The Economic Impact of the Expansion levels of the Remote Control on Traditional System

Elsanosy M. Elamin

Electrical Engineering Department, Faculty of Engineering, University of Kordofan, Elobeid, Sudan

Abstract: The systems are now generally deploying rapidly in their both quality and quantity to meet the current requirements of the development. The running operating expenses are also increasing proportionally to the system sophisticated. Therefore, the aided tools are required to assist in reducing the overall expenses versus the total throughput. The expansion levels of remote control are used as aided tool. The paper discusses the impact of expansion levels of remote control on the water pump station as tradition system. The remote control levels are applied gradually and consequently the impact is evaluated. The cost decreased as the remote control levels increased. The remote control system can be trusty applied to such systems.

Keywords: Control Levels, Decoders, Devices, Cost Reduction

I. INTRODUCTION

The tradition system in this case is water pump station was operated manually because of locating in far spacing positions. So, it required to be controlled according to the need of water size as a maximum throughput. Therefore, the control process can be carried out remotely to assist in reducing the cost of operators when high demand. The paper illustrates the way exploiting the remote control system and its impact on the station as overall cost reduction when applying the remote control levels gradually. The station is working 24 hours a day to provide a continuous supply of water. The working team is divided into three equal qualified shifts. Each one is consists of 9 engineers and 36 technicians when the station performing the full capacity. The overall team members of all shifts are 135 members. The water pump station is composed of 128 water pumps to be switched on/off according to the need.

II. THE REMOTE CONTROL SYSTEM

Is used to reduce the working team members at each shift. The key factor in expanding this system into multi-different levels is the decoders that are shown in the table 1[1], [2].

Table 1 shows the decoders used in expansion levels

Decoder Type	*No of Decoders*	*No of Controlled Devices*	*Controlled Devices*
1:2	7	14	10%
2:4	6	24	18%
3:8	5	40	31%
4:16	4	64	50%
5:32	3	96	75%
6:64	2	128	100%

The beating heart that of selecting devices according to the pre-defined scenario is the PC. The team member has to enter a controlling value related to the controlled device remotely through cell phone1 (MS1) via wireless network to the cell phone2 (MS2) as shown in fig 1. The controlling signal is generated by the remote user who carries MS1 in all the wireless coverage area to assure all the required security features such as authentication, integrity, and ciphering. The controlling signal is captured by the MS2 that attached to the DTMF. DTMF decoder extracts the controlling signal and converted into equivalent binary values and then transmitted to the PC through DB25 connector. The related PC codes react to the incoming controlling signal and processed to provide an appropriate decision to switch the relevant device. Selecting the relevant device is depending upon the addressing by 3:8 decoders. The 3:8 decoder is the basic element of building 8:128 decoder. It consists of two groups of 6:64 decoder. Every group is controlled by the Enable terminal (É) [1], [3]. The Enable terminal is selected and generated through the DB25 connector (2 and 3). When the terminal 2 is selected, it can activate the devices that belonged to the group 1 (dev1 up to dev65). And the terminal 3 can also activate the devices of group 2 (dev65 up to dev128). The HCF4069 is exploited to invert the values of output 2 and 3 of DB25 connector, because 3:8 decoder is enabled with low logic level. Whereas the rest of DB25 pins (9, 8, 7, 6, 5, and 4) are used as address to activate the relevant device.

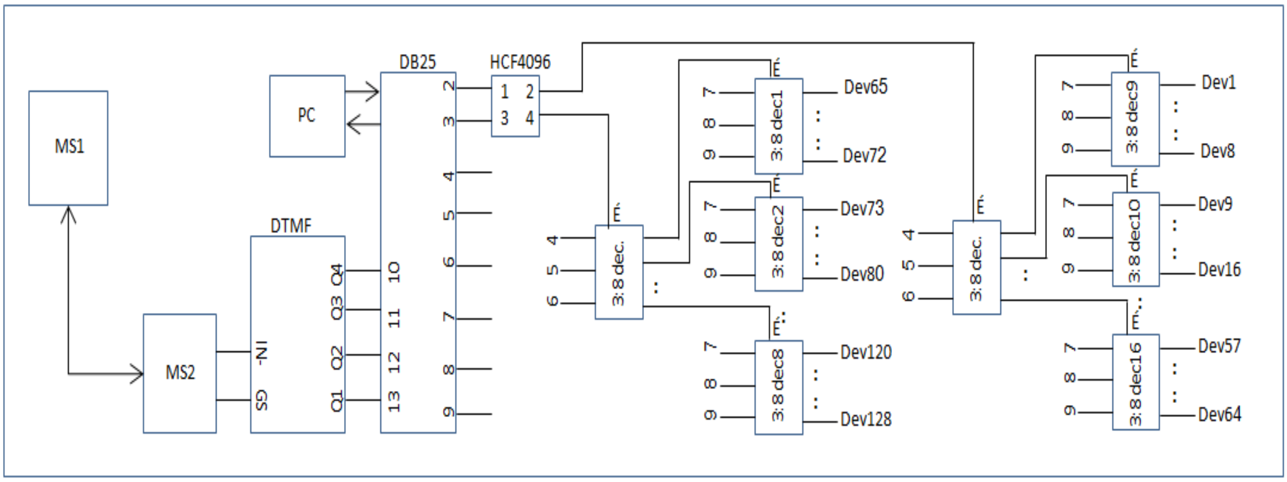

Fig. 1. Illustrates the maximum expansion level of remote control [4]

III. THE TRADITION SYSTEM

It established to provide a continuous water stream and operated under supervision of qualified shifts. Every working shift team members is formed of three engineers and 12 technicians for each department as shown in table 2 below [5], [6].

Table 2 shows the team members per a shift

	Mechanical	*Electrical*	*Instruments*
Engineers	3	3	3
Technicians	12	12	12

Now, the remote control system is gradually applied to the station. As a result, there is a number of left members from each shift as shown in table 3. The number of left members

The total number of the left members is distributed among the three different departments depending upon the criterion that for every left engineer there are also four technicians are left. The number of left members in table 3 is approximated to comply with the aforementioned criterion. Table 4 illustrate the distribution of both working and left members per shift relating to the different levels of the remote control system when applied.

Table 3 shows the number of left members for three shifts versus applied expansion level

No of Controlled Devices	*Controlled Devices*	*left members*	*No of the Left members*
14	10.94%	7%	9
24	18.75%	13.5%	17.5 ≈**15**
40	31.25%	23%	31≈**30**
64	50%	37.5%	49.9≈**48**
96	75%	56%	75.6≈**69**
128	100%	75%	101.25≈**99**

Table 4 shows the left team members/shift when the remote control levels applied

@ 7%	Working members			Left mem.	***@13%***	Working members			Left mem.
	Mech.	Elect.	Instrum.			Mech.	Elect.	Instrum.	
Eng.	3	3	3	0	*Eng.*	3	3	2	1
Tech.	11	11	11	3	*Tech.*	11	10	11	4
Total	14	14	14	3	*Total*	14	13	13	5
@23%	Working members			**Left mem.**	***@37%***	Working members			Left mem.
	Mech.	Elect.	Instrum.			Mech.	Elect.	Instrum.	
Eng.	3	2	2	2	*Eng.*	2	1	2	4
Tech.	10	9	9	8	*Tech.*	8	8	8	12
Total	13	11	11	10	*Total*	10	9	10	16
@56%	Working members			**Left mem.**	***@75%***	Working members			Left mem.
	Mech.	Elect.	Instrum.			Mech.	Elect.	Instrum.	
Eng.	2	1	1	5	*Eng.*	1	1	1	6
Tech.	6	6	6	18	*Tech.*	3	3	3	27
Total	8	7	7	23	*Total*	4	4	4	33

IV. RESULTS

The main cost that is been evaluated is the total payment to working members according to the fact that the cost of four technicians is equal to the one engineer cost. So, the overall cost of 27 engineers and 108 technicians is equal to the cost of 216 technicians. Table 5 shows the total cost reduction when applying the remote control system. It is found that the remote control system has a great impact when it applied to 50% of the water pumps of the station and up. The number of left members below the 50% is generally consists of technicians rather than engineers.

Table 5 shows the total cost reduction versus the total left members

Controlled Devices	Left Members			Cost Reduction
	Engineers	Technicians	Total	
10%	0	9	9	4.17%
18%	3	12	15	11.11%
31%	6	24	30	22.22%
50%	12	36	48	38.89%
75%	15	54	69	52.78%
100%	18	81	99	70.83%

Both fig 2 and 3 shows the relationship between controlled devices and both left members and cost reduction. It is clearly that remote control system is affect greatly on the station in reducing the working team members for each shift especially at full remote control. As a result, the payment for the working members is also reduced.

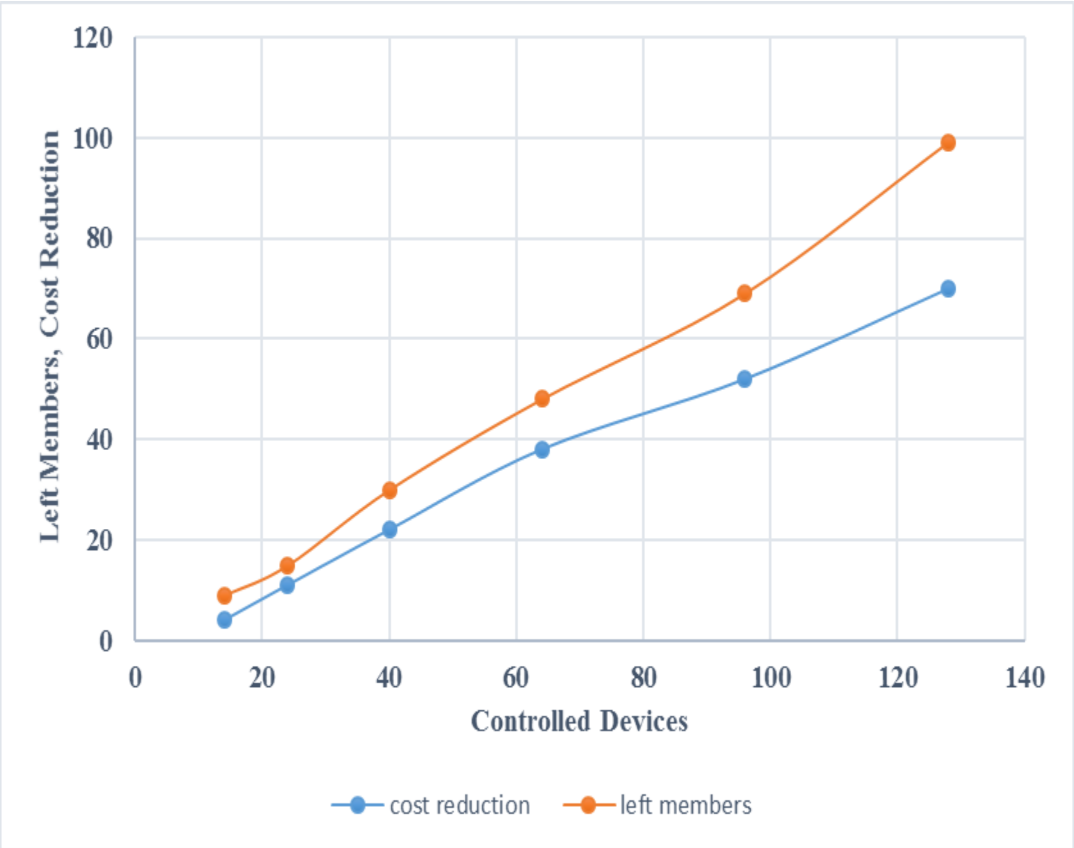

Fig 2 the controlled devices versus left members and cost reduction

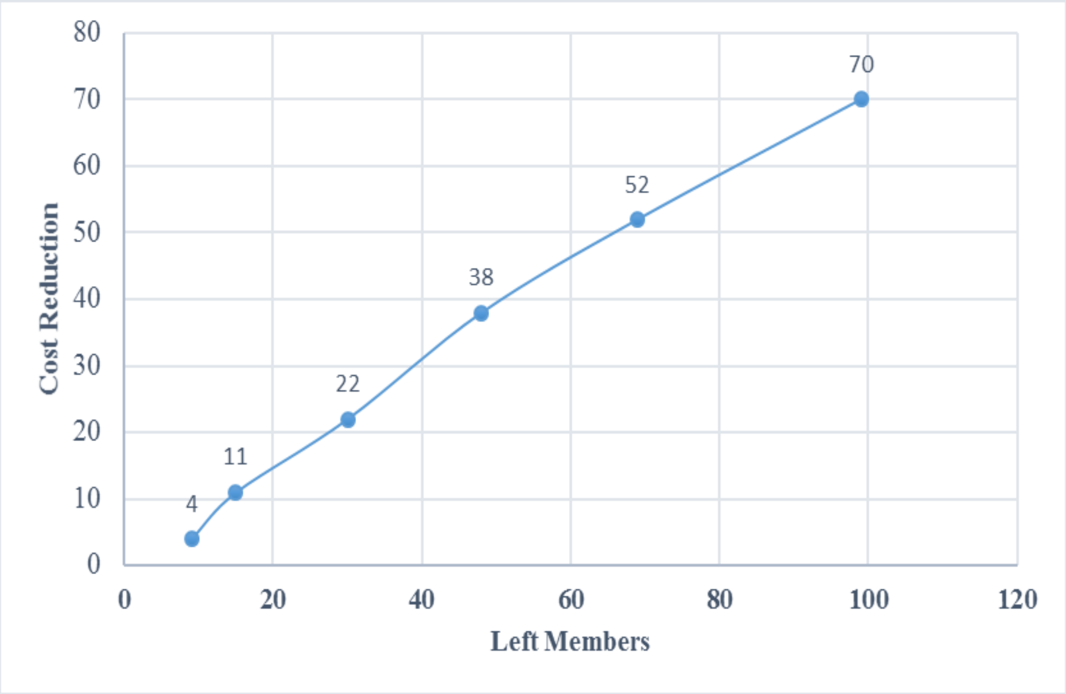

Fig 3 Left members versus cost reduction

V. CONCLUSION

The remote control system is applied gradually and it is impact is evaluated. Its impact shows the feasibility of using such systems especially the complicated one. The study focused only on the cost of member's payment. Also the system can be re-evaluated for running, maintenance, and capital cost to show the great impact.

Conflict of Interest: The author declares that he has no conflict of interest

Ethical Statement: The author declares that he has followed ethical responsibilities

REFERENCES

[1] Elsanosy M. Elamin, Murtada M. Abdelwahab, Abdelrasoul J. Alzubaidi, (2015). Wireless Secured Remote Control System Expansion, IOSR Journal of Engineering, Vol.3, pp 48-51.

[2] Elsanosy M. Elamin, Zohair M. E. Husein, Abdelrasoul J. Alzubaidi, (2015). "CDMA Based Secured Dual Gain Control of Helical Feed Parabolic Reflector Antenna", IJEEE International Journal of Electrical and Electronics Engineers, Vol.7, pp.257-263.

[3] Elsanosy M. Elamin, Abdelrasoul J. Alzubaidi, (2013). Secured Remote Switching DC Motors, IOSR Journal of Engineering IOSRJEN, Vol.3, pp.7-10.

[4] Robert L. S, George T. N, (1998). Pumping Station Design, Butterworth-Hieinmann, Montana.

[5] Elsanosy M. Elamin, Zohair M. E. Husein, (2016). The Maximum Expansion level of the Secured Remote Control System, IJEEE International Journal of Electrical and Electronics Engineers, Vol.8, pp.132-136.

[6] Hubbel R. C, (2012). Pump Station Maintenance, YCUA.

