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Research Paper

BLOCKAGE REMOVAL AND RF CONTROLLED PIPE INSPECTION ROBOT (BRICR)

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In this paper we are presenting pipe inspection robot with blockage removal device which is embossed in front of the robot. We are using this method to solve the problem of the blockage which could help to come over the problem in the work field of the sewage distributed lines, industrial pipe inspection, long routed pipe line of different plants. In this robot we have also installed the cleaning rotator which would clean the surface of the pipe, for inspection mini wireless camera is used to inspect the internal section of the pipe. The mechanism of the motors would be controlled by RF module thus it would be less costly and operation would be according to the controller who would be controlling the BRICR accordingly.

Keywords: BRICR, RF module

INTRODUCTION

Pipelines are basic connectivity for different industries as they use it as transport and also for other purpose, e.g., transporting of the oil, supply chain food factories, etc., sometime the major issues arises in sewage pipe that is the problem of blockage and the problem related to leakage cannot be detected by human inspection so it would be easy to locate the defect in the pipes. Inspection robot can reach up to the level or up to that roots where human cant approach.

Till now 'technology in inspection robot' has become very vast in which we have several tech which are doing a bit different thing but the targeted area is same as some of them are (The 33rd Annual Conference of the IEEE Industrial Electronics Society (IECON) 2007; ICROS-SICE International Joint Conference, 2009; and *International Journal of Engineering Trends and Technology (IJETT)*, 2014) as observations and the methods opt by the different papers shows the excellence. As further I am giving a direction of my project which shows the several points on which BRICR works.

It was basically design for the purpose of cleaning, blockage removal from the intruded pipe sections as it involves manual blades system easily controllable by manual switching

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which control accordingly to the use of the blades in the system.

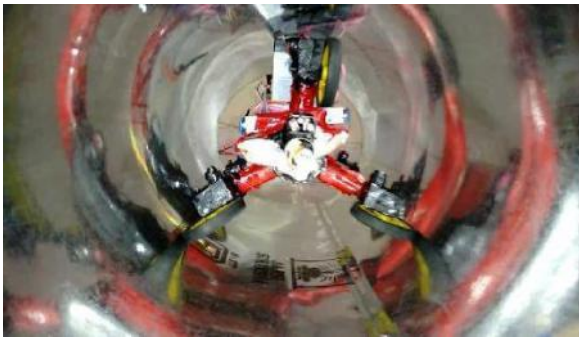
Further the below image shows the figure. Of the project, on further discussion the involvement of other part would also shows the degree of work and important discussion on the system power output and observation in the power consumption between the standard and deviated power.

Through the work at ease we can find the overall loss in effective region (within range of D (meters)) and at effective height of (Tx, Rx). Showing power can work at what minimum scale to propagate the waves at low power with a minimum loss.

Thus we have tested it as a working model it show further formulations and improvement that could help out the problem of power and long error check in the system and into the piper either it work in inspection or about whole system this would be help out in many different region or industrial application where human cant approach at ease by BRICR would do it easily in many different ways.

The BRICR is fully remote controlled which would loaded with two blades in which one would be automatic and another would be manually controlled and it would be carrying 6v battery and structure have strength to carry extra one in an emergency, thus by all this improvement the above covered issues would be solved by a single model.

Figure 1: Diagram



BRICR

Blockage Removal Pipe Inspection Robot (BRICR) as we name it because our main function was to remove the blockage and secondary was to make it fully wireless and equitable with lower cost.

Usually we have divide the BRICR into different parts which consist of working of parts, i.e., part 1 which is front portion which consist of blade or cutting tools as the part show the specification

Figure 2a: Part 1

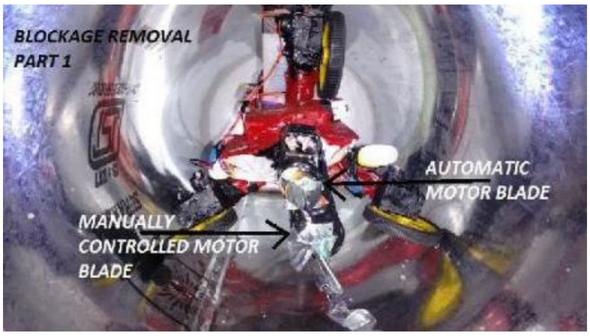


Figure 2b: Part 2

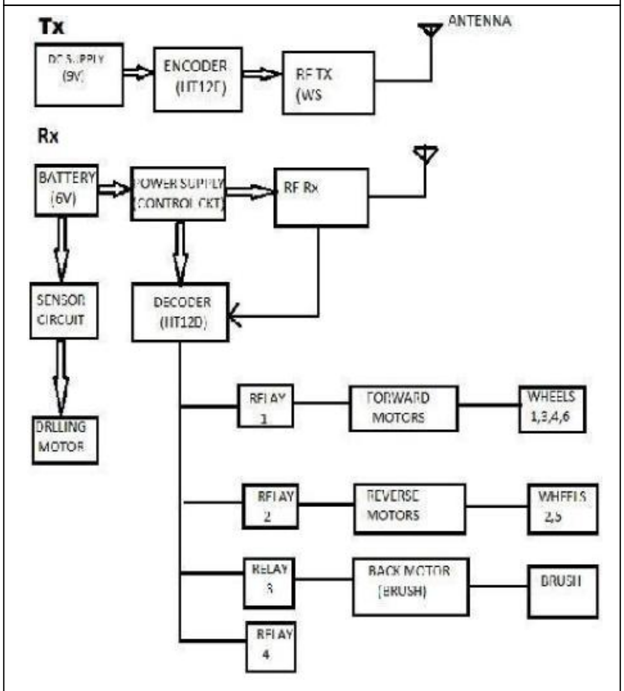
Similarly part 2 consits of cleaning rotar which would clean the surface of the pipe as it make the model cleaner robot also this is also manually controlled through the RF module as below figure shows the Part 2.

BLOCK DIAGRAM OF SYSTEM

Reference to Figure 3 in which the starting is from the transmitting signal carried from the power supply of 9v in which further we will discuss about the relation between output and output (Pt, Vs, Pr), now from transmitting signal the antenna would transmit signal and following signal would be accepted by the receiver.

Receiver part is powered by 6v power supply (battery 6v) in which battery also power circuit of the sensor which is followed by the drilling blades motor, thus after the signal is received the decoder ic would operate the output loads to move the BRICR.

Figure 3: Block Diagram



Further we would discuss about the relation in between the power output, power transmitted and some 3d plots, 2d graph to show how power of RF of our (BRICR) works at what losses and up to what distance.

RELATION BETWEEN POWER TRANSMITTED AND RECIEVED

Starting from the formula of power, taken from book (John Kraus *et al.*, 2006).

Power delivered to the load is P = V^2/(4*R) Watt, where R is antenna of radiation resistance matched to the load.

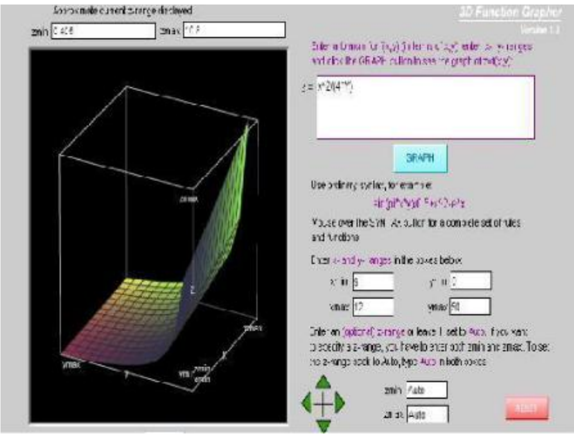
Further plotting the 3D plot of the (Pr, Pt)

1. Plot of the transmitted power (Graph 1)
2. Plot of the received power (Graph 2)
3. Output of (Pr, Pt) shows in the table content (Table 1) which is plotted or give output on Z-axis.
4. Pr vs Pt (dB) Graphs 3a and 3b, Table 2.

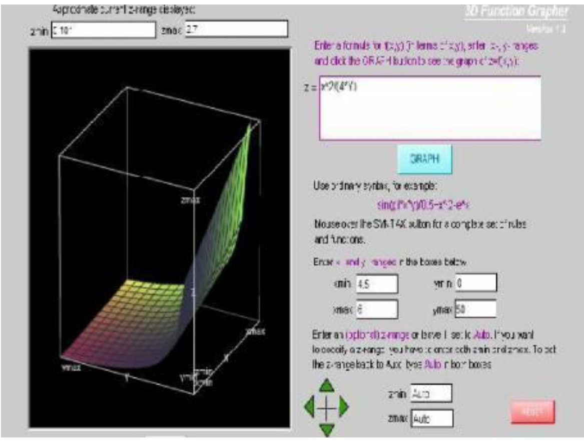
Table 1: Formula Based Inputs

SERIAL NO.	Pin=Pr(Z-axis) Watt	Pout=Pt(Z-axis) Watt	RF Power Conversion(dBm) PdBw=PdBm-30 Pout=Pt	RF Power Conversion(dBm) PdBw=PdBm-30 Pin=Pr
1	.101	0.405	26.07	20.04
2	0.337	1.43	31.55	25.28
3	0.573	2.46	33.91	27.5
4	0.809	3.49	35.43	29.08
5	1.045	4.525	36.56	30.19
6	1.281	5.55	37.44	31.08
7	1.517	6.85	38.19	31.81
8	1.753	7.615	38.82	32.44
9	1.989	8.645	39.37	32.99
10	2.22	9.67	39.85	33.46
11	2.7	10.8	40.33	34.31

Graph 1: Power Transmitted, Vt Input (9-12V), R(Ymax) = 50 ohm, Pt-Zaxis, Vt-X-axis



Graph 2: Power Received, Vr Input (4.5-6V), R(Ymax) = 50 ohm, Pr-Zaxis, Vr-X-axis



Pin = Pt = Vt^2/(4*R); Vt-apply voltage at transmitted antenna

Z = X^2/(4*Y) as this graph is plotted by using 3d online mathematic tool make it possible to plot 3d graph easily (www.math.uri.edu/~bkaskosz/flashmo/gra ph3d2/)

Similarly graph for Pout = Pr = Vr^2/(4*R), Vr apply voltage at receiver, Pr-received power

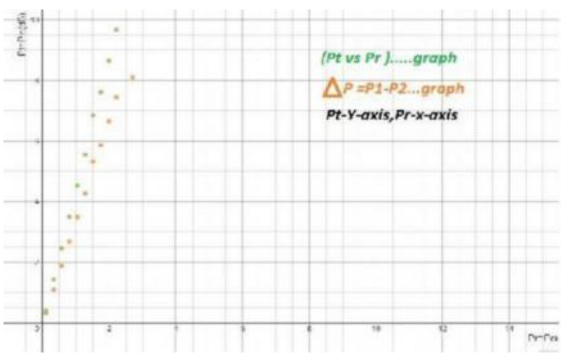
Thus the plot between Power Received and Power Transmitted and difference of them

Table 2: Power Input and Difference

Pr x	Pt y	ΔP $y-x$
.101	.405	0.304
.337	1.43	1.093
.573	2.46	1.887
.809	3.49	2.681
1.045	4.525	3.48
1.281	5.55	4.269
1.517	6.85	5.333
1.753	7.615	5.862
1.989	8.645	6.656
2.22	9.67	7.45
2.7	10.8	8.1

Graph 3: Pt Vs Pr

(a)



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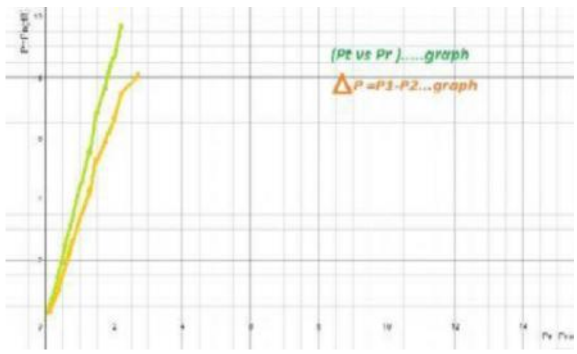
(b)



shows how it works between transmitted power and received power, where Table 2 and the the graph is obtained by use of (www.desmos.com)

TRASMISSION LOSS MEASUREMENT

Formula of FSPL (www.ece.uvic.ca/~peterd/35001/ass1a/nod e1.html) free space path loss basically tell about the loss in the signal strength, from the above reference the final output of formula come is for d distance in km and frequency in MHz, so formula is

Lo = 20log(d)+20log(fc)+32.4 dB, d = km;

Lo = 20log(d)+20log(fc)-27.55 dB, d = m;

Frequency = 434 MHz

Lo = 20log(d)+25.19, and we are operating it into the pipe whose diameter is 31.75 cm and lenth is 91.44 cm which would extended upto 10-15 m.

Now from the Table 3 in which the value of stance is taken x = d(meter)

Now according to loss measurement in RF conversion in which power is converted into dBm from the formula we have plot the graph the between Pr(dBm)Vs Pt(dBm) (www.pasternack.com/t-calculator-power-conv.aspx), (www.desmos.com) plot.

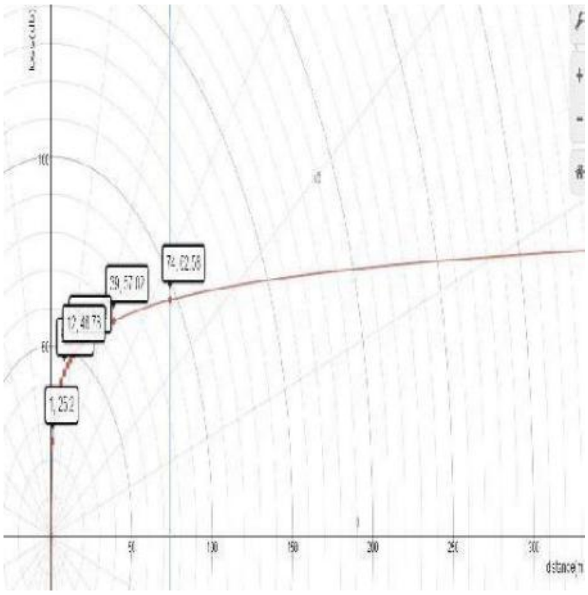
From Table 1

Similarly it would also calculate the Δ Power(P) (dBm) between output which would imply some of the information regarding to the losses in dBm and at what rate it would depend upon the output power and input power shown in Graph 7 and Table 4.

Table 3: Loss Measurement

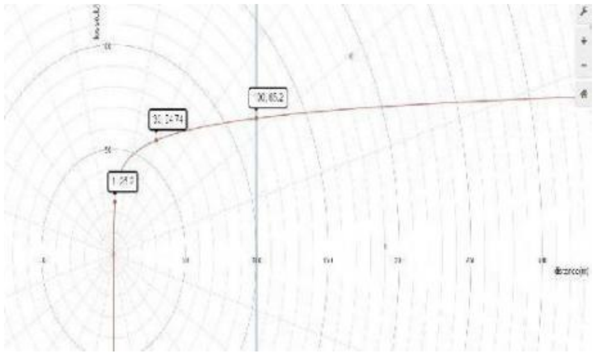
x	$20\log_{10}(x)+20\log_{10}(434)-27.55$
3	34.74222
6	40.76282
8	43.261594
10	45.199795
13	47.478662
15	48.72162
17	49.808773
19	50.774867
22	52.048248
24	52.804019
26	53.499262
29	54.447755

Graph 4: Graph of the Loss with Respect to Distance



ΔP = x-y, power difference, in this case, x and y are converted power from formula imply in the Graph 6.

Graph 5: Graph of Loss/Distance-min, max, Standard



Graph 6: Pt Vs Pr

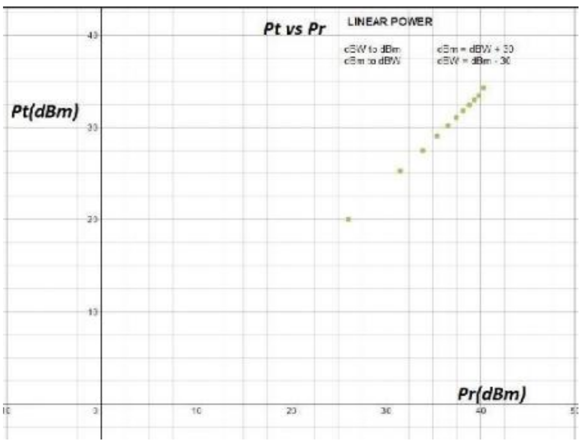
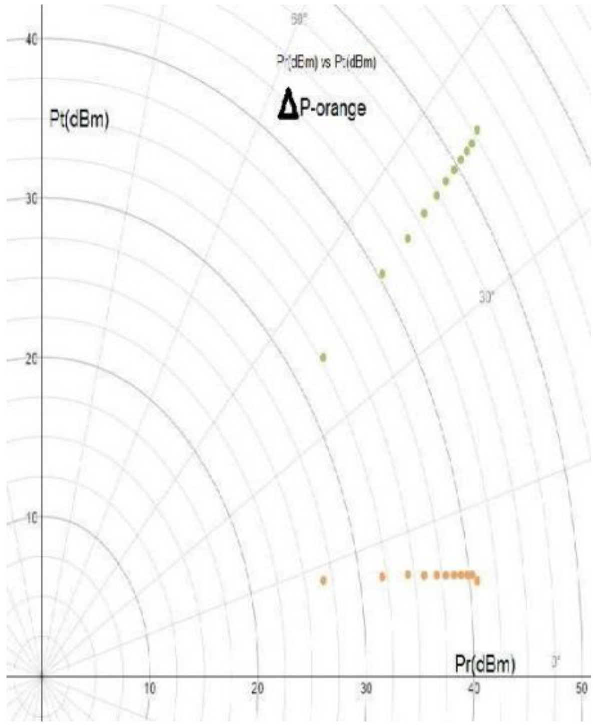


Table 4: Value for Graph 7

x	y	$x-y$
26.07	20.04	6.03
31.55	25.28	6.27
33.91	27.5	6.41
35.43	29.08	6.35
36.56	30.19	6.37
37.44	31.08	6.36
38.19	31.81	6.38
38.82	32.44	6.38
39.37	32.99	6.38
39.85	33.46	6.39
40.33	34.31	6.02

Graph 7: Points from Table 4



CONCLUSION

Since time immemorial a lot of inspection robots have cropped up. What BRICR has to offer has been discussed in the report vividly. The robot has potential to single handedly beat the existing marketable designs with great ease and more so the initial investment being lower, the BRICR is easy on the pocket.

Figure 4: Conclusion

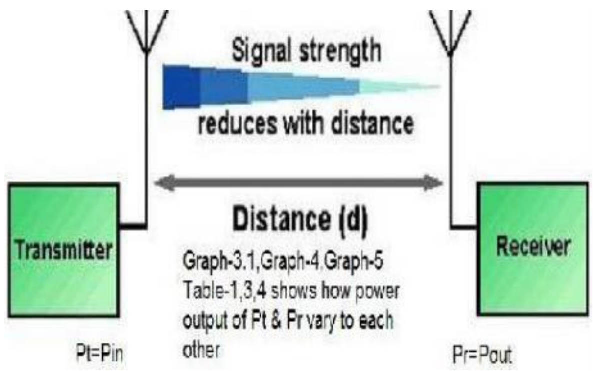
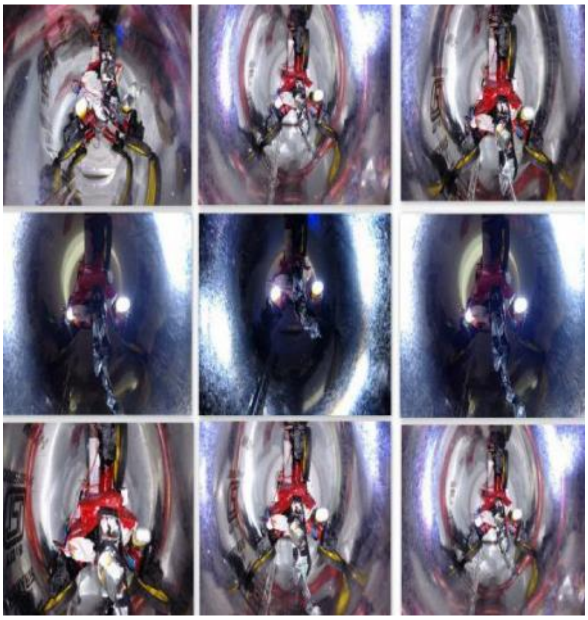


Figure 5: Inspection Tunnel



Till now the robots that were engineered were supposed to be inspection robots. If there is any hindrance of blockage that appeared in the pipeline those robots were at a dead end. Now we have come up with a design that not only is successful in inspecting the complete pipe but also removes the blockages in during its operation phase.

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