VOLUME MONITORING USES ULTRASONIC CENCOR BY INTERNET ACCESS AND SMS

FINAL ASSIGNMENT

Submitted in partial fulfillment of requirement

For the bachelor's degree of engineering

By :

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BRAWIJAYA UNIVERSITY MALANG
ENGINEERING FACULTY
ELECTRICAL ENGINEERING

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Has been approved by

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This final assignment has been examined and been approved

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INTRODUCTION

Writer saying praise and thanks to Allah Swt, which have for blessing, so that writer can finished the final assignment with the title "Volume monitoring uses ultrasonic censor by internet access and SMS".

In compilation of this report, writer getting many input from all side. Because of that, at this opportunity writer submit feel thanks to :

1. Mr. Ir. Wahyu Adi Priyono, Msc., as the advisor I.
2. Mr. Ali Mustofa, ST, MT., as the advisor II.

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Writer realize that proses of writing this final assigment many lack and error, so writer want input criticism ang suggestion for the completeness and perfection this account. Writer wish the final assignment can give benefit for all of us. Amien.

Malang, April 25th 2008

writer,

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ABSTRACT

Swasti Komala. 0210633075-63. 2006. *Volume Monitoring Uses Ultrasonic Censor by Internet Access and SMS*. Final Assignment Electrical Engineering, Engineering Faculty, Brawijaya University. Advisors: Ir. Wahyu Adi Priyono, Msc., and Ali Mustofa, ST, MT.

The development of information technology, especially in computer and telecommunication, obviously supports the activities performed by people, both individually and organizationally. Related with some matters above, we will be informed of the information that always changes time by time. Such as the volume of oil at the gas station tank, where the problems usually facing in distributing oil to gas station is the theft cases usually occurs namely from Gas Relocation Center to Gas Station, where the oil is often stolen. This condition results in loss experienced by the oil companies as well as society.

Based on this problem, its must developed monitoring system that can solve this problem. With using ultrasonic censor as the tool to calculated the distance for reference to calculate the volume in the tank, and maked website and suoftware to regulate SMS gateway as information line, so we can make device volume monitoring uses ultrasonic censor by internet access and SMS.

The volume information which access through SMS, could be done by sending SMS that contain of word 'VOLUME' to server HP, server HP sending information volume in the form of numeral with liter unit. The information of volume sent through SMS represents the last measured volume before accepting the request for information via SMS.The information of tank volume displayed in the website will be the tank volume measured every 5 minutes accompanied by the date and time. For the all, the monitoring system that be done is suitable with the planning and specification that be done before.

Key word : ultrasonic censor, volume, internet, SMS

CHAPTER I
PREFACE

1.1 Background

The advantage of human being compared with the other creature was situated in the intelligences in mastering science and technology. By the knowledge they possess, human beings were able to create many kind of arts from simple to very complex.

The development of information technology, especially in computer and telecommunication, obviously supports the activities performed by people, both individually and organizationally. In order to support the need, it is need innovations in providing information service, accurately and easily. This can be performed using the sophisticated technology, where some of them are performed using computer technology in developing any software and telecommunication technology by utilizing SMS facility as well as website giving updated information.

Related with some matters above, we will be informed of the information that always changes time by time. Such as the volume of oil at the gas station tank, where the problems usually facing in distributing oil to gas station is the theft cases usually occurs namely from Gas Relocation Center to Gas Station, where the oil is often stolen. This condition results in loss experienced by the oil companies as well as society.

Based on this, monitoring system should be developed in order to solve the problems cited above. This report was developed from the report titled as “The Design of Oil Volume Detection Using Tube Tank at Gas Station via Fixed Telephone” performed by Mr, Yorda Sepen Kamarba at 2005, where in the future the system were hoped would be more efficient and effective due to can be accessed in real time with attractive display.

1.2 Problem of Study

Based on the background above, the questions would be answered in this report were:

1. What are steps performed in designing the block diagram of hardware the monitoring volume system at the prototype of oil station tank by means of internet and SMS
2. How to use distance censor (Ultrasonic Range Finder) as the height measurement and volume quantification
3. How to make software comprising of volume ant time information as well as can be accessed by the other computer in the internet network
4. How to make software that has ability to deliver information through SMS.

1.3 Scope and Limitation

Based on the background cited above, this research was limited in the matters that:

1. The gas station tank was assumed in tube-shaped
2. The quantification of volume was performed every five minutes
3. The operation system used was Microsoft Windows XP Professional
4. The program used in all activities of the server was Delphi 7.0

1.4 Objective of Study

This research aimed at arranging and making the tool for monitoring volume using ultrasonic censor by means of internet and SMS

1.5 Reseach Design

This report was arranged below :

Chapter I Explaining the background, question, range, and the objective of the research

Chapter II Explaining basic theory comprising of PING distance, IP addressing, concept of SMS delivering, AT Command, Protocol Data Unit, Serial Communication RS 232

Chapter III Explaining the methodology, design and the making of the tool and the way in testing the tool

Chapter IV Explaining the block diagram design and the making of the tools comprising of work principle, tool specification, hardware and software design

Chapter V Explaining about the test and analysis that comprises of the test of each part and overall testing

Chapter VI Conclusion and suggestion

CHAPTER II
INTERNET AND SMS (SHORT MESSAGE SERVICE)

2.1 Computer Network

Computer network is group of computer, printer and the other instruments connected together. Information and data flow through the cable or wireless so enable the user exchanging the document and data, printing in the same printer and using the hardware/software connected in the network. Each computer, printer and peripheral are connected with the network so called as node. A computer network may has two, tens, hundreds, thousands or even millions of nodes.

2.1.1 Types of Computer Network

Generally, computer network is divided in five types, namely

- Local Area Network (LAN)

  LAN is a network individually owned by companies or campuses with some kilometers of the range. LAN is used to connect some workstations and peosnal computers in any location to share the resources, such as printer, and to share information. The maximal distance can be embraced by LAN is 10 kilometers. Yet the speed in delivering the data is relatively high, namely between 10 and 100 Mbps with low delay and low error factor.

- Metropolitan Area Network (MAN)

  Essentially, MAN is the other version of LAN with huge size and usually uses the same technology as LAN. MAN can embrace the offices of some companies with near location each other. It can be utilized for privat or public interest. MAN supports data or sound, even it can be connected with cable television network. This network can embrace up to 50 kilometers.

- Wide Area Network (WAN)

  Wide Area Network is a network embracing wide geographic, such as a country even a continent. WAN comprises of cables or telephone channels connecting a couple of router. The component used in the communication

is comprised of two components, namely transmission cable and switching element.

- Internet

  Internet is a network of computer networks that are interconnected. The use of internet enables the user to make contact, such as sharing information with the other networks.

- Wireless Network

  Wireless network is solution of communication that can be performed with network using wire. Wireless is often sued by means of satellite. This network enables more speed access than the wired-network.

2.1.2 Topology

Topology is a way to connect a computer to the other computer to establish a network. The topology usually used was bus, token-ring and star. Each topology has certain characteristic with the advantage and limitation.

- Bus

  It is a multipoint configuration where more than two instruments connected to a media and has ability to transmit through the media. A main cable connects every node to single channel of computer accessing them. In this topology, all terminals are connected to communication lane. The information delivered will be directly connected to purposed terminal without passing terminals in the network. Trouble in one computer connected to the network has no influence on the network, and the work of the network will be stopped if the main cable in trouble.

  The advantage in using this topology is economical in cable, simple cable layout, and easily developed. The limitation of this topology is difficulty in detection, high density traffic, the use of repeater for long distance, and if a client is error the network is dysfunction.

  Computer network using bus topology shown at figure 2.1

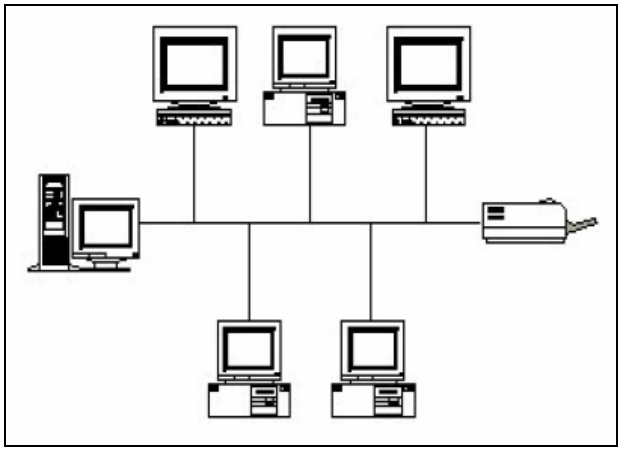


Figure 2.1 Bus topology
Source: Yuhefizar, 2003:10

- Ring

  This topology almost similar with bus topology, but it was connected like ring. Every node has the same level. The network is called as loop. The data are delivered to every node and all information received by the node was checked in term of the address to find the right address. If not for it, the information is passed up to find the right address. The terminals in the network are interdependent, so the error in any terminal will results in disturbance to all networks.

  The advantage in using ring topology is economical in cable and easy to search any error in the network. While the limitation in using this topology is the sensitivity to error, the error in deliverer media or terminal results in the work of network, dan the development of the network are not simple.

  Computer network using ring topology shown at figure 2.2

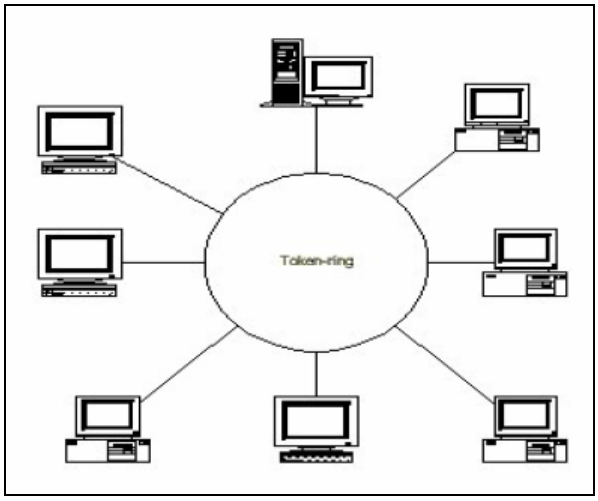


Figure 2.2 Ring topology
Source: Yuhefizar, 2003:11

- Star

  In the topology of star, all links should pass the center distributing the data to all node or client chosen (centered control). The center node is called as primary station or server and the other stations are called as client server where every time it can use the relationship of the network without control of server. Due to every computer has relationship with server through the individual cable, the bandwidth is wider, so that the use of star topology will improve the performance of the network entirely.

  Topology of star is the most flexible topology, due to the installation of the cable is easiest. Where the other advantage such as adding and reducing the stations connected is very easy without disturbing the other client. The control is centrally performed so it makes the detection easier and isolates the error and damage, as well as easy in managing the network. While the limitation of this topology is expensive in cable, and the HUB (central controller) is the critical element.

  This topology is shown at Figure 2.3

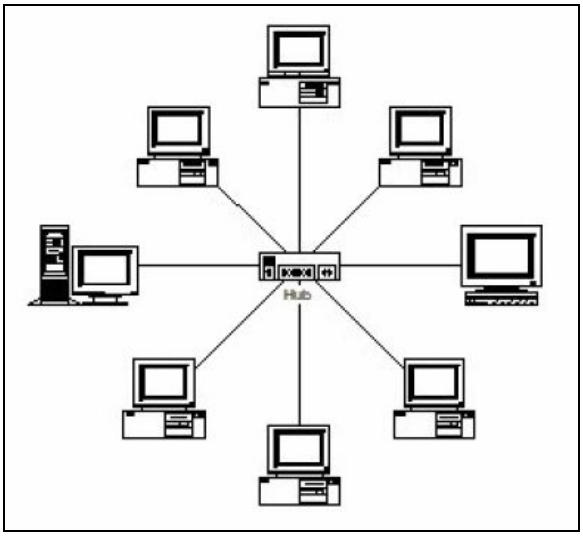


Figure 2.3 Star topology
Source: Yuhefizar, 2003:11

2.2 IP Addressing

Internet Protocol uses IP address as the identity. The data delivering will be wrapped in a packaged with labels of IP address of sender and IP address of receiver. If the IP of receiver find the package delivering with appropriate identity of IP address, the datagram will be taken and distribute to TCP. The distribution to TCP is passed through port connecting with the application need it.

The IP address is divided to be two sections, namely:

- **Network ID**
- **Host ID**

IP address is a couple of network ID and host ID. Network ID is part of IP address used in showing the network of the computer. While host ID is the part of IP address used to show workstation, server, router and all host TCP/IP in the network.

The format of IP was written in binary form or dotted decimal. The format are:

a. Binary format

Binary format is the writing of IP address with 32 binary numbers with 32 bit separated by dot in every eight bit. The every 8 bit is called as octet. The form of IP address is follow:

xxxxxxxx . xxxxxxxx . xxxxxxxx . xxxxxxxx

Every symbol “x” can be replaced by number 0 or 1, such as :

10100101 . 1010101 . 11110000 . 00010001

b. Dotted decimal format

Dotted-decimal format is the writing of IP address with 4 decimal numbers where each number is separated by dot. Every decimal number is the vaue of one octet of IP address.

IP address is grouped to classes to make the distribution easy to the registration of IP address. The IP addresses are grouped in five class, namely class A, class B, class C, class D and class E. The differences are founded in the size and amount.

- Class A

IP for class A is used by a few network amount but each network has many host

Format	: 0nnnnnnn hhhhhhhh hhhhhhhh hhhhhhhh
First bit	: 0
NetID length	: 8 bit
HostID length	: 24 bit
First Byte	: 0-127
amount	: 126 class A (0 and 127 as a back up)
Range IP	: 1.xxx.xxx.xxx until 126.xxx.xxx.xxx
Total IP	: 16.777.214 IP address every class A

- Class B

IP for class B is used by moderate network amount where each network has moderate amount of host

Format	: 10nnnnnn nnnnnnnn hhhhhhhh hhhhhhhh
The first 2 Bit	: 10
NetID length	: 16 bit
HostID length	: 16 bit
First Byte	: 128-191
amount	: 16.384 class B
Range IP	: 128.0.xxx.xxx until 191.255.xxx.xxx
Total IP	: 65.532 IP address every class B

- Class C

IP for class C is used by many network amount where each network has a few amount of host

Format : 110nnnnn nnnnnnnnn nnnnnnnn hhhhhhhh

The first 3 Bit : 110

NetID length : 24 bit

HostID length : 8 bit

FirstByte : 192-223

Amount : 2.097.152 class C

Range IP : 192.0.0.xxx until 223.255.255.xxx

Total IP : 254 IP address every class C

- Class D

  IP for class D is used for multicast network

  Format : 1110mmmm mmmmmmmm mmmmmmmm mmmmmmmm

  The first 4 Bit : 1110

  Bit multicast : 28 bit

  Byte inisial : 224-247

- Class E

  IP for class E is used for experimental interest

  Format : 1111rrrr rrrrrrrr rrrrrrrr rrrrrrrr

  The first 4 Bit : 1111

  Back up Bit : 28 bit

  Byte inisial : 248-255

2.3 SMS (Short Message Service)

SMS is a mechanism of delivering short message through mobile network. The SMS feature enable digital cellular terminal, such as handphone to send and receive text message up to 160 characters.

2.3.1 Basic Concept of Sending SMS

The delivering of message from hand phone (mobile originated) is not directly sent to purposed hand phone (mobile terminated), but the message is sent to SMS center (SMSC), then the message is sent to the purpose hand phone.

Figure 2.7 shown a basic concept of sending SMS.

Figure 2.4. Basic concept of sending SMS

Source: Khang, 2002

Using SMSC, one can know the status of the message sent, if it delivered or failed. If the purposed hand phone is active and receive the message, it will send the confirmation message. If the hand phone is off, the SMS will be saved at SMSC until validity period completed.

SMSC list GSM operator in Indonesia:

Table 2.1 SMSC List

GSM Operator	SMSC Number
Satelindo	62816124
Excelcomindo	62818445009
Telkomsel	6281100000
IM3	62855000000

Source: Khang, 2002

2.3.2 AT Command

AT command is the command used by cellular telephone, started with word AT, and then followed by the other character having unique function. AT Command of each SMS device is different, but it essentially same. In the course to SMS Centre, a message will be delivered in the form of hexa number collection in PDU (protocol data unit)

The AT Commands that are important for SMS are following:

a. AT+CMGS=n

   Used to send SMS where n is the amount of hexa PDU SMS started after the number of SMSC (maximal 160 characters)

b. AT+CMGR = n

Used to read SMS where n is index of memory where the incoming SMSs are stored

c. AT+CMGL = n

Used for checking the SMS. The value of n that can used :

- n = 0 for a new SMS in inbox,
- n = 1 for SMS in inbox,
- n = 2 for SMS in outbox,
- n = 3 for SMS in outbox,
- n = 4 for all SMS.

d. AT+CMGD = n

Used for erase SMS where n is number of SMS references that are will erased

In table 2.2 shown several of AT Command set that connected with SMS operation.

Table 2.2 Example of AT command

Perintah	**Fungsi**
AT	Prefix for all command
ATE0	Deactivation echo command
ATE1	Activation echo command
AT+CMGC	Sending SMS command
AT+CMGD	Deleting SMS in SMS memory
AT+CMGF	SMS Format
AT+CMGL	SMS list
AT+CMGR	Reading SMS
AT+CMGS	Sending SMS
AT+CMGW	Fill SMS to SMS memory

Source: Khang, 2002:91

2.3.3 PDU (Protocol Data Unit)

PDU was collection of hexadecimal number that has been standardized by certain agency named ETSI (European Telecommunication Standards

Institute). The PDU comprises of headers, the header for sending SMS to SMS Center is different with SMS received from SMS center.

PDU for sending SMS to SMS Center contain of 8 header:

a. SMS Centre number
b. Type of SMS
c. Reference number of SMS
d. HP Number receiver
e. SMS shape
f. Encoding scheme
g. Range time before SMS expired

   Validation time for SMS shows on the table 2.3.

Table 2.3 Interger Constante and SMS Validation

Integer (INT)	Range time SMS validation
0 – 143	(INT + 1) x 5 minutes (5 minutes – 12 hours)
144 – 167	12 hours + ((INT-143) x 30 minutes
168 – 196	(INT – 166) x 1 day
197 – 255	(INT – 192) x week

Source: Khang, 2002:13

h. Contents of SMS

PDU for SMS receive from SMS Center contain 8 header:

a. SMS Center Number
b. Type SMS
c. HP number receiver
d. SMS shape
e. Encoding scheme
f. Date and time SMS in SMS Centre symbolize by tweleve hexadecimal (six pasang) on format: yy/mm/dd hh:mm:ss
g. Validation time, if unlimited its symbolize with 00.
h. Contents of SMS.

CHAPTER III
HARDWARE SYSTEM

3.1 Ping Ultrasonic Censor

Ping Censor constitutes a tool used to measure the distance of a solid object with precision and without physical contact. Ping Censor has a measuring distance for 2 cm to 3.35 cm. This censor determines the distance using sonar, mainly ultrasonic pulse transmitted from unit to object. The determined distance comes from the time measurement against echo return. Output of Ping Censor will be the pulse width variable adjusting to the distance to object.

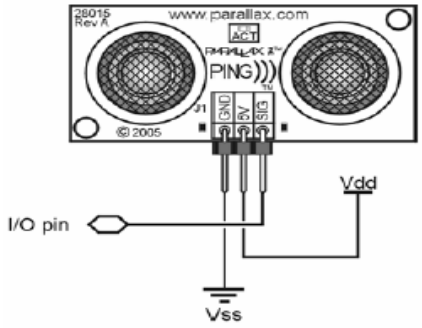


Figure 3.1 PING (Ultrasonic Range Finder)
Source: www.parallax.com/detail.asp?product_id=28015

PING censor have a 3 pin that each other is used for :

- (V_{DD}) used for power supply
- (V_{SS}) used for ground
- (I/O pin) used for input/ output signal line

3.1.1 List of technical specifications

- Range - 2cm to 3m (~.75" to 10')
- Supply Voltage: 5V +/-10% (Absolute: Minimum 4.5V, Maximum 6V)
- Supply Current: 25 mA typ; 30 mA max
- 3-pin interface (power, ground, signal)
- 20 mA power consumption
- Narrow acceptance angle
- Simple pulse in / pulse out communication
- Indicator LED shows measurement in progress

- Input Trigger - positive TTL pulse, 2 uS min, 5 uS typ.
- Echo Pulse - positive TTL pulse, 115 uS to 18.5 mS
- Echo Hold-off - 350 uS from fall of Trigger pulse
- Burst Frequency - 40 kHz for 200 uS
- Size - 22 mm H x 46 mm W x 16 mm D (0.85 in x 1.8 in x 0.6 in)

3.1.2 Ping Censor's way of operation

Ultrasonic censor detects the object by spreading short ultrasonic burst, and listening the echo. By the control of micro-controller in the censor, through trigger pulse, short ultrasonic burst circulated by censor remains as 40 khz. The journey of burst touches the object by 1130 feet/second and it returns to censor. Ultrasonic censor produces output pulse sent to the micro-controller that it ends when it detects the echo.

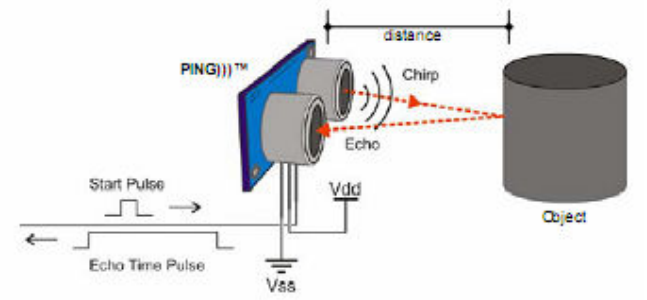


Figure 3.2 Ping censor's way of operation illustration
Source: www.parallax.com/detail.asp?product_id=28015

Figure 3.3 show the timing diagram Ping module.

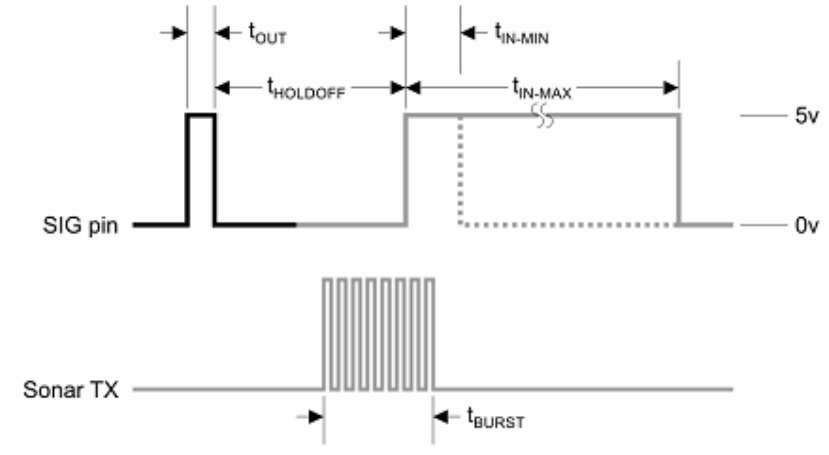


Figure 3.3. Timing diagram Ping module.
Source: www.parallax.com/detail.asp?product_id=28015

Explanation : t_{OUT} = 2 uS (min), 5 uS typical

$t_{HOLDOFF}$ = 750 uS

t_{BURST} = 200 uS @ 40 kHz

t_{IN-MIN} = 115 uS

t_{IN-MAX} = 18,5 mS

Microcontroller giving a control to the censor as trigger pulse with t_{OUT} min. 2 μs. After that, waitung $t_{HOLDOFF}$ for 750 μs. SIG signal became high as the sign calculated the time with t_{IN-MIN} 115 μS and t_{IN-MAX}18,5mS. Sonar signal that spread by the censor with frekuency 40kHz with time 200 μs that happened when $t_{HOLDOFF}$ until SIG signal become high.

3.2 Types of Tank

The shape of the underground tank in SPBU isn't a perfect cylinder, there are a protrusion that show in figure 3.4.

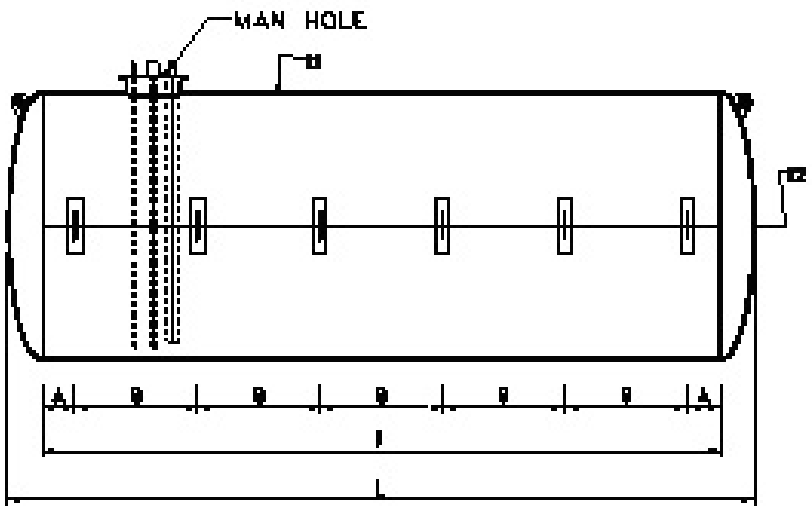


Figure 3.4 Underground tank
Source: www.sinarbaruperkasa.com

Tank used in gas station seems imperfect because the protrusion emerges in right and left sides. Tank volume may be varied. It seems five standard sizes for buried tank volume, in term of diameter, length, height and other variable. The volume and size of this buried tank complies the

standard of Royal Dutch/E 880/API 650. Table 3.1 shows buried tank standard size.

Table 3.1 Pertamina Underground Tank Standard

No	Type (liter)	Diameter (mm)	I (mm)	L (mm)	t1 (mm)	t2 (mm)	A (mm)	B (mm)
1	15000	2000	4750	5210	6	8	300	1037
2	20000	2500	4000	4540	8	10	300	1133
3	30000	2500	6100	6700	8	10	300	1100
4	45000	2500	9150	9950	8	10	300	1425
5	45000	2750	7500	8138	8	10	300	985

Source: www.sinarbaruperkasa.com

The cylinder's calculate with the tank is not full of water :

Cylinder's volume (dm^3) = wide of base (dm^2) x high (dm)

Wide of base (dm^2) = wide a circle in the side of cylinder that affected the water (dm^2)

high (dm) = length of the cylinder

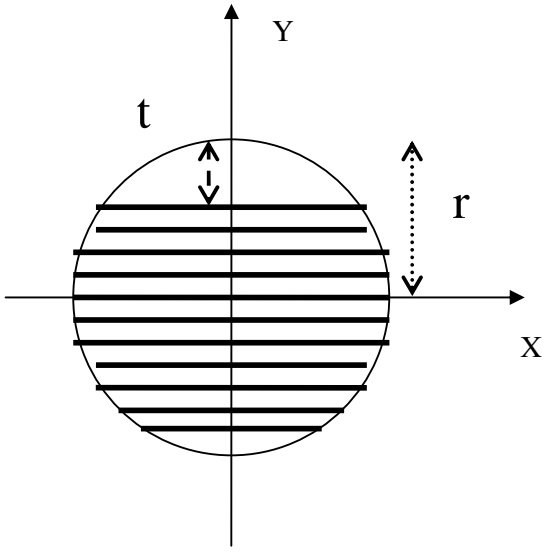


Figure 3.5 The circle illustration in X dan Y
Source: The planning of volume

equation of the circle : $x^2 + y^2 = r^2$

$$x^2 = r^2 - y^2$$

$$x^2 = \sqrt{\left(r^2 - y^2\right)}$$

Wide a circle that shade in adrawing = L

$$\mathrm{L} = 2\int_{-r}^{r-t} \sqrt{\left(r^2 - y^2\right)}\, dy$$

Example : $y = r.\sin\theta,\ \sin\theta = \dfrac{y}{r}$

If y = -r , So : $\sin\theta = \dfrac{-r}{r}$

$$\sin\theta = -1$$

$$\theta = -\frac{\pi}{2}$$

If y = r-t, So : $\sin\theta = \dfrac{r-t}{r}$

$$\theta = \arcsin\frac{r-t}{r}$$

$$\frac{dy}{d\theta} = r.\cos\theta,\ dy = (r.\cos\theta)d\theta$$

$$\mathrm{L} = 2\int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} \sqrt{\left(r^2 - r^2.\sin^2\theta\right)}(r.\cos\theta)d\theta$$

$$= 2\int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} \sqrt{\left(r^2\left(1-\sin^2\theta\right)\right)}(r.\cos\theta)d\theta$$

$$= 2\int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} \sqrt{\left(r^2.\cos^2\theta\right)}(r.\cos\theta)d\theta$$

$$= 2\int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} (r.\cos\theta)(r.\cos\theta)d\theta$$

$$= 2 \int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} \left(r^2.\cos^2\theta\right)d\theta$$

$$= 2 \int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} r^2\left(\frac{1}{2}+\frac{1}{2}\cos 2\theta\right)d\theta$$

$$= 2 \int_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}} \frac{1}{2}r^2+\left(\frac{1}{2}r^2\cos 2\theta\right)d\theta$$

$$= 2\left[\frac{1}{2}r^2\theta+\frac{1}{4}r^2.\sin 2\theta\right]_{-\frac{\pi}{2}}^{\arcsin\frac{r-t}{r}}$$

$$= 2\left[\left(\frac{1}{2}r^2\arcsin\frac{r-t}{r}+\frac{1}{4}r^2.2\frac{r-t}{r}\frac{\sqrt{r^2-(r-t)^2}}{r}\right)-\left(-\frac{1}{2}r^2\frac{\pi}{2}+0\right)\right]$$

$$= 2\left[\left(\frac{1}{2}r^2\arcsin\frac{r-t}{r}+\frac{r-t}{2}\sqrt{r^2-(r-t)^2}\right)+\frac{1}{4}\pi r^2\right]$$

$$= r^2\arcsin\frac{r-t}{r}+(r-t)\sqrt{r^2-(r-t)^2}+\frac{1}{2}\pi r^2$$

so the cylinder'c volume :

$$\text{V} = \left(r^2\arcsin\frac{r-t}{r}+(r-t)\sqrt{r^2-(r-t)^2}+\frac{1}{2}\pi r^2\right) \text{ x L}$$

Explanation :

V = cylinder's volume (dm^3)

$r^2\arcsin\frac{r-t}{r}+(r-t)\sqrt{r^2-(r-t)^2}+\frac{1}{2}\pi r^2$ = wide a circle in the side of cylinder that affected the water (dm^2)

r = radius of circle in the side of cylinder (dm)

t = the distance that calculate by the censor (dm)

π = phi constant = $\frac{22}{7}$

L = length of the cylinder (dm)

3.3 Modem

The actual modem has been abbreviated from **Mo**dulator-**Dem**odulator. Modulate may be the process of translating data from digital to analog to facilitate the transmission. Demodulate means the reverse, to translate from analog to digital.

In average, modem has data transfer capability of 56 kbps. The reliability of modem must be supported by favorable network system (phone wire), high speed and enough data track width (not too much considering ratio between track width and online modem capacity). These three conditions affect to each other on speed of data transmission.

3.3.1 Modem's Way of Operation

Getting maximum result from modem requires having ISP or other source to possess true modem digital (fully digital working modem, not analog or semi digital). In the relation of point to point, the phone central network works digitally with clean track (without noise/interference between wires). Figure 3.6 illustrates the modem's way of operation to transmit the downloaded data.

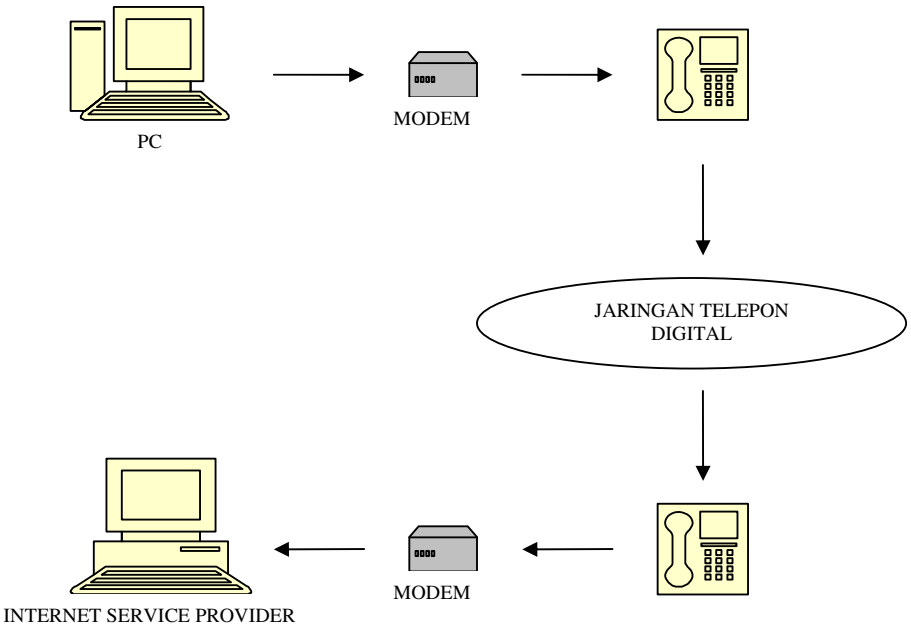


Figure 3.6 transmision download data illustrasion
Source: www.elektronikaindonesia.com

In this figure, PC sends data by connecting to modem. In the modem, set of A/D converter functions as converting data from analog signal to digital signal to be transmitted (upstream) to phone track (digital). Data of digital signal will be accepted by ISP modem and this digital signal may be converted to analog signal (downstream) by D/A converter.

3.4 Handphone Siemens C35

Handphone constitutes one of superior developing communication tools. Siemens remains as a handphone brand with several strengths, among others its strong signal. C35 has been a product of Siemens.

C35 communicates with computer through certain interface. In the communication between C35, and also some other Siemens' products, with computer, a rule becomes evident, called as PDU (Protokol Data Unit – Unit Data Protocol). Therefore, handphone and computer produce a communication.

3.4.1 Pin of Siemens C35

To have a connection with other devices such as computer and microcontroller, handphone Siemens C35 has pin as shown in Figure 3.7 and Table 3.2 details of the function of the pin.

Figure 3.7 Pin out Siemens C35/C45/S35/M35
Source: www.pinsout.ru

Table 3.2 Pin Keluaran Siemens C35/C45/S35,M35

Pin	Nama	Fungsi	In/Out
1	GND	Ground	
2	Self Service	Recognition / control battery charger	In / Out
3	Load	Charging Voltage	In
4	Battery	Battery	Out

5	Data Out	Data Sent	Out
6	Data In	Data Received	In
7	Z_Clk	Recognition / control accessories	
8	Z_Data	Recognition / control accessories	
9	MICG	Ground for microphone	
10	MIC	Microphone input	Out
11	AUD	Loudspeaker	Out
12	AUDG	Ground for eksternal speaker	

Source: www.pinsout.ru

3.5 RS 232 Serial Communication Standard

RS 232 refers to an interface of data transfer process between computers in serial formation. RS 232 represents the abbreviation of Recommended Standard Number 232. RS 232 has been designed being interface between data terminal device and data communication device, using serial binary data as the transmitted data. The standard manages the data communication between computer (Data Terminal Equipment-DTE) and computer tools (Data Circuit-Terminating Equipment – DCE).

RS 232 serial interface provides the determination of logic level as follows:

- Logic 1 called “mark” located between –3 Volt to –15 Volt.
- Logic 0 called “space” located between +3 Volt to +15 Volt.

Voltage area between –3 Volt to +3Volt seems invaled level, meaning the voltage area without logic such that it should be avoided. A data tract of RS232 showing such voltage indicates the error. The error also emerges in the more negative region from –15 Volt and the more positive region from +15 Volt.

In the standard, RS 232 must be determined through types of signal used to arrange the information exchange between DTE and DCE. Twenty-four types of signal develop but the most commonly used only

counts to 9 types of signal. The used connector has been determined in the RS 232 standard, in which the complete signal will consider DB25 connector while the 9 signals concern with DB9 connector. The signal of RS 232 at DB9 and DB25 connectors differs in leg arrangement. Figure 3.8 shows the pin configuration at DB9 connector.

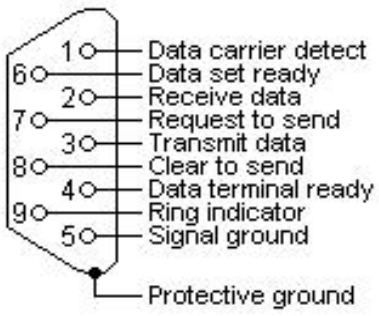


Figure 3.8 Connector pin configuration of DB9
Source: Lammert, 2006

The use of each pin in the DB9 seems as follows:

(1) Pin 1: Data Carrier Detect

Useful for DTE to prevent from accepting the data.

(2) Pin 2: Received Data (RxD/RD)

Useful as data transmission track from DCE to DTE.

(3) Pin 3: Transmitted Data (TxD/TD)

Useful as data transmission track from DTE to DCE.

(4) Pin 4: Data Transmitted Ready

Useful to inform DCE that DTE has been active and ready to work.

(5) Pin 5: Signal Ground

Useful for the reference of all interface voltage.

(6) Pin 6: Data Set Ready

Useful to inform DTE that DCE has been active and ready to work.

(7) Pin 7: Request to Send (RTS)

Useful to inform DCE that DTE will send the data. RTS becomes a hardware protocol preceding data transmission from DTE to DCE.

(8) Pin 8: Clear to Send

Useful to inform DTE that DCE has been ready to accept the data. CTS will be the hardware protocol preceding data transmission from DTE to DCE.

(9) Pin 9: Ring Indicator

CHAPTER IV
METHODOLOGY

This chapter explains the method used in designing Monitoring System of Volume Using Ultrasonic Censor by Means of Internet and SMS. The system design referred to question formulation that has been made before. The method used comprised of data collection that was performed through the study of literature, system design, the making of hardware and software, testing the tools and analyzing the result of the test, and making conclusion and suggestion.

4.1 Literature Study

The literature study was comprised of study of component characteristic would be used as well as all theory based on the bloc diagram of the system that has been designed, namely: Distance Censor of PING (Ultrasonic Range Finder), Mobile Phone Siemens C35, Internet and SMS

4.2 The Making of System

Designing and making the system were performed in some steps, steps of designing and making the system was performed by:

a. Determining system specification:

   The determination of system specification was performed to give explanation about the matters related with the work system

b. The making of block diagram of the system:

   This step was performed to ease in understanding work flow of the tool

c. System design for each block comprised of:

   1) Hardware design

      Hardware in this system comprised of:

      - Prototype tank
      - Censor PING (Ultrasonic Range Finder)
      - Censor box
      - DB 25
      - DB 9

- PC
- HP
- Cabel data HP siemens C35
- Modem
- Cabel

2) Software design

It was started by making flow diagram. The software was functioned to order all sistem comprising of some hardware so that the system appropriately works. This software was made using Borland Delphi 7.0

d. The design of entire system

This steps comprised of relate all hardware and the software supporting the performance of the tools used

4.3 System Testing

The testing was purposed to test if the tools made work appropriately. The testing was performed at the hardware and the software. The steps used in testing the tools were:

1. Testing the system in each block
2. Accommodating the system from some blocks to be a unity system
3. Testing the series entirely

4.4 Analysis

The analysis performed after testing the system and the data was obtained. After that, analysis was performed in order to understand the appropriateness of the theories, compared with the specification of tools and evaluating the work system of the tool.

4.5 Conclusion and Suggestion

The conclusion was based on the result of realization and testing the tool referring to the objectives and question formulation. The suggestion was given

after knowing the lack in the system, with the hope that the system would be improved in the future.

CHAPTER V
THE ENGINEERING AND TESTING OF SYSTEM

5.1 The Engineering of System

The engineering of tool in this system consists of the engineering of hardware and software. For hardware, it involves some phases of planning, including planning the prototype, set of censor and software for SMS application and Internet using Delphi program.

The objective of Final Assignment seems about planning the volume-monitoring tool using ultrasonic censor through Internet access and SMS. This system has been made to understand the volume using ultrasonic censor and the information can be accessed through Internet and SMS.

5.1.1 System Diagram Block

System diagram of block of volume monitoring employs ultrasonic censor through Internet access and preplanned SMS, as shown in Figure 5.1.

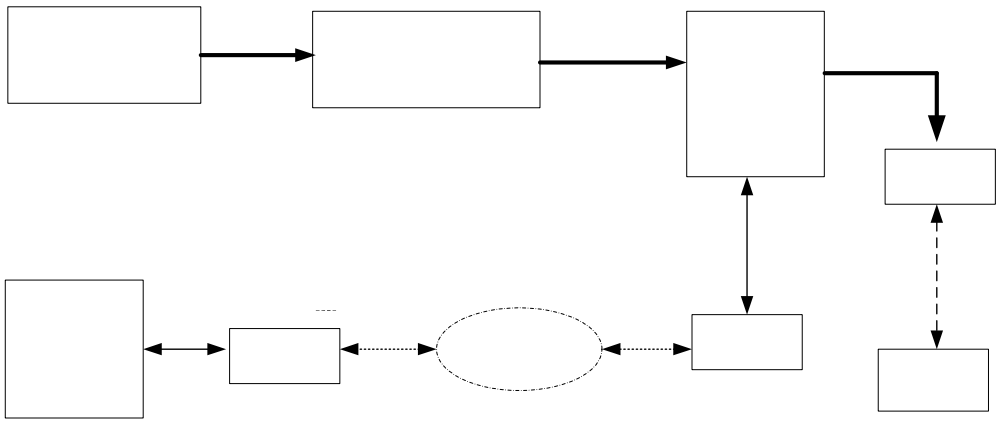


Figure 5.1 Diagram block system.
Source: Planning of system

Tool's way of operation :

1. Ultrasonic censor measures the object distance by spraying ultrasonic wave (40 kHz) during t_{BURST} (200 μs), waiting the pulse and getting the pulse width.
2. Pulse width will be calculated by micro-controller, and then, the data of measured pulse width should be sent to server computer.
3. Pulse width may be used as a guide to measure the distance or tank volume. The process of calculating the tank volume evolves by server computer.
4. The calculation of volume run for once of five minutes and the data enter into server database.
5. Client may ask for information of tank volume through SMS, and HP connects with server computer when it sends information of tank volume with the last volume calculation.
6. Client may ask for information of tank volume through Internet and server computer will reveal the information of tank volume based on database.

5.1.2 The engineering of hardware

Hardware used in this system submits to the one supporting the measurement process of tank volume and facilitating the information dissemination through Internet access and SMS. The required tools include:

- Ultrasonic censor
- Tank Prototype
- Microcontroller with IC AT89C51
- Ultrasonic censor box
- Siemens C35 and SIM Card used for receive and send SMS from HP server to user HP and the opposite.
- Personal Computer with Operating System (Windows XP), using Prosessor Pentium IV with 256 Mb memory.

5.1.2.1 Sensor Ultrasonik

Ultrasonic censor used will be the Ping ultrasonic censor from Parallax. Ultrasonic censor detects the object by spreading short ultrasonic burst, and listening the echo. By the control of micro-controller in the censor, through trigger pulse, short ultrasonic burst circulated by censor remains as 40 khz. The journey of burst touches the object by 1130 feet/second and it returns to censor. Ultrasonic censor produces output pulse sent to the micro-controller that it ends when it detects the echo.

Figure 5.2 and 5.3 shows Ping Ultrasonic censor dimension.

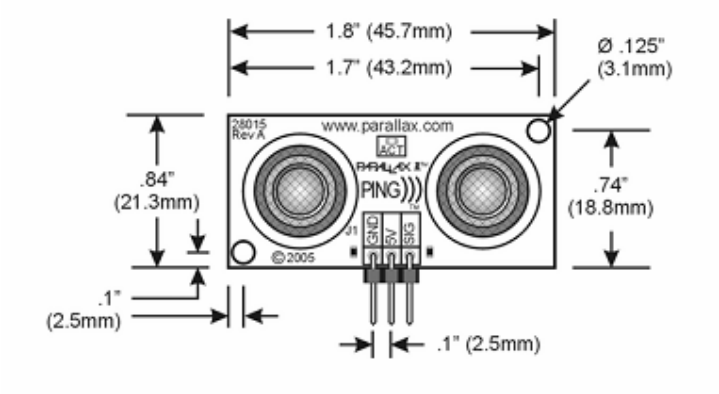


Figure 5.2 Dimension of Ping ultrasonic censor from the top.
Source: www.parallax.com/detail.asp?product_id=28015

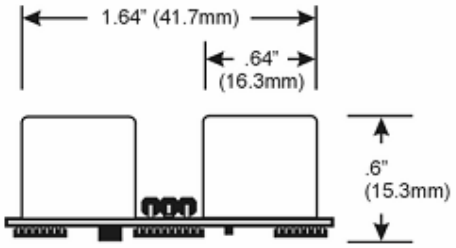


Figure 5.3 Dimension of Ping ultrasonic censor from the side.
Source: www.parallax.com/detail.asp?product_id=28015

Three pins of Ping ultrasonic censor come into consideration: V_{DD} as power supplay, V_{SS} as ground, and I/O as input/output path of signal.

5.1.2.2 The planning of Tank Volume

In the planning of tank volume, the tank used will be those usually used in gas station, as buried tube. Figure 5.4 shows the planning of tank dimension.

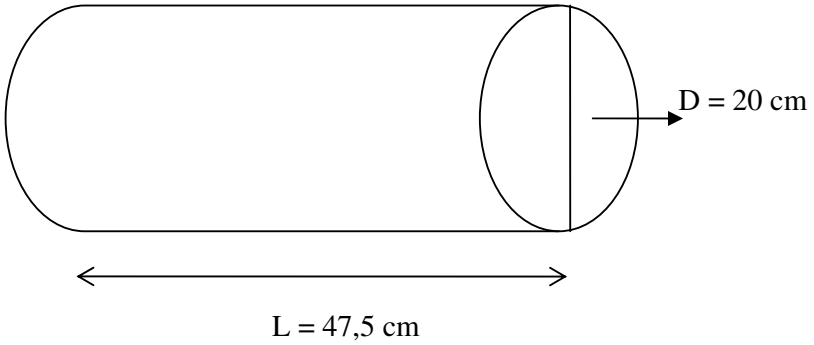


Figure 5.4 the planning of the tank volume.
Source: planning of system

L = length = 47,5 cm

D = diameter = 20 cm

r = radius = 10 cm

So the tank's volume :

$$V = \pi r^2 t$$

The tank isn't vertical position (horizontal) so $t = L$

$$V = \pi r^2 L$$

The calculate of distance that doing by ultrasonic censor is a distance shaped high cylinder's diameter that not contain of water, in this topic it is assumsed with "t" variable.

The cylinder's volume in "t" variable :

$$V = (r^2.\arcsin\frac{r-t}{r} + (r-t)\sqrt{r^2-(r-t)^2} + \frac{1}{2}\pi r^2) \text{ x L}$$

$$V = (10^2.\arcsin\frac{10-t}{10} + (10-t)\sqrt{10^2-(10-t)^2} + \frac{1}{2}\pi 10^2) \text{ x } 47{,}5$$

$$V = (100.\arcsin\frac{10-t}{10} + (10-t)\sqrt{100-(10-t)^2} + 50\pi) \text{ x } 47{,}5$$

Explanation :

V = cylinder's volume (dm^3)

$r^2 \arcsin\frac{r-t}{r} + (r-t)\sqrt{r^2-(r-t)^2} + \frac{1}{2}\pi r^2$ = wide a circle in the side of cylinder that

affected the water (dm^2)

r = radius of circle in the side of cylinder (dm)

t = the distance that calculate by the censor (dm)

π = phi constant = $\frac{22}{7}$

L = length of the cylinder (dm)

5.1.2.3 The planning of Microcontroller Application

AT 89C51 has been produced by Atmel. Withstanding the architecture of MCS-51, the microcontroller utilizes on-chip memory for easily deleted Flash Rom program due to its relatively cheaper price compared to EPROM type, and due to its 2 kbyte internal EEPROM.

In this set of system, the most important component refers to AT89C51 microcontroller. Microcontroller system functions as a medium of data processing and interfacing between ultrasonic censor and computer. The planning of microcontroller can be shown in the Figure 5.5:

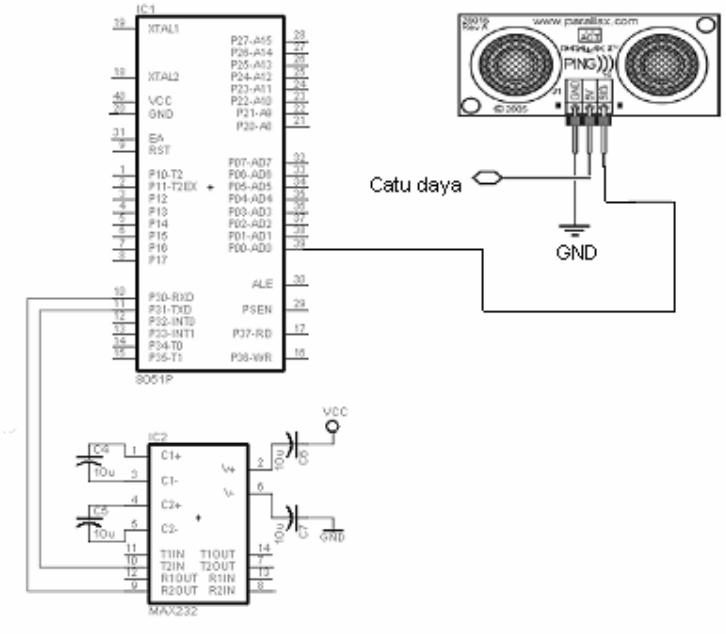


Figure 5.5 Planning of microcontroler series
Source: Planning of system

In this set of AT89C51 microcontroller, pin 30 and 31 (RxD and TxD) have a relation with pin 9 and 10 in the IC max 232.

5.1.2.4 Interface RS 232

In this planning, interface taht used is IC MAX 232, the combination of the pin that used :

1. Pin 2 : connected with PC (Rx)
2. Pin 7 : connected with PC (Tx)
3. Pin 9 : connected with microcontroller (RxD)
4. Pin 10 : connected with microcontroller (TxD)

5.1.2.5 HP Siemens C35

Hand phone Siemens C35 becomes an important communication tool to transfer the measured tank volume by system to client hand phone by using SMS. The communication of hand phone and computer considers asynchronous serial communication with baudrate 19200 bps. Figure 5.6 shows the set of cross-section of hand phone by DB 9.

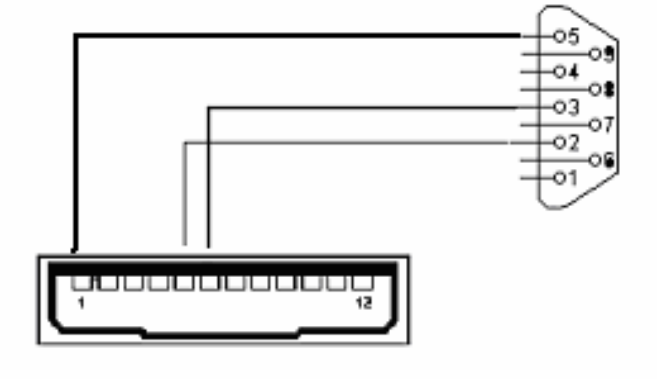


Figure 5.6 Interface HP with DB 9.
Source: Planning of system

1. Pin 2 : Dihubungkan ke Pin 5 (data out)
2. Pin 3 : Dihubungkan ke Pin 6 (data in)
3. Pin 5 : Dihubungkan ke ground

5.1.3 The planning of software

The software appears being planned using Borland Delphi 7. Easy description of the program operation flow and the preparation of software requires flow diagram. The following will be the planned flow diagram.

- Flow diagram of main program
    1. Flow diagram of SMS checking
    2. Flow diagram of the instruction of data requirement to microcontroller
    3. Flow diagram of the data receipt from microcontroller
- Flow diagram of microcontroller
- Flow diagram of volume monitoring through internet access

5.1.3.1 Flow diagram of main program

Server initiates for data collection based on the measurement by ultrasonic censor and measuring the tank volume. The result of tank volume measurement and timing of measurement come into database. The measurement and calculation of volume run about once in five minutes. Figure 5.7 shows the flow diagram of the flow from the program in the server.

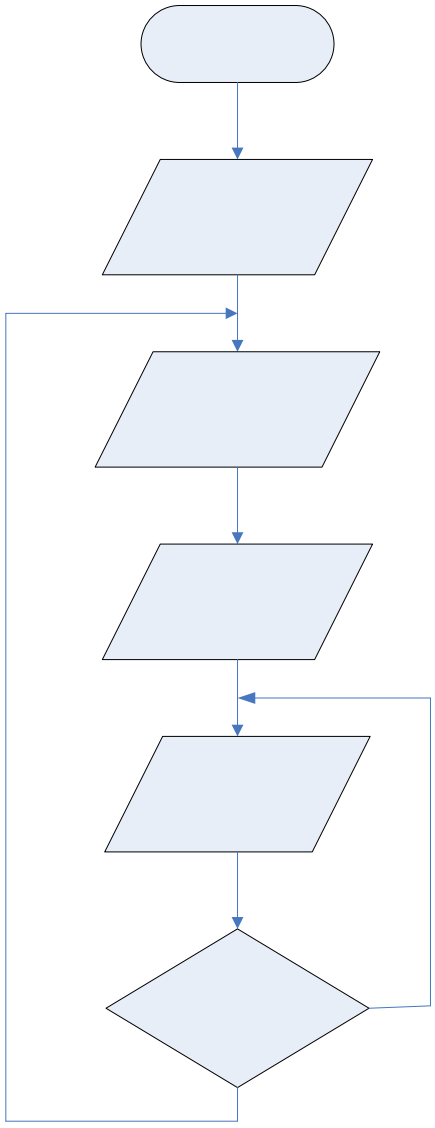


Figure 5.7. Flow diagram server.
Source: planning of system

a. Flow diagram for SMS checking

Client sends SMS to server to ask for the information of tank volume. SMS sent by server to client will be the latest information of tank volume data, by measuring the distance and the calculation of the last processed volume. Figure 5.8 indicates the flow diagram of the flow from the program of volume monitoring through SMS access.

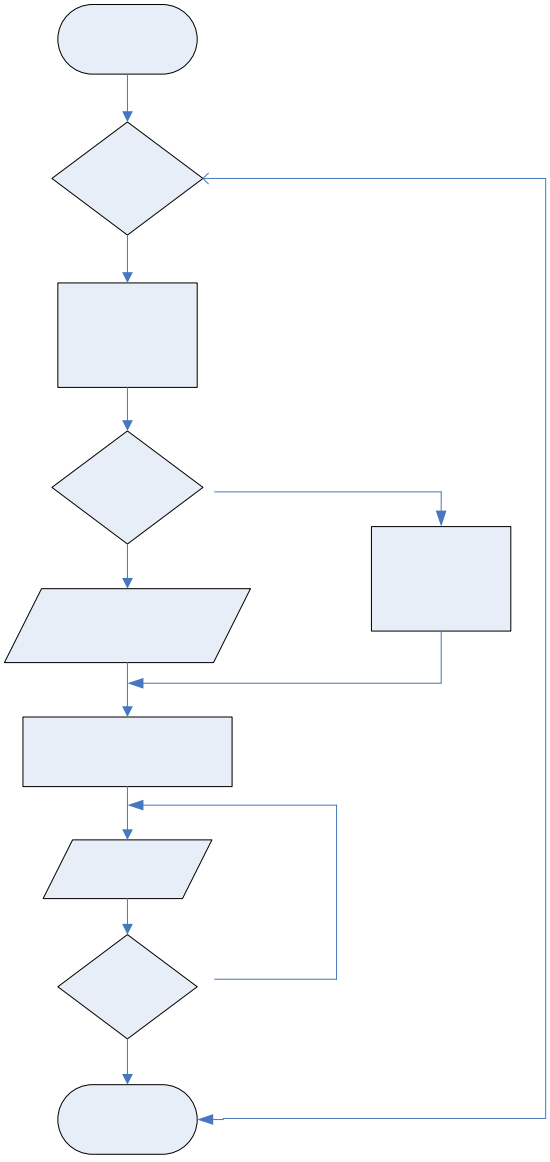


Figure 5.8 Flow diagram for SMS checking.
Source: Planning of system

b. Flow Diagram of The Instruction of Data Requirement to Microcontroller

Server computer requires the data of results of water height measurement from microcontroller. The data request develops by sending the character "V" to the microcontroller, with the connection of port com. Figure 5.9 displays the flow diagram of the flow from the instruction of data requirement for microcontroller.

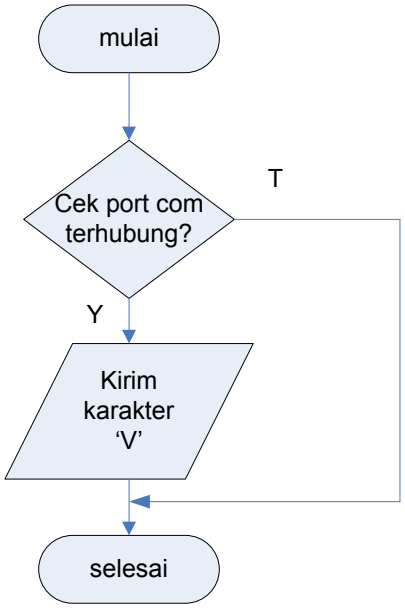


Figure 5.9. Flow diagram of the instrucstion of data requirement to microcontroller.
Source: Planning of system

c. Flow Diagram of The Data Receipt from Microcontroller

Microcontroller receives the request for data of the measurement results with the character “V” (#13). If the request seems true, the results of measurement in form of time unit variable convert into height, and then the measurement of volume evolves. The results of measuring the volume, with the data and time, should be stored. Figure 5.10 exhibits the flow diagram of data receipt from microcontroller.

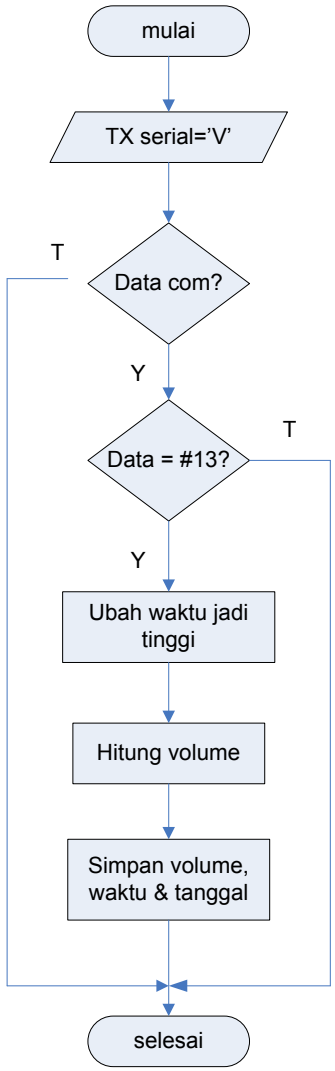
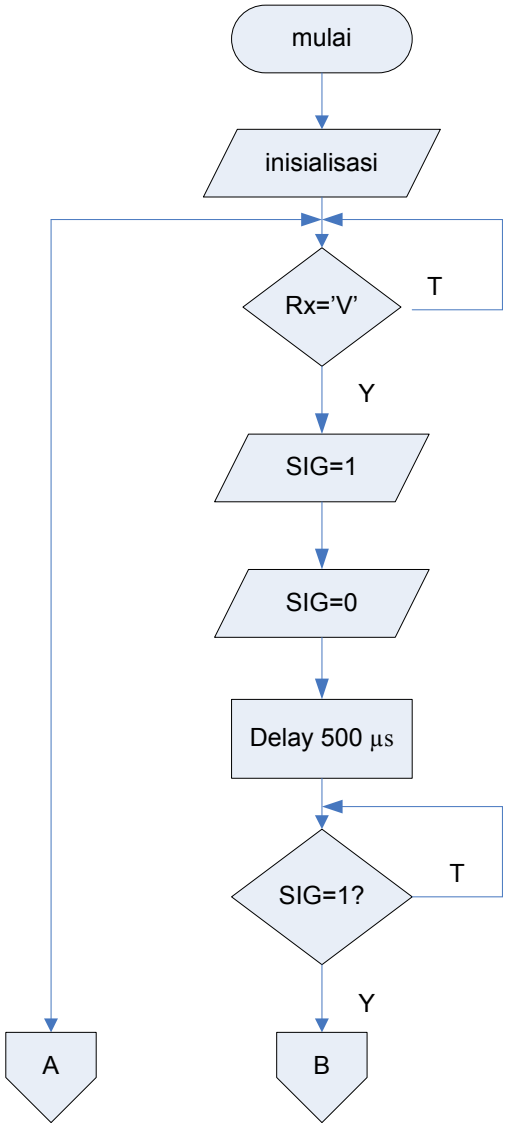


Figure 5.10. Flow diagram of the data receipt from microcontroller.
Source: Planning of system

5.1.3.2 Flow diagram of microcontroller

Microcontroller initiates and detects Rx whether it complies with the determined character, “V” or not. If SIG=1, then the counter turns ON while if SIG =0, the counter turns OFF. As the results of measurement emerge, the microcontroller sends the results serially. Counter backs to 0 and conducts recalculation if Rx = “V”.



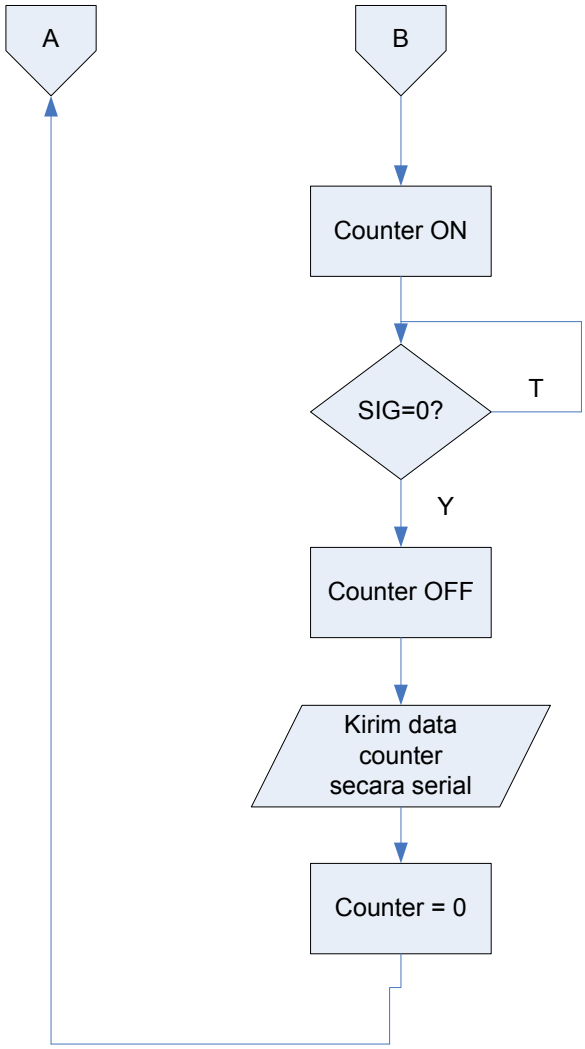


Figure 5.11. Flow diagram of microcontroller.
Source: Planning of system

5.1.3.3 Flow Diagram of Volume Monitoring through Internet Access

When the server may be at "ON" condition, data of tank volume and timing of measurement can be revealed continuously. Client accessing the Internet, therefore, can examine the tank volume continuously, in which the results of measurement pertains to the result of volume measurement in every 5 minutes. Figure 5 shows the flow diagram of the flow from volume monitoring program through Internet access.

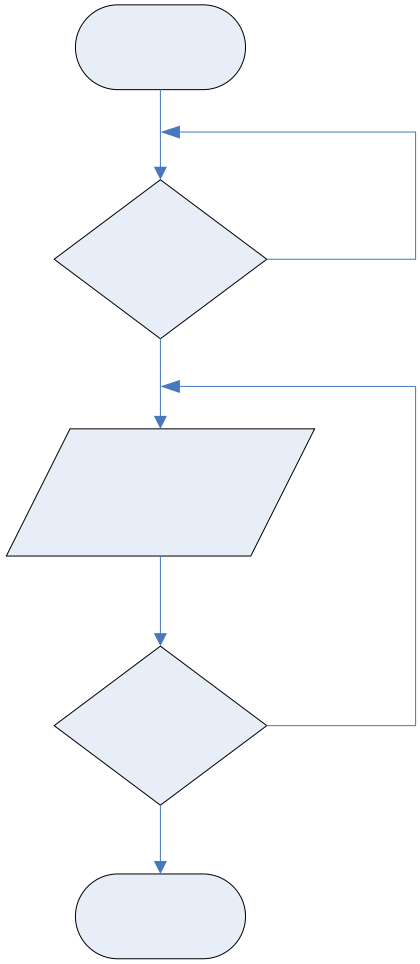


Figure 5.12. Flow diagram of volume monitoring throught internet access.
Source: Planning of system

mulai

Server ON

Y

5.2 The Testing of System

The testing of system involves the testing of: RS 232 serial communication, tank volume, HP-based and PC-based data transmission, web display on the PC, and entire system.

5.2.1 The Testing of Microcontroller

5.2.1.1 The objective :

To examine the serial communication process between computer and microcontroller through RS 232.

5.2.1.2 The equipment used :

a. RS 232 series
b. Microcontroller AT89C51
c. Computer with hyperterminal program
d. Serial cabel with DB9 connector

5.2.1.3 Diagram Block :

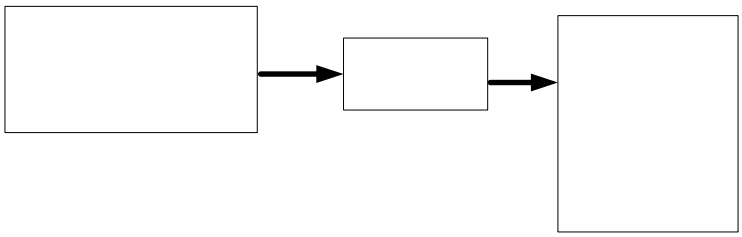


Figure 5.13 Diagram block testing transfer data between RS232 with microcontroller.
Source: testing of system

The steps of testing :

1. To set the equipment as shown in Figure 5.19.
2. To arrange the 9600 bps hyperterminal boud rate.
3. To prepare the testing program with the following flow diagram :

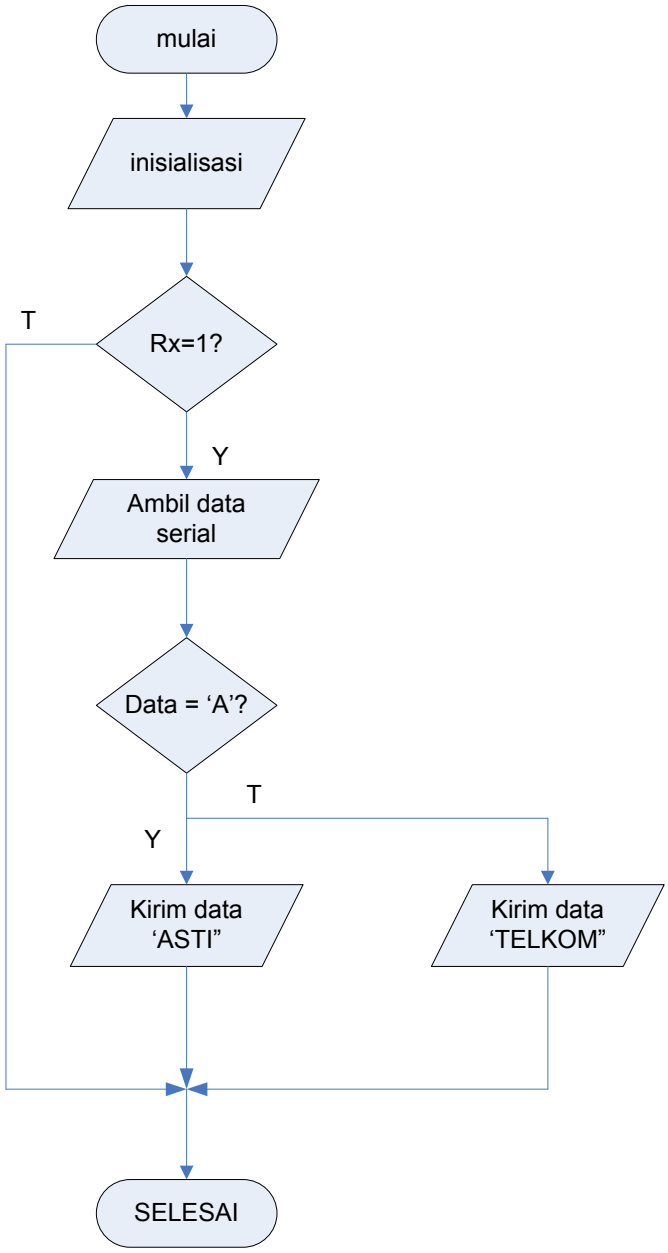


Figure 5.14. Flow diagram testing RS 232 serial communication.
Source: testing of system

5.2.1.4 Data of results of testing :

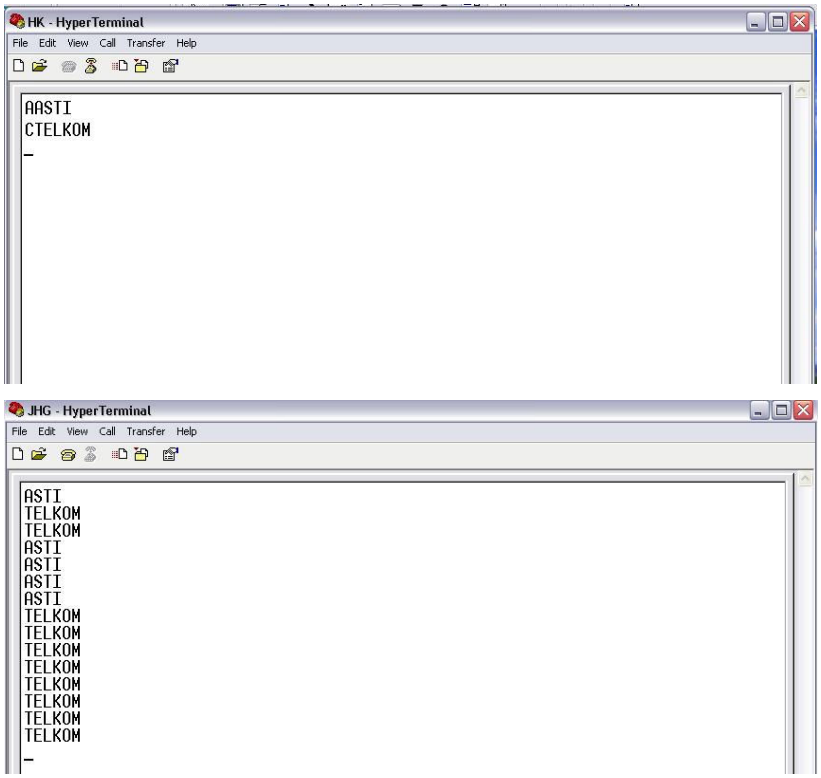


Figure 5.15. Result of testing serial communication RS 232.
Source: Pengujian

5.2.1.5 The analysis of results of the testing of microcontroller :

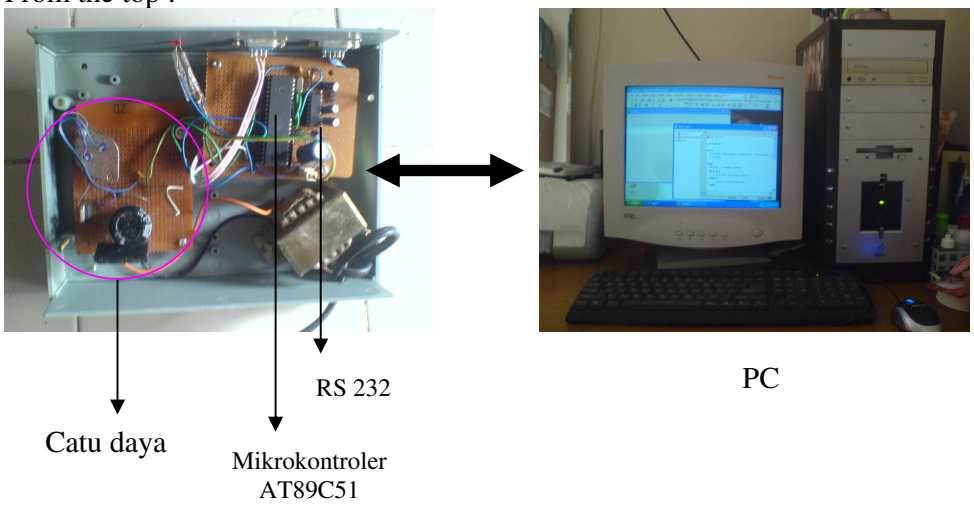
Microcontroller has a program to respond when the microcontroller receives the data from computer. When the data of computer denotes “A”, microcontroller gives a response by sending data denoted “ASTI”. The results can be seen in the hyperterminal program. Instead of character “A”, the response given by microcontroller will be “TELKOM”.

5.2.1.6 Conclusion:

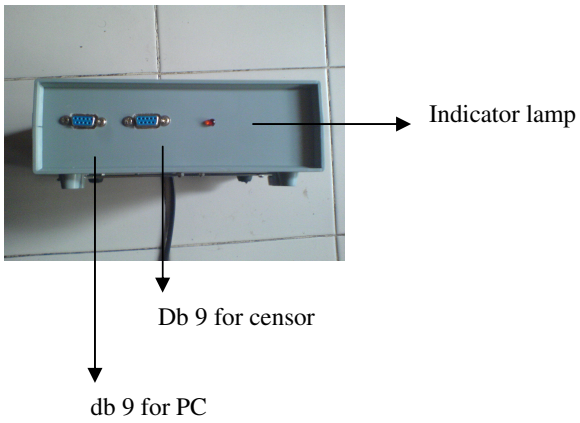
Serial communication process between computer and microcontroller through RS 232 develops well (the given respond complies with the expected program output).

5.2.1.6 Photo :

From the top :



From the side :



5.2.2 The Testing of Tank Volume

5.2.2.1 The objective :

To examine whether the liquid volume in the tank has been measured with censor based on the actual volume.

5.2.2.2 The equipment used :

a. Tank prototype
b. Ultrasonic censor
c. Microcontroller series
d. RS 232 series
e. PC

5.2.2.3 Diagram Block :

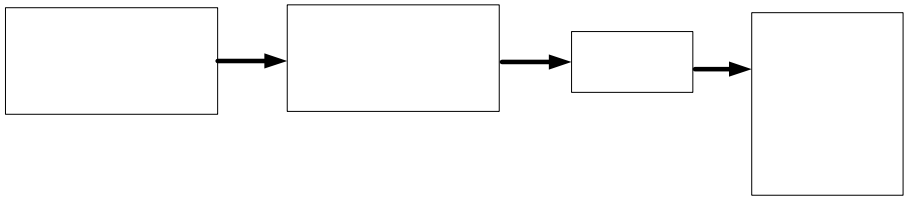


Figure 5.16 Diagram block testing of the tank volume.
Source: testing of system

The steps of testing :

1. To connect ultrasonic censor with microcontroller and microcontroller with PC through RS 232.
2. To put the program into microcontroller.
3. To put the volume measuring program into PC server.
4. To observe the output of monitor.

5.2.2.4 Data of results of testing :

Table 5.1 Testing of volume

No	Actual Volume (liter)	The tested Volume (liter)	Error (%)
1	1	1,02	2,00
2	3	3,11	3,66
3	5	5,09	1,80
4	7	7,23	3,28
5	9	9,14	1,55
6	11	11,28	2,54

Sumber: testing of system

Calculated :

1. Actual volume = 1 liter

   The tested volume = 1,02 liter

$$\%error = \left| \frac{TheTestedVolume - ActualVolume}{ActualVolume} \right| x100\%$$

$$\%error = \left| \frac{1.02 - 1}{1} \right| x100\%$$

$$= 2\%$$

2. Actual volume = 3 liter

   The tested volume = 3.11 liter

$$\%error = \left|\frac{3.11-3}{3}\right| x100\%$$

$$= 3.66\%$$

3. Actual volume = 5 liter

   The tested volume = 5.09 liter

$$\%error = \left|\frac{5.09-5}{5}\right| x100\%$$

$$= 1.80\%$$

4. Actual volume = 7 liter

   The tested volume = 7.23 liter

$$\%error = \left|\frac{7.23-7}{7}\right| x100\%$$

$$= 3.28\%$$

5. Actual volume = 9 liter

   The tested volume = 9.14 liter

$$\%error = \left|\frac{9.14-9}{9}\right| x100\%$$

$$= 1.55\%$$

6. Actual volume = 11 liter

   The tested volume = 11.28 liter

$$\%error = \left|\frac{11.28-11}{11}\right| x100\%$$

$$= 2.54\%$$

5.2.2.5 The analysis of results of the testing of tank volume:

The difference becomes evident between the actual volume and the tested volume. The miscalculation can be considered by searching for the difference between both volumes to get the error percentage. The error percentage may be in each liter.

$$\%\text{error/liter} = \frac{\sum \Delta V}{\sum V} x100\%$$

$$= \frac{(0{,}02+0{,}11+0{,}09+0{,}23+0{,}14+0{,}28)}{(1+3+5+7+9+11)} x100\%$$

$$= \frac{0,87}{36} x100\%$$

$$= 2,41\%$$

5.2.2.6 Conclusion:

The measured volume cannot be 100 % similar to the actual volume. It becomes evident because of the imprecision of the frame to support the tank position causing the inaccuracy of water height measurement. The miscalculation of volume in each liter counts to 2.41 %.

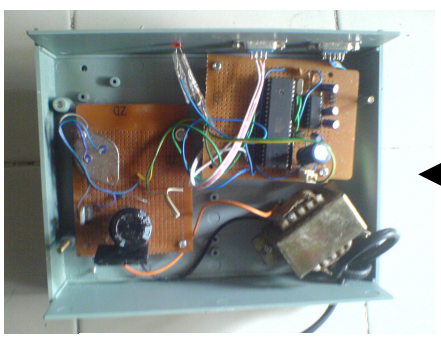
5.2.2.7 Photo :

From the top :

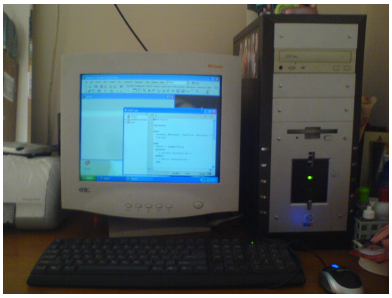
From the side :

Ultrasonic censor

Tank



Microcontroller
AT89C51



PC

5.2.3 The Testing of SMS Transmission

5.2.3.1 The objective :

To observe whether the information request through SMS from Client hand phone gains the respond in form of SMS reply from server containing with the information of volume.

5.2.3.2 The equipment used :

a. Data cabel Siemens C35
b. PC (Personal Computer)
c. Handphone Siemens C35
d. Handphone

5.2.3.3 Diagram Block :

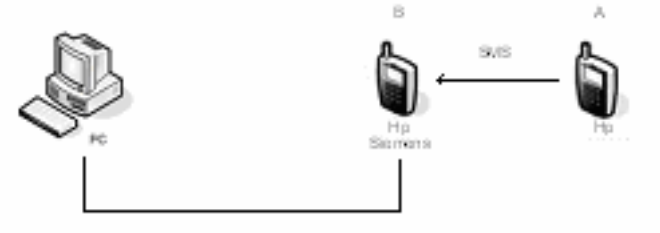


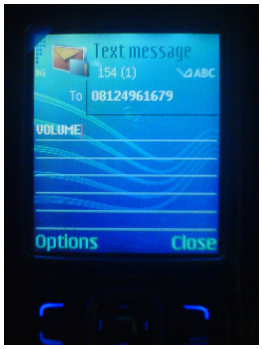
Figure 5.17 Diagram block testing data transfer HP and PC
Source: Testing of system

The steps of testing :

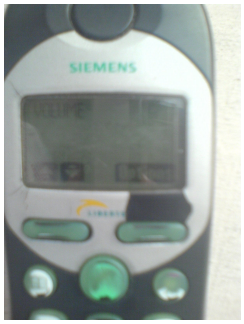
1. To connect cellular phone B to PC using Siemens data wire
2. To transmit SMS from HP A to HP B.
3. To wait the SMS reply from HP B to HP A.

5.2.3.4 Data of results of testing :

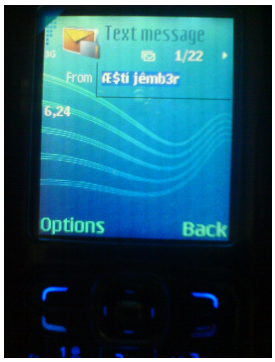
1. HP Client asks for the information of volume by typing "VOLUME" and transmitting it into HP server.



2. HP server accepts SMS with content "VOLUME".



3. HP server transmits the information of the last volume measurement.
4. HP Client accepts the SMS of the information of volume.



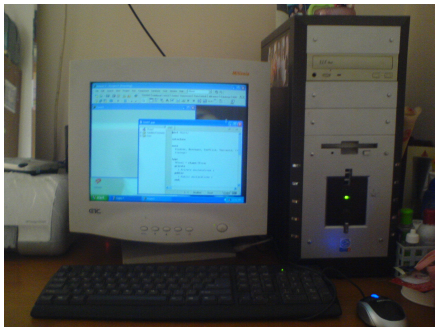
5.2.3.5 The analysis of results of HP- and PC-based data transfer:

HP Client gets the information of volume through SMS by sending SMS to the server by the word VOLUME. After the server receives SMS, automatically, server replies the SMS with the information of the last measured volume in term of liter unit.

5.2.3.6 Conclusion:

The testing of SMS transmission by HP Client to HP server complies with the previous planning. The request of the information of volume by HP Client gets the respond of reply SMS from server containing the last measured volume.

5.2.3.7 Photo :



Data cabel

HP Siemens C35

PC

HP

5.2.4 The Testing of Web Display on the PC

5.2.4.1 The objective :

To understand the display on the PC, when the request for information of volume run from Internet.

5.2.4.2 The equipment used :

a. Ultrasonic censor
b. Mikrokontroler AT89C51
c. RS 232
d. PC server

5.2.4.3 Diagram Block :

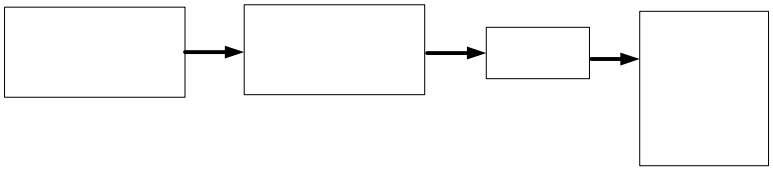
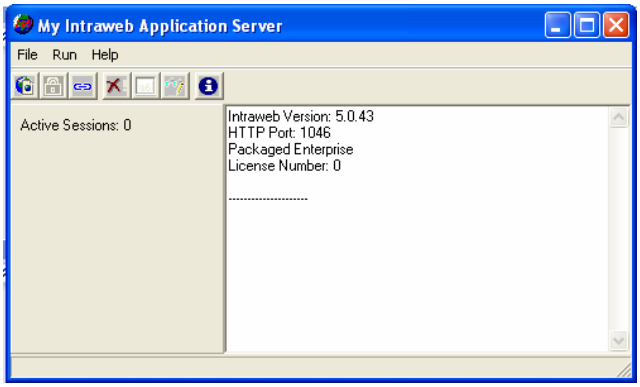


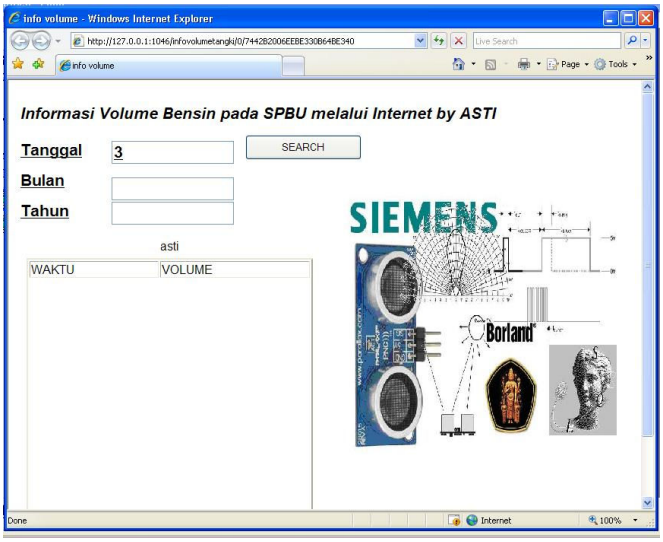
Figure 5.24 Diagram block the testing of web display on the PC
Source: Testing of system

5.2.4.4 The steps of testing and Data of results of testing:

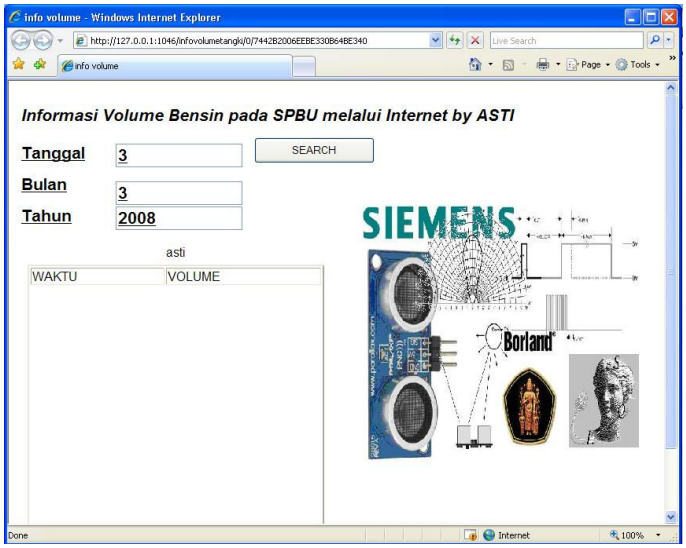
1. Click on My Intraweb Application Server.



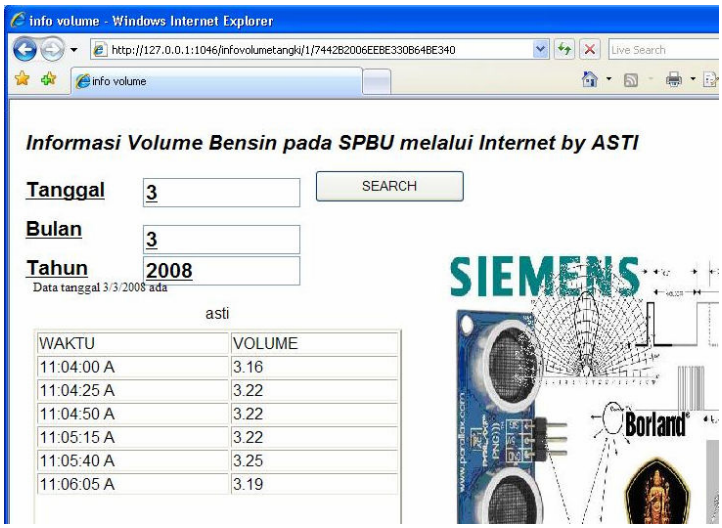
2. Click on “Launch selected browser and execute application”.



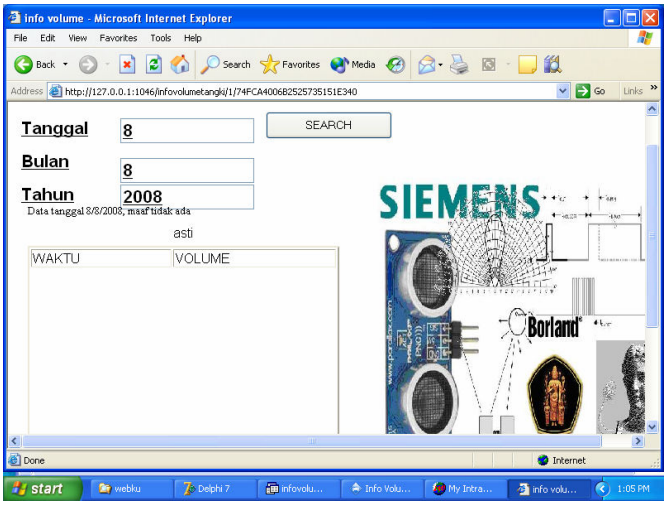
3. Fill the date, month and year in the expected information of volume.



4. Click on “Search”.
5. The display of information shows within the column of time and volume.



6. If the information of volume cannot be found, then the information of data may not exist.



5.2.4.5 The analysis of results of the testing of web display on the PC:

When accessing information through Internet network, the date, month and year should be filled completely, such that the information of volume may stand in the available column. The wrong answer, likes the unexpected date, month and year, possibly deserves the information of unfavorable data.

5.2.4.6 Conclusion:

The information of tank volume, with data and time, can be accessed through Internet network.

5.3 Tool Specification

System specification seems as follows:

a. Server uses Personal Computer (PC).
b. System measures volume from 0 liter to 14.915 liters.
c. Error percentage of system has been ± 2.41 %.
d. Period of measured data collection will be 5 minutes.
e. Tank volume remains at liter unit.
f. The display of information on the client computer reveals date, timing, and volume.
g. The information of volume sent through SMS relates to the volume of the last measurement results before SMS transmission.

CHAPTER VI
SUMMARY

6.1. Conclusion

Based on results of experiment about the problem and objective, it may conclude that:

1. Volume monitoring system utilizes ultrasonic censor through Internet access and SMS made on the previous planning.
2. Ultrasonic censor measures tank volume, the time distance of ultrasonic wave, and tank height to obtain tank volume.
3. System sensitivity remains at ± 2.14 % while the accuracy of volume measurement relies on the tank position and water calm in the tank.
4. The information of volume sent through SMS represents the last measured volume before accepting the request for information via SMS.
5. The information of tank volume displayed in the website will be the tank volume measured every 5 minutes accompanied by the date and time.

6.2. Suggestion

The results of this final assignment appear far from being perfect. Therefore, we suggest that:

1. The provisioning of password for information access through Internet access should be important to improve information security.
2. The preparation of reminder through SMS and website must be provided for the user of the information of volume when the tank volume run out.

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APPENDIX 1

Listing Program Unit UPembuka

```
unit Upembuka;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
  Dialogs, DB, DBClient, MConnect, SConnect, ExtCtrls, StdCtrls, jpeg;

type
  TPembuka = class(TForm)
    Timer1: TTimer;
    Label1: TLabel;
    Image1: TImage;
    Label2: TLabel;
    procedure FormCreate(Sender: TObject);
    procedure Timer1Timer(Sender: TObject);
  private
    { Private declarations }
  public
    { Public declarations }
  end;

var
  Pembuka: TPembuka;

implementation

uses Uutama;

{$R *.dfm}

procedure TPembuka.FormCreate(Sender: TObject);
begin
 label1.Caption:='Welcome to My System';
 label1.Font.Size:=1;
 pembuka.Caption:='Welcome';
 timer1.Enabled:=true;
 timer1.Interval:=500;
end;

procedure TPembuka.Timer1Timer(Sender: TObject);
begin
 if pembuka.Caption='Welcome' then
 begin
 label1.Font.Size:=label1.Font.Size+3;
 if label1.Font.Size>10 then
 begin
  timer1.Enabled:=false;
  futama.show;
  pembuka.Hide;
 end;
 end
 else
 begin
  label1.Font.Size:=label1.Font.Size+3;
  if label1.Font.Size>10 then
```

```
  begin
   timer1.Enabled:=false;
   application.Terminate;
  end;
 end;

end;

end.
```

APPENDIX 2

Listing Program Unit UUtama

```
unit Uutama;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
  Dialogs, Menus, StdCtrls, CPort, ExtCtrls, ComCtrls, jpeg, Grids,
  DBGrids, DB, DBTables, XPMan, ADODB;

type
  TFutama = class(TForm)
    MainMenu1: TMainMenu;
    File1: TMenuItem;
    Keluar1: TMenuItem;
    Panel1: TPanel;
    Setting1: TMenuItem;
    Comport11: TMenuItem;
    ComPort21: TMenuItem;
    Process1: TMenuItem;
    OpenCom11: TMenuItem;
    OpenCom21: TMenuItem;
    Panel2: TPanel;
    ComPort1: TComPort;
    ComPort2: TComPort;
    Memo1: TMemo;
    Bsetcom2: TButton;
    Bsetcom1: TButton;
    Bopencom2: TButton;
    Bopencom1: TButton;
    Edit1: TEdit;
    Edit2: TEdit;
    Tvolume: TTimer;
    PengukuranVolume1: TMenuItem;
    Mulai1: TMenuItem;
    Selesai1: TMenuItem;
    Edit3: TEdit;
    Edit4: TEdit;
    Label1: TLabel;
    Edit5: TEdit;
    Label2: TLabel;
    Edit6: TEdit;
    Label3: TLabel;
    Label4: TLabel;
    Edit7: TEdit;
    Label5: TLabel;
    Label6: TLabel;
    Label7: TLabel;
    ComboBox1: TComboBox;
    Label8: TLabel;
    statcmgl: TShape;
    kondisi2: TShape;
    Edit8: TEdit;
    Edit9: TEdit;
    Memo2: TMemo;
    Label9: TLabel;
    Label10: TLabel;
    sb1: TStatusBar;
    Image1: TImage;
```

```
    Button1: TButton;
    Button2: TButton;
    Button3: TButton;
    Label11: TLabel;
    Button4: TButton;
    Button5: TButton;
    Table1: TTable;
    ds1: TDataSource;
    DBGrid1: TDBGrid;
    XPManifest1: TXPManifest;
    Label12: TLabel;
    ADOConnection1: TADOConnection;
    ADOTable1: TADOTable;
    Label13: TLabel;
    procedure Keluar1Click(Sender: TObject);
    procedure Bsetcom1Click(Sender: TObject);
    procedure Bopencom1Click(Sender: TObject);
    procedure ComPort1AfterOpen(Sender: TObject);
    procedure ComPort1AfterClose(Sender: TObject);
    procedure TvolumeTimer(Sender: TObject);
    procedure ComPort1RxChar(Sender: TObject; Count: Integer);
    procedure FormClose(Sender: TObject; var Action: TCloseAction);
    procedure Edit4Change(Sender: TObject);
    procedure Mulai1Click(Sender: TObject);
    procedure Selesai1Click(Sender: TObject);
    procedure FormCreate(Sender: TObject);
    procedure ComPort2AfterOpen(Sender: TObject);
    procedure ComPort2AfterClose(Sender: TObject);
    procedure ComPort2RxChar(Sender: TObject; Count: Integer);
    procedure ComPort2Error(Sender: TObject; Errors: TComErrors);
    procedure Button1Click(Sender: TObject);
    procedure Bsetcom2Click(Sender: TObject);
    procedure Bopencom2Click(Sender: TObject);
    procedure Button2Click(Sender: TObject);
    procedure Button3Click(Sender: TObject);
    procedure Button4Click(Sender: TObject);
    procedure Button5Click(Sender: TObject);
  private
    { Private declarations }
    procedure tabelbaru(var strku:string);
    procedure ConvertMSG(var strku:string);
    procedure phonezero;
    procedure volumeawal;
    procedure kirimsms(var strku:string);
    procedure ukurvolume;
    //function PDU2Text(pdudata: string): string;
  public
    { Public declarations }
  end;

var
  Futama: TFutama;

implementation

uses Upembuka,math;

{$R *.dfm}
```

```
procedure tfutama.tabelbaru(var strku:string);

begin
 with Table1 do begin
  Active := False;
  TableType := ttdefault;
  TableName := strku;

  { Don't overwrite an existing table }

  if not Table1.Exists then
  begin
    { The Table component must not be active }
    { First, describe the type of table and give }
    { it a name }
    { Next, describe the fields in the table }
    with FieldDefs do
    begin
      Clear;
      with AddFieldDef do
      begin
        Name := 'waktu';
        DataType := ftstring;
        size := 10;
      end;
      with AddFieldDef do
      begin
        Name := 'volume';
        DataType := ftString;
        Size := 10;
      end;
    end;
    { Call the CreateTable method to create the table }
    CreateTable;
  end;
end;
end;

{prosedur penerimaan dan pembacaan sms}
function PDU2Text(pdudata: string): string;
var
        pdu,isi,hasilteks,huruf: string;
        i: integer;
        m,n,vgeser,sisa,
        c,d,e,f,panjang: byte;
        hasil,dbiner: array[1..9000] of byte;
begin
        if length(pdudata)=0 then begin
                Result := '';
                exit;
        end;
        pdu := copy(pdudata,3,length(pdudata));
        isi:= '';
        panjang := length(pdu) div 2;
        for i := 1 to panjang do begin
                huruf := copy(pdu, i*2 - 1, 2);
                dbiner[i] := StrToInt('$' + huruf);
```

```
        end;
        m := 1;
        vgeser := 0;
        sisa := 0;
        n := 1;
        while n <= panjang do begin
                c := dbiner[n];
                d := c shl vgeser;
                e := d or sisa;
                f := e and $7F;
                hasil[m] := f;
                Inc(vgeser);
                c := dbiner[n];
                d := c shr (8-vgeser);
                sisa := d;
                inc(m);
                inc(n);
                if vgeser >= 7 then begin
                        hasil[m] := sisa and $7F;
                        inc(m);
                        sisa := 0;
                        vgeser := 0;
                end;
        end;
        hasilteks := '';
        for i := 1 to m - 1 do
                hasilteks := hasilteks + chr(hasil[i]);
        Result := hasilteks;
end;

procedure tfutama.ConvertMSG(var strku:string);
var pdu,aa,
   smsc,tipe,bentuk,
   skema,batas: string;
   p,i: integer;
begin
        pdu := strku;
        {ambil sms center}
        smsc := '';
        p := StrToInt('$' + copy(pdu, 1, 2)) - 1;
        pdu := copy(pdu,5,length(pdu)-4);
        for i := 1 to p do begin
                smsc := smsc + pdu[i*2];
                smsc := smsc + pdu[i*2-1];
        end;
        if smsc[length(smsc)] = 'F' then
                smsc := copy(smsc, 1, length(smsc) - 1);
        Memo1.Lines.Add('smscenter:'+smsc);
        pdu := copy(pdu, p*2+1,length(pdu)-p*2);

        tipe := copy(pdu, 1, 2);

        pdu := copy(pdu, 3, length(pdu)-2);

        edit1.Clear;
        p := StrToInt('$'+copy(pdu,1,2));
        if p mod 2 = 1 then inc(p);
        pdu := copy(pdu,5,length(pdu)-4);
```

```
        for i := 1 to p div 2 do begin
              edit1.Text:= edit1.Text + pdu[i*2];
              edit1.Text := edit1.Text + pdu[i*2-1];
        end;
        if edit1.Text[length(edit1.Text)] = 'F' then
              edit1.Text := copy(edit1.Text, 1, length(edit1.Text) - 1);
        memo1.Lines.Add('pengirim:'+edit1.Text);
        pdu := copy(pdu,p+1,length(pdu)-p);

        bentuk := copy(pdu,1,2);
        pdu := copy(pdu, 3, length(pdu)-2);

        skema := copy(pdu,1,2);
        pdu := copy(pdu, 3, length(pdu)-2);

        edit2.Text := pdu[6]+pdu[5] + '-' + pdu[4]+pdu[3] + '-' +
                  pdu[2]+pdu[1] + ' ' +
                  pdu[8]+pdu[7] + ':' + pdu[10]+pdu[9] + ':' +
                  pdu[12]+pdu[11];
        memo1.Lines.Add('tanggal:'+edit2.Text);
        pdu := copy(pdu, 13, length(pdu)-12);

        batas := copy(pdu,1,2);
        pdu := copy(pdu, 3, length(pdu)-2);
        AA := PDU2Text(pdu);
        memo1.Lines.Add('Isi='+AA);
end;

procedure tfutama.phonezero;
begin
 statcmgl.Brush.Color:=clred;
 edit8.Clear;edit9.Clear;edit1.Clear;edit2.Clear;
 memo1.Clear;memo2.Clear;label9.Caption:='';
 //mulai1.Enabled:=true;selesai1.Enabled:=false;
end;

procedure tfutama.volumeawal;
begin
 edit3.Clear;
 edit5.Clear;edit6.Clear;edit7.Clear;
 panel1.Caption:='0';edit4.Text:='000';
end;

{prosedur pengiriman sms}
function setsmsc(strku:string):string;
var
 smscku,smscku2:string;
 btku,iku:byte;
begin
smscku:=strku;
 if pos('62',smscku)<>0 then
 begin
  btku:=length(smscku);
  if (btku mod 2)<>0 then
  begin
   btku:=(length(smscku) div 2)+2;
   smscku:='91'+smscku+'F';
  end
```

```
  else
  begin
   btku:=length(smscku)div 2;
   smscku:='91'+smscku;
  end;
  {memo1.Text:='91';}smscku2:=copy(smscku,1,2);
  for iku:=1 to btku do
  begin
   smscku2:=smscku2+copy(smscku,(iku*2)+2,1)+copy(smscku,(iku*2)+1,1)
  end;
  iku:=(length(smscku2))div 2;
  if iku<10 then
   smscku2:='0'+inttostr(iku)+smscku2
  else
   smscku2:=inttostr(iku)+smscku2;
  smscku:=smscku2;
 end;
 if smscku2<>'' then
  result:=smscku2
 else
  result:='000';
end;

function setnotujuan(var strku:string):string;
var
 btku,iku:byte;
 strku2:string;
begin
 if pos('62',strku)<>0 then
 begin
  btku:=length(strku);
  if (btku mod 2)<>0 then
  begin
   btku:=(length(strku) div 2)+2;
   strku:='91'+strku+'F';
  end
  else
  begin
   btku:=length(strku)div 2;
   strku:='91'+strku;
  end;
 end
 else
 begin
  strku:='81'+strku;
  if (length(strku)mod 2)<>0 then
  begin
   strku:=strku+'F';
  end;
 end;
for iku:=1 to btku do
 begin
 strku2:=strku2+copy(strku,(iku*2)+2,1)+copy(strku,(iku*2)+1,1)
 end;
 iku:=(length(strku2))-2;
 if iku<16 then
  strku2:='0'+inttohex(iku,0)+strku2
 else
```

```
  strku2:=inttohex(iku,0)+strku2;
result:=strku2;

end;

function msg2pdu(var strku:string):string;
var
 strku2:string;
 iku1,iku2:integer;
 btku1,btku2:byte;
begin
 iku1:=length(strku);
 strku2:='';
 iku2:=0;
 repeat
  iku2:=iku2+1;
  if (iku2 mod 8)=0 then
  begin
  iku2:=iku2;
  end
  else
  begin
   btku1:=ord(strku[iku2]);btku1:=btku1 and $7f;
   btku1:=btku1 shr ((iku2 mod 8)-1);
   btku2:=ord(strku[iku2+1]);btku2:=btku2 and $7f;
   btku2:=btku2 shl (7-((iku2 mod 8)-1));
   btku1:=btku1 or btku2;
   if btku1>15 then
    strku2:=strku2+inttohex(btku1,0)
   else
    strku2:=strku2+'0'+inttohex(btku1,0);
  end;
 until(iku2=iku1);
 if iku1<16 then
  strku2:='0'+inttohex(iku1,0)+strku2
 else
  strku2:=inttohex(iku1,0)+strku2;
 result:=strku2;
 {hasil sub program adalah:
  pengubahan format data teks 8 bit menjadi 7 bit dalam bentuk heksadesimal
  ke karakter dan sudah disertakan jumlah karakter sms yang akan dikirim}
end;

procedure tfutama.kirimsms(var strku:string);
var
 smscku,notujuan:string;
 btku:integer;

begin
 memo2.Clear;
 {format pengriiman sms dgn AT+command /pdu
  format:
    AT+CMGS=<LENGTH><CR>
    pdutext<ctrl^Z/esc>

  FORMAT SMS/PDUTEXT:
  <no smscenter><tipe sms=01><referensi no=00>
  <no tujuan><bentuk sms=0><sms dlm 7bit=00><isi sms>}
```

```
  {isi sms:
   <panjang isi><isi>}
 btku:=combobox1.ItemIndex;
 case btku of
  0:smscku:='62855000000';
  1:smscku:='62811000000';
  2:smscku:='62818445009';
  3:smscku:='6289644000001';
 end;
 smscku:=setsmsc(smscku);
 notujuan:=edit1.Text;
 notujuan:=setnotujuan(notujuan);
 BTKU:=length(strku);
 strku:=msg2pdu(strku);
 strku:=strku+#26;
 strku:=smscku+'0100'+notujuan+'0000'+strku;
 memo2.Clear;
 memo2.Text:=strku;
 btku:=btku+13;
 if btku<16 then
  SMSCKU:='0'+inttohex(btku,0)
 else
  SMSCKU:= inttohex(btku,0);
 SMSCKU:='AT+CMGS=160'+#13;
 end;

procedure tfutama.ukurvolume;
var
 tku,rku:real;
 hasilku:real;
 semenku:real;
 strku:string;
begin
 strku:=copy(edit4.Text,1,3);
 semenku:=strtofloat(strku)*256;
 strku:=copy(edit4.Text,4,3);
 semenku:=semenku+strtofloat(strku);
 edit4.Text:=floattostr(semenku);
 tku:=strtofloat(edit4.Text);
  tku:=tku/29.034;//(strtofloat(edit10.Text));
 rku:=1;
 tku:=tku/10;
 edit4.Text:=floattostr(tku);
 tku:=tku/10;
 semenku:= (arcsin((rku-tku)/rku));
 hasilku:=(sqr(rku)*semenku)+((rku-tku)*(sqrt((sqr(rku))-(sqr(rku-tku))))+(0.5*pi*sqr(rku)));
 hasilku:=hasilku*4.75;
 str(hasilku:3:2,strku);
 edit5.Text:=strku; {}
end;

procedure TFutama.Keluar1Click(Sender: TObject);
begin
  if comport1.Connected then
   comport1.Close;
  if comport2.Connected then
   comport2.Close;
  selesai1.Enabled:=false;
```

```
 end;

procedure TFutama.Bsetcom1Click(Sender: TObject);
begin
 comport1.ShowSetupDialog;
end;

procedure TFutama.Bopencom1Click(Sender: TObject);
begin
 if bopencom1.Caption='Open' then
 begin
  if comport1.Connected then
  begin
   showmessage('Port com yang anda pilih sedang dipakai atau error');
  end
  else
   comport1.Open;
 end
 else
   comport1.Close;
end;

procedure TFutama.ComPort1AfterOpen(Sender: TObject);
begin
 bopencom1.Caption:='Close';
 opencom11.Caption:='Close Com 1';
 end;

procedure TFutama.ComPort1AfterClose(Sender: TObject);
begin
 bopencom1.Caption:='Open';
 opencom11.Caption:='Open Comport1';
end;

procedure TFutama.TvolumeTimer(Sender: TObject);
var
 strku,filetofind:string;
 dtku:tdatetime;
 iku,iku1:integer;
 konku:boolean;
begin
 tvolume.Enabled:=false;
 tvolume.Interval:=1000;
 edit3.Clear;
 Panel1.Caption:=inttostr(strtoint(panel1.Caption)+1);

 {sub program pengukuran volume tangki}
 if panel1.Caption='600' then
 begin
  strku:='V';panel1.Caption:='0';
  if comport1.Connected then
  begin
   comport1.WriteStr(strku);
   sb1.SimpleText:='Pengambilan data volume';

  end;
 end;
```

```
if statcmgl.Brush.Color=clred then
 begin
  sb1.Panels[0].Text:='hp Status standby';
  sb1.SimplePanel:=true;
 end;

{sub program penanganan sms}
IF comport2.Connected then
begin

 if statcmgl.Brush.Color=clred then
 begin
  sb1.Panels[0].Text:='Status standby';
  statcmgl.Brush.Color:=cllime;
 end
 else
 if statcmgl.Brush.Color=cllime then
 begin
  case strtoint(label11.Caption) of

   0:begin
      {pemeriksaan ada tidaknya sms baru}
      if strtoint(label13.Caption)=5 then
      begin
       memo1.Clear;
       memo2.Clear;
       kondisi2.Brush.Color:=clsilver;{tunggu jawaban hp}
       strku:='AT+CMGL=0'+#13#10;
       COMPORT2.WriteStr(strku);
       label11.Caption:='1';
       tvolume.Interval:=1000;
       label13.Caption:='0';
      end
      else
      begin
       label13.Caption:=inttostr(strtoint(label13.Caption)+1);
      end;
     end;
   2:begin
      iku:=0;label9.Caption:='';
      repeat
       {mencari segment memori penyimpanan sms}
       if Pos(':',memo2.Lines[iku])<>0 then
        label9.Caption:=label9.Caption+copy(memo2.Lines[iku],
        pos(':',memo2.Lines[iku])+1,pos(',',memo2.Lines[iku])-pos(':',
        memo2.Lines[iku]));
       iku:=iku+1;
      until(pos('OK',memo2.Lines[iku])<>0);

      if label9.Caption<>'' then
      begin
       {pengecekan segment memori sms berhasil}
       panel2.Caption:=label9.Caption;
       label11.Caption:='3';
      end
      else
      begin
       phonezero;label11.Caption:='0';
```

```
      statcmgl.Brush.Color:=cllime;
     end;

    end;
   3:begin
     {ada sms baru dan melaksanakan proses perubahan data
     sms menjadi data teks}
     memo1.Clear;
     sb1.Panels[1].Text:=label9.Caption;
     if {pos(',',label9.Caption)}label9.Caption<>'' then
     begin
      {iku:=strtoint(copy(label9.Caption,1,pos(',',label9.Caption)-1));
      strku:=copy(label9.Caption,pos(',',label9.Caption)+1,length(label9.Caption));
      label9.Caption:=strku;}
      {strku:=inttostr(iku);}
      iku1:=0;konku:=false;
      repeat
       if pos('CMGL:',memo2.Lines[iku1])<>0 then
       begin
       memo1.Lines.Add(memo2.Lines[iku1]);
        iku1:=iku1+1;strku:='';
        repeat
         strku:=strku+memo2.Lines[iku1];
         iku1:=iku1+1;

        until((pos('OK',memo2.Lines[iku1])<>0)or(pos('CMGL:',
         memo2.Lines[iku1])<>0));
        convertmsg(strku);
       end
       else
        iku1:=iku1+1;
      until((pos('OK',memo2.Lines[iku1])<>0));
      label11.Caption:='4';
      tvolume.Interval:=1000;
     end
     else
     label11.Caption:='3';
    end;
   4:begin
     iku:=0;konku:=false;
     memo2.Clear;
     repeat
      if (pos('pengirim:',memo1.Lines[iku])<>0)then
       edit1.Text:= copy(memo1.Lines[iku],pos('pengirim',
       memo1.Lines[iku])+9,
        length(memo1.Lines[iku]));
      if (pos('Isi=',memo1.Lines[iku])<>0)then
      begin
       strku:=memo1.Lines[iku];
       if strku='Isi=VOLUME'
THEN
       begin
        {sms dgn keyword benar,kirim jawaban benar}
        konku:=true;label11.Caption:='5';
        strku:='Volume tanggal '+edit7.Text+', waktu: ';
        strku:=strku+edit6.Text+' adalah= '+edit5.Text;
        iku1:=iku+1;
        repeat
```

```
  if(pos('+CMG',MEMO1.Lines[iku1])<>0)then
  begin
   memo2.Lines.Add(memo1.Lines[iku1]);
   memo2.Lines.Add(memo1.Lines[iku1+1]);
   memo2.Lines.Add(memo1.Lines[iku1+2]);
   memo2.Lines.Add(memo1.Lines[iku1+3]);
   memo2.Lines.Add(memo1.Lines[iku1+4]);
   iku1:=iku1+4;
  end
  else
  begin
   if memo1.Lines[iku1]<>'OKE' then
    memo2.Text:=memo2.Text+memo1.Lines[iku1]
   else
    memo2.Lines.Add(memo1.Lines[iku1]);
  end;
  iku1:=iku1+1;
 until(iku1=memo1.Lines.Count);
 memo1.Text:=memo2.Text;
 memo2.Clear;
 kirimsms(strku);
 memo2.Text:=strku;
end
else
begin
 {sms dgn keyword salah,kirim pringatan sms salah}
 konku:=true;label11.Caption:='5';
 strku:='keyword salah ';
 iku1:=iku+1;
 repeat
  if(pos('+CMG',MEMO1.Lines[iku1])<>0)then
  begin
   memo2.Lines.Add(memo1.Lines[iku1]);
   memo2.Lines.Add(memo1.Lines[iku1+1]);
   memo2.Lines.Add(memo1.Lines[iku1+2]);
   memo2.Lines.Add(memo1.Lines[iku1+3]);
   memo2.Lines.Add(memo1.Lines[iku1+4]);
   iku1:=iku1+4;
  end
  else
  begin
   if memo1.Lines[iku1]<>'OKE' then
    memo2.Text:=memo2.Text+memo1.Lines[iku1]
   else
    memo2.Lines.Add(memo1.Lines[iku1]);
  end;
  iku1:=iku1+1;
 until(iku1=memo1.Lines.Count);
 memo1.Text:=memo2.Text;
 memo2.Clear;
 kirimsms(strku);
 memo2.Text:=strku;
end;
end;
iku:=iku+1;
if iku>=memo1.Lines.Count then
begin
 konku:=true;
```

```
    end;
   until(konku);

  end;
 5:begin
   {cek kondisi hp siap kirim/tdk}
  if pos('>',memo2.Text)<>0 then
   begin
    strku:=copy(memo2.Text,1,pos(#26,memo2.Text));
    comport2.WriteStr(strku);
    label11.Caption:='6';
   end
   else
   begin
    if pos('ERROR',memo2.Text)<>0 then
    BEGIN
     strku:=copy(memo2.Text,1,pos(#26,memo2.Text));
     memo2.Clear;
     memo2.Text:=strku;
     //strku:= inttohex(btku,0);
      //SMSCKU:='AT+CMGS='+SMSCKU+#13;
      strku:='AT+CMGS=160'+#13;
      label11.Caption:='5';
      if comport2.Connected then
      begin
        comport2.WriteStr(strku);
      end;
    end
   end;
   {strku:='Volume tanggal '+edit7.Text+', waktu: ';
   strku:=strku+edit6.Text+' adalah= '+edit5.Text; }

  end;
 6:begin
   {cek keberhasilan pengiriman sms}
   if pos('OK',memo2.Text)<>0 then
   begin
    memo2.Clear;
    if pos('pengirim',memo1.Text)<>0 then
     label11.Caption:='4'{cek sms yg perlu direspon}
    else
     label11.Caption:='0';{kembali ke awal}
   end
   else
   begin
    if pos('ERROR',memo2.Text)<>0 then
    begin
     strku:='AT+CMGS=160'+#13;
     if comport2.Connected then
     begin
      comport2.WriteStr(strku);konku:=false;
     end;
     label11.Caption:='5';
    end;
   end;
  end;
end;
```

```
 end;
end;
dtku:=time;
strku:=timetostr(dtku);
edit6.Text:=strku;
dtku:=date;
if edit7.Text=datetostr(dtku) then
 edit7.Text:=datetostr(dtku)
else
begin
 edit7.Text:=datetostr(dtku);
 strku:=edit7.Text;
strku:='D'+strku;
strku:=buatfilename(strku);
strku:=strku+'.DB';
sb1.Panels[2].Text:=strku;
FileToFind := FileSearch(strku, GetCurrentDir+'\Data');
if FileToFind = '' then
begin
 strku:=GetCurrentDir+'\Data\'+strku;
 strku:=sb1.Panels[2].Text;
 strku:=copy(strku,1,length(strku)-3);
 tabelbaru(strku);
 table1.Active:=false;
end
else
begin
 table1.Active:=false;
 strku:=copy(strku,1,length(strku)-3);
 table1.TableName:=strku;
end;
end;

if selesai1.Enabled=false then
 tvolume.Enabled:=false
else
 tvolume.Enabled:=true;
end;

procedure TFutama.ComPort1RxChar(Sender: TObject; Count: Integer);
var
 strku:string;
begin
 comport1.ReadStr(strku,count);
 edit3.Text:=edit3.Text+strku;
 if pos(#13,strku)<>0 then
 begin
  edit4.Text:=copy(edit3.Text,1,6);
  edit3.Text:='000';
  ukurvolume;
  {penyimpanan data volume}
   //strku:=st
   {if table1.Active then
   begin
    table1.Append;
    table1.FieldValues['waktu']:=edit6.Text;
    table1.FieldValues['volume']:=edit5.Text;
    table1.Post;
```

```
   end;}
   if adotable1.Active then
   begin
    adotable1.Append;
    adotable1.FieldValues['Tanggal']:=edit7.Text;
    adotable1.FieldValues['WAKTU']:=edit6.Text;
    adotable1.FieldValues['VOLUME_TANGKI']:=edit5.Text;
    adotable1.Post;
   end;
  end
  else
  begin

  end;
 end;

procedure TFutama.FormClose(Sender: TObject; var Action: TCloseAction);
begin
 if comport1.Connected then
   comport1.Close;
  if comport2.Connected then
   comport2.Close;
 selesai1.Enabled:=false;
 tvolume.Enabled:=false;
 pembuka.show;
 pembuka.Label1.Font.Size:=1;
 futama.Hide;
 pembuka.Label1.Caption:='Godbay and Thank"s a lot';
 pembuka.Caption:='Bye - bye';
 pembuka.Label2.Caption:='YnY WorkShop'+#13#10+'08986315211';
 pembuka.Label2.Visible:=true;
 pembuka.Timer1.Enabled:=true;
 table1.Active:=false;
 table1.Close;
 adotable1.Active:=false;
 adoconnection1.Connected:=false;
end;

procedure TFutama.Edit4Change(Sender: TObject);
{var
 tku,rku:real;
 hasilku:real;
 semenku:real;
 strku:string; }
begin
 {tku:=strtofloat(edit4.Text);
 tku:=tku/(strtofloat(edit10.Text));rku:=1;
 //edit4.Text:=floattostr(tku);
 if tku>10 then
 begin
  //tku:=20-tku;
  tku:=tku/10;
  semenku:= (arcsin((tku-rku)/rku));
  //semenku:=radtodeg(semenku);
  str(semenku:5:4,strku);
  semenku:=strtofloat(strku);
  //semenku:=semenku/180;//semenku:=semenku*0.314;
  hasilku:=(sqr(rku)*semenku)+((tku-rku)*(sqrt((sqr(rku))-(sqr(tku-rku))))+(0.5*0.314*sqr(rku)));
```

```
 hasilku:=hasilku*5;
 hasilku:=7.5-hasilku;
 str(hasilku:3:2,strku);
 edit5.Text:=strku;
end
else
begin
 if tku<10 then
 begin
  tku:=tku/10;
  semenku:= (arcsin((rku-tku)/rku));
  //semenku:=radtodeg(semenku);
  str(semenku:3:4,strku);
  semenku:=strtofloat(strku);
  //semenku:=semenku/180;//semenku:=semenku*0.314;
  hasilku:=(sqr(rku)*semenku)+((rku-tku)*(sqrt((sqr(rku))-(sqr(rku-tku))))+(0.5*0.314*sqr(rku)));
  hasilku:=hasilku*5;
  //hasilku:=hasilku+7.5;
  str(hasilku:3:2,strku);
  edit5.Text:=strku;
 end
 else
 begin
  edit5.Text:='7.5';
 end
end; }
end;

procedure TFutama.Mulai1Click(Sender: TObject);
begin
 mulai1.Enabled:=false;
 futama.Caption:='Proses sedang berjalan';
 tvolume.Enabled:=true;
 Selesai1.Enabled:=true;
 kondisi2.Brush.Color:=clred;
end;

procedure TFutama.Selesai1Click(Sender: TObject);
begin
 mulai1.Enabled:=true;
 selesai1.Enabled:=false;
 tvolume.Enabled:=false;
 futama.Caption:='Proses dihentikan';
 phonezero;
 statcmgl.Brush.Color:=clred;
end;

procedure TFutama.FormCreate(Sender: TObject);
var
  FileToFind,strku: string;

begin
 label7.Caption:='0'; label13.Caption:='0';
 phonezero;tvolume.Enabled:=false;
 mulai1.Enabled:=true;selesai1.Enabled:=false;
 sb1.SimpleText:='Silakan Mulai Program';
 volumeawal;//edit10.Text:='5.8';
 futama.Caption:='ASTI program skripsiku';
```

```
 label11.Caption:='0';
 {strku:=datetostr(date);
 edit7.Text:=strku;
 strku:='D'+strku;
 strku:=buatfilename(strku);
 strku:=strku+'.DB';
 sb1.Panels[2].Text:=strku;
 FileToFind := FileSearch(strku, GetCurrentDir+'\Data');
 if FileToFind = '' then
 begin
   strku:=GetCurrentDir+'\Data\'+strku;
  strku:=sb1.Panels[2].Text;
  strku:=copy(strku,1,length(strku)-3);
  tabelbaru(strku);
  table1.Active:=false;
  end
 else
 begin
   strku:=copy(strku,1,length(strku)-3);
  table1.TableName:=strku;
 end;
  table1.Active:=false;
  strku:=sb1.Panels[2].Text;
  table1.Active:=true;}
  STRKU:=GETCURRENTDIr+'\DATA\infovolume.mdb';
  {Provider=Microsoft.Jet.OLEDB.4.0;Data Source=D:\A r E k -
2\Jemo\UB_ASTI\prog1\Data\infovolume.mdb;Persist Security Info=False}
  adoconnection1.ConnectionString:='Provider=Microsoft.Jet.OLEDB.4.0;Data Source='+
   strku+';Persist Security Info=False';
  adoconnection1.Connected:=true;
  adotable1.TableName:='VOLUME1';
  adotable1.Active:=true;
end;

procedure TFutama.ComPort2AfterOpen(Sender: TObject);
begin
 statcmgl.Brush.Color:=cllime;
 bopencom2.Caption:='Close';
end;

procedure TFutama.ComPort2AfterClose(Sender: TObject);
begin
 phonezero;
 bopencom2.Caption:='Open';
 panel2.Caption:='0';
 statcmgl.Brush.Color:=clred;
end;

procedure TFutama.ComPort2RxChar(Sender: TObject; Count: Integer);
var
 strku:string;
begin
 comport2.ReadStr(strku,count);
 edit8.Text:=edit8.Text+strku;
 if pos(#13#10,edit8.Text)<>0 then
 begin
  memo2.Text:=memo2.Text+edit8.Text;
  edit8.Clear;
```

```
end;

if statcmgl.Brush.Color=cllime then
begin
 case strtoint(label11.Caption) of
  1:begin
     if pos('OK',memo2.Text)<>0 then
     begin
      if pos('CMGL:',memo2.Text)<>0 then
      begin
       {respon hp ada sms baru}
       label11.Caption:='2';
      end
      else
      {Hp merespon tapi tdk ada sms baru}
      begin
       label11.Caption:='0';
       memo2.Clear;
      end;
     end
     else
     if pos('ERROR',memo2.Text)<>0 then
     begin
      {hp mengirimkan status error}
      label11.Caption:='0';
      memo2.Clear;
     end;
    end;
  5:begin
     if pos('>',memo2.Text)<>0 then
     begin
      sb1.Panels[1].Text:='SIAP KIRIM';
     end;

    end;

 end;
end;

end;

procedure TFutama.ComPort2Error(Sender: TObject; Errors: TComErrors);
begin
 showmessage('Maaf Port Com sedang digunakan atau tidak bisa dipakai');
 phonezero;
end;

procedure TFutama.Button1Click(Sender: TObject);
var
 strku:string;
begin
 {strku:=memo2.Text;
 kirimsms(strku);
 button1.Enabled:=false; }
 //button2.Enabled:=true;
 strku:='AT+CMGL=1'+#13#10;
 if comport2.Connected then
 begin
```

```
  COMPORT2.WriteStr(strku);
  statcmgl.Brush.Color:=clred;
 end
end;

procedure TFutama.Bsetcom2Click(Sender: TObject);
begin
 comport2.ShowSetupDialog;
end;

procedure TFutama.Bopencom2Click(Sender: TObject);
begin
 if bopencom2.Caption='Open' then
  comport2.Open
 else
  comport2.Close;
end;

procedure TFutama.Button2Click(Sender: TObject);
var
 iku,iku1:integer;
 strku:string;
 konku:boolean;
begin
    if statcmgl.Brush.Color=clyellow then
   begin
    iku:=0;label9.Caption:='';
    repeat
     if Pos(':',memo2.Lines[iku])<>0 then
      label9.Caption:=label9.Caption+copy(memo2.Lines[iku],
       pos(':',memo2.Lines[iku])+1,pos(',',memo2.Lines[iku])-pos(':',
       memo2.Lines[iku]));
     iku:=iku+1;
    until(pos('OK',memo2.Lines[iku])<>0);
    if label9.Caption<>'' then
    begin
     statcmgl.Brush.Color:=clblue;
     panel2.Caption:=label9.Caption;
    end
    else
    begin
     phonezero;
     statcmgl.Brush.Color:=cllime;
    end;
   end
   else
   begin
    {proses pembacaan data sms yang diterima}
    if statcmgl.Brush.Color=clblue then
    begin
     sb1.Panels[1].Text:=label9.Caption;
     if pos(',',label9.Caption)<>0 then
     begin
      iku:=strtoint(copy(label9.Caption,1,pos(',',label9.Caption)-1));
      strku:=copy(label9.Caption,pos(',',label9.Caption)+1,length(label9.Caption));
      label9.Caption:=strku;
      strku:=inttostr(iku);iku1:=0;konku:=false;
      repeat
```

```
      if pos('CMGL: '+strku,memo2.Lines[iku1])<>0 then
      begin
       konku:=true;
      end;
       iku1:=iku1+1;
     until((konku)or(pos('OK',memo2.Lines[iku1])<>0));
     iku1:=iku1-1;
     strku:=memo2.Lines[iku1];edit9.Text:='';
     edit9.Text:=copy(strku,pos(',,',strku)+2,length(strku)-1);
     if edit9.Text<>'' then
     begin
      iku1:=iku1+1;strku:='';konku:=false;
      repeat
       strku:=strku+memo2.Lines[iku1];
       iku1:=iku1+1;
       if(pos('CMGL:',memo2.Lines[iku1])<>0)or(pos('OK',
        memo2.Lines[iku1])<>0)then konku:=true;
      until(konku);
      edit8.Text:=strku;
      {proses ubah data format PDU ke karakter}
      //memo1.Text:=edit8.Text;
      convertmsg(strku);
      if pos('Isi = VOLUME',memo1.Text)<>0 then
       statcmgl.Brush.Color:=clwhite
      else
       statcmgl.Brush.Color:=clpurple;
     end;

    end;
   end;
  end;

end;

procedure TFutama.Button3Click(Sender: TObject);
var
 strku:string;
 iku,iku1:integer;
 konku:boolean;
begin
{ strku:='AT+CMGF=0'+#13#10;
 if comport2.Connected then
  comport2.WriteStr(STRKU);}
  case strtoint(label11.Caption) of
    0:begin
      {pemeriksaan ada tidaknya sms baru}
      memo1.Clear;
      memo2.Clear;
      kondisi2.Brush.Color:=clsilver;{tunggu jawaban hp}
      strku:='AT+CMGL=1'+#13#10;
      COMPORT2.WriteStr(strku);
      label11.Caption:='1';
      tvolume.Interval:=4000;

     end;
    2:begin
      iku:=0;label9.Caption:='';
      repeat
```

```
    {mencari segment memori penyimpanan sms}
    if Pos(':',memo2.Lines[iku])<>0 then
     label9.Caption:=label9.Caption+copy(memo2.Lines[iku],
     pos(':',memo2.Lines[iku])+1,pos(',',memo2.Lines[iku])-pos(':',
     memo2.Lines[iku]));
    iku:=iku+1;
   until(pos('OK',memo2.Lines[iku])<>0);

   if label9.Caption<>'' then
   begin
    {pengecekan segment memori sms berhasil}
    statcmgl.Brush.Color:=clblue;
    panel2.Caption:=label9.Caption;
    label11.Caption:='3';
   end
   else
   begin
    phonezero;label11.Caption:='0';
    statcmgl.Brush.Color:=cllime;
   end;

  end;
 3:begin
   {ada sms baru dan melaksanakan proses perubahan data
   sms menjadi data teks}
   memo1.Clear;
   sb1.Panels[1].Text:=label9.Caption;
   if pos(',',label9.Caption)<>0 then
   begin
    {iku:=strtoint(copy(label9.Caption,1,pos(',',label9.Caption)-1));
    strku:=copy(label9.Caption,pos(',',label9.Caption)+1,length(label9.Caption));
    label9.Caption:=strku;}
    {strku:=inttostr(iku);}
    iku1:=0;konku:=false;
    repeat
     if pos('CMGL: ',memo2.Lines[iku1])<>0 then
     begin
      //konku:=true;
      memo1.Lines.Add(memo2.Lines[iku1]);
      iku1:=iku1+1;strku:='';
      repeat
       strku:=strku+memo2.Lines[iku1];
       iku1:=iku1+1;

      until((pos('OK',memo2.Lines[iku1])<>0)or(pos('CMGL: ',
       memo2.Lines[iku1])<>0));
      convertmsg(strku);
     end
     else
      iku1:=iku1+1;
    until((pos('OK',memo2.Lines[iku1])<>0));
    //memo2.Clear;
    label11.Caption:='4';
    tvolume.Interval:=1000;
   end;
  end;
 4:begin
   iku:=0;konku:=false;
```

```
memo2.Clear;
repeat
 if (pos('pengirim:',memo1.Lines[iku])<>0)then
  edit1.Text:= copy(memo1.Lines[iku],pos('pengirim',
  memo1.Lines[iku])+9,
   length(memo1.Lines[iku]));
 if (pos('Isi=',memo1.Lines[iku])<>0)then
 begin
  strku:=memo1.Lines[iku];
  if {pos('}strku='Isi=VOLUME'{,strku)<>0 }THEN
  begin
   {sms dgn keyword benar,kirim jawaban benar}
   konku:=true;label11.Caption:='5';
   strku:='Volume tanggal '+edit7.Text+', waktu: ';
   strku:=strku+edit6.Text+' adalah= '+edit5.Text;
   iku1:=iku+1;
   repeat
    if(pos('+CMG',MEMO1.Lines[iku1])<>0)then
    begin
     memo2.Lines.Add(memo1.Lines[iku1]);
     memo2.Lines.Add(memo1.Lines[iku1+1]);
     memo2.Lines.Add(memo1.Lines[iku1+2]);
     memo2.Lines.Add(memo1.Lines[iku1+3]);
     memo2.Lines.Add(memo1.Lines[iku1+4]);
     iku1:=iku1+4;
    end
    else
    begin
     if memo1.Lines[iku1]<>'OKE' then
      memo2.Text:=memo2.Text+memo1.Lines[iku1]
     else
      memo2.Lines.Add(memo1.Lines[iku1]);
    end;
    iku1:=iku1+1;
   until(iku1=memo1.Lines.Count);
   memo1.Text:=memo2.Text;
   memo2.Clear;
   //kirimsms(strku);
   memo2.Text:=strku;
   //sleep(3000);
  end
  else
  begin
   {sms dgn keyword salah,kirim pringatan sms salah}
   konku:=true;label11.Caption:='5';
   strku:='keyword salah ';
   iku1:=iku+1;
   repeat
    if(pos('+CMG',MEMO1.Lines[iku1])<>0)then
    begin
     memo2.Lines.Add(memo1.Lines[iku1]);
     memo2.Lines.Add(memo1.Lines[iku1+1]);
     memo2.Lines.Add(memo1.Lines[iku1+2]);
     memo2.Lines.Add(memo1.Lines[iku1+3]);
     memo2.Lines.Add(memo1.Lines[iku1+4]);
     iku1:=iku1+4;
    end
    else
```

```
          begin
           if memo1.Lines[iku1]<>'OKE' then
            memo2.Text:=memo2.Text+memo1.Lines[iku1]
           else
            memo2.Lines.Add(memo1.Lines[iku1]);
          end;
          iku1:=iku1+1;
         until(iku1=memo1.Lines.Count);
         memo1.Text:=memo2.Text;
         memo2.Clear;
         //kirimsms(strku);
         memo2.Text:=strku;
        end;
       end;
       iku:=iku+1;
       if iku>=memo1.Lines.Count then
       begin
        konku:=true;
       end;
      until(konku);
     end;

   end;
end;

procedure TFutama.Button4Click(Sender: TObject);
var
 strku:string;
 iku,iku1:integer;
 konku:boolean;
begin
 {ada sms baru dan melaksanakan proses perubahan data
      sms menjadi data teks}
      memo1.Clear;
      sb1.Panels[1].Text:=label9.Caption;
      {if pos(',',label9.Caption)<>0 then
      begin  }
       {iku:=strtoint(copy(label9.Caption,1,pos(',',label9.Caption)-1));
       strku:=copy(label9.Caption,pos(',',label9.Caption)+1,length(label9.Caption));
       label9.Caption:=strku;}
       {strku:=inttostr(iku);}
       iku1:=0;konku:=false;
       repeat
        if pos('CMGL: ',memo2.Lines[iku1])<>0 then
        begin
         //konku:=true;
         memo1.Lines.Add(memo2.Lines[iku1]);
         iku1:=iku1+1;strku:='';
         repeat
          strku:=strku+memo2.Lines[iku1];
          iku1:=iku1+1;

         until((pos('OK',memo2.Lines[iku1])<>0)or(pos('CMGL: ',
          memo2.Lines[iku1])<>0));
         convertmsg(strku);
        end
        else
         iku1:=iku1+1;
```

```
      until((pos('OK',memo2.Lines[iku1])<>0));
      //memo2.Clear;
      memo1.Lines.Add('OK');
      label11.Caption:='4';
      tvolume.Interval:=1000;
     {end; }

end;

procedure TFutama.Button5Click(Sender: TObject);
var strku:string;
begin
 strku:=memo2.Text;
 //convertmsg(strku);
 strku:= PDU2Text(strku);
 memo1.Text:=strku;
end;

end.
```

unit IWUnit1;

```
{PUBDIST}

interface

uses
  IWAppForm, IWApplication, IWTypes, Classes, Controls, IWControl, IWGrids,
  IWDBGrids, DB, ADODB, IWCompEdit, IWCompButton, IWCompLabel, jpeg,
  IWExtCtrls, IWCompMenu;

type
  TformMain = class(TIWAppForm)
    IWDBGrid1: TIWDBGrid;
    ADOConnection1: TADOConnection;
    ADOTable1: TADOTable;
    DataSource1: TDataSource;
    IWEdit1: TIWEdit;
    IWEdit2: TIWEdit;
    IWEdit3: TIWEdit;
    IWGrid1: TIWGrid;
    IWButton1: TIWButton;
    IWLabel1: TIWLabel;
    IWImage1: TIWImage;
    IWLabel2: TIWLabel;
    IWLabel3: TIWLabel;
    IWLabel4: TIWLabel;
    IWTimer1: TIWTimer;
    IWLabel5: TIWLabel;
    IWMenu1: TIWMenu;
    procedure IWAppFormCreate(Sender: TObject);
    procedure IWButton1Click(Sender: TObject);
    procedure IWAppFormDestroy(Sender: TObject);
    procedure IWTimer1Timer(Sender: TObject);
  public
  end;
```

```
implementation
{$R *.dfm}

uses
  ServerController;

procedure TformMain.IWAppFormCreate(Sender: TObject);
var
 strku:string;
begin
 iwedit1.Text:='1';iwedit2.Text:='1';iwedit3.Text:='2008';
 //iwgrid1.ColumnCount:=2;
 //iwgrid1.RowCount:=2;
 //if iwgrid1.CellExists(0,0) then
   iwgrid1.Cell[0,0].Text :='WAKTU';
 //if iwgrid1.CellExists(1,0) then
   iwgrid1.Cell[0,1].Text :='VOLUME';
   iwlabel5.Caption:='Informasi Volume Bensin pada SPBU melalui Internet'+#13#10+'by ASTI';
;
   //iwtimer1.Enabled:=true;
   iwlabel1.Caption:='';
   adoconnection1.ConnectionString:='Provider=Microsoft.Jet.OLEDB.4.0;Data Source=D:\A r E
k - 2\Jemo\UB_ASTI\prog1\Data\infovolume.mdb;Persist Security Info=False';
   adoconnection1.Connected:=true;
   adotable1.Active:=true;
end;

procedure TformMain.IWButton1Click(Sender: TObject);
var
 strku:string;
 ketemu:boolean;
 iku:integer;
begin
 if(iwedit1.Text<>'')and(iwedit2.Text<>'')and(iwedit3.Text<>'')then
 begin
  strku:=iwedit2.Text+'/'+iwedit1.Text+'/'+iwedit3.Text;
  ketemu:=adotable1.Locate('Tanggal',strku,[]);
  if ketemu then
  begin
   iwlabel1.Caption:=('Data tanggal '+strku+' ada');
   iku:=0;
   repeat
    iku:=iku+1;
    iwgrid1.Cell[iku,0].Text:=adotable1.FieldValues['WAKTU'];
    iwgrid1.Cell[iku,1].Text:=adotable1.FieldValues['VOLUME_TANGKI'];
    ADOTABLE1.Next;
   until((strku<>adotable1.FieldValues['Tanggal'])or(adotable1.Eof));
  end
  else
   iwlabel1.Caption:=('Data tanggal '+strku+', maaf tidak ada');
 end;
end;

procedure TformMain.IWAppFormDestroy(Sender: TObject);
begin
 adotable1.Active:=false;
 adoconnection1.Connected:=false;
 iwtimer1.Enabled:=false;
```

```
end;

procedure TformMain.IWTimer1Timer(Sender: TObject);

begin
 //strku:='Informasi Volume Bensin pada SPBU melalui Internet'+#13#10+'by ASTI';

end;

end.
```

APPENDIX 3

Listing Program Microcontroller

```
;*******************************
;* AT89C51,CRYSTAL 11,059MHz *
;* KOMPUTER INTERFACE                *
;* SENSOR ULTRASONIC          *
;*
;*******************************
;
; 1 INC=2.86 CM,1CM=0.35INC
;0.0388 CM/us
;
;
tmodt0          equ     01h
TMODS           EQU   20H
SIG     EQU   P2.7
TXLED           EQU   P2.0
SIGLED          EQU   P2.1
OSLED           EQU   P2.2
DATAS           EQU   08H
CH1     EQU   09H
CL1     EQU   0AH
CSIGH           EQU   0BH
CSIGL EQU   0CH
DATINT          EQU   0DH
;
                ORG   00H
                LJMP  MULAI
;
;               LJMP  EX0RLI                ; ke layanan interupsi INT0
                ORG   0BH
                LJMP  INTT0         ; vektor interupsi timer 0
                ORG   1BH
;               LJMP  T1RLI         ; vektor interupsi timer 1
;
                ORG   23H
                LJMP  SERIALINT   ;vektor interrupsi serial
;
                ORG   30H
;*****************************
;* PROGRAM UTAMA
;*****************************
;
MULAI:
                MOV   SP,#30H
                MOV   P2,#0FFH
                MOV   A,#TMODS
                ORL    A,#TMODT0
                LCALL         INITSERIAL
```

```
                LCALL       INITT0
                CLR   SIG
                MOV   CH1,#00H
                MOV   CL1,#00H
                MOV   DATINT,#00
;

MULBAL1:
                DJNZ  CL1,MULLAN1
                DJNZ  CH1,MULLAN1
                CPL   OSLED
MULLAN1:
                MOV   A,DATINT
                CJNE  A,#01H,MULBAL1
                CLR   ES
                MOV   DATINT,#02H
                LCALL       UKURJARAK
                MOV   DATINT,#00
                LJMP  MULAI
;
;******************
;SERIAL INISIALISAI
;******************
;
INITSERIAL:
;               MOV   PCON,#0
                MOV   TMOD,A                ;timer 1 mode autoreload
                MOV   TH1,#0FDH   ;SET BAUDRATE 9600BPS
                MOV   TL1,#0FDH
                MOV   SCON,#50H
                SETB  TR1
                SETB  ES
                SETB  EA
                RET
;
;********************************
; INISIALISAI TIMER 0
;********************************
;
INITT0:
                MOV   TMOD,A
                SETB  EA
                SETB  ET0
                MOV   TH0,#00H
                MOV   TL0,#00H
                RET
;
```

```
;*******************************
;* SERIAL INTERRUPT
;*******************************
;
SERIALINT:
                PUSH  PSW
                PUSH  ACC
;               PUSH  DPH
;               PUSH  DPL
                JB      TI,SIBAR
                LCALL         TERIMADATA
SIBAR:
;               POP   DPL
;               POP   DPH
                POP   ACC
                POP   PSW
                RETI
;
;************************************
; INTERRUPT TMER 0
;************************************
;
INTT0:
                CLR   TF0
;               SETB  TR0
;               LCALL         INITT0
                CLR   SIG
                RETI
;
;************************************
; TERIMA DATA SERIAL
;************************************
;
TERIMADATA:
;               JB      RI,TDLAN1
;               LJMP  TDBAR
;TDLAN1:
                MOV   A,SBUF
                MOV   DATAS,A

                CJNE  A,#'V',TDLAN2
;               MOV   CSIGH,#0FFH
;               MOV   CSIGL,#0FFH
;               LCALL         UKURJARAK
                MOV   DATINT,#01H
                LJMP  TDBAR
TDLAN2:
                MOV   DPTR,#KATA1
```

```
                LCALL       KIRIMKATA
                MOV  DATINT,#00H
TDBAR:

                CLR   RI
                RET
;
;*********************************
; KIRIM DATA KATA MELALUI SERIAL
;*********************************
;
KIRIMKATA:
                MOV  A,#00
KKBAL1:
                MOVC        A,@A+DPTR
                MOV  DATAS,A
                LCALL       SERIALOUT
                MOV  A,DATAS
                CJNE A,#10,KKLAN1
                RET
KKLAN1:
                INC   DPTR
                MOV  A,#00
                LJMP KKBAL1
;
;*************************************
; PENGUKURAN JARAK MELALUI SENSOR ULATRASONIC
; PING)))™ Ultrasonic Distance Sensor (#28015)
;*********************************************
;
UKURJARAK:
                MOV  DPTR,#0000
;               CLR   ES
                SETB SIG
                NOP
                NOP
                NOP
                NOP
                NOP
                NOP
                NOP
                CLR   SIG
;               NOP
;               NOP
;               NOP
                SETB SIG
;               NOP
                MOV  A,p2
```

```
                MOV   R7,#250
                DJNZ  R7,$
                MOV   A,P2
                CLR   TF0
UJBAL2:
;               MOV   A,P2

                JNB   SIG,UJBAL2
                SETB  TR0
                NOP
                NOP
                NOP
                NOP

UJBAL1:
                JB    SIG,UJBAL1
                CLR   TR0
                MOV   CSIGH,TH0
                MOV   CSIGL,TL0

                MOV   DATAS,CSIGH
                MOV   A,DATAS
;               CLR   C
;               SUBB  A,#0B7H
;               MOV   DATAS,A
                LCALL       KODEKARAKTER
                MOV   DATAS,CSIGL
                MOV   A,DATAS
;               CLR   C
;               SUBB  A,#0BBH
;               MOV   DATAS,A
                LCALL       KODEKARAKTER
                MOV   A,#10         ;KODE 13 / 0D H AKHIR DATA
                LCALL       SERIALOUT
                MOV   A,#13
                LCALL       SERIALOUT
                RET
;
;****************************************
; MENGUBAH KODE BILANGAN MENJADI KODE
; KARAKTER
;****************************************
;
KODEKARAKTER:
                MOV   A,DATAS
                MOV   B,#100
                DIV   AB
                MOV   R6,A
```

```
                LCALL       KIRIMKODE
                MOV  A,B
                MOV  B,#10
                DIV  AB
                MOV  R6,A
                LCALL       KIRIMKODE
                MOV  A,B
                MOV  R6,A
                LCALL       KIRIMKODE
                RET
;
;*****************************
; KIRIM KODE KARAKTER
;*****************************
;
KIRIMKODE:
;               PUSH ACC
;               MOV  A,R6
                ORL  A,#30H
                LCALL       SERIALOUT
;               POP  ACC
                RET
;
;*********************************
;* KIRIM DATA SERIAL
;*********************************
;
SERIALOUT:
;               JB   TI,$
;               CLR  ES
                MOV  SBUF,A
                JNB  TI,$
                NOP
                CLR  TI
                CLR  TI
;               SETB ES
                RET
;
KATA1:          DB   'ASTI',13,10
KATA2:          DB   'TELKOM',13,10

                END
```