

The Design of Humanoid Robot Using C# Interface on Bluetooth Communication

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Abstract—This paper proposes a remote control system based on a user and humanoid robot via Bluetooth. A user can control the robot using a C# interface and each parts of robot can be moved independently around the robot about a remote location. Providing motor position change in a mechanical system and automatic controlling of the data from the measuring instrument reduce process time and reduce loss of labor. The automatic controlling of the data from the measuring instruments supplied with microprocessor. At the same time, it has been studied how to do data transfer is made via Bluetooth module using the C# interface and how it is used the incoming data for servo motors control on microprocessor in detail.

Index Terms—remote control, humanoid robot, control circuit, control interface

I. INTRODUCTION

Remote Control and monitoring techniques are so important for developing world. A person can manage his or her farm away from miles. Thus, he or she reduce energy losses and unnecessary costs. The most important point of these advantages is preventing waste of time [1]. Although several equipments connect to devices via wires, wireless equipments are offered for lots of advantages. These advantages are independent work space, no cable charge and not affecting by environmental conditions [2].

Wireless communication technology also increases space to move and reduces distance is between controller and the controlled system. Bluetooth is a kind of wireless communication technology, is cheaper and more useful than other wireless communication technologies [3].

System offers a new approach to control home appliances from a remote terminal, with an option from a local server, using the internet and radio connection. The system is accomplished by personal computers, interface cards, radio transmitters and receivers, microprocessors, ac phase control circuits, along with window-type software and microprocessor control software. The system is designed to control home

appliances' on/off, to regulate their output power, and to set their usage timing. The prototype of this system was tested and responded successfully, which verifies the feasibility of this system's theory and concept [4].

While some robots are controlled by connecting to the internet with servers remotely with the introduction of Social Network Services (SNS) and similar other services, the popularization of mobile devices such as smartphones and tablets, have been on the increase. These services are developed by Information Communication Technology (ICT) Software engineers [5].

Phase one comprised of the development of a 6 DoF left anthropomorphic arm and left exo-frame. Second phase is illustrated the development of the right arm, right exo-frame, torso, backbone, human machine interface and omni-directional locomotion system. Dexto:Eka: will be able to communicate with a remote user through Wi-Fi. An exo-frame capacitates it to emulate human arms and its locomotion is controlled by joystick. A Graphical User Interface monitors and helps in controlling the system [6].

Independent move command is necessary for robots like humans. A human take some commands from other humans or from reflexes, though some commands are created by itself. The humanoid robot can be managed from C# commands. C# commands are transmit to microprocessor. These commands are translated to machine languages. Then motors move the humanoid robot according to microprocessor code.

II. CIRCUIT SCHEMA AND MICROPROCESSOR CODE

16F877 microprocessor library is defined below.

```
#include <16F877.H>
#fuses XT, NOWDT, NOPROTECT,
NOBROWNOUT, NOLVP, NOPUT, NOWRT, NODEBUG,
NOCPD
#use delay(CLOCK=4000000)
#use rs232(baud=9600, xmit=PIN_C6,
rcv=PIN_C7, parity=N, STOP=1)
#use fast_io(b)
```

Pin_C6 and Pin_C7 is activated for communicating with a Bluetooth module. Pin_B is set a output for servo motor using.

```
Byte data;
int x, time, time1;
```

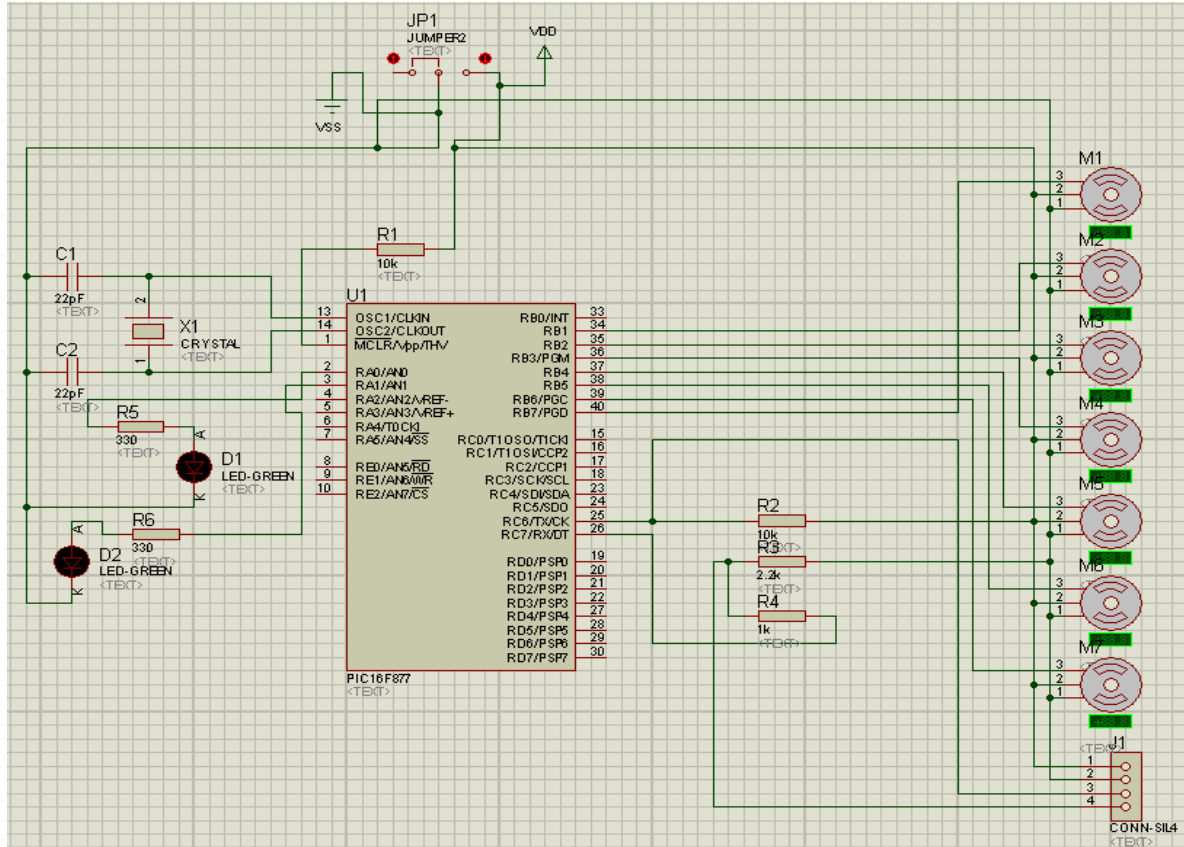


Figure 1. Servo motor control circuit with bluetooth module

"Data" is called a byte variable is defined above and incoming data on this variables via Bluetooth appoint to the "data" variable. Integer variables are defined. "x" variable is defined for "for loop". "time" and "time1" variables are defined for square wave generation time in servo motor. Fig. 1 shows circuit schema of control circuit on circuit designer program.

```

setup_psp(PSP_DISABLED); setup_adc_ports(N
O_ANALOGS); setup_adc(ADC_OFF);
setup_psp(PSP_DISABLED);
setup_spi(SPI_SS_DISABLED);

setup_timer_0(RTCC_INTERNAL/RTCC_DIV_1
); setup_timer_1(T1_DISABLED); //
setup_timer_2(T2_DISABLED, 0, 1);
setup CCP1(CCP_OFF);
setup CCP2(CCP_OFF);
set_tris_b(0x00); output_b(0x00);
set_tris_a(0x00); output_a(0x00);
for(i=0; i<3; i++)
{
    output_high(pin_a0); delay_ms(500);
    output_low(pin_a0); delay_ms(500);
}
output_high(pin_a0);
delay_ms(500);
    
```

General settings defined in this section of the microprocessor. At the same time was reset all outputs. To understand the functionality of the system status LED

connected to pin a0 for loop with a 500 ms interval was allowed to flash 3 times.

```

data = getch();
if (data == 'k')
{
    output_high(pin_a1);
    delay_ms(60);
}
data = getch();
if (data == 'l')
{
    time = 4;
    time1 = 16;
}
else if (data == '2')
{
    time = 1;
    time1 = 19;
}
for (x = 0; x < 1; x++)
{
    output_high(PIN_b0);
    delay_ms(time);
    output_low(PIN_b0);
    delay_ms(time1);
}
output_low(pin_a1);
    
```

This part of the code is the first "getch()" not come from a bluetooth data that is controlled by command and until the bluetooth program expects data from this section. Data as soon as the data comes from taking the data

variable. For example, our incoming byte value 'k' perceives the letter we send a signal to the servo motor in the head section of our humanoid robot. Then the program is waiting for 60 ms and the data comes from a Bluetooth beats our variable data read again. Our incoming value '1' of the humanoid robot head turns at an angle of 30 degrees in the right direction. Our incoming value if '2' is a humanoid robot turns his head to the left direction at an angle of 30 degrees. In this respect our values of a and b before you define the variable we created in milliseconds to 20 milliseconds can set a square wave. As seen in the example code above that of our humanoid robot right arm and left arm movements are written into likewise microprocessor. HC-06 Bluetooth module is used for Bluetooth communication. One of the most important factors of our using this module, provides data flow is two-sided.

III. BLUETOOTH MODULE HC 06

HC06 Bluetooth-Serial Module Card is designed for use Bluetooth SSP (Serial Port Standart) and application of wireless serial communication. PINs that taken out have the advantage to rapid prototyping and can be used easily with Arduino microprocessor, a breadboard, various circuits, etc. Standard PIN structure provides opportunity to control easily in any required area. In

addition connections can be made easily with Jumper cables, which accompany with Bluetooth module. This card supports Bluetooth 2.0, provides communication at the 2.4GHz frequency and also has communication distance about 10 meters. This module has a common usage of area as robotic, hobby etc. Specifications;

- Bluetooth Protocol: Bluetooth 2.0+EDR(Enhanced Data Rate)
- 2.4GHz communication frequency
- Sensitivity: ≤ -80 dBm
- Output Power: $\leq +4$ dBm
- Asynchronous Speed: 2.1 MBps/160 KBps
- Synchronous Speed: 1 MBps/1 MBps
- Security: Authentication and Encryption
- Supply Voltage: 1.8-3.6V(Recommended 3.3V)
- Current: 50 mA
- Dimension: 43x16x7mm

IV. C# INTERFACE

The interface that is shown in Fig. 2 prepared with C# for sending data via Bluetooth. "Search for device" button allows to make connection with other devices via computer Bluetooth. For this purpose InTheHand.Net.Personal.dll is utilized. Surrounding devices can find easily by this C# codes. Executing codes that searching starts;

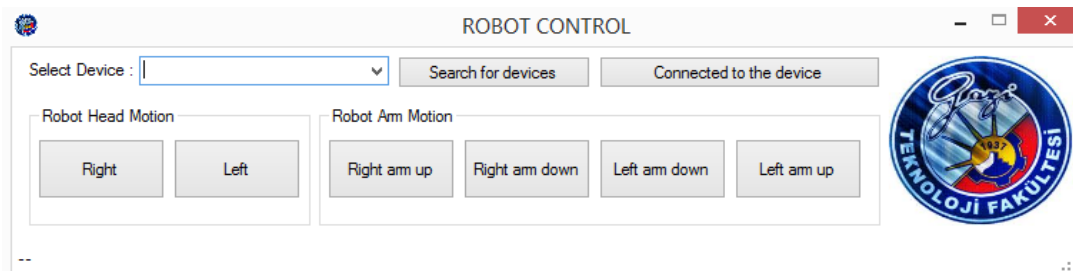


Figure 2. C# Interface

```
comboBox1.DataSource = null;
comboBox1.Items.Clear();
devices.Clear();
Thread bluetoothsearch = new Thread(new
ThreadStart(find));
bluetoothsearch.Start();
```

If searching process has already done, values of the first three rows are reset. Thread command uses for not slow down the program cause of searching progress that takes time and the program jump to searching part then store operation after that process goes on starting.

```
try
{
    BluetoothClient client = new BluetoothClient();
    devices = client.DiscoverDevicesInRange();
}
catch
{
    MessageBox.Show("Bluetooth is off. Please turn
on.", "WARNING SCREEN",
```

```
MessageBoxButtons.OK,
MessageBoxIcon.Exclamation);
return;
}
info("Searching process is over...Total " +
devices.Length.ToString() + " device found...");
device = devices.Length;
foreach (BluetoothDeviceInfo d in devices)
{
    devices.Add(d.DeviceName);
}
```

"Try catch" command used for give information to user in case of error that Bluetooth is off. We take advantage of Bluetooth device of computer for searching device. When searching process over, lower-left corner of interface give us warning information about number of found device. Program create loop as the number of devices found also register this information into named "devices" list that created already. Then registration loading into comboBox1. After that when the searching

progress over, we choose device and click “Connect to Device” button. If the connection is done, blinking light start lighting up continuously and, lower-left corner of

interface give us warning information of “connection done” after connection we can give command and humanoid robot (Fig. 3) moves.



Figure 3. The prototype pictures of humanoid robot

V. CONCLUSION

In this study, a humanoid robot is controlled with a C# interface using Bluetooth communication. C# interface and Bluetooth device supply remote control and command. It can be easily moved whatever desired position. However each servo motor of humanoid robot can moved independently owing to the C# interface. For developing this project, Humanoid robot can walk, stand up or serving anything (especially elder people).

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