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Wireless Secured Remote Control System Expansion

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Abstract:-The wireless secured remote control system can be directly controls the devices through eight data lines from data register in PC via DB25 connector [1]. The paper shows how to expand the data lines up to more than eight lines. The system is principally structured into hardware and software to show that the independent interface of more devices requires dependant software to drive the relevant devices. The hardware grouped into wireless network, PC, interfaced circuits, and controlled devices.The usage of wireless network provides the system with user mobility while performing the control processes in addition to the ease of maintenance and other important issues**.**

Keyword:*CDMA, HCF4555B, PC,mobile, controlled devices.*

I. INTRODUCTION

The system aims to expand the controlled devices. The principal part of the system is PC. It used instead of microcontroller to aid in controlling more devices through a software program that react to the transmitted signal from a mobile user. PC provides a flexible feature to edit or reconstruct the program to comply with any more interfaced devices to the existing system as updating process [4]. The updating process that can be carried out by means of exploiting HCF4555B decoder/multiplexer to expand the output of the eight data lines up to twentyfour lines. The new twenty four output lines are possible to assist in controlling about almost up to 24 devices. The controlled devices are all determine the reasonable required interface circuit. The utilization of HCF4555B in expanding such systems is playing the major role in addressing the required controlled devices. So, the reasonable required interfaced circuit can be coupled in between the devices and decoder output**.**

II. THE SYSTEM ELEMENTS

The system elements are all playing an integrated role in assisting the signal to go across the system stage. The system elements have to act to each other to help in performing the required control processes by mobile user. The overall system is parted into two major categories:

- Hardware
- Software

The hardware of the system is structured into many different stages. Each one is differed from other in its components and role [2]. The general concept of the system performance is the remote control of many different devices that attached to the PC by means of wireless network such as GSM or CDMA technology.

III. HARDWARE

The main factor that acts principally in control is the controlling signal that used by the mobile user. The employment of the mobile station provides the user with mobility**.**

1. **CDMA technology**: is the environment that the controlling signal be initiated and transmitted to perform the controlling process. CDMA technology can provide the user with digital signal processor, radio transceiver, air interface to CDMA network, and DTMF generator. In addition, the wireless network is also preventing interferences phenomenon and other highly important features. The transmitted signal passes through CDMA network to the called mobile phone that resides with HM9270D and PC.
2. **The HM9270D**: is a complete DTMF receiver integrating both the bandsplit filter and digital decoder functions. The filter section uses switched capacitor techniques for high and low group filters and dial tone rejection. Digital counting techniques are employed in the decoder to detect and decode all 16 DTMF tone pairs into a 4-bit code. External component count is minimized by on-chip provision of a differential input amplifier, clockoscillator and latched 3-state bus interface [7].
3. **PC:**Both new interface devices and code modifications of the controlling software can be carried out within PC to improve the security feature in addition to the security issues in CDMA network when control process

took place. The controlling software acts as beating heart of the system as well as regarded as developing tool to strengthen the way of controlling.

4. **The HCF4555B**: is a monolithic integrated circuit fabricated in Metal Oxide Semiconductor technology available in DIP and SOP packages. The HCF4555B is a dual 1 of 4 decoder / demultiplexer. Each decoder has two select inputs (A and B), an Enable input ($\bar{E}$), and four mutually exclusive outputs. On the HCF4555B the outputs are high on select. When the Enable input is high, the outputs are low regardless of the state of the select inputs A and B [5].
5. **The DB-25 male connector**: is used for device control and communication through software program.It consists ofdata, control, and status lines to be used as input/output buses. these lines are connected to relevant registers as stated in table 1

Table 1: Parallelport address

Register	LPT1	LPT2
Data register(base address0)	0x378	0x278
Status register(base address+1)	0x379	0x279
Control register(base address+2)	0x37a	0x27a

6. **The load:** The controlled devices can be any low current devices such as Beverage Cooler/ Heater, Coffee Maker, Ionic Vehicle Air Purifier / Deodorizer, Rechargeable Inflator Compressor, RoadPro Air Compressor, Portable Stove, and portable oven. Or any heavy current devices through relays.

IV. PERFORMANCE CONCEPT

The performance of the system is basically can be demonstrated according to the schematic diagram in fig1. The hardware elements show the importance of each one to reveal the overall signal transition across the system.

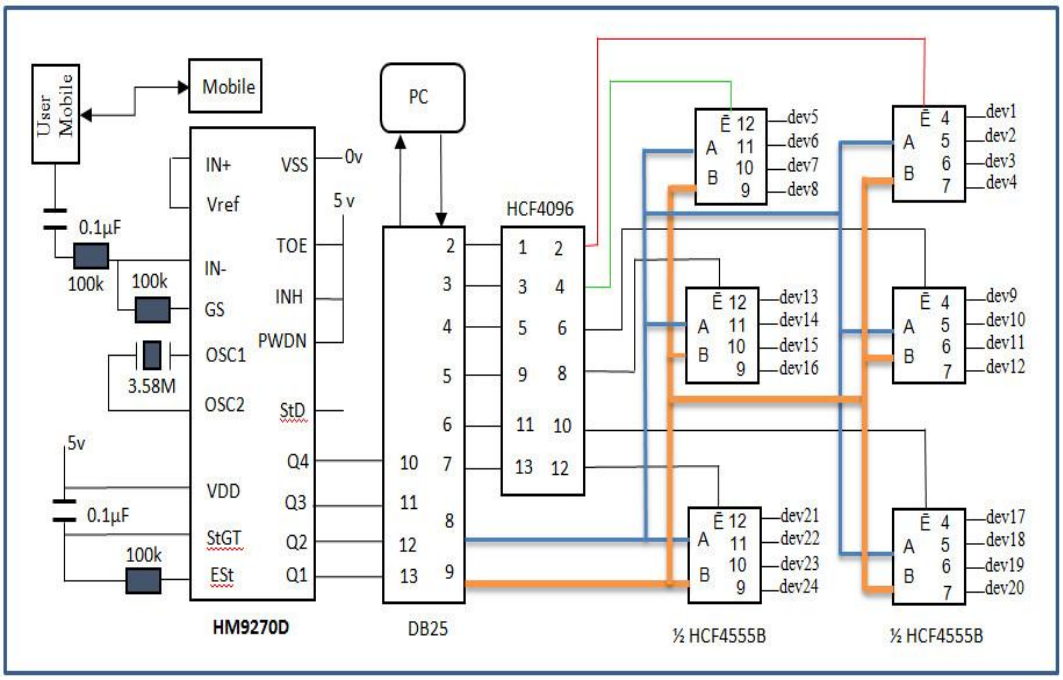

Fig.1 shows the pin configuration of the system

1. **CDMA Network:** the controlling signal starts travelling from the user mobile across the network performing all the security issues such as authentication, confidentiality, anonymity, and integrity. Then, it reaches the called mobile phone which is located with the controlled devices. The calling mobile phone or mobile usercan enter the password to authorize him to the system in order to perform all the necessary required control processes. So, the output of the called mobile phone is then route the controlling signal via a coupling capacitor tothe HM9270D so as to decode the signal into relevant equivalent binary value to be manipulated via PC program software.

2. **The HM9270D:** In the first stage of the HM9270D, the incoming controlling signal that comes from far distant user mobile station represents the input conditions to the HM9270D through the RC adjustable gain circuit to set the signal according to the application requirements [7]. Such a function is done inside the

HM9270D by the buffer circuit which is represented by operational amplifier providing a unity gain and buffer the other input components. Then, the buffer circuit followed by the band pass filter which is minimize the incoming signal bandwidth. This filter is succeeded by splitting circuit to feed high and low pass filters to drive a digital detect circuit through high gain comparators which are limiting the signal to prevent detection of unwanted low level signal. The digital detection circuit consists of digital counting technique to determine the frequencies of the incoming signal and to verify that the incoming signal components correspond to standard DTMF frequencies. So, a valid DTMF signal decoded to yield the output combinations as Q_1 – to - Q_4.

3. **PC:** The HM9270D is directly interfaced to the PC by means of status lines of the DB25 connector to transmit the signal frequencies. The processor reads the incoming frequency values at the status register (0x379) and processes them with program codes. Then, reacts properly to the appropriate device through the data lines, which are related to the data register (0x378), up to interface circuits. The interface circuit used to buffer and boosts the signal while in its way to the controlled devices. Then, the HCF4555B decoder / multiplexer is used to expand the output eight lines up to twenty data lines for controlling more devices.

4. HCF4555B: is been exploited to play a fundamental role in expanding the output lines of data register. It consists of three input as A, B, and $\bar{E}$ (enable chip) to yield four outputs. So, three pieces of HCF4555B can be usedand enabled with six data lines (every chip enabled with two lines). The diagram in fig1 shows the relevant configuration [5]. Therefore, only two lines (A and B) output of data register used as address to every single chip of HCF4555B. Accordingly, the threechips can be enabled via HCF4096 hex inverters. So, the overall possible output lines are 24. Fig1 depict the relevant processes.

5. **The Enhancer**: for well designed system, the load has to be driven in appropriate manner and with adequate output voltage. In this paper all of the controlled devices are required to be driven with 12 VDC and above. Therefore, the chip ULN 2803A satisfies what is exactly required. This chip helps signal enhancement during travelling all over the system. So, three chips are utilized in between HCF4555B and the controlled devices [5], [7].

V. THE SOFTWARE

When the incoming signal receives to the PC program codes, the codes reacts to the signal according to the predefined scenario in algorithm in Figure 2 that specify the operation of the devices

The scenario that the system has to carry out sequentially depends upon the controlling signal that sent from user. The controlling signal is a combination of just decimal numbers[1]. The program software act as follows:

- The Turbo C++ firstly put all the controlled devices in an idle state when starting.
- The Turbo C++ received only the correct password and initialized the system, otherwise the system will disconnect after only three attempts.
- Reading the received signal from the mobile useras an output of the HCF9270D at the relevant address of DB25 connector.
- Reacting to the incoming signal as appropriate decision to drive load.
- Showing the device states to show the right decision [1], [2].

The following is the table2 that shows the approach of activating the devices.

Table2 shows the way of activating the devices

I/P	DB O/P	ACTIVATE	I/P	DB O/P	ACTIVATE	I/P	DB O/P	ACTIVATE	I/P	DB O/P	ACTIVATE
01	0x01	Dev1	07	0x42	Dev7	13	0x08	Dev13	19	0x50	Dev19
02	0x81	Dev2	08	0xC2	Dev8	14	0x88	Dev14	20	0xD0	Dev20
03	0x41	Dev3	09	0x04	Dev9	15	0x48	Dev15	21	0x20	Dev21
04	0xC1	Dev4	10	0x84	Dev10	16	0xC8	Dev16	22	0xA0	Dev22
05	0x02	Dev5	11	0x44	Dev11	17	0x10	Dev17	23	0x60	Dev23
06	0x82	Dev6	12	0xC4	Dev12	18	0x90	Dev18	24	0xE0	Dev24

Fig 2 shows the flowchart of the system that depict the process of activating the devices (dev1, dev6, dev11, dev16, dev18, and dev24) as example

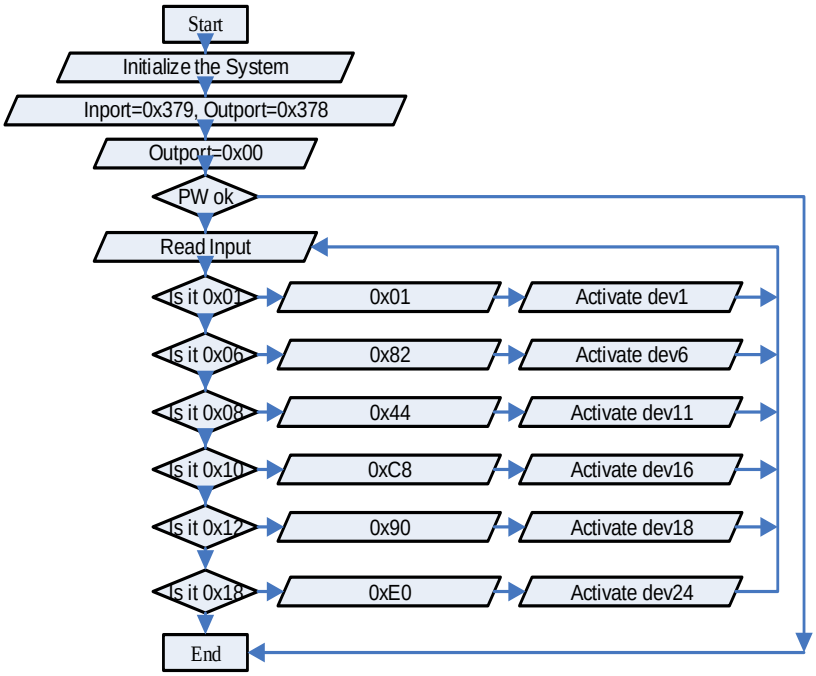

Fig 2 algorithm of the system

VI. RESULTS AND DISCUSSION

The wireless secured control system expansion is presented and tested under different constrains of input values. Table3 shows the operation modes of dev1, dev6, dev11, dev16, dev18, and dev24. It results in a reasonable output as specified by the software program. The obtained results are listed below in table 3. The pressed keys are relevant to the devices according to the predefined operation of the devices as stated in table 2.

Table3 shows the result of devices operation

Pressed key	DB25 Output	Activate
01	0x01	Dev1
06	0x82	Dev6
11	0x44	Dev11
16	0xC8	Dev16
18	0x90	Dev18
24	0xE0	Dev24

VII. CONCLUSION

In this paper, the wireless secured remote control system expansion is proposed and tested according to the predefine scenario. It provides reasonable results that enable the system to be reliable and applicable in many different fields of remote control such as industrial complex. This work may experience some difficulties that may affect the operation of the system when there is no feedback of operation status. So, it is highly important the system supplied with feedback by any means to verify the operation status.

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