Master-Slave Circuit Communication by Using PC Bluetooth Based Technique

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الخلاصة

الهدف من هذا البحث هو عمل محاكاة للبلوتوث في جهاز الكمبيوتر عن طريق تصميم دائرتين (الاساسية والثانوية) والتي تعمل بصورة مماثلة لعمل جهاز بلوتوث. يصف هذاالبحث كيفية التحكم عن بعد بجهاز البلوتوث في الحاسوب عن طريق استخدام المايكروكونترولر باستخدام جهازي Bluetooth، عندما يقوم الجهاز الأول (في الدائرة الرئيسية) على سبيل المثال بارسال حرف «A» من المايكروكونترولر في hex فان جهاز البلوتوث الثاني (في الدائرة الثانوية) سيستلم الحرف «A» أيضا في hex. وفي هذه الحالة سيقوم المايكروكونترولر في الدائرة الثانية بفهم الاشارة ومعالجتها لإنجاز المهمة المطلوبة. تم استخدام المصد (CD4050B) لنقل البيانات من جهاز البلوتوث الى المتحكم الدقيق بفولتية حيث يستطيع المتحكم الدقيق التعامل معها. وتم استخدام نوعين من منظمات الفولتية أ النوع الاول (L7805) هذا النوع من المنظمات يستخدم لتنظيم الفولتية المستلمة من المصدر (7) فولت الى (5) فولت مناسبة لعمل المتحكم الدقيق. النوع الثاني (LD330V) لتقليل الفولتية الى (3.3) فولت لضمان عمل جهاز البلوتوث وبعض الدايودات الضوئية.

الكلمات المفتاحية

البلوتوث، المايكروكونترولر،محطة لا سلكية.

Abstract

The aim of this research is to implement a simulation of PC Bluetooth by designing two circuits (master and slave) which will perform a task in similar way as the PC Bluetooth. The project describes how to control the wireless plant (by using Bluetooth devices).This project is consist of two Bluetooth devices: the first device (transmitter circuit) sends the character "A" for example in hex from microcontrollerand the second Bluetooth device (receiver circuit) will receive the character "A" also in hex. The microcontroller in the slave circuit will understand this character and it will perform a particular task (how to control to the plant wireless). Buffer no. (CD4050B) which used to transfer data from Bluetooth devices to Microcontroller with voltage that Microcontroller can be operated to it , (Regulators) that have two no. the first no. is (L7805) this type of regulator used to regulate voltage that received from power supply (7)V to (5)V so that Microcontrollers can be operated to it. The second regulator is (LD330V) which used to reduced voltage to (3.3)V in order to operate the Bluetooth devices, and many led to compensate the plant.

Keywords

Bluetooth, Microcontroller, wireless plant.

1. Introduction

Circumstances that we find ourselves in today in the field of microcontrollers had their beginnings in the development of technology of integrated circuits. This development has made it possible to store hundreds of thousands of transistors into one chip. That was a prerequisite for the production of microprocessors, and the first computers were made by adding external peripherals such as memory, input-output lines, timers and other. Further increasing of the volume of the package resulted in creation of integrated circuits [1].

PC Remote Control is a remote desktop application to help users to control computers and laptops via Wi-Fi and Bluetooth on mobile devices. PC remote control is supported by Windows. The Bluetooth wireless technology is set to revolutionize the way people perceive digital devices in our homes and office environment [2]. The recent developments in technology which permit the use of radio frequency (RF) technology such as Bluetooth, and radio spectrum have enabled different devices to have capabilities of communicating with each other [3]. Bluetooth is a new and developed technology enabling to connect the electronic devices such as computer, Mobile, key board, and headphone to exchange data and information without wires or cable.

1.1. Literature survey:

Wireless communication is used in many applications by using light ray in the range of infrared and this light ray is not seen by eye. The light ray is called Infrared because it has frequency smaller than frequency of red light. Infrared is used in the remote control which is called Infrared Data Association (IrDA), also it is used in many terminal devices of computer [4].

Although the device depends on infrared but it has two problems. The First problem is that, the technology uses the infrared works only in the range of the light of slight vision, this mean that, we should direct remote control to TV directly in order to control it. The second problem is that, the technology uses infrared is the one to one technique, which enable exchange infrared between two devices only, i.e., exchanging information between computer and held computer devices by infrared, but it is not able to exchange information between computer and Mobil.

The reader may be asking if the device will exchange information and data in a radio signal works at (2.45) GHZ, then what about overlapping between signals which may cause the confuse we may notice on the TV screen when overlaps with wireless signals? The problem of overlapping is solved in an intelligent method, the signal of Bluetooth is poor and its range is about 1mw if it is compared with the signal of Mobil which reach to 3w. This poor in signal make the range of Bluetooth signal effect in limit circular, and its diameter is (10) m [5].

1.2. Background:

1.2.1. Master and Slave circuits:

Bluetooth 2 Stick is an additional board which enables the microcontroller to communicate with wireless devices [6] as shown in Fig.(1) and Fig.(2).

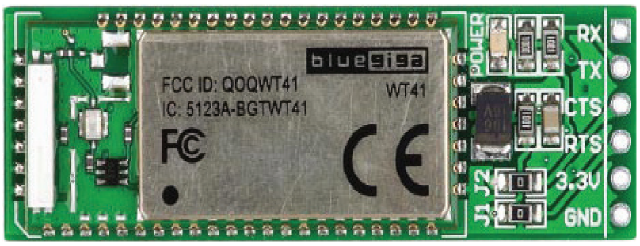

Fig. (1): External view of Bluetooth (2) Stick block diagram.

Key features: Serial UART communication, Range up to 50m and (3.3 V) DC power supply.

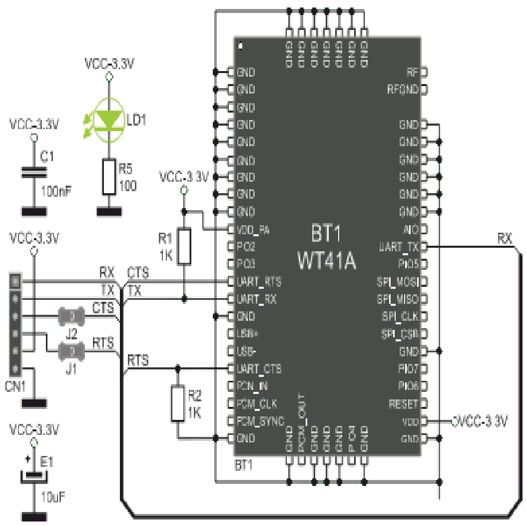

Fig. (2): Pin diagram of Bluetooth 2 Stick

1.2.2. Microcontroller:

The microcontroller consists of integrated circuits contained both processor and peripherals. That is how the first chip containing a microcomputer, or what would later be known as a microcontroller came about .There are twelve general purpose input/output (I/O) pins available. Depending on which peripherals are enabled, some or all of the pins may not be available as general purpose I/O. In general, when a peripheral is enabled,the associated pin may not be used as a general purpose I/O pin as shown in Fig. (3) [7,8].

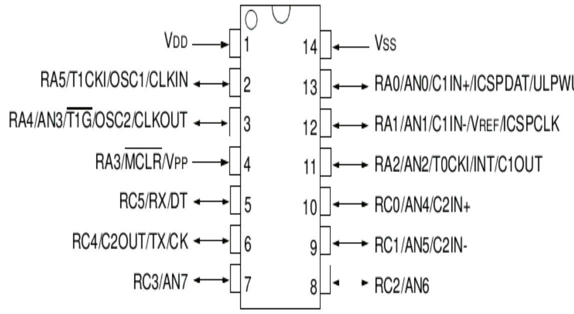

Fig. (3): External diagram for PIC16F688 with peripheral

1.2.3.Regulator

There are many type of regulator, here we uses two type of them. First is

L7805 and the second is LD330VFig.(4). [9].

Fig.(4): regulator L7805

1.2.3.1.Features for L7805

1-output current to 1.5A.

2-output voltages of 5;5.2;6;8;8.5;9;10;12; 15;18;24V.

1.2.3.2 Features for LD330V

1- Output current to 1.5A.

2-Output voltage 3.3V.

1.2.4.Description of Regulator

The L78xx series of three-terminal positive regulators is available.Several of them fixed output voltages, making it useful in a wide range ofapplications. These regulators can provide local on-card regulation,eliminating the distribution problems associated with single pointregulation. Each type employs internal current limiting, thermal shut-down-and safe area protection, making it essentially indestructible. If adequateheat sinking is provided, they can deliver over (1) A output current.Although designed primarily as fixed voltage regulators, these devices canbe used with external components to obtain adjustable voltage and Currents Fig.(5).

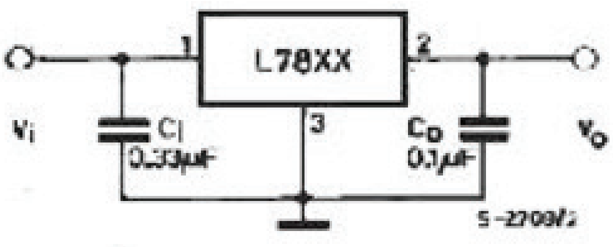

Fig.(5): application circuit

1.2.5 CMOS Hex Buffer/Converter

The CD4050B device is non-inverting hex buffers, and feature logic level conversion using only one supply voltage (VCC). The input-signal high level (VIH) can exceed the VCC supply voltage when this device is used for logic-level conversion. (VCC =5V, VOL ≤ 0.4V, and IOL ≥ 3.3mA). The CD4050B is designated to replacement for CD4010B. Because the CD4050B require only one power supply, they are preferred over the CD4010B and should be used in place of the CD4009UB and CD4010B in all inverter, current driver, or logic-level conversion applications. In this applications the CD4050B is pin compatible with the CD4010B and can be substituted for this device in existing as well as in new design. Figure blew present diagram and pin configuration for buffer fig.(6).[10]

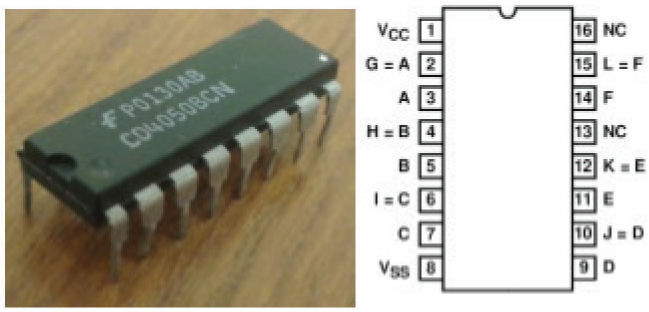

Fig.(6): block diagram and pin configuration for buffer

2. Theoretical part

2.1. Transmitter circuit (Master Circuit):

Fig.(7) illustrates a typifies transmitting circuit which contains upon (Bluetooth ,microcontroller and Buffer Voltage Amplifierwhich connect Bluetooth with microcontroller) because Bluetooth operate at (3.3)Vwhile microcontroller operate at (5)V, so Bluetooth transmit the data to the buffer in (3.3)V then the buffer transmit the same data to the microcontroller at 5V. The circuit contains a power of (7) V and voltage regulators to convert the high voltage to (5) V and (3.3)V. The green LED to show the waiting time (delay); in waiting the LED have been off. When the power switch become ON then, wait more than half minute we note that the green LED is light. That means Bluetooth ready to receive information from switch and transmit it to the second Bluetooth. Fig.(8) illustrates a buffer for Master circuit.

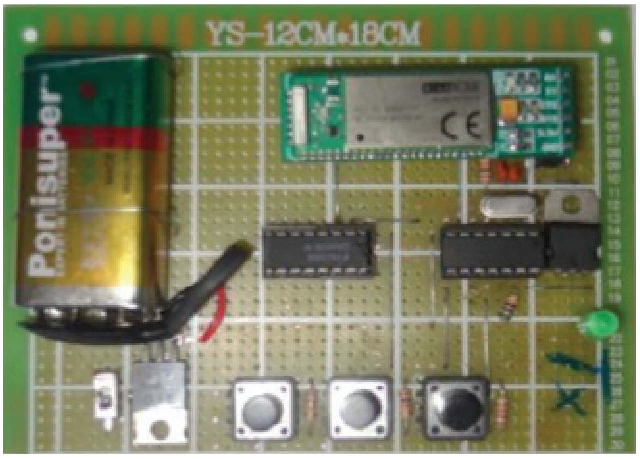

Fig. (7): Master circuit

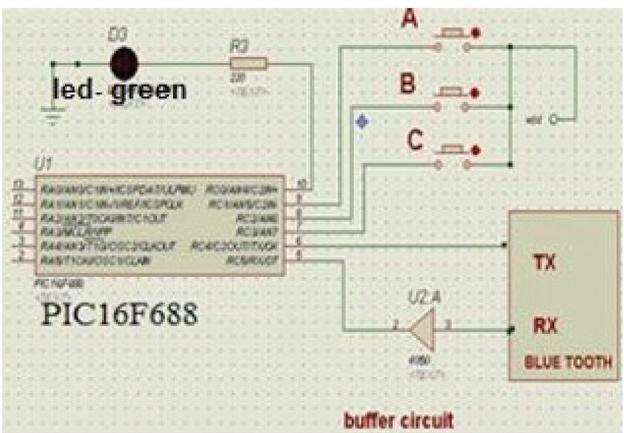

Fig. (8): Buffer for Master circuit

program Master:

```
ORG 0200
START:
CLR C
CLR PC.5
MOV C,PC.5
JHG : JNB C,JHG
SETB PA.0
LCALL DELAY ;          5 Sec.
DD: MOV C,PA.3 ;       Press SW3
JNB C,Q
SJMP Q1
Q: MOV C,PC.3 ;        Press SW2
JNB C,QM
SJMP Q2
QM: MOV C,PC.4 ;       Press SW1
JNB C,DD
SJMP Q3
;……………..........................……………………
Q1: MOV R0 ,#4
CLR C
MOV R1,#00001010b
MOV A,R1
SWAP A
PPP: RLC A
MOV PC.5,C
DJNZ R0, PPP
SJMP DD
;……………..........................……………………
Q2: MOV R0 ,#4
CLR C
MOV R1,#00001011b
MOV A,R1
SWAP A
MMM: RLC A
MOV PC.5,C
DJNZ R0,MMM
SJMP DD
;………………………..
Q3: MOV R0 ,#4
CLR C
MOV R1,#00001011b
```

```
MOV A,R1
SWAP A
KKK: RLC A
MOV PC.5,C
DJNZ R0,KKK
SJMP DD
;……………………………......................……….
DELAY:
MOV R2, #180d
W: MOV R3, #180d
W1: MOV R4,#142d
W2: DJNZ R4, W2
DJNZ R2,W1
DJNZ R2,W
RET
;…………………….......................….......
END
```

2.2. Receiver circuit (Slave Circuit):

The receiver system consist of Bluetooth (to transmit and received data), microcontroller, buffer, voltage regulator circuit (5V, 3.3V), power supply and three LED as shown in Fig. (9).

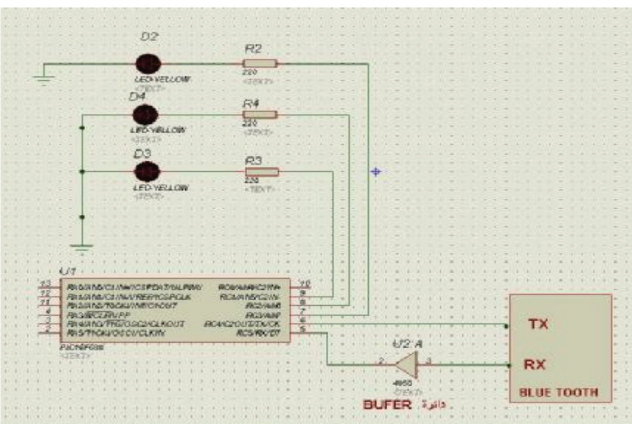

Fig. (9): Buffer for Slave circuit

The whiteLED Operates after half minute but it must find the second Bluetooth device operates in order to make connection. When the white LED operates, this mean that Bluetooth device is ready to receive data from the first device. As shown in Fig. (10).

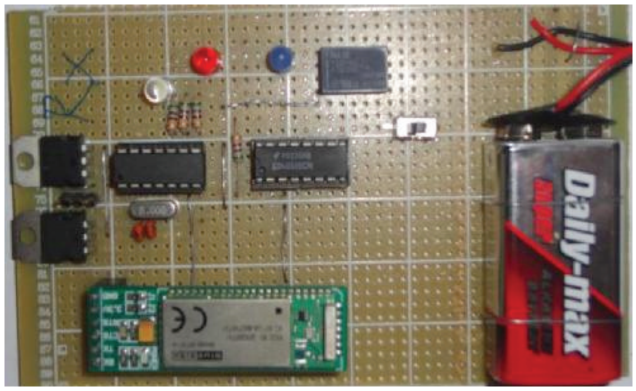

Fig. (10): Received circuit

Slave Program:

```
ORG 0200SRART:
MOV A,#00H
CLR C CLR Pc.5
MOV C,PC.5LL: JNB C,LL
SETB PA.0
MOV R0,#10d
NN: LCALL DELAY
DJNZ R0, NN ; 5 Sec.
CLR C
MOV R0,#00H
MOV A,R0
QQ: MOV C,PC.5
RLC A
CJNE A,#00001010b,MM
SJMP LM
MM: CJNE A,#00001011b,KK
SJMP LMC
KK: CJNE A,#00001100b,QQ
SJMP LMCD
LMC: SETB PA.3 ;Red Led
LCALL DELAY ;0.5 Sec.
```

```
SJMP QQ
SJMP LMCD
;……………................................…………….
LMC: SETB PA.3 ;Red Led
LCALL DELAY ;0.5 Sec.
SJMP QQ
;………...............................……………………
LMCD: CLR PA.3 ;Red Led
CLR PA.0 ;White Led
CLR PC.4 ;Blue Led
SJMP QQ
;………………..............................................……….
LM: MOV R0,#00H
MOV A,R0
CLR C
TT: SETB PC.4
MOV C,PC.5
JNB C,TT
MOV C,PC.5
RLC A
CJNE A,#00001010b,MM
SJMP LM
MM: CJNE A,#00001011B,KK
SJMP NN
GG: CJNE A,#00001100b,LM
SJMP LMCD
;………………...............................................…………
NN: SETB PA.3 ; Red Led
LCALL DELAY
SETB PC.4 ; Blue Led
SJMP LM
;……..............................………………………
DELAY: ; 0.5 Sec.
MOV R2,#80d
W1: MOV R3,#80d
W2: MOV R4,#80d
W3: DJNZ R4,W3
DJNZ R3,W2
DJNZ R2,W1
RET
;……………………………...................……
END
```

3. Practical part:

The project unit operates by putting the switch of power in position ON after sure that power supply in each circuit Slave first then Master in the same time, and wait, nearly more half a minute, until the white LED is light in slave as shown in Fig. (12) and light the green LED in master. The Master circuit is shown in Fig. (11). After the amid switch goes to ON, the blue LED will operate as a step signal. Fig. (13) illustrates the blue LED.

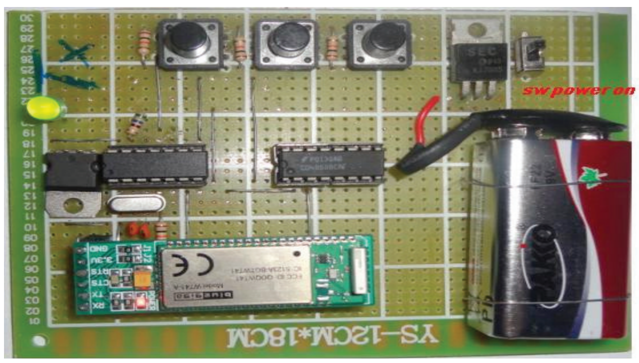

Fig. (11): Master Circuit in Operating Case

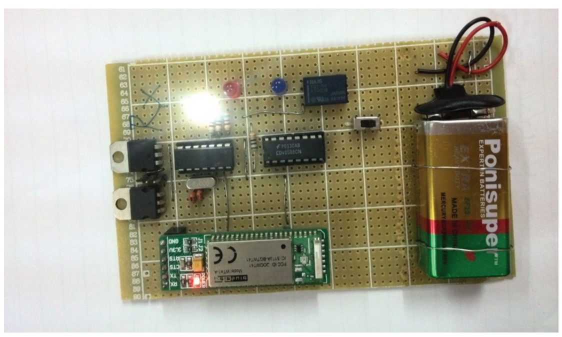

Fig. (12): Slave Circuit in Operating mode

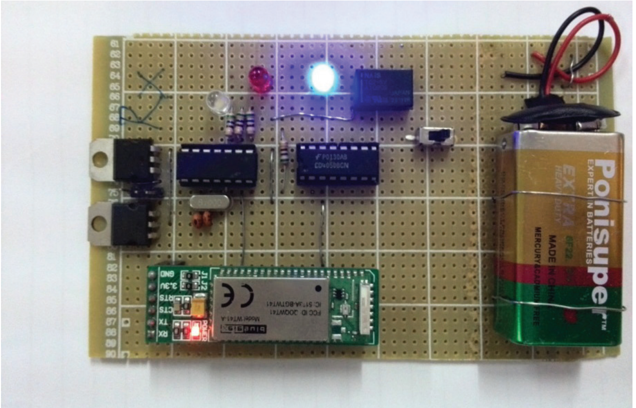

Fig. (13): Slave Circuit part 1

4. Results:

1. The y-axes in Fig. (14) refers to the input and an output voltage which is measured in volts and the x-axes refers to the time that is measured in second. The response of any signal at output is delayed after the input signal in the same point of seconds as shown in Table (1).

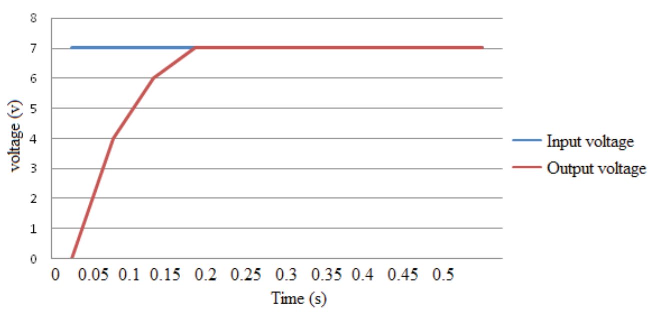

Fig. (14): Unit step response of the Slave part (1).

Table (1): Voltage values of slave circuit part (1).

A	B	C
Input Voltage (volt)	Output Voltage (volt)	Time (second)
7	0	0
7	4	0.05
7	6	0.1
7	7	0.15
7	7	0.2
7	7	0.25
7	7	0.3
7	7	0.35
7	7	0.4
7	7	0.45
7	7	0.5

When the last switch goes ON, the red LED will operate as an impulse as shown in Fig. (15).And if we press the first switch, the three leds will reset as shown in Fig. (16).

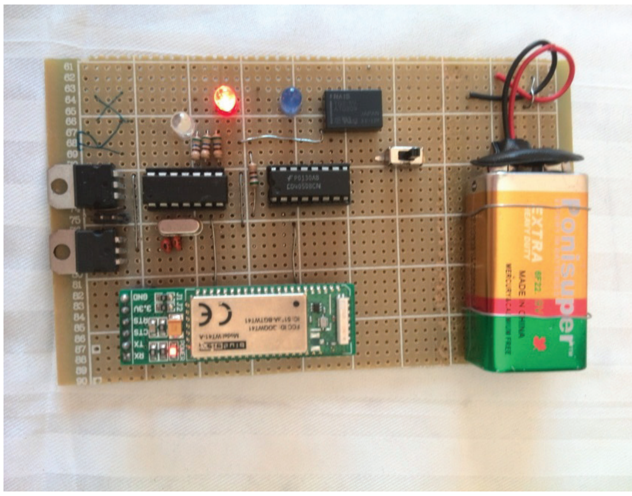

Fig.(15): Slave circuit part2

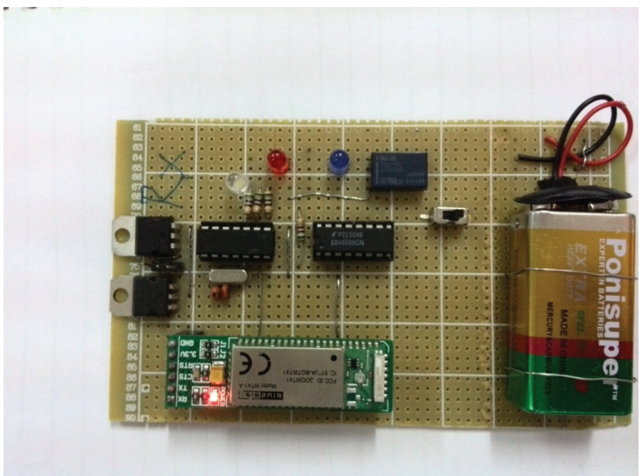

Fig.(16): Slave Circuit in Reset case

The y-axes in Fig.(17) refers to the input and output voltage which is measured in volt. And the x-axes are the time measured in second. The response values of impulse response of the Slave circuit in the same point of seconds as shown in Table (2) while the graphical representation of results is indicated in Fig. (17).

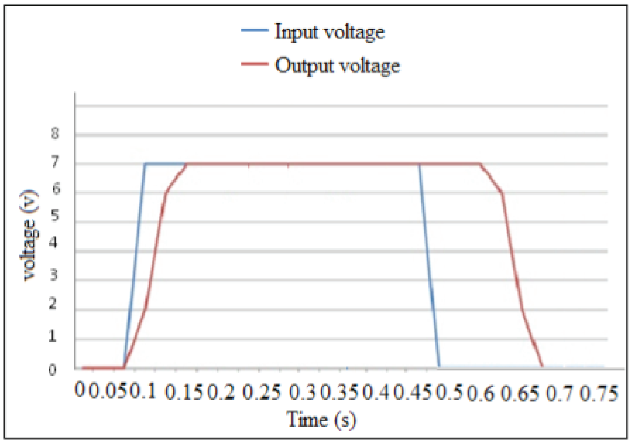

Fig. (17): Impulse response of the Slave part 2.

Table (2): Values of impulse response of the Slave circuit part2.

A	B	C
Input Voltage (volt)	Output Voltage (volt)	Time (second)
0	0	0
0	0	0.05
0	0	0.1
2	2	0.15
7	6	0.2
7	7	0.25
7	7	0.3
7	7	0.35
7	7	0.4
7	7	0.45
0	7	0.5
0	7	0.55
0	7	0.6
0	6	0.65
0	2	0.7
0	0	0.75

4. After many experiment for this project we found that the distance between the two circuits (master and slave) is about 50m in free space.

5. Discussion:

The Software and Hardware structure of the Bluetooth circuits had been introduced. Also the suitable commands where examined to show the reliability and applicability required in such system.The Software model represents a flexible, reliable and powerful way of controlling the Bluetooth circuit. Here in this project the Bluetooth circuits has been designed to control two leds. If we send the signal(character) from the master circuit by pressing one of these switches, the Slave circuit must receive the same signal(character) to implement a particular task. If the Slave circuit received any other signal(character) that is invalid in the microcontroller in the Slave circuit, the Slave circuit cannot make any operation. In future we will attempt to send data to the long distance, and use the Bluetooth device to receive data from cameras, control the fans and other devices in the refinery or factories.

6. Conclusion:

From the results obtained, we can conclude the following:

The project represents a Bluetooth circuit examined and tested as the same as the PC Bluetooth with the suitable choices.

Enable to send data for distance exceeds (50)mand these very important to control to any plant or process in case of dangerous or other cases.

Bluetooth devices used as expedient to transform data and enable microcontroller, when the Master circuit send particular signal so, the Bluetooth in the Slave circuit receive the signal and enable the microcontroller to perform a particular task (in this project enable led).

Impossible to send and receive data in the same time. This mean that Bluetooth operate in a Simplex Mode.

Bluetooth devices frequency is not effect with other signal (or affectability is very small) because of pokier of its signal.

LED in Slave circuit operate in (5) V, this leads to the supplied voltage must be not less than the specified voltage.

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