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Prototype of Communication System from HT with HP Using Tone Encoder Decoder Based on Interface Method

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ABSTRACT

The military communication network system according to technical instructions still uses conventional methods according to the radio devices in each frequency work area in carrying out operational tasks. The wide coverage area does not reach all areas with frequency signals, especially cellphone signals. While the function of cellphones has currently provided many benefits for the community and remote areas, due to signal problems, cellphones cannot yet be fully used as a communication tool. The discovery of the ROIP repeater system or radio of Internet protocol actually greatly helps communication using multiple communication tools, but currently this technology requires servers and devices that require stationary places, while in the area of   operation, soldiers need a communication interface system between HT and cellphones that is mobile. While currently cellphones (HP) and Handy Talky (HT) are communication tool systems that have different frequency work areas and different technology tool modules. From the existing problems, a study was made on the interface system that can communicate between HT and cellphone. In this study, an interface tool was created with a communication system from HT to cellphone using the Dual Tone Multi Frequency (DTMF) method. This study uses several equipment, namely HT, HP, DTMF, Atmega8 microcontroller, max232, and wavecom. So that the communication system can be implemented from two directions in full duplex.

Keywords: Interface, DTMF, Wavecom, HT, HP

Introduction

In the military, communication is a very important factor in determining the success of a unit in carrying out an activity. Delivering information or orders in carrying out Army operational tasks requires adequate equipment, so that information or orders given by the Commander's elements can be clearly received by troops in the field. With the increasing development of science and technology, various types of radio communication devices have emerged with various brands along with their respective advantages and disadvantages [1]. Today, several Army units use similar communication devices in carrying out operational tasks, including using communication from cellphones to cellphones and communication from military SSB radios or HTs to military SSB radios or HTs. While cellphone technology is currently developing rapidly, it has the advantage of being able to communicate over very long distances, but is limited by the range of the BTS signal area [2]. Military radios or HTs have the advantage of being able to communicate anywhere, including areas that are not covered by BTS signals. Military radios or HTs can still communicate, but military radios/HTs cannot communicate over long distances. Based on the above problems, the researcher conducted a study entitled "Prototype Of Communication System From Ht With Hp Using Tone Encoder Decoder Interface Method" [3]. This study aims to improve the ability of the communication system between different frequency bands, namely by using the interface method so that the communication system from HT to HP can occur.

Material and Methods

Material

DTMF (Dual-Tone Multi-Frequency) is a coding system used to send telecommunication signals in the form of tones using an encoder system and received back by the decoder converted into digital form or to the actuator. Wavecom is a component used to regulate the interface communication system between two transmitter and receiver devices on different carrier frequencies. HT and HP are types of communication devices but have different characteristics because HT or Handy Talky is an analog communication system while HP or hand phone is a type of digital communication system that can be programmed and requires a pulse signal to communicate.

Methods

The method applied in this study is an experimental method to prove the hypothesis. As shown in Figure 1, the interface method is applied in a telecommunications system between HT and HP in full duplex, where the microcontroller regulates the switching system on the wavecom after DTMF is active because there is an interrupt signal on the HT and HP which is used as a controller instruction on the wavecom through the microcontroller command.
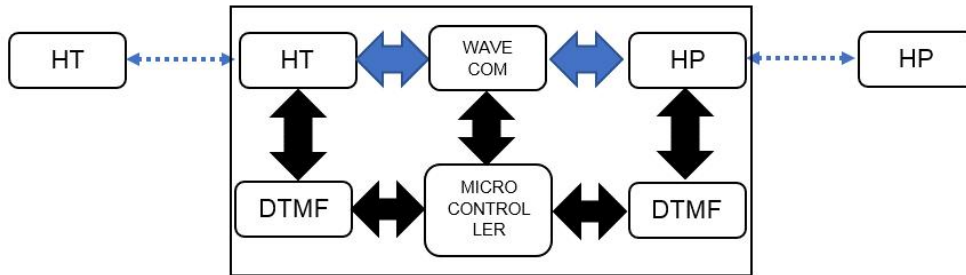

Figure 1. Diagram Block of Interface HT to HP Full Duplex System

Results and Discussion

Dual Tone Multiple Frequency (DTMF) will work after receiving an interrupt signal from HT or HP then DTMF sends a tone code in this case there are 9 predetermined tone frequencies. In previous research, the DTMF tone code was sent from a communication device [7]. How the system works is that the interrupt signal in the form of a DTMF tone code is sent from the first HT transmitter sent and received by the second HT which then the tone code is translated into binary form this system is known as a DTMF encoder which functions to translate the DTMF code sent from the first HT to the second HT. The interrupt signal on the second HT is interfaced by the microcontroller for wavecom switching so that it can be connected to the cellphone signal according to the intended number. When the second cellphone activation number receives the signal, communication will occur between the first HT and the second cellphone after going through the interface system. The microcontroller used in this study is the ATMega8 Microcontroller. Atmega8 is a microcontroller produced by Atmel Corporation. This type of microcontroller is included in the AVR (Alf and Vegard's Risc processor) type as figure 2. atmega 8 microcontroller working system.
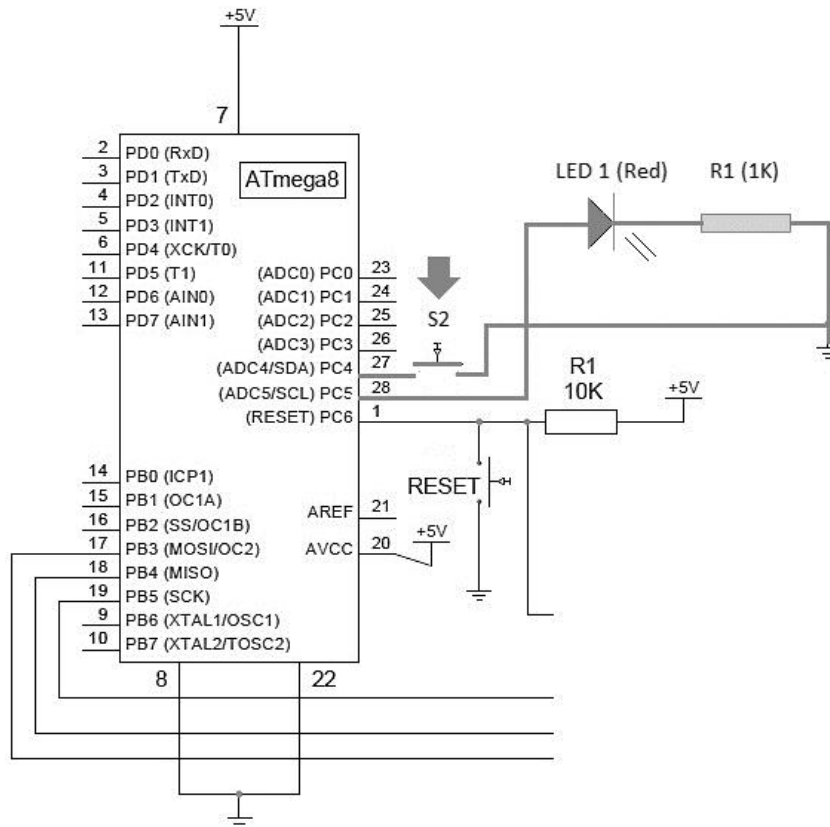

Figure 2. Atmega 8 microcontroller working system

As shown in Figure 2. In this study, the PB0, PB3, PB4, and PB5 pins on the microcontroller are pins used as communication lines with the DTMF circuit, in addition there is a pin used as an interrupt line, namely the PD2 pin as interrupt0[8]. Then the PC5 pin functions to activate the relay to press the PTT on the HT when communication is taking place. The PD0 pin as RX and PD1 as TX, function as a serial data communication line with wavecom. As shown in Figure 3. In the design of the wavecom data communication path between the pins on DB15 with DB9, DB9 with RJ11, and DB15 with RJ11 along with their descriptions. The DB15 connector is the path used on Wavecom to communicate with the microcontroller circuit. The DB9 connector is the path used on the microcontroller circuit to communicate with wavecom. The RJ 11 connector is a connector used in telephone networks, but in this study RJ 11 is used as an audio path between wavecom and HT. The use of connections/ports on wavecom is by connecting the sound output pin (speaker) on HT with the sound input pin (microphone) on the wavecom and connect the sound output (speaker) on the wavecom to the sound input (microphone) on the HT so that communication occurs.
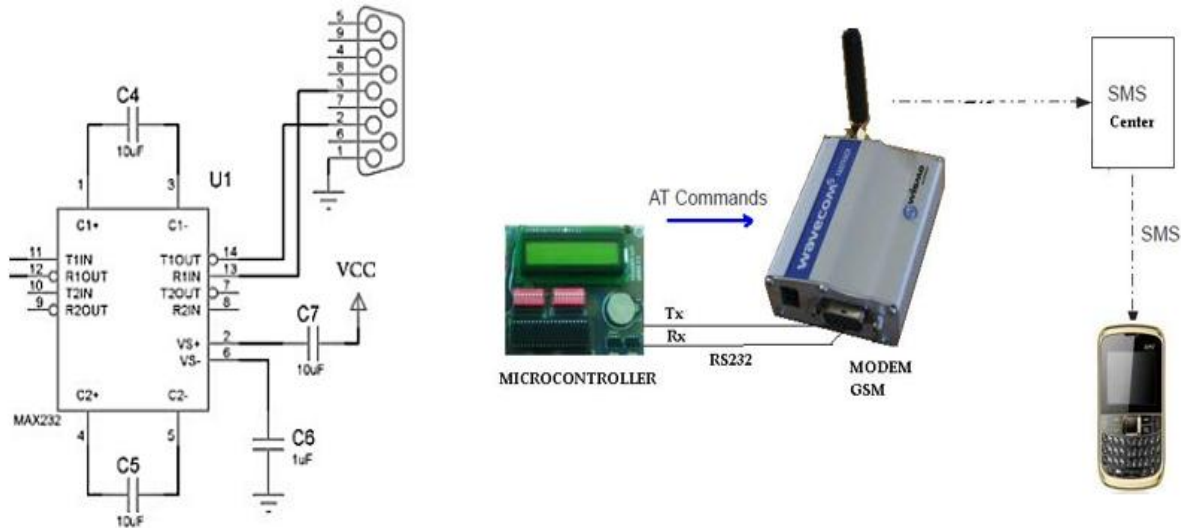

Figure3. Communication system of microcontroller to wavecom and to HP or HT

The DTMF tone code received by the second HT is converted by the DTMF decoder into binary numbers, the results of the binary numbers will be translated by the microcontroller to make a call to the cellphone number that has been registered/stored on the wavecom, then the microcontroller will give an AT Command in the form of Autodial, namely an automatic call to the registered number, then the PTT on the first HT is on then the cellphone will be able to receive the call made by wavecom as shown in Figure 3. full duplex communication system between HT and cellphone.

As shown in Figure 4, the audio signal form is shown on the HT and HP. This full duplex communication shows that analog communication is converted into digital communication via wavecom and the communication change is regulated using a two-way switching system controlled by the microcontroller after receiving an interrupt signal from the HT/HP that activates DTMF to send a tone to the microcontroller. Furthermore, wavecom sends the specified HP number to receive the call, then two-way communication can occur as shown in Figure 4.
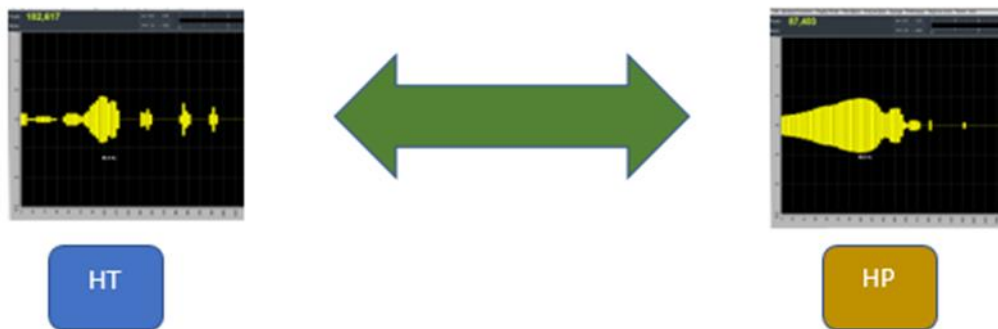

Figure 4. Two-way communication voice signal form

Conclusion

The results of laboratory tests show that HT and HP can communicate well in full duplex, but the speed of sound factor affects the switching speed of the microcontroller, because when communicating quickly, data collisions occur due to late data transfer when sending and receiving data.

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