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by Yana Hendriana

Remote Control System as Serial Communications Mobile using a Microcontroller

Yana Hendriana
Departement of Informatics
Universitas Ahmad Dahlan
Yogyakarta, Indonesia
yanahendriana@tif.uad.ac.id

Richki Hardi
Department of Informatics
Universitas Malikussaleh
Aceh, Indonesia
richkihardi@gmail.com

Abstract—Remote control technology has been developed by utilizing various transmission media. Some of them are remote control by the media using infrared, radio, internet and telephone line. Remote control system via the telephone line has an advantage in terms of distance range and practicality compared to other media. The presence of mobile phone or mobile phone that has been known and used by many people, who are able to communicate wherever they are, without being limited by space and range of cable lengths could be a solution for the needs of remote objects as described above. One of the most popular mobile phone function is to send and receive SMS. SMS is suitable for the control system of wireless real time because the speed of data delivery, efficiency and breadth of coverage, but the excess mobile phone with SMS facility of its still needs to be connected to a control device to be able to control on / off devices electric remotely.

Keywords—microcontroller, mobile, remote

I. INTRODUCTION

At this time control on-off various electrical devices still mostly controlled manually by pressing the on-off switch. The development of lifestyle and social dynamics today demonstrates the growing importance of practicality and efficiency led to the need to control various electrical devices not only be done manually which requires us located in front of the electrical device and pressing the on-off switch to activate it but it can also be done remotely (remote control). Remote control technology has been developed by utilizing various transmission media. Some of them are remote control by the media using infrared, radio, internet and telephone line. Remote control system via the telephone line has an advantage in terms of distance range and practicality compared to other media.

The remote monitoring and control can be facilitated by graphical user interfaces. The information appliance can be a home lighting system, a home alarm system, a home entertainment system, a water gardening system, a home heating system, a home cooling system, and a television system having recording capabilities [1].

The presence of mobile phone that has been known and used by many people, who are able to communicate wherever they are, without being limited by space and range of cable lengths could be a solution for the needs of remote control as described above. One of the most popular mobile phone function is to send and receive SMS. SMS is suitable for the control system of wireless real time because the speed of data delivery, efficiency and breadth of coverage, but the excess mobile phone with SMS facility of its still needs to be connected to a control device to be able to control on-off devices electric remotely.

Today's wireless networks are characterized by a fixed spectrum assignment policy. However, a large portion of the assigned spectrum is used sporadically and geographical variations in the utilization of assigned spectrum ranges from 15% to 85% with a high variance in time. The limited available spectrum and the inefficiency in the spectrum usage necessitate a new communication paradigm to exploit the existing wireless spectrum opportunistically [2].

The methodology used in this project is prototyping model Currently one of the control device that is practical and widely used is a microcontroller that is a chip that serves as an electronic control circuit and can store programs therein. The major advantage is availability microcontroller RAM and I/O support that has a very compact size and more flexibility to be connected and controlling the other devices.

In this research tool designed specifications are as follows:
1. Communication between a mobile phone with a microcontroller using a serial communication with standard RS232.
2. Using artificial micro controller Atmel is AT89S51.
3. Using AT-Command command to access the phone through the serial data port.
4. The remote control using a mobile phone via the GSM network operator.
5. Can control the on / off 8 electrical devices.

The aim of this study to design and realize the interface between the mobile phone with a microcontroller to perform remote control. And can be useful in understanding the

communication between a mobile phone with a microcontroller as a means of controlling the remote control.

Serial communication is serial data transmission that the data are sent one by one in sequence, there are two ways serial data communication, the data communication is synchronous and asynchronous data communication. In synchronous serial data communication, the clock is sent together with the serial data, while asynchronous serial data communication, the clock is not shipped with the serial data, but raised individually on either the sender (transmitter) and on the receiver side.

Communication between mobile phone with a microcontroller used in this research is a serial asynchronous full-duplex nature, meaning that the serial port can send and receive at the same time. based on the RS232 standard voltage level for the RS232. Mobile have different voltage levels to TTL or RS232 voltage levels, but for compatibility mobile phone to be connected to a PC for a variety of purposes so on each type of available phone data cable compatible with a standard RS232 interface for connection to a PC, a data port for SSL configuration type of phone used is the Siemens S45. For this reason we used a standard RS232 serial communication as the basis for an interface between a mobile phone with a microcontroller unit.

II.   LITERATURE REVIEW

The prototype was demonstrated successfully in multiple road and traffic scenarios by transmitting the traffic safety messages to the Bluetooth-enabled cell phone. The next step is to show effectiveness of this system in a realistic environment for which a workzone environment has been chosen to relay traffic safety messages to vehicles approaching the workzone [3].

The microcontroller that used to control the PLC modem and home appliances is PIC16F877. PIC is used to detect zero-crossings and 120 KHz X-10 carrier signal on the line. A MAX232 is used in the communication between microcontroller and computer. Power line carrier modem is used as a translator to make data communication on the electrical line as the electrical line is an analog environment while the microcontroller is digital environment [4].

A remote home security system offers many more benefits apart from keeping home owners, and their property, safe from intruders. The system is a low power consumption security alarm system developed by applying WSN and GSM technology. The system is composed of the microcontroller based wireless sensor network center node with GSM module, data collecting node, device control node and mobile phone. The wireless sensor network data collecting node module is connected with Pyroelectric Infrared Detector, Temperature Sensor, Smoke Detector and Gas Sensor separately [5].

The system is SMS based and uses wireless technology to revolutionize the standards of living. This system provides ideal solution to the problems faced by home owners in daily life. The system is wireless therefore more adaptable and cost-effective [6].

The HACS system provides security against intrusion as well as automates various home appliances using SMS. The system uses GSM technology thus providing ubiquitous access to the system for security and automated appliance control. Field conditions were site-specifically monitored by six in-field sensor stations distributed across the field based on a soil property map, and periodically sampled and wirelessly transmitted to a base station. An irrigation machine was converted to be electronically controlled by a programming logic controller that updates georeferenced location of sprinklers from a differential Global Positioning System (GPS) and wirelessly communicates with a computer at the base station. Communication signals from the sensor network and irrigation controller to the base station were successfully interfaced using low-cost Bluetooth wireless radio communication. Graphic user interface-based software developed in this paper offered stable remote access to field conditions and real-time control and monitoring of the variable-rate irrigation controller [7].

The MSP430 microcontroller family offers ultra-low power mixed signal, 16-bit architecture that is perfect for wireless low-power industrial and portable medical applications. This book begins with an overview of embedded systems and microcontrollers followed by a comprehensive in-depth look at the MSP430. The coverage included a tour of the microcontroller's architecture and functionality along with a review of the development environment. Start using the MSP430 armed with a complete understanding of the microcontroller and what you need to get the microcontroller up and running [8].

The system is SMS based and uses wireless technology to revolutionize the standards of living. This system provides ideal solution to the problems faced by home owners in daily life. The system is wireless therefore more adaptable and cost-effective. The HACS system provides security against intrusion as well as automates various home appliances using SMS. The system uses GSM technology thus providing ubiquitous access to the system for security and automated appliance control [9].

A microcontroller is a microprocessor plus. A microcontroller is the brain of an electronic system such as a microprocessor as the brains of the computer. A plus for the microcontroller is the presence of memory and Port Input / Output in a compact IC packaging. This capability is programmable, comprehensive features (internal ADC, internal EEPROM, Port I / O, Serial Communications, etc.), and also an affordable price allows the microcontroller used in various systems electronically, such as robots, automation of industrial, alarm systems, telecommunications equipment , to household appliances [10].

III.   RESEARCH METHODS

The methodology used in this project is prototyping model [11]. The system utilizes a serial port connection on the mobile phone data connector found on every mobile phones for mobile data exchange with peripherals such as handsfree or update for the program, while the microcontroller acts as a processor, serial data received from the mobile phone. Communication between a mobile (cell phone) with microcontroller is a serial asynchronous nature of full-duplex, meaning that the serial port can send and receive at the same time, it is necessary for an interface to synchronize both devices (ie: mobile and mikrokontoler) in this case follow the RS232 standard as described in the previous chapter, so that both devices can communicate (exchange data). In accessing the mobile phone, the microcontroller sends the AT-Command command is a command that begins with AT+(like command>

(prompt) on DOS) which will be delivered by the micro via serial port to instruct the mobile phone in order to run applications such as reading and sending SMS. Having established communication, the tool will detect the presence or not the phone, after which the phone will continue in standby and wait for incoming SMS, incoming SMS to a mobile phone is detected, a command or not, if not then the SMS was removed automatically from phone memory, if the incoming SMS is an SMS command it was known to be encoded by a micro controller and then forwarded to the output of the tool. Then it can be described block diagram the working principle of the system as follows:
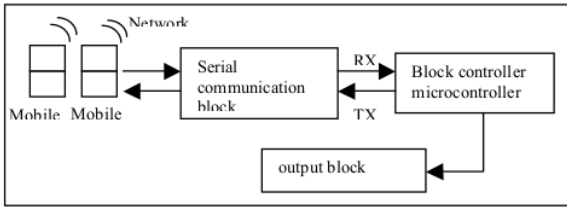

Fig. 1. work principle

At the beginning of the program conducted initialization serial communication, once their phones are detected, the tool will read the contents of the text message received on the location inbox I and organize protection of length to SMS, SMS eligible to be encoded, after coded tool, the command will be implemented in PORT 2 outputs on the microcontroller. To communicate with a mobile phone is used command AT-COMMAND. Then the main program flowchart can be described as follows:
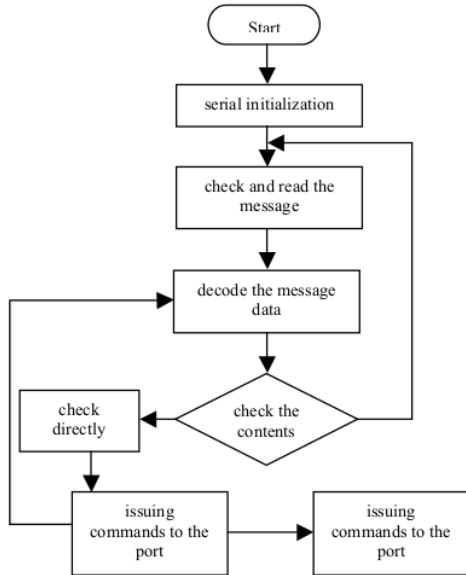

Fig. 2. Program Flowchart

The purpose of testing to determine whether the micro is in good condition. With the equipment used circuit power supply, serial connection cable, computer programs, and DT-51 testboard Low Cost Micro System.

Steps Testing

1) DT-51 Series of Low Cost Micro System and set your computer as illustrated.
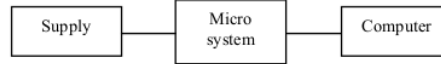2) The block diagram of a micro controller testing below:

Fig. 3. Micro testing

3) Turn circuit DT-51 Low Cost Micro System to provide the supply voltage DC 9V
4) Load testboard program into the microcontroller to program the microcontroller ISP Downloader Software.
5) Running testboard programs that exist in microcontroller.
6) Observing the test results.

IV. RESULT AND DISCUSSION

For the test port of micro controller is done by inserting a short program on CD kit DT-51 to issue a square wave at all pin port 0, port 1, port 2, port 3 except port 3.0 and 3.1 ports that are used as serial communication lines. If communication goes well, the simulation program testboard.exe will appear a list of data sent and received (0 = 0, 1 = 1, 2 = 2, etc.) as well as appearing window shows "Success!" As shown in Figure 4. While the square wave can be seen through

Oscilloscope or connected with the LED so that it looks flame-extinction of the LED. Thus the micro in good condition. Then the simulation image testboard successful program can be seen below:
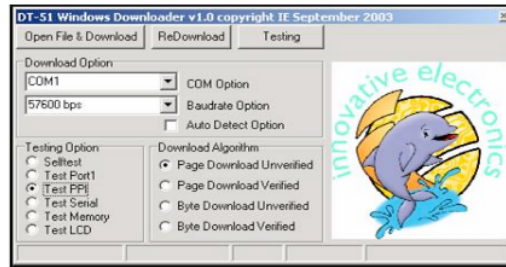

Fig. 4. Simulation program successful test board

Objective testing is to determine whether the serial strand with IC MAX232 work well to convert RS232 to TTL voltage levels. With Equipment Used namely power supply circuit, connecting cable, serial strand circuit with IC 232 and Mobile max.

a. Step-by-Step Testing

▪ Assembling circuit serial strand, mobile phones and set your computer as illustrated. The block diagram strand test series below:
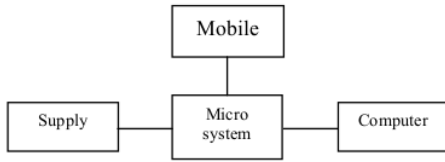
Fig. 5. block testing

- Turn circuit serial strand to provide the supply voltage DC 9V
- Typing the command AT + CMGW = 125 on hyperterminal program to send an SMS from your computer to the memory of the mobile phone inbox as shown in the image above
- Observing the test results.

b. Testing max232 is done by typing the command to fill an SMS to the phone memory is with the command "AT + CMGW = 125", this command is sent serially from computers to mobile phones, it turns out after running the program, in memory inbox handphone previously there has been a blank SMS typed. This proves that max232 IC has been functioning well to turn the mobile phone into a voltage level RS232 voltage levels so that the phone can communicate with a computer, as shown in Figure Command send SMS from PC to mobile phone below:
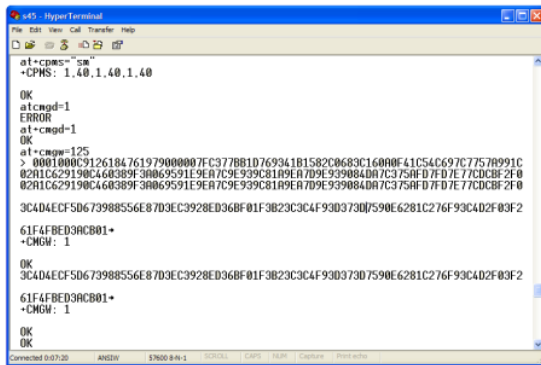

Fig. 6. Command to send SMS from PC

The purpose of this test is to determine whether the system has been assembled to work in accordance with the desired specifications. And Used Equipment consisting of: Power supply with 9V DC output voltage, circuit system that has been created, Two phones with SMS facility to the sender and receiver and RS232 data cable for Siemens S45 mobile phone.

a. Step-by-Step Testing
- Assembling such a system in the image of testing the entire system block diagram below:
- Turning on the system by providing a supply voltage of 9V DC.
- Sending an SMS command "XXXXXXXX" to the phone system where 'X' is the number 1 or 0.
- Observing the test results.

b. Test result
The first time the power supply is connected, the power LED on the instrument will light indicating that the power supply is connected to the appliance and mobile phones were left in standby mode, and then try to send an SMS containing "xxxxxxxx" after the SMS is received by mobile tool, the output of the tool will be xxxxxxxxx where x is a number 1 or 0 which means 1 is on, and 0 is off, evidenced by the lighting under the terms of the order as in the table below, then phone the sender will receive an SMS reply of tools that includes "Status: xxxxxxxx has been realized!" as shown in the table. Then the tool back on standby again in order to receive further orders, based on testing can be concluded that the appliance is able to function according to the desired specifications.

TABLE I.   READING STATUS

1	2	3	4	5	6	7	8	SMS	Read
Legible initial status LED									

Legible initial status LED								SMS	Read
1	2	3	4	5	6	7	8		
0	0	0	0	0	0	0	0	10000000	Completed
1	0	0	0	0	0	0	0	11000000	Completed
1	1	0	0	0	0	0	0	11100000	Completed
1	1	1	0	0	0	0	0	11110000	Completed
1	1	1	1	0	0	0	0	11111000	Completed
1	1	1	1	1	0	0	0	11111100	Completed
1	1	1	1	1	1	0	0	11111110	Completed
1	1	1	1	1	1	1	0	11111111	Completed
1	1	1	1	1	1	1	1	00000000	Completed

c. Analysis System
When we send an SMS containing the command to activate the first output 10000000, SMS content is actually command 7-bit encoding scheme, because if you type a letter or number on the phone keypad means that we have made 7 1/0 digits sequentially. While the micro-data to be processed is in the form of hex numbers PDU berskema 8 bits and hex numbers in the form of SMS commands: 10000000 is a C 6 83 31 18 C1 60, the conversion results of the test as shown in the table below.

TABLE II.   7-BIT ENCODING SCHEME

			b7	0	0	0	0	1	1	1	1
			b6	0	0	1	1	0	0	1	1
			b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1	0	1	2	3	4	5	6	7
0	0	0	0	0	@	Δ	SP	0	¡	P	¨	p
0	0	0	1	1		!	1	A	Q	a	q
0	0	1	0	2	$	Φ	"	2	B	R	b	r
0	0	1	1	3		Γ	#	3	C	S	c	s
0	1	0	0	4		Λ		4	D	T	d	t
0	1	0	1	5		Ω	%	5	E	U	e	u
0	1	1	0	6		Π	&	6	F	V	f	v
0	1	1	1	7		Ψ	'	7	G	W	g	w
1	0	0	0	8		Σ	(	8	H	X	h	x
1	0	0	1	9		Θ	)	9	I	Y	i	y
1	0	1	0	10	LF	Ξ	*	:	J	Z	j	z
1	0	1	1	11			+	;	K	Ä	k	ä
1	1	0	0	12			,	<	L	Ö	l	ö
1	1	0	1	13	CR		-	=	M		m	
1	1	1	0	14		ß	.	>	N	Ü	n	ü
1	1	1	1	15			/	?	O		o	

TABLE III. CONVERSION SMS COMMANDS TO FORM HEXA

SMS commands	Data received hexa on the micro input	Data scheme 7-bit conversion results at the output of the micro
10000000	31 18 0C 06 83 C1 60	10000000
11000000	B1 18 0C 06 83 C1 60	11000000
11100000	B1 58 0C 06 83 C1 60	11100000
11110000	B1 58 2C 06 83 C1 60	11110000
11111000	B1 58 2C 16 83 C1 60	11111000
11111100	B1 58 2C 16 8B C1 60	11111100
11111110	B1 58 2C 16 8B C5 60	11111110
11111111	B1 58 2C 16 8B C5 62	11111111

7 bits of data received will be converted to form micro hex 8 bit karenamikro scheme works on the number 8 bit encoding scheme, and then converted to ascii form and will be moved to the micro output port as the output tool. After the output is realized, micro sends a command to be mobile tool sends SMS reply containing status taken from the command data stored in RAM.

V. CONCLUSION

Overall from design, realization and testing of the system, a number of conclusions from this research include:

1) Overall means of communication between the mobile phone with a micro series can work and function as expected so it can be used as a remote control device. This tool can perform control when there is an SMS in phone memory.
2) Mobile phone, which can be used only supports AT-Command.
3) The data cable cell phone use should be the original or who can communicate in full-duplex to transmit simultaneously receive data from and to the micro.
4) This tool can remotely control up to hundreds and even thousands km depending on the extent of the GSM network.
5) Sooner or later the arrival of SMS is very dependent on the state of the network from each service center.
6) Costs used for controlling reasonably priced.

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