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Modelling System Parameters for Improvised Performance in Free Space Optics (FSO) Networks

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ABSTRACT- Free space optics (FSO) is a remote method for correspondence that send information by means of an optical source. The medium among transmitter and recipient is a free space that has an away from of sight for imparting the sign. Air, vacuum, and space can go about as free space. Establishment of this framework is financially savvy contrasted with different frameworks and can be set up with in less time. The upside of this framework is it can send a lot of information because of high transmission capacity. A portion of the components which influence the transmission of FSO are downpour, mist, fog and actual obstacles. Two FSO joins are planned in this paper one with a variety of laser and one with a solitary laser, we are going to investigation the Max. Q along with the Bit error rate esteem for the two frameworks at various constrictions. Multiplexing of the signals is carried out to estimate the performance of the system. Due to the use of multiplexing high bit rates are achieved. The link distance under consideration for this experimental simulation was at 10 km which includes various power levels of the laser. Performance of the two links is compared in the results with the parameter of BER at various power levels by using BER analyzer.

Keywords: Bit error rate (BER); Link distance; Attenuation; Wavelength division multiplexing (WDM); Free space optic (FSO).

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1. INTRODUCTION

In Free Space Optics the information exchanged from transmitter to recipient as light through air. FSO is Implemented where physical association is not conceivable. FSO still needs some enhancement to make do in the terrible climate conditions. It tends to be actualized in various regions of the long and short separation view able pathway (LOS) interchanges [1]-[8]. Nonlinearity's which are mulled over in this examination are for the most part mist (gentle, thick, overwhelming), rain (mellow, typical substantial) and thick snow. The perceivability in every one of the cases is inside 1 – 5kms. FSO is a viewable pathway innovation that utilizes lasers to give optical transfer speed associations or FSO is a methodology that multiply the light in free space infers air, space and vacuum like remotely transmit information for media transmission and PC organizing. Right now, FSO is equipped for up to 2.5Gbps of data, trades through the air, allowing optical system without requiring fiber optic connection or anchoring range licenses [1]. FSO requires light, which can be engaged by either LEDs or lasers. The main contrast is the transmission media. Light travels faster in air than in glass [2]. So FSO is considered as the other means for radio. This is focused on ground-to-ground correspondences. FSO parts are contain three phases: transmitter to send of optical radiation through the air complies with the Beer-Lambert's without law space transmission channel where exist the cloud, rain, smoke, and mist. Ordinary connections are between 300 m and 5 km, albeit longer separations can be conveyed, for example, 8– 11 km are conceivable depending. For longer distance communication wavelength division multiplexing is used which can simultaneously accompany many signals through a single channel and bidirectional communication can coexist [4][9]-[11]. In WDM different signals of various wavelengths are multiplexed through a multiplexer and every individual signal is assessed through a demultiplexer.

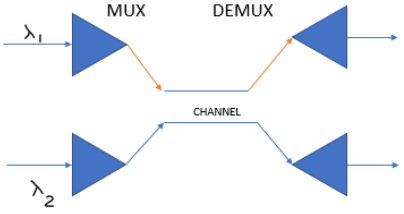

Fig.1 Block Diagram of multiplexing

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2. PROPOSED FSO SYSTEM METHOD

In free space optics it consists of three components: *i.e.*, transmitter, channel, and receiver. The primary component is a transmitter which consists of Continuous wave laser and a pseudo random generator. The data signal is imposed on light to produce the input signal through the machzender interferometer [3]. The signal thus obtained is passed through the Free space optical link with known attenuation values with a selected modulation format such as RZ, NRZ, CSRZ. The output of the FSO is then applied to EDFA to amplify the signal strength and then passed through a photodetector which converts a light signal into electrical signal where a PIN photodiode or avalanche photodiode will serve the purpose. The received signal is then passed through a low pass filter and is analyzed through the eye patterns using the BER Analyzers [9][6].

Table 1: Parameters of the system design

Transmission data rate	2.7gbps
Link distance	10km
Transmitted power	30db
Wavelength	1552
Extinction ratio	40db

In system1 8*1 arrays of CW, lasers and all the eight frequencies are considered. At the input side, WDM multiplexer is used and at the receiver side, De- Multiplexer is used. The performance of signal is analyzed using BER and the quality factor is calculated subsequently.

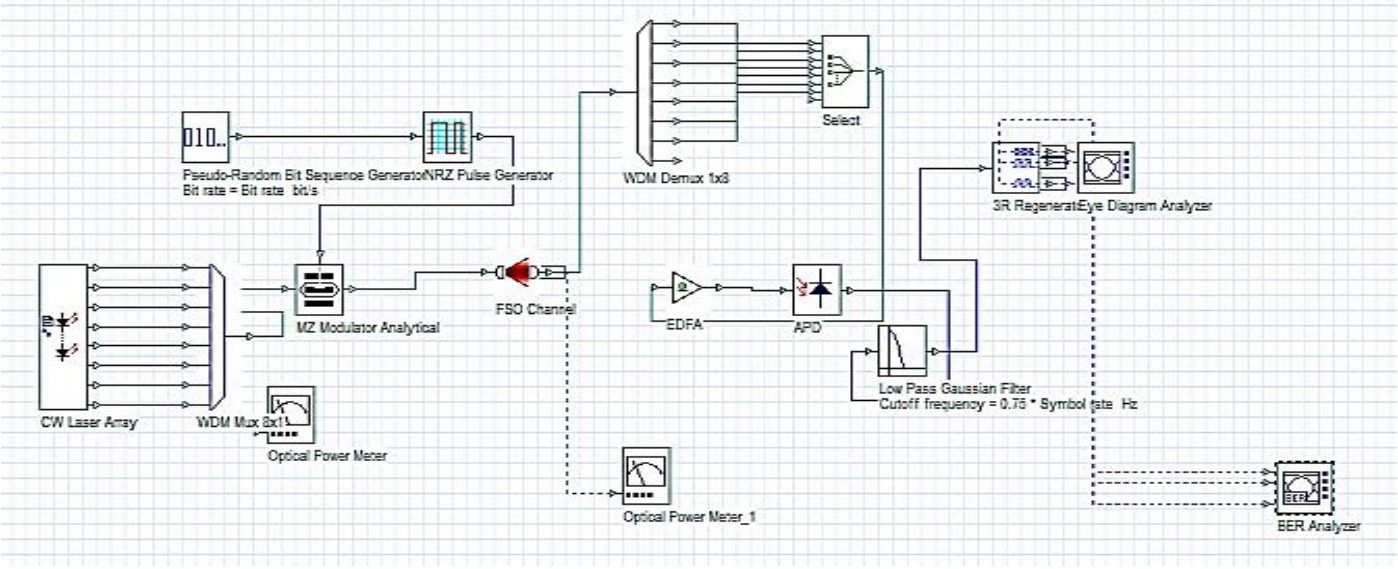

Fig. 2 SYSTEM 1 with 8*1 Arrays

In system 2 design one Continuous wave laser source is used in order the improve the performance of the system (1) so initially there is no need of using Wavelength division Multiplexing and De-Multiplexing as we do not require an array of light sources for light transmission and data availability [33].

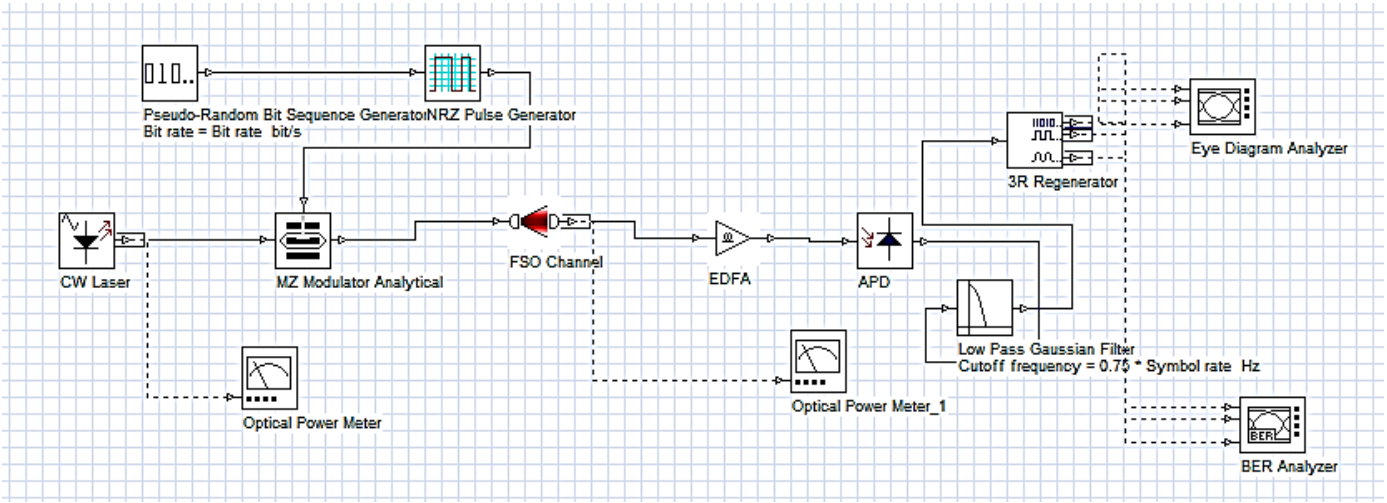

Fig .3 SYSTEM 2 with single input source

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3. RESULTS

An array of CW lasers with 8 different sources are used in design. The various values of attenuation and link distances are tabulated *table2*, and its Bit error Rate is shown in the *fig 4,5,6,7,8*. In all the figures for various values of attenuation in Db/km is calculated and is also represented in tabular columns. In Free space optical system whenever the link distance changes simultaneously *(2)(3)* the attenuation in the link is 0.08dB/km the quality factor is 10.96, similarly when is attenuation is 0.25 for lesser laser power the quality factor is reducing to 10.91and if the attenuation is 0.7 the quality factor is 10.82 and if the attenuation is 2.51 the quality factor is furthermore decreasing. For longer distances such as 80Km the signal is not received at all at the receiver and Bit error rate is 1 which means all the data is in error and the quality factor in turn is resulting as zero. So, to improve the performance of the system a single input system is developed.

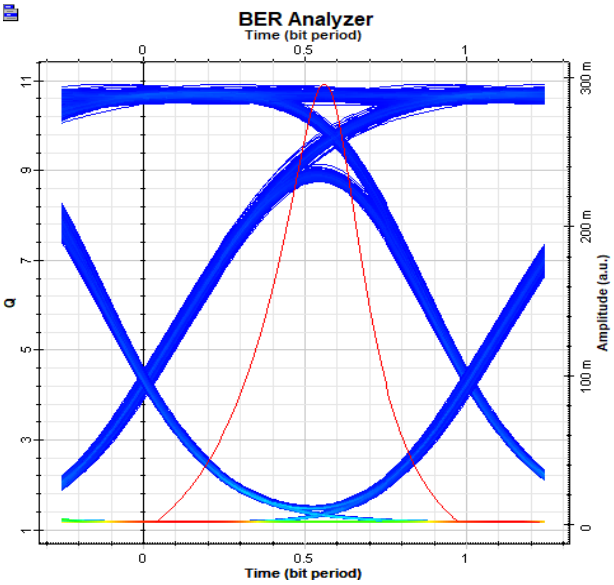

Fig.4 BER analyzer output at 0.08db/km

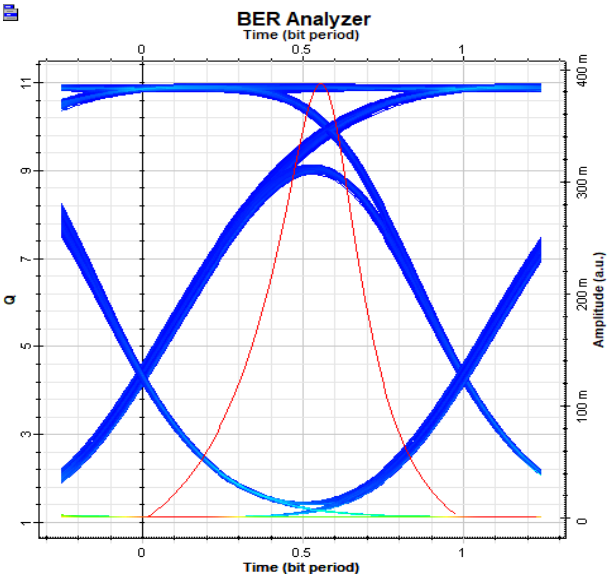

Fig.5 BER analyzer output at 0.25db/km

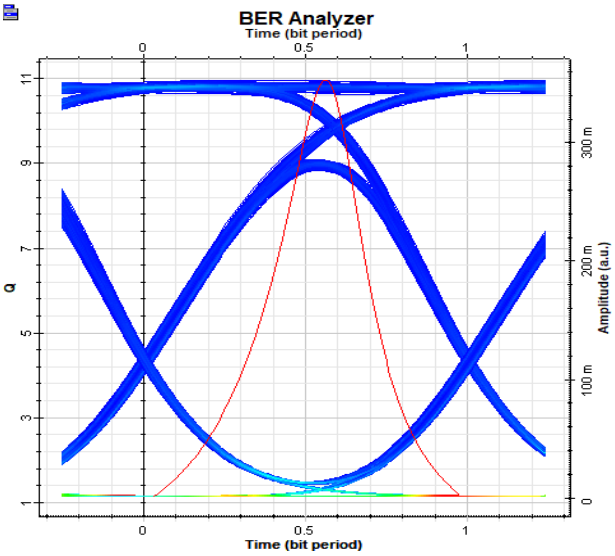

Fig.6 BER analyzer output at 0.7db/km

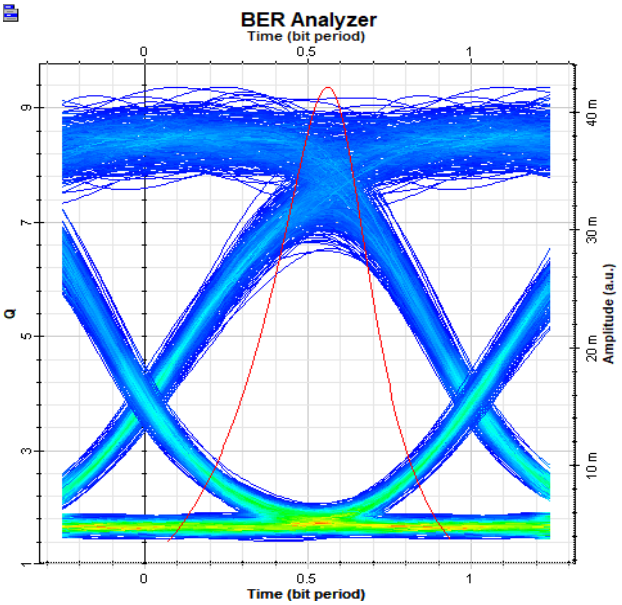

Fig.7 BER analyzer output at 2.51db/km

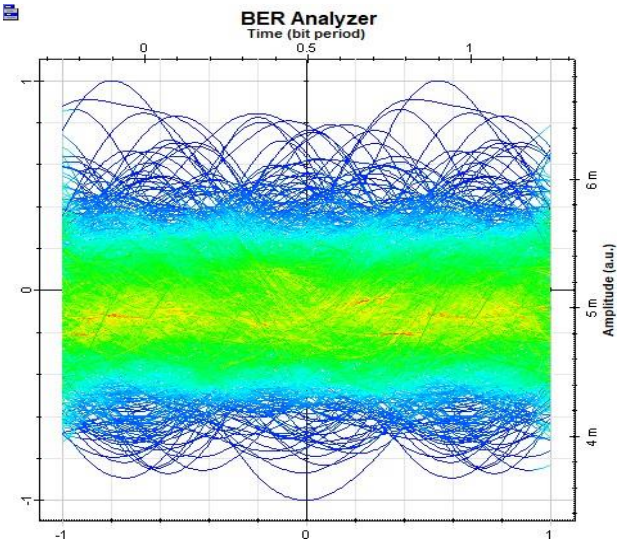

Fig.8 BER analyzer output for 80km at 0.7db/km

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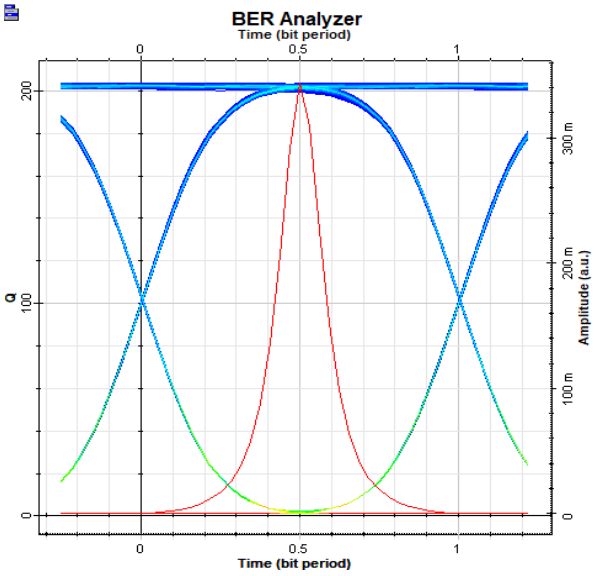

Fig.9. BER analyzer output at 0.08dB/km

In system 2 only a Continuous wave laser is used. Different values of attenuation and the performance analysis of the system are analyzed as follows, BER is shown in *fig. 9,10,11,12,13[*5]. A single input source with RZ modulation and a continuous power supply is used to design the system module. Same values for system 1 and 2 are considered to analyze the variation and improvement of the Quality Factor. When the attenuation is 0.08dB/km for a link distance of 10Km the Quality Factor is 205 which is very great improvement in comparison with system 1 design. When the attenuation is 0.25 the Q value is resulting as 203.As the attenuation is 2.51 still the signal is received at the receiver with no errors but with a reduced Q Factor.

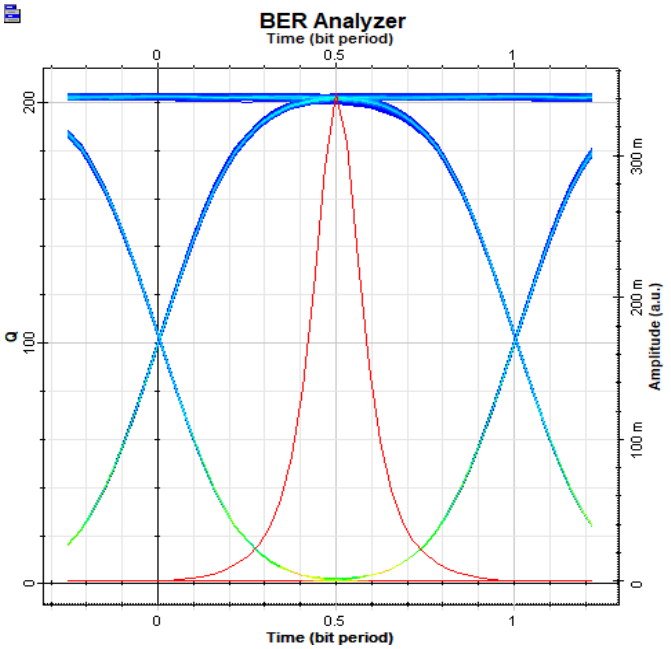

Fig.10 BER analyzer output for 0.25db/km

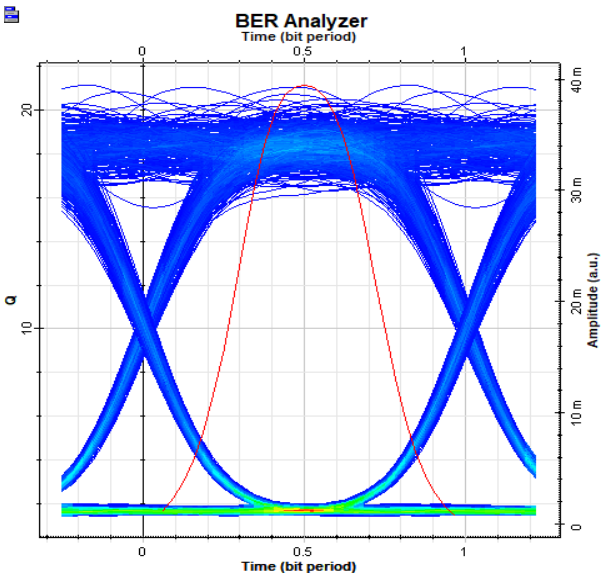

Fig.11 BER analyzer output at 0.7db/km

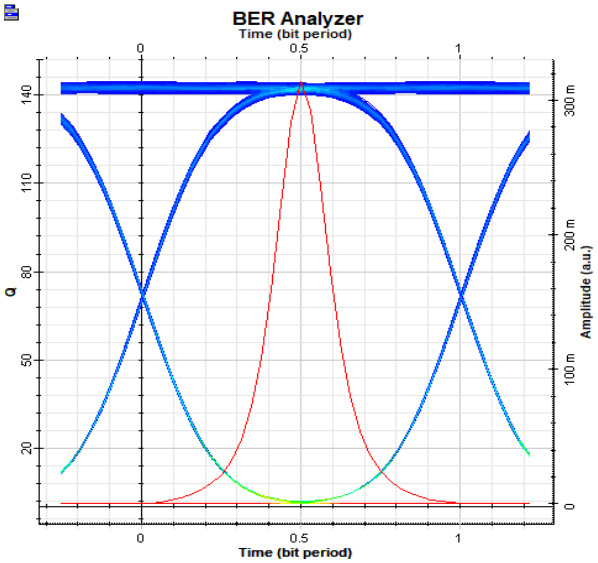

Fig.12 BER analyzer output at 2.51db/km

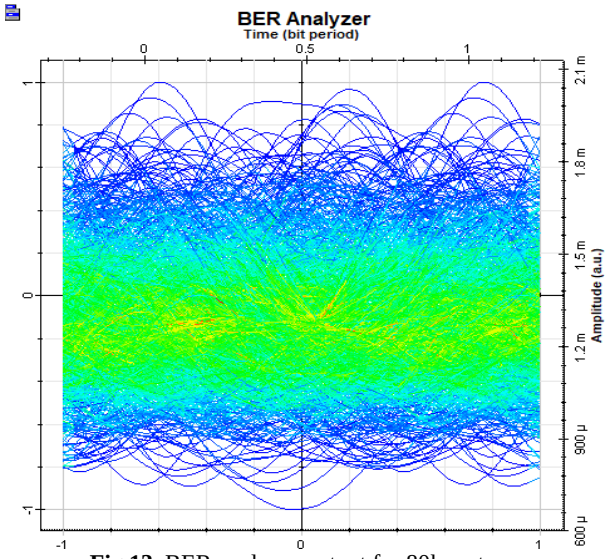

Fig.13. BER analyzer output for 80km at --

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The comparative analysis of both models is mentioned above and if the link distance is increasing the bit error rate of the system also increase rapidly with various values of attenuations and with the constant distance the Quality factor value decreases and system performance also decreases.

Performance of system 1 and system 2 can be compared from the graphs 2 to 13 for different attenuations. From the results, we can decide that system2 has the better transmission capacity for different attenuations compared to system 1[6][7]. But the problem lies with system 2 is it can transmit only one signal at a time.

4. CONCLUSIONS

Free space optics (FSO) is a new way of communication in which transmission of the data is done in free space, which is very less cost, establishment of channel is quite easy compared to the rest of the models. To increase the efficiency of the system and to get better Q values in the different weather conditions research is going on. To derive best results and to solve the issues different technologies are combined. In this paper same optimized parameters are used for two systems; simulation is done for the two different models using *optiwave* software. We can observe that in system 1 Q value is less compared to system 2 for different attenuation and link distance. Under the attenuation value of 2.37db/km, the Q value is more for system2[11]. By increasing the number of inputs, the loss will be increased hence there will be a decrease in the received power. In system 2 only one laser is used hence the loss will be less, the quality factor is good compared to system 1. From this, we can decide that at various attenuation ranges characteristics can be modified and improvised for system 2 with less complexity and circuitry [12]. By increasing the number of inputs, the loss will be increased hence there will be a decrease in the received power. In system 2 only one laser is used hence the loss will be less, the quality factor is good compared to system 1. From this, we can decide that at various attenuation ranges characteristics can be modified and improvised for system 2 with less complexity and circuitry [13].

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