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REVIEW OF PRECISION ANTENNA ALIGNMENT: AN IOT-BASED APPROACH FOR ENHANCED CONNECTIVITY

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Abstract : In the domain of satellite communication, antenna positioning or tuning takes on heightened importance, as it directly impacts the reception of standard broadcast signals. The antenna must be oriented at a precise angle to capture the strongest possible signal, and manual adjustments are often impractical and challenging to achieve with pinpoint accuracy. The result of this manual intervention is often suboptimal signal reception. This paper addresses these challenges head-on with an innovative IoT-driven Antenna Positioning System that provides remote control over antenna positioning. The automatic antenna positioning system primarily functions to identify the source of signal. The paper leverages the power of the Blynk app as a remotecontrol interface, facilitating signal transmission to the Arduino via the internet. The idea is to develop a system which will control the movement of the dish antenna in all directions. This groundbreaking paper empowers users to effortlessly manipulate antenna positions using simple commands. With just an Android mobile device and an internet connection, users gain seamless access to antenna position control. This system promises to revolutionise antenna management, enhancing the efficiency and convenience of wireless communication setups.

Keywords: Precision antenna alignment, IoT-Technology, enhanced connectivity, automatic antenna placement.

I. INTRODUCTION

Antenna technology is an indispensable part of the development of wireless communication. As we know wireless communication systems work on antennas for reception of signals. It is necessary to properly position the antennas in the direction of the transmitter for effective wireless communication. The Automatic antenna positioning system primarily functions to identify the source of signal. The Automatic Antenna Positioning System is designed to fulfil this critical function by efficiently identifying the source of signals. In the contemporary world of technology, the Internet of Things (IoT) stands out as a revolutionary force, poised to transform industries, cities, and the very fabric of our daily lives. Its influence on communication systems, in particular, cannot be overstated. IOT is one of the latest and emerging technologies with the ability to transform the beautiful world like industries with smart machines, smarter cities, etc. However, the importance of technology like IOT in communication systems has a very great impact. In wireless communication concepts antennas are important for receiving signals. For very effective results of wireless communication the proper direction of antennas matters. So in my research I propose a very dynamic model for antenna positioning based on IOT technology.

Wireless sensor networks (WSNs) systems based on Internet of Things (IoT) have developed rapidly in recent years. The interesting thing is that the motors using the IOT concept will change direction from anywhere across the world. The direction of transmitting stations changes with time means when the transmitting station changes over time the antenna direction needs to be automatically changed accordingly. In simple words, this model will help us in monitoring the direction of antennas and transmit new coordinates to properly position the antennas. The Internet of Things being a fascinating and exciting concept has one of the major challenging aspects of having a secure ecosystem encompassing all building blocks of IoT architecture. In IoT (Internet of things), “things” refer to a wide range of devices such as heart monitoring implants, remotely handling home appliances, biochip transponders used on farm animals, cameras that stream live feeds of wild animals in coastal waters, etc. Thus we can say that “things” are a “mixture of hardware, software, data, and services”

However, the full realization of IoT's potential, while promising and exciting, presents a significant challenge: ensuring a secure ecosystem that envelops all the building blocks of IoT architecture. In the expansive world of IoT, "things" encompass a diverse array of devices, from heart monitoring implants to remotely controlled household appliances, biochip transponders used for tracking farm animals, and cameras streaming live feeds of wildlife in coastal waters, among others. Thus, "things" collectively constitute a fusion of hardware, software, data, and services, exemplifying the multifaceted nature of the IoT landscape. This research embarks on the journey to harness the power of IoT to revolutionize antenna positioning, keeping pace with the dynamic

world of wireless communication and offering the promise of more effective and efficient communication systems for a vast range of applications.

II. LITERATURE REVIEW

Surya Deo Choudhary et al. The system is designed to position the antenna for effective communication. The system primarily functions to detect the signal. The system will detect the strong signal and will position the antenna according to the strong signal detected. The antenna will be stationary as long as the signal link is established.[1]

Prajwal Basnet et al. The project is designed to develop a dish positioning system that can be operated based on the Android application. The main application of using the dish system is for proper transmission and reception of the signal. To properly position the antenna according to maximum frequency it needs to be adjusted manually.[2]

M.IIakkiya, et al. To detect a strong signal the automatic positioning of the antenna is necessary. To detect the strong signal and position the antenna for proper communication. It works on RSSI values that the receiver detects. It monitors the signal strength on the LCD display.[3]

Rahane Suraj Dildar et al. The idea is to develop a system to position the antenna based on the microcontroller. The antenna can be monitored and controlled by the android. The antenna can be positioned with the help of servo motors. The servo motor position will be based on the microcontroller.[4]

Pooja Revane, et al. The Internet of Things being a fascinating and exciting concept has one of the major challenging aspects of a proper system for communication based on IOT. Along with IOT the sensors and actuators will also help the system to work. The controller handles the operation of the antenna. The Atmega328 low-power 8-bit RISC controller is the main controller of the system for working the antenna. The accelerometer will position the antenna.[5]

Godse Sharayu Devidas. et al. In this paper, the author introduces a PIC microcontroller that was designed to develop a satellite dish positioning system which can be operated by using a Bluetooth control. The main point of using a dish is to receive signal from satellites and other Broadcasting sources. This Android Based Antenna Positioning System is a very innovative system as it helps to position the antenna with the help of an android application. This helps the antenna to point straight towards the sending signal device so as to capture the signal. For this the system uses a PIC microcontroller and LCD screen.[6]

Amritha Mary A. S., Divyasree M V, Jesna Prem, Kavyasree S M, Keerthana Vasu, In this paper, the author discussed the main application of using a dish is to receive signals from satellite or other broadcasting sources. In order to position the dish to the exact angle to receive the maximum signal of a particular frequency it needs to be adjusted manually. To overcome the difficulty of adjusting manually, this proposed system helps in adjusting the position of the dish through an android application device.[7]

Neha Pravin Pophale, In this paper, the author, introduces a system In which the system sensors can be mounted so that the antenna can detect the signal and the strong signal's frequency can be loaded on the IOT module. When the direction of a transmitting station changes over time, the antenna direction must also be changed accordingly. This system will help to monitor the antenna direction and strong signal to position the antenna according to the strong signal. Ultrasonic sensors will act like transmitters and receptors.[8]

Amit Dvir, Yehuda BenShimol, Yoav Ben-Yehezkel, Michael Segal. This article addresses a real-life problem which is obtaining communication links between multiple base stations sites. This is done by positioning a minimal set of fixed-access relay antenna sites on a given terrain. To minimise the number of relay antenna sites is considered difficult due to substantial installation and maintenance costs. Despite the potential significant cost saving by eliminating even a single antenna site, a hardly optimal manual approach is employed due to the computation complexity of the problem.[9]

Prof. S. A Maske, Mr. Shelake Aniket V, Mr.Shinde Anup S, Mr. Mugade Nitin K. In this paper, a microcontroller was designed by the author to develop a dish positioning system which can be operated by using a remote control. The main point of using a dish is to receive signal from satellites and other broadcasting sources. In order to get the exact angle of position of the dish, it needs to be adjusted manually. To overcome the difficulty of adjusting manually, this paper helps in adjusting the position of the dish through a remote control.[10]

Ramanathan, Ram. The author presents a broad-based examination of this potential, focusing on exploiting the longer ranges as well as the reduced interference that beamforming antennas can provide. He considers a number of enhancements to a conventional ad hoc network system, and evaluates the impact of each enhancement using simulation.[11]

Wu, ChienHsiang,et. al, In this paper, the author evaluates the most advanced literature and techniques. A comprehensive description from different perspectives covers several adaptive antenna structures, including diversity antennas, phased array antennas, and beamforming specific learning methods. After that, this paper divides it into different categories, from intelligent learning algorithms and feature data perspectives in a different light to analyse and discuss. This article expects to help readers understand the latest intelligent technology based on adaptive antennas. Further, it sheds novel light on future research directions to meet the development needs of adaptive antennas for future wireless networks.[12]

Murthy, N.et al. In this paper, the author introduces a system in which the Data is encoded using a space-time block code and the encoded data is split into n streams which are simultaneously transmitted using n transmit antennas. The received signal at each receive antenna is a linear superposition of the n transmitted signals perturbed by noise. Maximum likelihood decoding is carried out by dividing the signals transmitted from different antennas. This uses the orthogonal structure of the space-time block code and gives a maximum-likelihood decoding algorithm, which is based only on linear processing at the receiver. Space-time block codes

are designed to achieve the maximum diversity order for a given number of transmit and receive antennas subject to the constraint of having a simple decoding algorithm. This paper presents a simple two-branch transmit diversity scheme.[13]

Nobandegani,et al. In this paper, the author will remove almost ever-present yet practically difficult to meet conditions and shall introduce a new linear space-time block code that due to having some inherent redundancy as well as diversity is well suited to correlated fading channels. We will discuss the properties of the proposed code, derive its maximum likelihood (ML) decoder and provide simulation results which show its superiority to the highly used orthogonal space-time block codes in a wide range of signal to noise ratios in correlated fading channels.[14]

Rahman, et al. in this paper, an electronic steering parasitic array radiator (ESPAR) antenna used as a beamformer to handle the interference and extend the communication range from the sensors or tags is suggested. In addition, an efficient method, namely beam scanning (BS), is proposed to find the directions of tags. The beam scanning method (BSM) can be used for the selective beam switching (SBS) system by designing an ESPAR or array of ESPAR antennas with the help of CST studio. The antennas exhibit higher gain (8.17 dBi, 11.40 dBi) and proper radiation pattern in a particular direction. In addition, the MATLAB simulation findings indicate that the proposed BSM algorithm provides longer communication range, i.e., 25 m. In order to maximise range while avoiding interference, it is necessary to determine the direction and precise orientation of the tag in the
WSN communication systems.[15]

Kishore, et. al, In this paper, the author reviewed smart antenna 5G for Internet of Things (IoT) application. Beamforming is a 5G active antenna technique that uses directional radio links to concurrently and selectively supply high bandwidth to certain mobile devices. Multi-antenna systems are required when using larger frequency ranges. The better the propagation conditions for electromagnetic waves, the higher the frequency. To some extent, multi-antenna arrays and beamforming can assist mitigate this. Radio signals can be transmitted and received in a spatially targeted manner due to beamforming. The better the beamforming works, the more dipoles (antenna elements) are available.[16]

Makara,et al. In this paper, the author present a deep-neural-network-based method that has memory that can be used to predict the best reception directions for moving users. The best direction is the highest expected signal level at the next moment. The resulting method allows for a user-side antenna management system. The result was evaluated using three different metrics, thus detailing not only its predictive ability, but also its usability.[17]

E. Bjornson, et al. In this paper , the author suggests appropriate signal processing schemes and use cases to efficiently exploit mMIMO in both frequency bands. the way in which mMIMO can be exploited in these bands is radically different, due to their specific propagation behaviours and hardware characteristics. This article reviews these differences and their implications, while dispelling common misunderstandings.[18]

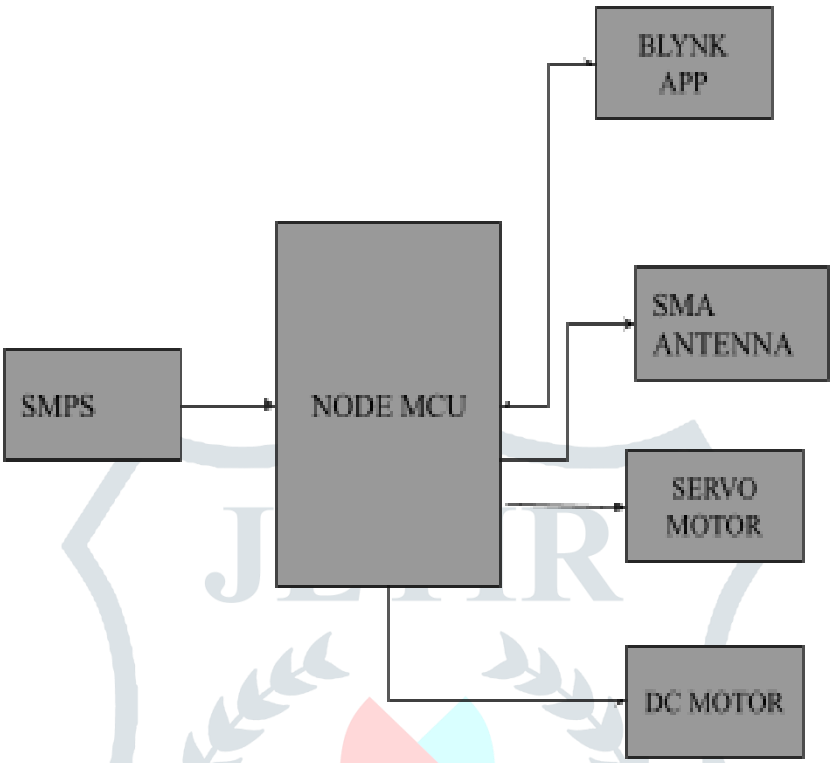
The "Precision Antenna Alignment: An IoT-Based Approach for Enhanced Connectivity" paper presents an exciting opportunity to revolutionise the way we optimise connectivity for IoT applications. By integrating cutting-edge technologies such as the Node MCU microcontroller, servo motors, and the Blynk app, this project offers a solution to a pressing challenge in the field of antenna alignment. With the potential to significantly enhance connectivity while mitigating risks associated with manual positioning, this endeavour not only promises to improve the efficiency and reliability of IoT networks but also opens doors to innovation and exploration in the realm of wireless communication. Embarking on this paper is an invitation to be at the forefront of technological advancement, driving meaningful change in how we harness the power of connectivity for a smarter and more connected world.

III. RESEARCH METHODOLOGY

Due to the significant potential for unanticipated, harmful mishaps that can occur during the manual antenna placement procedure, there is an urgent need for automatic devices that can perform the same function safely. a cheap automatic android based. Using a rotating servo motor connected to the microcontroller, an antenna positioning system can assist in modifying the sector antennas' positions.

The proposed system, "Precision Antenna Alignment: An IoT-Based Approach for Enhanced Connectivity" integrates key components to enhance connectivity. A Blynk application will allow users to control the antenna's position easily via a mobile interface. The system employs SMA antennas for efficient radiation detection. High torque servo motors for both the X and Yaxes ensure precise positioning. A reliable SMPS power supply provides consistent power. Together, these components enable automated and accurate antenna alignment, optimizing connectivity for IoT applications.

BLOCK DIAGRAM



DESCRIPTION

The Block diagram shows the components for an IoT-based system for precision antenna alignment. In the above diagram we have used Node MCU as a microcontroller, which receives power from an SMPS (Switch Mode Power Supply). We have used the SMPS Module as an input device connected to the Node MCU. And in the output device we have used the SMA Antenna, a DC motor, and a servo motor connected to the microcontroller. The microcontroller controls two motors: a servo motor for precise positioning along the X-axis and a DC motor for positioning along the Y-axis. An SMA antenna is connected to the system for efficient radiation detection. And also, we have used the Blynk app to show all the notifications. This system automates the antenna alignment process, reducing the risk of harm during manual positioning and improving the overall connectivity for IoT applications.

IV. SYSTEM REQUIREMENT

- **Hardware Requirement**
  1. NodeMCU
  2. Servo Motor
  3. DC Motor
  4. SMPS Module
  5. SMA Antenna
- **Software Requirement**
  1. Arduino IDE
  2. Proteus
  3. Blynk Application

V. CONCLUSION

The "Precision Antenna Alignment: An IoT-Based Approach for Enhanced Connectivity" system represents a pivotal step towards ensuring safe, efficient, and automated antenna positioning. By leveraging an Android-based application through the Blynk platform, users can seamlessly control antenna positions, eliminating the risks associated with manual adjustments. The integration of SMA antennas for radiation detection and high-torque servo motors for precise positioning enhances the system's capability to optimize connectivity. With a robust power supply in place, the proposed IoT-based approach not only addresses the urgent need for safety in antenna alignment procedures but also significantly contributes to the seamless integration of IoT applications by

ensuring a reliable and accurate connectivity solution. This innovation holds promise for advancing the efficiency and safety of antenna alignment processes in various contexts, thereby paving the way for enhanced connectivity in the rapidly evolving landscape of IoT technologies.

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