USE OF ULTRASONIC SENSOR BY DETECTING VEHICLE SAFE DISTANCE BASED ON ARDUINO UNO

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ABSTRACT

With the rapid growth of vehicles, improving road safety has become a necessity. Ultrasonic sensors provide an effective and efficient solution for measuring distance on vehicles, which can be implemented to improve traffic safety. Therefore, we need a system that can detect the distance between vehicles to make it safer. One way to detect a vehicle's safe distance is to use an ultrasonic sensor. An ultrasonic sensor is a tool that can detect a safe distance to a vehicle. This system is designed as an integration between Arduino Uno, ultrasonic sensors, and data processing algorithms. The Arduino Uno program was developed to control ultrasonic sensors, read distance data, and send alerts if potential risks are found. The implementation of the ultrasonic sensor on the Arduino Uno succeeded in proving its ability to detect safe distances between vehicles with high accuracy. By using the right algorithm, the system can provide early warning when a potential risk of collision is detected. Test results show a fast and reliable response from the system This research confirms the effectiveness of Arduino Uno-based ultrasonic sensors in improving traffic safety by detecting safe distances between vehicles.

Keywords: *Parking Sensors,* Arduino Uno, Ultrasonic Sensor

INTRODUCTION

One situation where the number of vehicles passing by is greater than the road capacity, namely traffic jams[1].A sensor that is useful for ultrasonic sensors to convert physical quantities (sound) into electrical quantities and vice versa. Ultrasonic waves are sound waves that have a frequency of 21,000 Hz. Living creatures, especially humans, cannot be heard by the ears of ultrasonic sensors. Ultrasonic vibrations can pass through solid, liquid and gas substances. The movement of ultrasonic sound on the surface of a solid is almost the same as the movement of ultrasonic sound on the surface of a liquid, however, ultrasonic sound waves will be absorbed by textiles and foam.[2].

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The tools created must be able to be used and sought after by many people. To achieve this goal, production costs need to be kept as low as possible. This can be done by optimizing the production process by considering the constraints needed to meet the functional needs of the tool[3].

Arduino, an electrical system, has an open and flexible base that is very easy to use, in terms of software and hardware. For this reason, strengthening the Arduino means using capacity that exceeds it so that there is a place for program coding code that will be carried out by other hardware devices or supporting modulation (hardware support) with a certain capacity. This can make it easier for people to find out more about microcontrollers.[4]. Arduino Uno has a minimum of 14 electronic I/O pins (6 of which are used as PWM outputs), 6 analogues, a 16 MHz crystal oscillator, USB connection, ISCP header, power jack, the last part is a reset button.[5].

A device that has a new control system figure that has been arranged in a chip/integrated circuit is called a microcontroller. If you use a microcontroller system, all control can be more efficient. The advantage of a microcontroller is that it has a control system equipped with various supporting features, including processor, A/D converter, memory, analog and even digital I/O and processing digital and analog data.[6].Jumper cables are used to connect components on the breadboard without other electronic devices. The part of the connector that is used for plugging in is called the male connector, and the part that is plugged in is called the female connector. There are 3 distribution of connecting cables as follows: Female for Female, Male for Female and Male for Male[7].

This system was carried out to carry out research on "parking distance detection systems in cars by applying distance sensors and Arduino Uno"[8].A control device (Microcontroller) is a form of computer in which all or not all of the items are united in one IC (Integreted Circuits) item which often means a small part of a one-chip computer. There are also a number of constructor cores, storage (various small RAM, file storage, or the like), and input and output equipment. Control devices can also be called modern electrical materials that have input output as well as directions through events that are recorded and eliminated using a selected type. For this control device, the way it works can also be to capture and record signals.[9].

Information technology develops along with the emergence of new software, hardware and mobile devices, emerging through an achievement, in the form of providing support to living things in increasing effectiveness and making it easier to complete businesses by relying on knowledge system sources. The developing knowledge system provides and can also convey the needs of living creatures today which require many things that can be applied through an efficient system on all sides of living creatures in carrying out activities.[10].The sensor works on a basic basis by reacting to a sound stream and then being able to be used to detect (pause) an object of a specific size. Why is it called an ultrasonic sensor because this sensor uses sound

flow (ultrasonic sound). Sound waves that have a fairly high frequency, namely 21,000 Hz, are ultrasonic waves. Ultrasonic sounds fail to be picked up by living creatures with ears. Ultrasonic sound can travel through solids, liquids and gases. The speculative ultrasonic sound in front of a solid is almost similar to the speculative ultrasonic sound in the presence of a liquid. however, the ultrasonic sound stream begins to be sucked through the foam as well as the garment[11].

The function of the microcontroller is to direct when the ultrasonic signal must be sent, adding up the time value through the wave when it will start to be sent. The assembly sequence is received again, calculates the data from the ultrasonic sensor and then conveys it to the LCD, and displays early information using a buzzer and LED. Ultrasonic sensors can be applied to the bumper or tail of the car. Ultrasonic sensors emit signals that are used to detect a distance to objects in front of them. Distance sensors can be implemented in this way containing measurement distances ranging from 3 cm to 4 m. The LCD is placed on the car dashboard so that the driver can see more clearly the distance between the car and obstructing objects. The LED can provide a visual warning to the driver and the buzzer provides an audible warning[12],

Various research has been carried out regarding IoT implementation, such as creating IoT applications for forensic activities, searching for botnet attacks in IoT environments, and establishing smart stadiums using cloud computing and IoT. This research will help increase productivity and prevent machines. The aim of this research is to develop tools that can facilitate the efficient delivery of temperature information to operators, staff and decision making. The aim is to enable them to make quick and precise decisions in response to increasing temperatures. This research focuses on product design, information systems, as well as implementation and testing to further ensure optimal performance.[13]

In the industrial scope, the current development of companies operating in the manufacturing sector has caused many rapid developments, as a result all industries are required to work better in responding to competition in the future. Not all elements driving success in a company have the advantage of the processing method, the determination of which is in the expenditure. In manufacturing, it is very important to need technological encouragement that can stand out in processing processes that have good value. This processing is very prominent in the industry to achieve success at a production stage. This can be seen in industrial achievements through the resulting management gains. So from there, fertility is a very important element that must be present in increasing the fertility of tools/components that can change the performance of a business.[14]

METHOD

Research Phase

The aim of the research is to explain a situation clearly and in detail regarding the object being studied[15]. Carrying out research must be systematic. Research methods explain the framework of thinking so that it can be understood. Flowchart describes a research flow diagram. The flow diagram shows the beginning to the end of the process carried out. Research flow diagram in figure 1
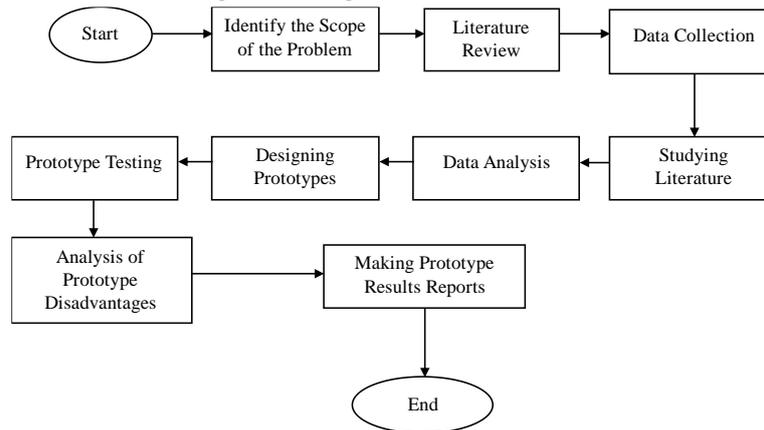

*Figure 2.1*Prototype method flow diagram

The research process starts from studying the literature and knowing the scope of the problem. Researchers study literature related to the problem to be studied to find out the problem in more depth. After understanding the problem, the researcher explores the scope of the problem to be studied. The scope of the problem will determine the scope of the research to be carried out. The data that has been collected is then analyzed to answer research questions. This data analysis can be carried out using various methods, depending on the type of data and research objectives. After the data is analyzed, the researcher assembles a prototype based on the results of data analysis. This prototype can be a new product or system.

After the prototype is assembled, researchers carry out tests or experiments on the prototype to find out if the prototype can meet user needs. Experiments on prototypes can be carried out in various ways, different prototypes have different methods. After the prototype was tested, the researcher analyzed the shortcomings of the prototype. This analysis is to find out weaknesses in the prototype. If the shortcomings in the prototype can be overcome, then the prototype can be used to create research results reports. This report contains the results of data analysis, prototype testing results, and recommendations for prototype improvements. If there are too many shortcomings in the prototype, the researcher must repeat the research process again from the beginning. The research step is complete if the research report has been created or arranged neatly. This research report can also be used for various

purposes, for example to publish research results, submit research proposals, or as observation data in selecting results.

Software and Hardware

Software is software in the form of information contained on a computer. Software is digital data that is not physically visible but can be seen when used by a computer user. Examples of software objects are Microsoft Office applications, Antivirus, etc. Hardware is the part of a computer device that is visible or has a physical form. Examples of hardware include keyboards, displays, printers, mice, etc. that can be touched. The tools needed in this prototype, among others, are based on analysis of prototype design models from previous research

Table 1.1prototype tools and materials

| Component	Amount	Function
Arduino Uno	1	It can be used to facilitate electronic control in all areas.
breadboard	1	The board is white and functions as a place to arrange parts and assemble them without using tools.
Buzzers	1	Converts electrical vibrations into sound vibrations.
USB cable	1	Can be used to transfer data, charge, or control electronic devices
Ultrasonic sensor	1	a tool that operates by utilizing sound reflections to identify the position of certain objects in the surroundings.
Jumper cables	5	Can be used to connect two electronic components that have the same type of connector

Block Diagram
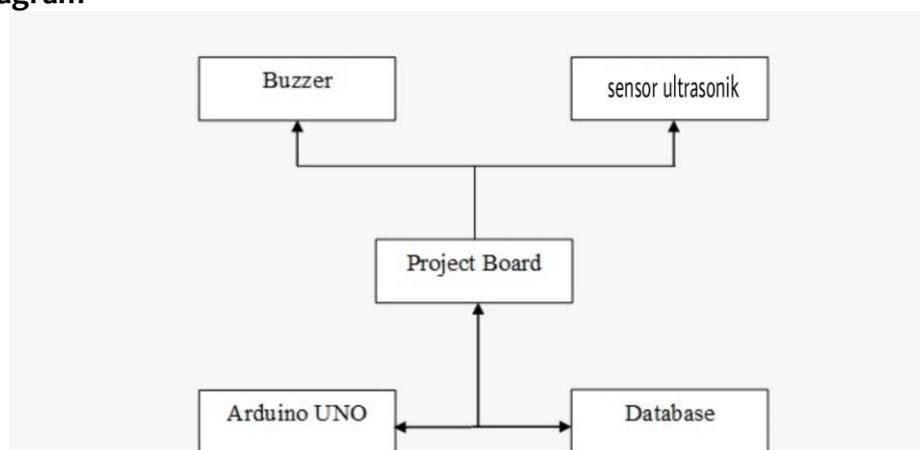
Figure 2.2Ultrasonic Sensor Block Diagram

The block diagram in the image above shows the components of an Arduino device. Each component block has its own function. The database block stores the Arduino program code. The program code contains commands from the programmer to Arduino to run the sensor system. The program code is written in Arduino IDE. This project involves integrating the sensor with an Arduino Uno, a 5V buzzer, and a database. The ultrasonic sensor detects the presence of certain objects in front of it and gives a signal to the Arduino Uno, the main part of the system. If the sensor detects a certain object in front of it, the Arduino Uno activates the 5V buzzer to provide a warning (sound). All these components are assembled and connected using a project board (breadboard), thus creating a system that can detect certain objects in front of it (parking).
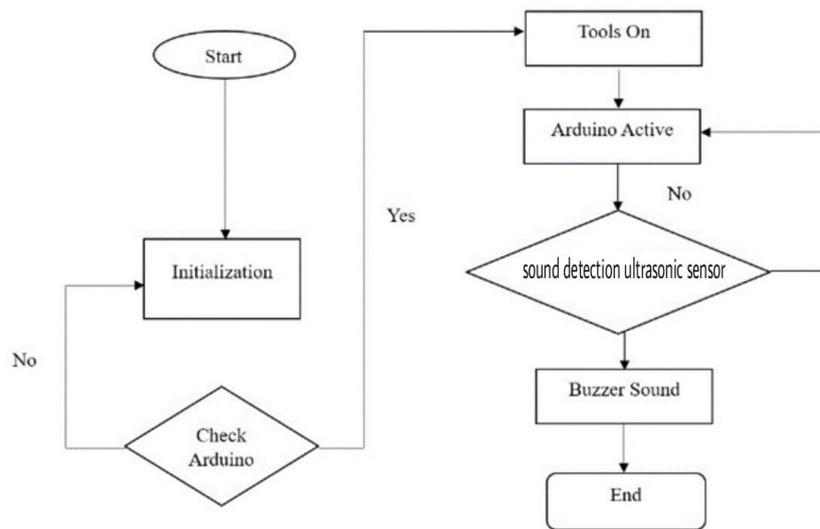
Flow chart

Figure 2.3 Workflow Chart

The image above explains how the ultrasonic sensor circuit works. When an object is directed in line at a certain distance in front of the connected ultrasonic sensor, the connected buzzer will make a sound. This means that the ultrasonic sensor knows that there is an object that is exactly in line in front of the ultrasonic sensor, then the buzzer will sound indicating that an object is approaching and if it gets closer, the buzzer will sound louder.

RESULTS AND DISCUSSION

Evaluation of these automated component counting circuits involves a step-by-step testing process for each item, aimed at ensuring that each item exhibits satisfactory performance and is free from installation errors or defects.

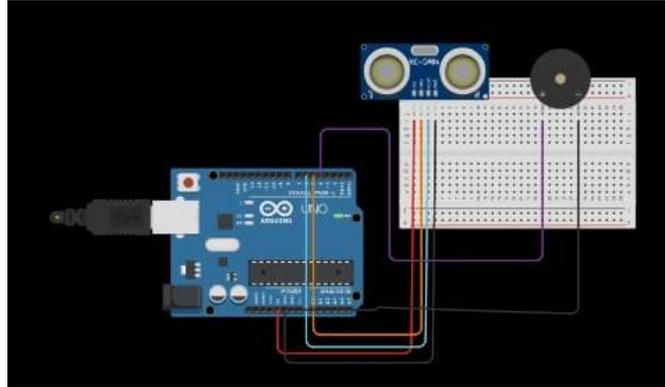**The Role of Car Parking Sensor Circuits**

Figure 3.1 Car parking sensor circuit

In this research the author created a series of ultrasonic (parking) sensors. An ultrasonic sensor is a tool that detects distance by utilizing the presence of an object whose distance is measured. Near and far, the objects detected are the output results applied by the ultrasonic sensor whose distance has been set. The most important part is Arduino Uno R3, the ultrasonic (parking) sensor is assembled using other components. The detector used to detect fire is a buzzer.

Car Parking Sensor Design Results

After experimenting with simulations using the Arduino UNO website, the author began to compile the Arduino physical circuit. The following are the results of assembling an ultrasonic (parking) sensor system using Arduino UNO type R3.
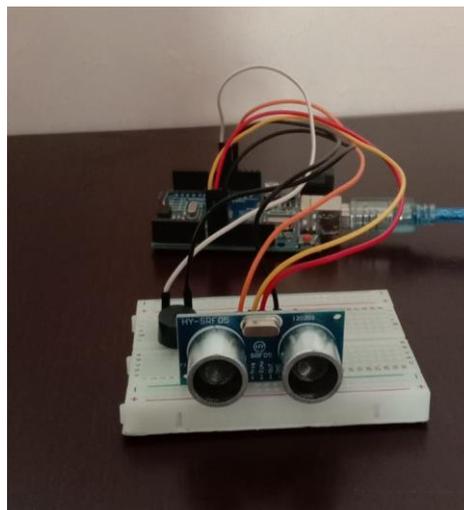

Figure 3.2Physical circuit of ultrasonic sensor

The image above shows that the system uses an ultrasonic sensor to detect the distance to an object. This sensor works by detecting whether an object is present or not. The image also shows a buzzer which functions as an alarm to provide warnings.

This circuit can use a power source from a laptop connected to a USB cable or another power source such as a battery, power bank, etc.

Car parking sensor test results

The process of testing the automatic parking sensor system circuit is carried out in stages on each component to ensure that each component has the appropriate minimum performance or that there are no installation errors or component damage.

Figure 3.3Testing of ultrasonic sensors

Figure 3.3 shows the results of testing the ultrasonic (parking) sensor connected to the Arduino UNO R3. When voltage is applied or when a program is executed, the Arduino indicator light is red. Similar to Arduino, the parking sensor can function when an object is brought close to the ultrasonic sensor, the buzzer will give a signal in the form of sound waves.

CONCLUSION

The implementation of an ultrasonic sensor with Arduino Uno for a microcontroller-based distance detection (parking) system has succeeded in building an effective solution for detecting the presence of objects at a distance. With a detection accuracy of 98%, this system can provide a warning in less than 1 second, enabling a fast response to the driver when parking. The use of ultrasonic (parking) sensors, which work by detecting the distance of an object, provides additional reliability in detecting parked vehicles.

CONFESSION

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