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## Design of Digital Height Measurement Based Microcontroller AT89C51

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### ARTICLE INFO

#### *Article history:*

Received December 09, 2019  
Revised December 18, 2019  
Accepted December 27, 2019

#### *Keywords:*

Height, Sound, and Ultrasonic Sensors.

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### ABSTRACT

Height measuring instrument is a tool that can be used by humans to assist in the process of determining height. Most height gauges in use today are analog or manual height gauges. In today's technological developments, the author will make an automatic height measuring device using ultrasonic sensors to calculate data from received objects. The sensor is used to measure the working distance at a frequency of 40 KHz so as not to interfere with human hearing. As the control center of this measuring instrument, it uses the Arduino Uno Microcontroller. This measuring instrument is capable of measuring an object with the accuracy of the sensor reading the data, namely the maximum height of 195 cm and the minimum height of 50 cm. The advantage of this tool is that it uses a microcontroller and sensor technology, while to display measurement results using an LCD and LCD measuring instruments can move according to the height of the object, to move the LCD a DC motor is used as the driver. And the measurement results are issued through the speaker in the form of sound that has been stored on the SD Card in WAV format, making it easier for blind people to know the user's height. The drawback of this tool is the construction of the tool and sensor readings, so that the results obtained from the measurements still contain some errors.

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### 1. INTRODUCTION

Measurement is Thing which important in world knowledge knowledge. Tall is wrong one quantity physical which often be measured in various necessity. Equipment which used During this still character manuals, which it means to get a high data still use human power where This method has been abandoned and replaced by measuring tools that are automatic. Where Thing this aim to make it easier for users to operate.

In line with the times, it takes a height measuring tool that could work by automatic, To do process measurement, read results measurement, while notifying the measurement results automatically. With utilise technology electronic wrong the only one covers field micro writertry for make tool measuring tall body which based on microcontroller. This tool is expected to make it easier for users to measure height and can be used as information on how tall a person is, this information can be stored and can be viewed again at the next measurement to find out development tall body somebody which usually required as something notes.

With background behind here designed a tool which could make it easy person in To measurement tall body. Measurement tallbody this utilise principle reflection wave voice with frequency certain. Therefore, the authors use the frequency of ultrasonic waves 20 KHz, where these waves can propagate through solids, liquids, and gases. However, to measure the distance of objects used a signal with a frequency of 40 KHz with the speed of sound is 344 m/s, making it easy to calculate the delay time and in use wave this no disturbing system hearing man.

By using a microcontroller the data will be processed and issued in written form through a display device that can move up and down so that easy to read and in the form of sound through the speaker. Voice data first recorded and stored on the *SD Card* in *WAV format*. This tool will help Public in process measurement tall body.

#### A. Microcontroller AT89C51

The AT89C51 microcontroller is one type of microcontroller from the MCS-51 family which is packaged in a 40-pin DIL ( *Dual In Line* ) standard which has its own configuration. This microcontroller is manufactured by ATMEL with characteristics that are completely *compatible* with the instruction set and the industry standard output pins of Intel's MCS-51 family.

The AT89C51 microcontroller is an EEPROM version of the 80C51AH whose internal programmable and electrically erased internal program memory has 4 Kbytes of internal flash EPROM technology that can store data even when the power supply on the chip is turned off ( *Stewart, 1997* ).

#### B. AT89C51 . Pin Configuration

The AT89C51 Microcontroller configuration is classified into voltage source pins, isolator pins, control pins, input/output pins for external interrupt processes. The image of the AT89C51 pin configuration can be seen in the image below.

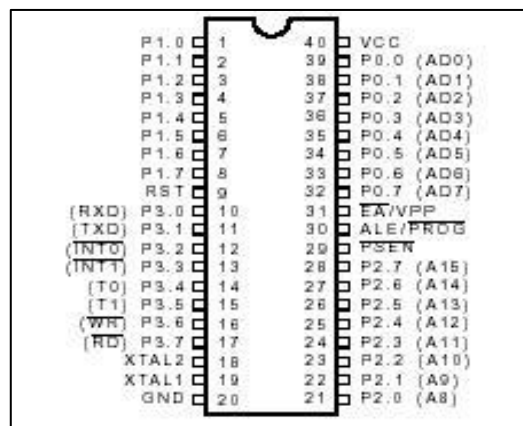


Image 1. AT89C51 . pin configuration

The functions of the pins on the AT89C51 are as follows:

- *Vcc*  
Vcc is the positive pin of the 5 Volt DC voltage source.
- *vss*  
Vss is a voltage source grounding pin
- port 0  
*full duplex* input/output port . This port can be used as a *multiplex* bus to low address and data bus during external program memory or data access.
- port 1  
Port 1 is an 8 bit full duplex input/output port, each pin can be used as input or output without depending on the other pins.
- port 2

Port 2 is the same as port 0/port 1. This port can be used as a high-address bus as long as there is access to external program memory or data.

- 3 ports  
Port 3 is also the same as port 2 but this port has the following features :
  - P3.0 (RxD) : input serial data receiver
  - P3.1 (TxD) : serial data sender output
  - P3.2 (INT 0) : interrupt 0 external
  - P3.3 (INT 1) : interrupt 1 external
  - P3.4 (T 0) : external input time / counter 0
  - P3.5 (T 1) : external input time/counter 1
  - P3.6 (WR) : external data memory write strobe
  - P3.7 (RD) : external data memory read strobe
- RST/VPD  
This pin is used to reset the AT89C51 microcontroller system. Changes in the voltage level from low to high will reset the microcontroller.
- ALE/PROG  
This pin is used to lock the low address when external program memory accesses during normal operation.
- PSEN  
PSEN ( *Program Strobe Enable* ) is a pin that connects external program memory to the bus during normal operation.
- EA/XDD  
External program enable pin on the microcontroller. Active in low position.
- XTAL1  
This pin is the input to the high gain oscillator amplifier. This pin is connected to the crystal/oscillator source from the outside.
- XTAL2

This pin is the output of the oscillator amplifier. This pin is connected to the crystal/ground if using an internal crystal source.

## 2. RESEARCH METHOD

Based on on destination which want to achieved method- method which used in the preparation of this research is :

1. Literature study, namely by getting data by reading books and journals related to the problemsdiscussed in study this.
2. design hardware. Stage this aim for look for form modelthe optimal system of the system to be made taking into account from various factors problem and needs which has determined like on picture under.
3. design Software. In Stage this, writer use Microcontroller as the "brain" of device designers entered on program use language C use *Codevision software AVR* .
4. Tool measurement and testing. Taking measurements and testing tool for see performance from tool which has designed is toolwhich made could working well.
5. Analysis and conclusion of experimental results. After the tool works with good, then the last step is to draw conclusions from the results analysis from the problem that occur.

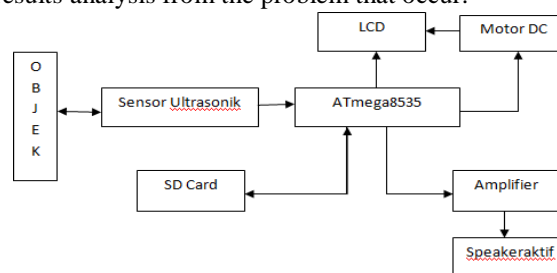


Figure 2. Planning block diagram

### 3. RESULTS AND DISCUSSIONS

Device gauge tall body based on microcontroller this using the HCSR-04 ping sensor which will basically function as a reader sensor distance. Data in the form of writing will in show on LCD which could move follow tall object and data in the form of voice which there is on *SD Card* output to the speaker. These components can be seen in picture under.



Figure 3 . Tool Measuring Tall Body Automatic for component explanation could viewed on table

Table 1. Description of the automatic height measurement tool

No	Name	Information
1	HCSR-04	Component sensors distance
2	LCD	Display components
3	Motorcycle DC	Component mover LCD
4	Speaker	Component carrier voice

The sensor will work when the emitted wave hits an object object (human), the sensor will read the distance of the object and process the data to microcontroller and will be temporarily stored in the program, which will later displayed through the LCD and sound through the speakers. LCD will move down according to height body object and display height body object. When the height has been displayed then the program directly will read voice data on *SD Card* and Secrete sound through the speakers.

#### A. Description of Tool Usage

From Figure 4 is the hardware of a height measuring instrument with t sound output. In the circuit there is a minimum Arduino system Uno, LCD that functions as a viewer, active speakers as *an output device* sound, *SD Card* that functions as a sound storage with WAV format thathas been recorded and motor DC as LCD drive up and down. This tool canworks on DC voltage 5V, voltage generated from the adapter that connected direct on voltage electricity air conditioning 220 Volt. When already get a voltage of 5 volts, the height meter will active, however for To do measurement tall body user more first press the butto to start the measurement.

The sensor will start to work and process the data on the microcontroller where the data will be displayed on the LCD and output in the form voice through speaker active so that user or sufferer tuna neutral

will be easier to know their height. Furthermore, the LCD will also move down in accordance with tall body user so that it is easy to read.

**B. Testing Tool**

Tool testing is useful for obtaining specification data from the used tool has made so that will make it easy to analyze error and damage which will occur on moment tool work.

**1. Test Sensor ultrasonic HCSR-04**

Test on part this relate with accuracy sensors ultrasonic CSR -04 in measure distance. Test this conducted with method compares the actual height with the height reading on the sensor with fetch some data from tall body somebody which found in table 4.2.

Table 2. Test result Sensor ultrasonic on tall body person

Tall In fact (cm)	Reading Sensor (cm)	Error (%)
130	90	44.44
140	69	102.90
150	105	74.42
160	188	14.90
170	119	42.86

From results test on table 2 seen measurement tall body get error results with an average of 55.9 % . These data show that the level of measurement accuracy is still far from the actual height. So that The author conducted an experiment to collect data by using several media surface flat, wave and circle, for knowing level accuracy which is good for assisting in height measurement. Here's the result table testing Ultrasonic sensor in various form field.

Table 3. Test result Sensor ultrasonic in various forms field

Field Flat	
Tall In fact (cm)	Reading Sensor (cm)
130	130
140	141
150	151
160	161
170	171

Table 4. Test result Sensor ultrasonic in various forms field

Field Wave	
Tall Actual (cm)	Reading Sensors (cm)
130	127
140	139
150	149
160	162
170	166

Table 5. Test result Sensor ultrasonic in various forms field

Field Ball	
Tall Actual (cm)	Reading Sensors (cm)
130	173
140	183
150	178
160	193
170	197

From the tests carried out in three different fields, the results show on testing field flat which have results level accuracy which good. The uneven surface of the object during measurement affects the reading sensor so that the measurement results are not stable as in the measurement results on field wavy and ball. So that on taking data measurement tallbody is carried out using a flat plane in order to get the best results can accurately seen on table 7.

Table 7. Measurement results on a person's height using the fieldflat

No	Tall In fact (cm)	Sensor Reading (cm)	Distance Error (%)
1	70	72	2.85
2	90	92	2.22
3	112	113	0.90
4	116	117	0.86
5	120	121	0.83
6	129	130	0.77
7	135	136	0.74
8	150	151	0.66
9	160	161	0.62
10	166	167	0.60
		Flat- flat	1.105

From table 7 data which generated by sensors still there is 1.105 % error which seen, based on from existence data could concluded that level accuracy will it is better if the measured object has a height close to the sensor, with In other words, the higher the object being measured, the better the accuracy level and object surface uneven moment measurement too take effect on sensor readings which may cause unstable measurement results, by Therefore, when taking measurements using the help of a thin board to measure get the surface that flat.

#### 4. CONCLUSION

This study discusses the lamp props using the force of gravity. The results of this study can be concluded as follows:

1. Device already could measure something object tall body somebody.
2. Program has capable showing tall body somebody with flat plane assistance due to the object being measured and the surface being uneven affect the ping sensor readings so that objects that are be measured must use device which the surface flat like boardthin to help reading sensors.

**ACKNOWLEDGEMENTS**

Thank you to everyone who was involved in writing this article

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