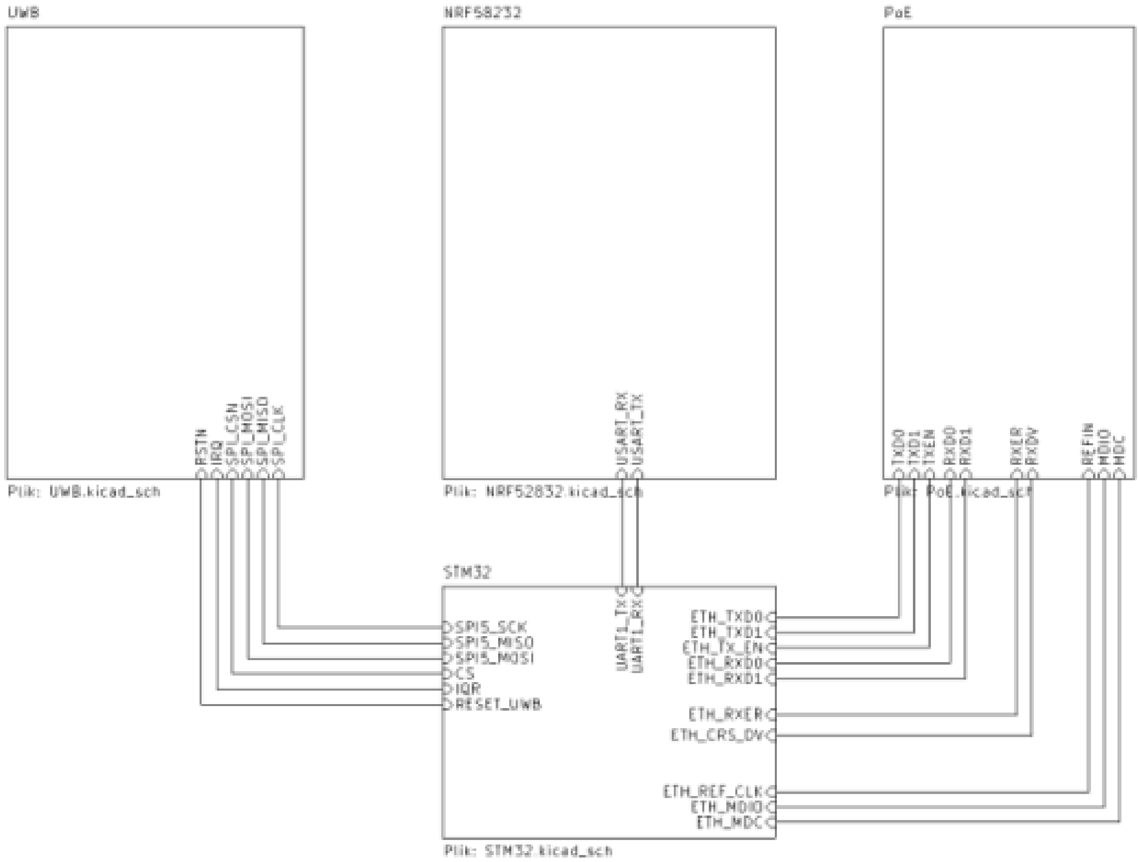

Figure 4: Block diagram of UWB circuit.

The 3D model of the UWB anchor is shown in the figure below. The anchor was designed according to the previously made electrical schematic shown in Figure 4. Figure 4 shows the block diagram as it would be unreadable to present all the components of the schematic

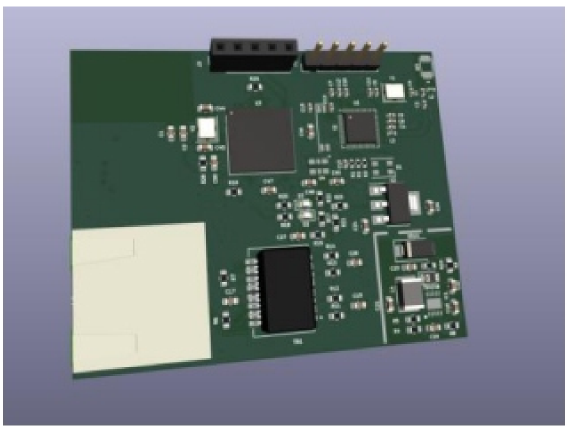

Figure 5: 3D anchor model.

The fabricated device was used to perform the research presented in this article.

V. RESULTS

Knowing the basic technical parameters of the distance measurement methods discussed, it is possible to select the appropriate localization method depending on the expected results. In the case of locating single objects in a small space, RSSI-based localization will be suitable due to its low energy consumption. However, in the case of locating multiple objects in a large space, the ToF-based localization method will be the most optimal, especially when the localized objects are close to each other. Table 1 shows the differences between object localization based on distance measurement methods through signal strength (RSSI) and the ToF frame transit time calculation method.

Parameters	RSSI	ToF
Accuracy of measurement	1-2 [m]	0.1-0,4 [m]
Minimal number of receivers	1	3
Data acquisition (time)	fast	slow
Complexity of system	easy	complicated
Battery consumption	low	high

Table 1 Differences between RSSI and ToF measurement method

The following graphs shows the results of RSSI signal strength measurements between individual receivers (anchors) and one transmitter

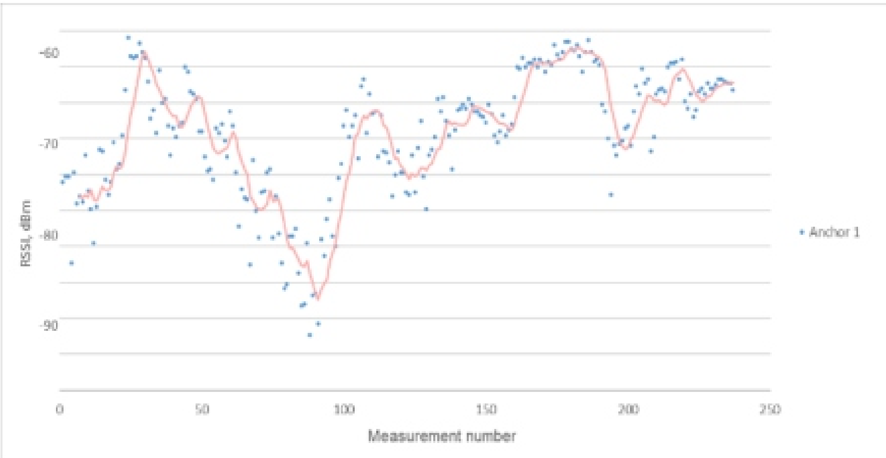

Figure 6: Graph of RSSI values for anchor 1.

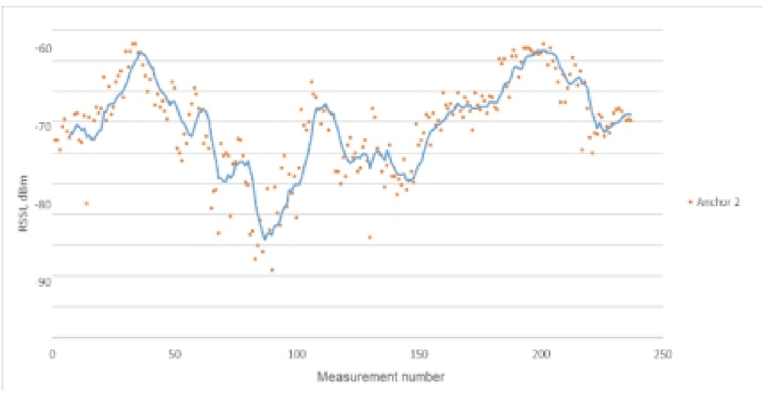

Figure 7: Graph of RSSI values for anchor 2.

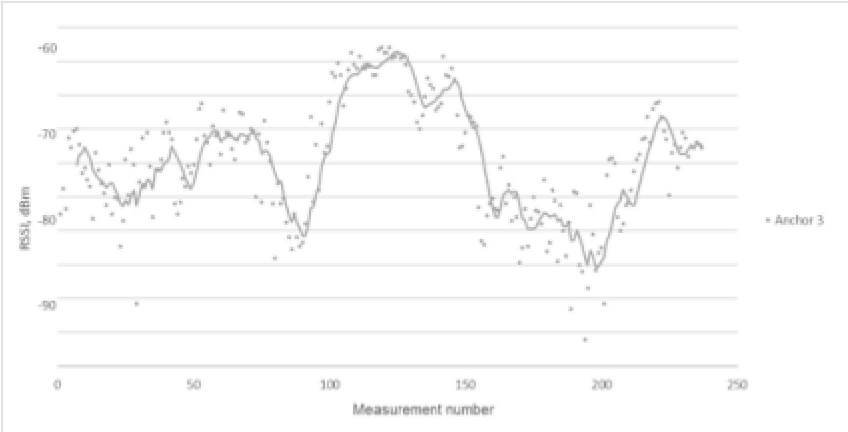

Figure 8: Graph of RSSI values for anchor 3.

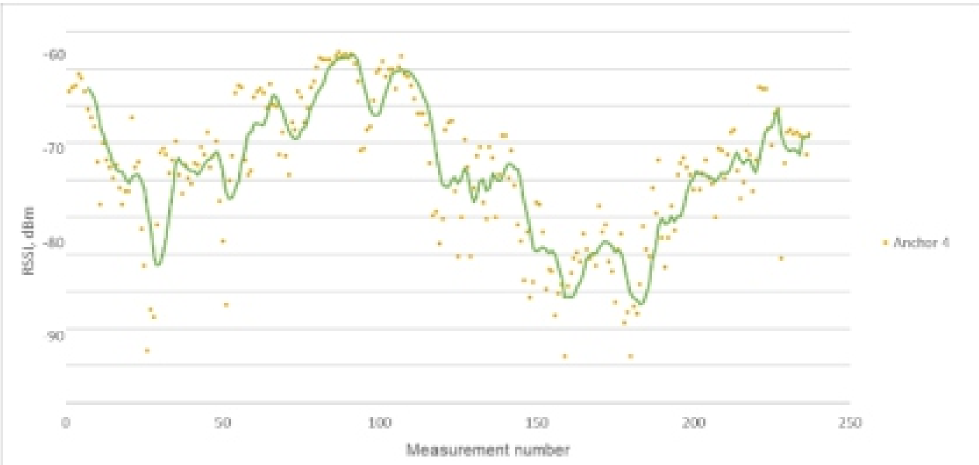

Figure 9: Graph of RSSI values for anchor 4.

To make the chart more readable, a trend line based on a moving average value has been added to each series. This makes it clear when the market has moved away from a given anchor and when it has moved towards it. The previously discussed drawbacks of RSSI measurement, i.e. the instability of signal strength depending on distance, can be read off the graph. During the measurements, the signal power varied significantly (approx. ±9 dBm) even when there was no change in the distance between the anchor and the transmitter.

The figures below show the results of distance measurements using the ToF method. It can be seen that the results are stable and do not change in a stepwise manner compared to the RSSI measurement method.

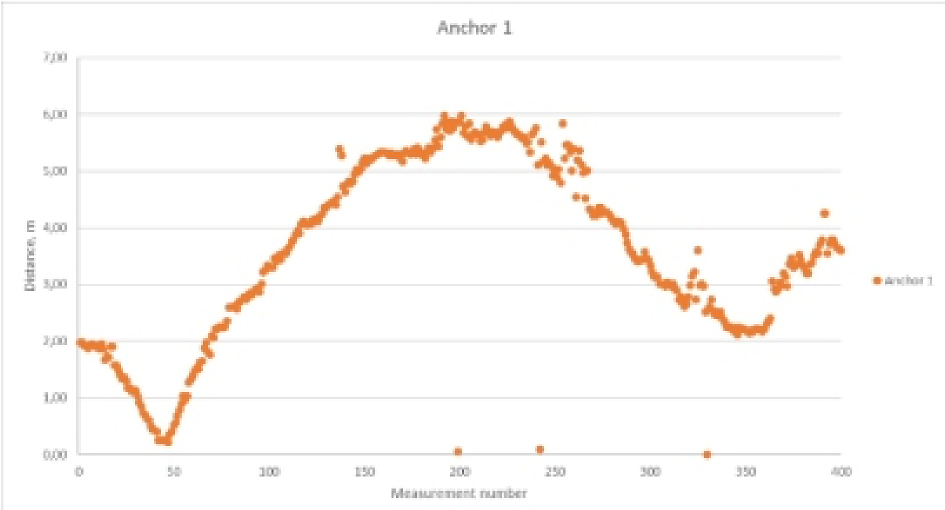

Figure 10: Graph of ToF values for anchor 4.

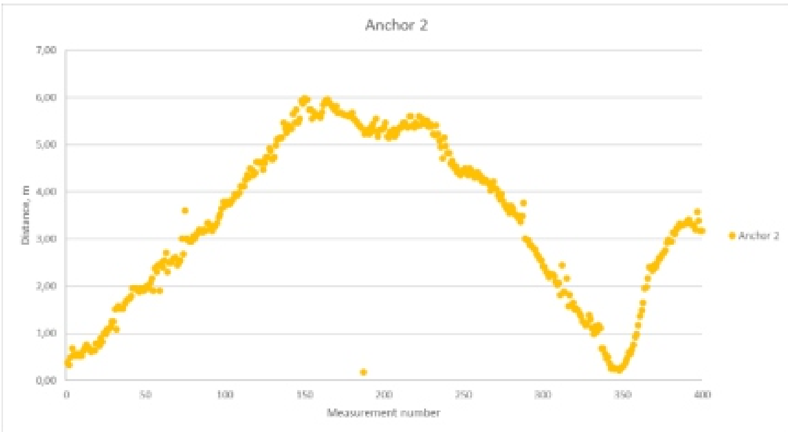

Figure 11: Graph of ToF values for anchor 4.

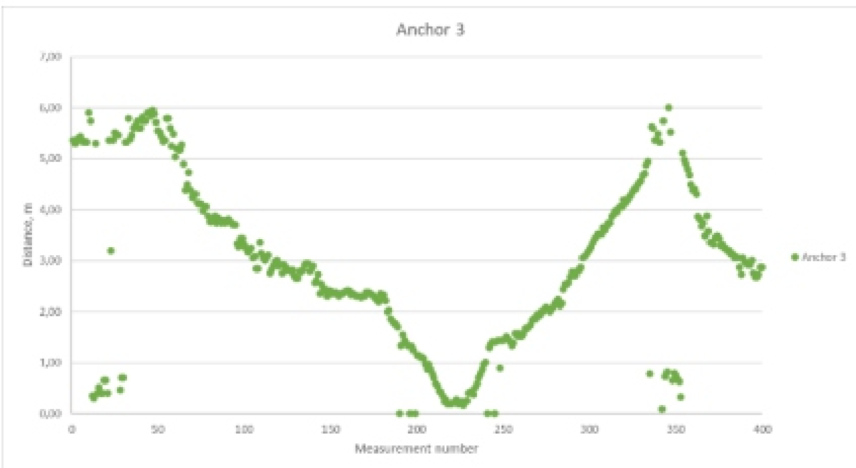

Figure 12: Graph of ToF values for anchor 4

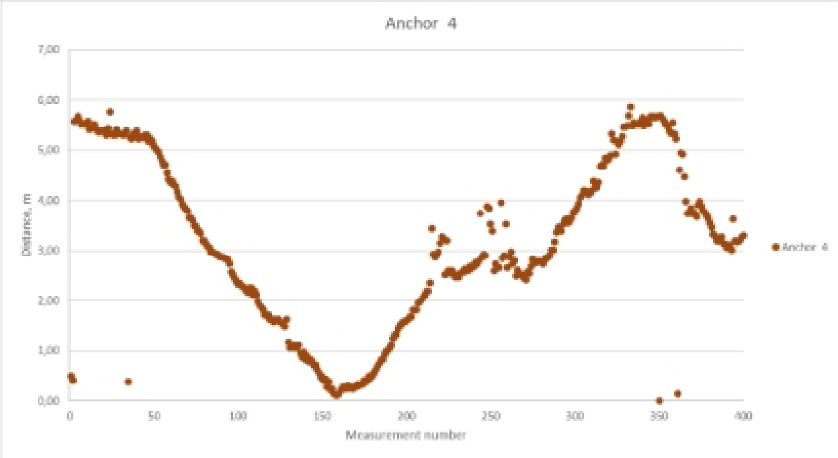

Figure 13: Graph of ToF values for anchor 4.

During testing of the ToF distance measurement method, it was noted that there was some interference during the measurements. It was therefore decided to carry out stability measurements by placing the transmitter in one position and taking 400 measurements. The graph below shows the results of the measurements.

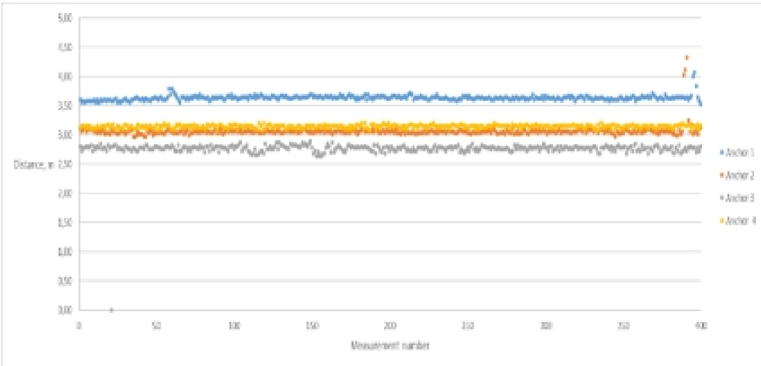

Figure 14: Graph of ToF values for anchor 4.

VI. CONCLUSION

Comparing the results in the method RSSI and Tof, it can be seen that the distortion in the RSSI method is significantly higher compared to the ToF method. In the RSSI method of measuring signal power, it can be seen that the greater the distance between transmitter and receiver, the more stable the signal power becomes. The choice of the appropriate distance measurement method depends on the expected end results. In the case of searching for single objects in a limited space, distance measurement based on RSSI proves to be a better solution, as the measurement accuracy is acceptable in many cases, and relatively small batteries can be used. In the case of locating multiple objects in large spaces and especially when the objects are very close to each other, a system based on the ToF measurement method is the best solution, due to its high accuracy. the disadvantage of this system is the high power consumption of the transmitting equipment.

REFERENCE

[1] Fischer G. , Klymenko O., Martynenko D., and Luediger H., "An Impulse radio UWB transceiver with high-precision TOA measurement unit," in International Conference on Indoor Positioning and Indoor Navigation (IPIN '10).

[2] Garbaruk M., Time and frequency analysis of signals used in pulsed antenna ultra-wideband radiocommunication systems (2007), 6th International Conference on Antenna Theory and Techniques, 276-277, doi: 10.1109/ICATT.2007.4425183.. Ramkumar, H.M. Kittur, and P. M. Kannan, "ASIC implementation of modified faster carry save adder," Eur. J. Sci. Res., vol. 42, no. 1, pp.53–58, 2010.

[3] Kang M., Kang J., Lee S. W., Park Y., Kim K., NLOS mitigation for low-cost IR-UWB RTLS (2011) IEEE International Conference on Ultra-Wideband (ICUWB), 96-100, doi: 10.1109/ICUWB.2011.6058931.

[4] Kolakowski J., "Application of ultra-fast comparator for UWB pulse time of arrival measurement," in IEEE International Conference on Ultra-Wideband (ICUWB '11).

[5] Maj M. Rymarczyk T., Kania K., Niderla K., Styła M., Adamkiewicz P.: Application o the Fresnel zone and Freespace Path for image reconstruction in radio tomography, International Interdisciplinary PhD Workshop 2019, IIPhDW 2019, 15 – 17 May 2019, Wismar, Germany.

[6] Slovák J., Vašek P., Šimovec M., Melicher M. and Šišmišová D., "RTLS tracking of material flow in order to reveal weak spots in production process," 2019 22nd International Conference on Process Control (Pc19), 2019, pp. 234-238, doi: 10.1109/PC.2019.8815220.

[7] J. R. Fernandes and D. Wentzloff, "Recent advances in IR UWB transceivers: An overview," Proceedings of 2010 IEEE International Symposium on Circuits and Systems, 2010, pp. 3284-3287, doi: 10.1109/ISCAS.2010.5537916.

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