A Design And Build A Robot Vacuum Cleaner

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Abstract. In this paper design of the robot Vacum Cleaner, based on the Arduino Mega 2560 is the can walk and vacuum the floor. In this study, a microcontroller is used to regulate the work of the robot based on data obtained by six sensors, and the robot's movement is driven by motor driver to the left and right, forward and backward, where the input is given through the keypad in the form of dust and garbage thisness, provided that if the dust thickness is (30mg)/(mm)3 then the LCD will display binary logic "1", and if the Dust thickness is ≥0,30 mg/mm3then the data will be displayed on the LCD is binary logic "0".In designing this robot, four ultrasonic sensors are needed as proximity sensors, also needed a sensor to detect the thickness of the dust,as well as an infrared sensor as a sensor to detect thick garbage. In testing the vacuum cleaner robot, the four ultrasonic sensors, S1,S2,S3,S4 are designed as the cardinal directions, north south,east west, as input data on the microcontroller, and two motor drivers as microcontroller outputs that can move forward and backward,forward turn left, forward turn right, backward turn left, backward turn right as an output to move the robot vacuum cleaner. When the vacuum cleaner robot moves, the dust sensor will detect dust, if the dust thickness is 0,30 mgmm3 , the LCD is logic "1", the sensor will. Work and the vacuum cleaner will sweep the flour while sucking, if the dust thickness ≥30mgmm3 , infra red sensor will work with a logic LCD display logic "0", then the motor driver will stop. The vacuum cleaner does not suck up dust or thick garbage.

Keywords: Robot, Vacuum Cleaner, Arduino Mega 2560 Microcontroller, Sensor, motor driver

1. Introduction

In this era of globalization, innovation in the field of technology is increasing rapidly, and humans are required to work faster to achieve goals. Along with the development of technology, the presence of Robots really helps humans to work faster, more efficiently and safety. In this study, a Robot Vacuum Cleaner based on the Arduino Mega 2560, which was designed to sweep the floor to clean dust, was developed and used as an electronic demonstration model in the control system and electronics laboratory Program of Study Electrical Engineering UKIP.

2. Methodology

The design, of a robot vacuum cleaner based on the Arduino Mega 2560, requires hardware and software design, and requires literature. In this study, several supporting literatures were used. Observation methods are also carried out, namely examining the components that will be used in the design of the Robot Vacuum Cleaner.

a. Desain Hardware with Preparing tools and components .

Microcontroller.

A microcontroller is an inexpensive single-chip. Single-chip computer means that the entire computer system lies within the confines of the integrated circuit chip. The microcontroller on the encapsulate sliver of Silikon has features similary to those of our standard personal computer. Primary,the microcontroller is capable of storing and running a program (its most important feature). The microkontroller contains a CPU Central Processing Unit), RAM (Random-Access Memory), ROM (Read -Only Memory), I/O (input/output) lines, Serial and pararel ports, timers, and some times other bulit-in peripherals such as A/D (Analog-to digital and D/A (digital-to Analog).converters. Microcontroller is a chip that serves as the brain to control the input and output processes of electronic circuit. Write and compile program code (source code), is programming code using languages supported by the microcontroller. Fill the program compilation results to the microcontroller IC. Filling the program is the work that is done after the program has been created and compailed. Seen of the pigure bellow (Figure 1).

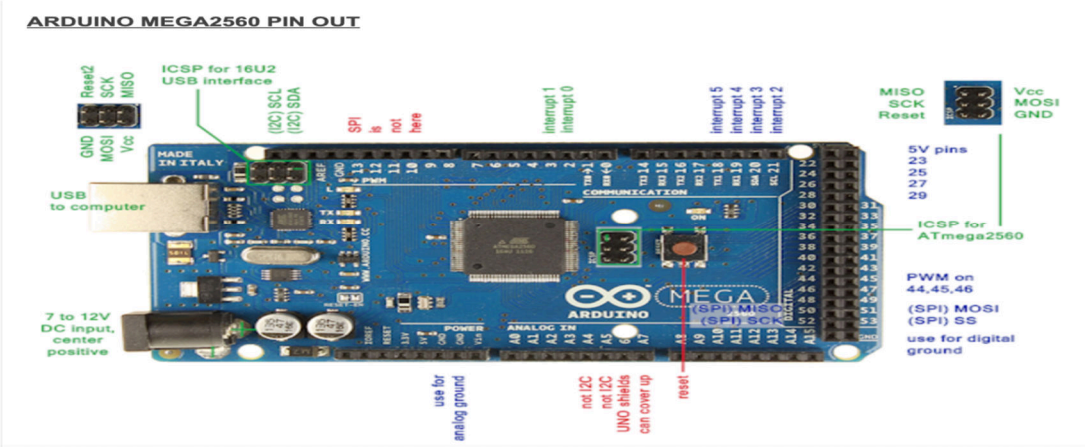


Figure 1. Arduino Mega2560

b. Ultrasonic Sensor

The ultrasonic sensor is a sensor that function to change physical quantities in from of sound into electrical quantities and vice versa. This sensor works on the principle of the reflection of sound wave. This ultrasonic sensor is generally used to detect the presence of an object a certain distance in front fit. The ultrasonic sensor has. The ability to detect objects further away, especially for hard objects on hard objects that have a rough surface wave it will be reflected more strongly than objects with a soft surface. This Ultrasonic sensor consist of a series of ultrasonic transmitter called transmitters and the ultrasonic receiver circuit is called the receiver. Seen of the picture the low.

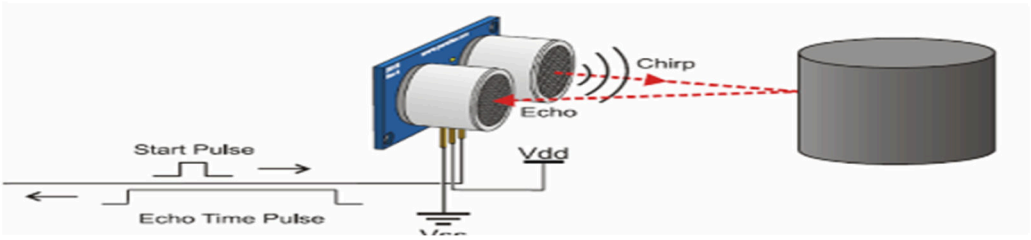


Figure 2. Ultrasonic Sens

c. Infra red sensor

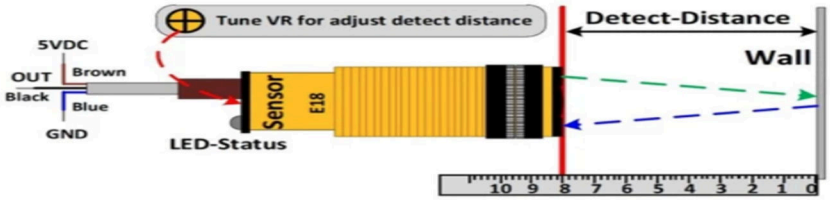


Figure 3. Infra Red Sensor

Sensor Red is an object detections sensor/proximity switch, that is capable of detecting objects within 25 cm, where a pair of transmitter and receiver is mounted on the head of proximity switch to detected objects or obtacles in the form of thick trash, detect obstacles and obtacles in the robot Vacuum Cleaner.

d. Dust Sensor

Figure 4. Dest Sensor

The dust sensor is used to detect and suck up dust provided that if the thinkness of the dust is < 0,30 mg/mm3, the sensor will work, The LCD lights up with a logic ”1”, then the driving motor will work and the relay will work active low will move the Robot Vacuum Cleaner to sweep and suck the dust, otherwise if the thickness of the dust > 0,30 mg/mm3, then the sensor is not working then the LCD display is Logic “0”, then the motor stopped and the vacuum cleaner didn’t work.

Figure 5. Measuring Dust Density Using Dust sensor +Arduino

3. Result and Discussion

In this study, the hardware design of The Robot vacuum cleaner system requires input data with several sensors , namely ultrasonic sensors, Infra red sensors, dust sensors.
This robot vacuum cleaner design uses four Ultrasonic Sensors, wich are arranged in such a way as to the cardinal direction at 25 m from the sensor to detected any obstruction. In this design, four sensors are needed as input data, in detecting obstacles and obtacles from the vacuum cleaner robot, so that it can drive the motor drive as output data to drive the vacuum cleaner robot. The four ultrasonic sensors are designed, arranged according to the cardinal directions longitudinally i.e. north to south, and two sensors mounted crosswise from east to west. This position determines the movement of the motor drive sensor configuration is set at distance of 25 meters from obstructions, and motor drive movement, also set rotate left, right ,forward, backward, turn left, and turn right based on presence of of obatacles configuration of four ultrasonic sensors, as proximity sensors, we can see for this figure 5

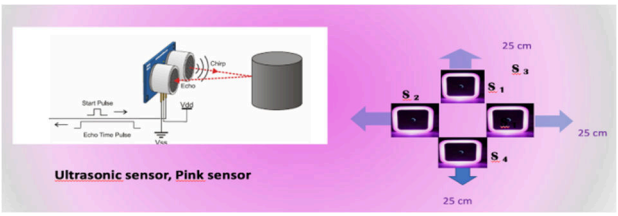


Figure 6. configuration of four ultrasonic sensors, as proximity sensors

3.1 Desain Software.

The robot movement algorithm is programmed using Code Vision AVR C Compiler software . The working steps of the robot program are shown in the following flowchart :

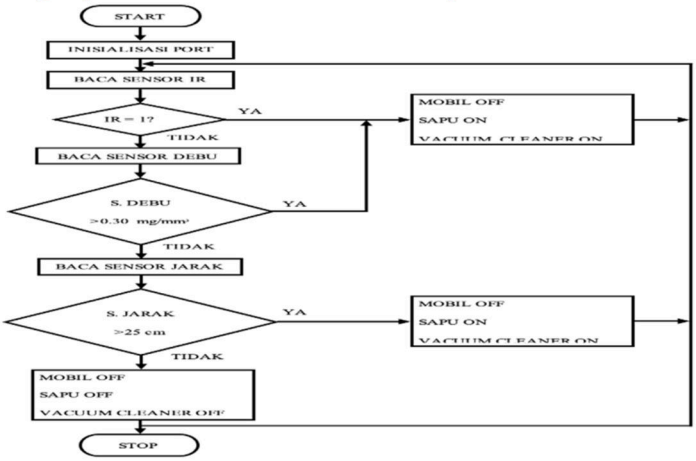


Figure 7. Flow Chart

In this study the C language is used as basic program which will later be flashed into the Arduino Mega 2560 Microcontroller IC type. Ports wich The program begins with initializing and declaringpor bets which will later be used as data input/output. After the initialization process, the program will check the conditions in the environment and match it with the existing data. If there are similar conditions, the program will execute these conditions according to the predetermined process and the robot will move according to the results of the process, and if there is no match between the program conditions, will continu to loop continuously until a suitable condition is found. During the looping processs, the robot will always move.

3.2 The Results Of The Input And Output

Design of the Robot Vacuum Cleaner based on the Arduino Mega 2560 Microcontroler can be seen in table 1 below.

Table 1. Functional Relations between Sensors and Motor Drivers Programmed on the Microcontroler

Input Data (Sensor Ultrasonik)					Output data (Driver Motor)	
No	S_4	S_3	S_2	S_1	MD_1	MD_2
0	0	0	0	0	Stop	Stop
1	0	0	0	1	Backward	Backward
2	0	0	1	0	Stop	Forward turn right
3	0	0	1	1	Stop	Backward turn right
4	0	1	0	0	Forward turn left	Stop
5	0	1	0	1	Backward turn left-	Stop
6	0	1	1	0	Forward Backward	Forward Backward
7	0	1	1	1	Backward	Backward
8	1	0	0	0	Forward	Forward
9	1	0	0	1	Turn left	Turn right
10	1	0	1	0	Stop	Forward turn right
11	1	0	1	1	Stop	Turn right
12	1	1	0	0	Forward turn left	Stop
13	1	1	0	1	Turn left	Stop
14	1	1	1	0	Forward	Forward
15	1	1	1	1	Stop	Stop

Sofware desain of the Robot Vacum Cleaner that is injected into the Microcontroller can determined. Vacum Cleaner according to detection of ultrasonic sensors which are mounted vertically up and down and mounted horizantally on the righ of the Robot. The movement of the motor driver is determined by the position of the barrier as well as position the ultrasonic sensor.

The Relationship between input and output on the microcontroller, namely sensor detection with motor drive movement is set with several combination variations statement as in table 1 with Boolean statement as follows. S1,S2,S3,S4 logic “0”, means that there are no obstacles if Sensor S1,S2,S3, S4 “1”, it means that in front of the Sensor there is a barrier combination variation of four input variables o namely the position of the barrier and the sensor will determine a number of combinations of movements from the two motor Drivers at the microcontroller output, then the two motor drives will move, namely moving forward or backward, turning left and right, forward and

turning left or right, backward by turning left or right , the Description is sequentially sequential from 0000 up to 1111. We can see in full in table 1above.

3.3 Desain Harware of System Robot Vacuum Cleaner

The results of the System Robot Vacuum Cleaner Hardward design can be see in figure 7

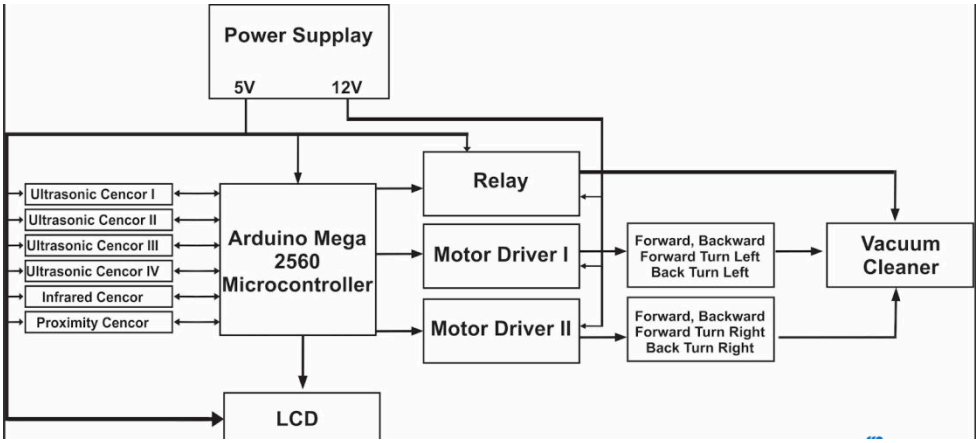
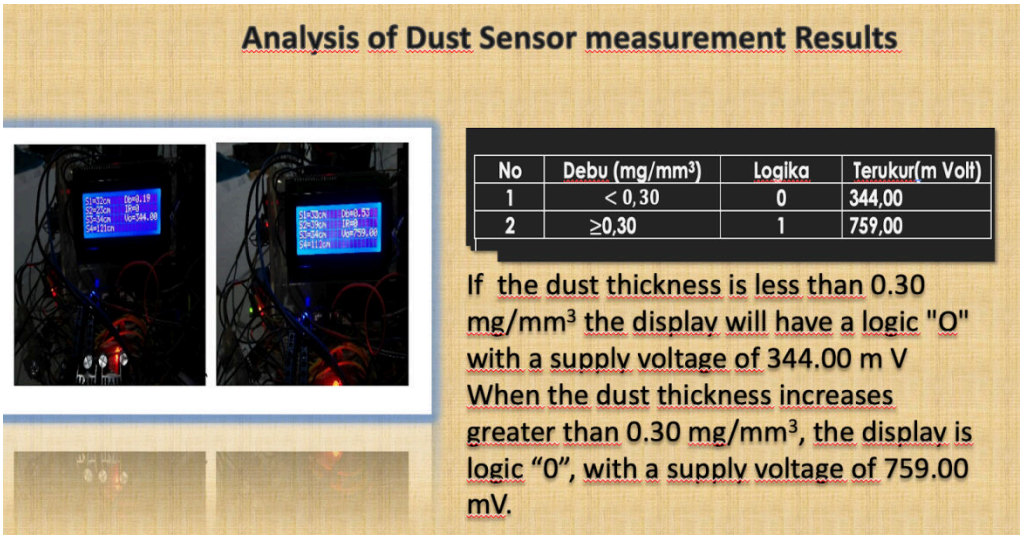


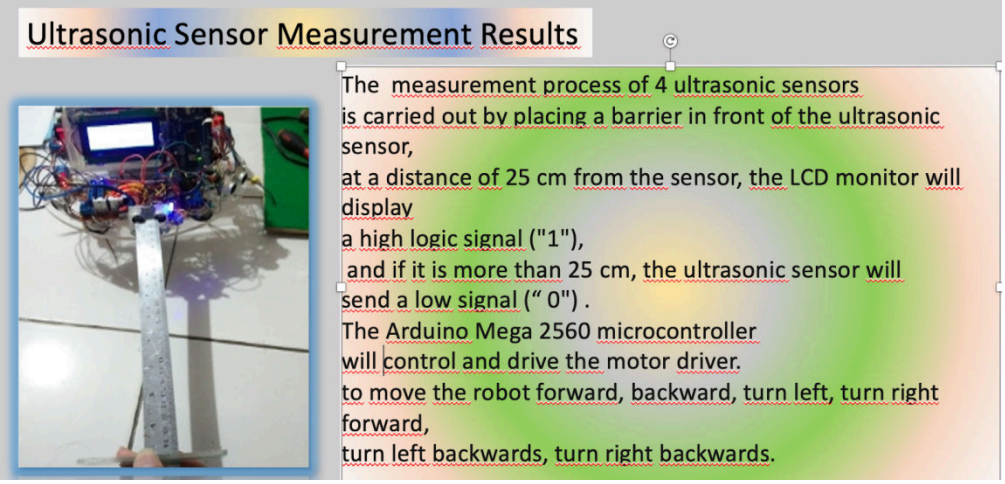
Figure 8 Blog diagram system Robot Vacuum Cleaner

In the block Diagram , this sytem describes in an integrated manner how the Vacuum cleaner robot is controlled by the Arduino Mega 2560 Microcontroller. Where the input data are three types of sensors, namely ultrasonic sensors infrared sensors, and Vacum sensors.

Four Ultrasonic sensors function to detect obstacles, based on the direction and position of the barrier. The Four ultrasonic sensors detect at a distance of 25 cm from the barrier, the microcontroller will control the movement of the motor drive in accordance with the detection of the position Of the barrier, with the number of combination of robot movement as much as 2n movement variable, we can see in the table 1. Likewise, the Infra red sensor functions to detect and detect dust thickness data with the conditions; if the dust thickness > 0.30 mg/mm3, then the infrared sensor, displays a discrete signal with a logic “1”, and for a thickness ≤ 0.30 mg/mm3 a discrete signal thickness with a logic “0 ” which will be displayed on the LCD monitor, logic “0” . If logic “0”, the dust sensor will drive the drive motor to move left and right, backward, forward, forward, turn right, backward turn right, forward turn left, backward turn left. The vacuum cleaner robot will move and sweep the floor according to the combination of variations in the input data of the barrier position and based on the detection of dust thickness from the infrared sensor.

Testing is done by testing each part of the block diagram of the system of the robot, to determine the rliability of the robot vacuum cleaner system.





4. Conclusion

1. In this research about Design of Microcontroler Arduino Mega 2560 ,we need four Ultrasonic cencors to detect the obstales in 25 cm distance A dust censor that can detect dust which size less than egual to 0,30 mg/mm3, will make the LCD with logic "1", then the driver will move as peras the condition of the obstacles and operate the vacuum cleaner to sweep and clean the dust.
2. The software design uses C++, assembly language , with input data in form of distance data,wich will appear on the LCD, and will be read by

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